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Supplementary Information

Renseignements supplémentaires

References for CMD 24-H7.1 from the Canadian Nuclear Laboratories Ltd.

Références pour le CMD 24-H7.1 des Laboratoires Nucléaires Canadiens Ltée

In the Matter of the

À l'égard des

Canadian Nuclear Laboratories Ltd.

Laboratoires Nucléaires Canadiens Ltée

Application for the renewal of the nuclear research and test establishment decommissioning licence for the Whiteshell Laboratories site

Demande visant le renouvellement du permis de déclassement d'un établissement de recherche et d'essais nucléaires pour le site des Laboratoires de Whiteshell

Commission Public Hearing

Audience publique de la Commission

October 23, 2024

23 octobre 2024

Canada

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Canadian Nuclear Laboratories | Laboratoires Nucléaires Canadiens

Public Information Program for Canadian Nuclear Laboratories

CW-513430-REPT-001

Revision 9.0

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1. INTRODUCTION

As Canada's premier nuclear science and technology laboratory, Canadian Nuclear Laboratories (CNL) is a world leader in the development of innovative nuclear science and technology products and services. Guided by an ambitious corporate strategy known as Vision 2030, CNL works under the direction of Atomic Energy of Canada Limited (AECL), a federal Crown corporation, to fulfil three strategic priorities of national importance – restoring and protecting the environment, advancing clean energy technologies, and contributing to the health of Canadians.

By leveraging the assets owned by AECL, CNL also serves as the nexus between government, the nuclear industry, the broader private sector, and the academic community. CNL works in collaboration with these sectors to advance innovative Canadian products and services towards real-world use, including carbon-free energy, cancer treatments and other therapies, non-proliferation nuclear technologies and waste management solutions.

1.1 Land Acknowledgement

CNL operates on sites located on the traditional lands, waterways and ceded and unceded territories of Indigenous peoples. CNL recognizes and affirms all First Nations, Métis communities, and Inuit in this land we now know as Canada. We acknowledge, respect, and seek to better understand Indigenous history, rights, and title on the lands where we work and develop projects. At CNL we wish to honour and respect the importance of the relationship between Indigenous peoples and their lands, waters, and territories.

1.2 Commitment to Truth and Reconciliation

In alignment with the Truth and Reconciliation Commission Call to Action #92 Business and Reconciliation [4], CNL is committed to advancing truth and reconciliation through meaningful actions. CNL continues to enhance its corporate Indigenous relations program, in collaboration with Indigenous Nations, communities and organizations, through the development of a formal reconciliation action plan, and the establishment of an Indigenous procurement policy. All communications, plans and reporting are reviewed to ensure balanced language and acknowledgement of Indigenous rights and Indigenous knowledge, CNL strives to integrate this into all CNL activities.

1.3 CNL Sites

CNL manages and operates the following sites owned by AECL under a Government-owned, Contractor-operated or "GoCo" model.

1.3.1 Chalk River Laboratories (CRL)

The largest of CNL's sites, Chalk River Laboratories (CRL), is in Renfrew County in the province of Ontario, on the southern shore of the Ottawa River, approximately 200 km northwest of Ottawa. Established in 1944 as Atomic Energy of Canada Limited, the site is approximately 3,700 hectares (ha) (9,100 acres). The Ottawa River forms the eastern boundary of the site.

Abutting the CRL property to the southeast is Canadian military base Garrison Petawawa. The Town of Laurentian Hills lies to the southwest of the site and the Town of Deep River to the northwest.

As one of the region's largest employers, CRL retains more than 3,500 administrative, trades, technical, engineering and scientific staff. While most employees work at the Chalk River site, some staff work in the Town of Deep River where there are two offices, remotely from home offices, or a hybrid of on-site and remote.

The Chalk River site houses over 100 unique laboratories or facilities dedicated to the delivery of nuclear science and technology. There is also a significant effort underway to address historic nuclear liabilities through environmental remediation, decommissioning of aging/redundant facilities, and management of historic wastes, and to revitalize and renew the campus through capital investment in buildings and infrastructure.

CNL operates the CRL site in accordance with Canadian Nuclear Safety Commission (CNSC) Nuclear Research and Test Establishment Operating Licence (NRTEOL-01.01/2028). The current licence expires 2028 March 31.

On 2024 January 9 the Canadian Nuclear Safety Commission announced its decision to amend CNL's nuclear research and test establishment operating licence for CRL to authorize the construction of a near surface disposal facility. The amended nuclear research and test establishment operating licence remains valid until 2028 March 31.

1.3.2 Whiteshell Laboratories (WL)

The second largest of CNL's sites, Whiteshell Laboratories (WL), is located near the Local Government District of Pinawa in the province of Manitoba. The main part of the site is located on the east bank of the Winnipeg River, approximately 100 km northeast of Winnipeg. WL, a Class 1B nuclear facility, was established in the early 1960s and covers an area of about 4,375 hectares (ha) (10,800 acres). CNL is currently decommissioning and remediating the site.

WL retains approximately 350 administrative, trades, technical and scientific staff.

CNL operates the WL Closure Project in accordance with CNSC Nuclear Research and Test Establishment Decommissioning Licence (NRTEDL-W5-8.00/2024). The current licence expires 2024 December 31.

1.3.3 Decommissioning Sites

On behalf of AECL, CNL manages Canada's nuclear legacy liabilities at various sites across Canada. These nuclear legacy liabilities are the result of more than 60 years of nuclear research and development conducted by the National Research Council of Canada and AECL on behalf of the Government of Canada. The liabilities consist of outdated and unused research facilities and buildings, buried, and stored radioactive waste, and affected lands.

Since 1952, AECL/CNL has safely, and cost effectively managed Canada's nuclear research facilities and the waste generated by their operation. During this time, CNL improved waste management technologies and developed expertise in best practices.

Continued decommissioning and waste management activities will occur at the Chalk River Laboratories and the Whiteshell Laboratories. CNL also operates other sites across Canada that fall under the CNL Public Information Program (PIP); these are outlined below.

1.3.4 Prototype Reactor Sites (Waste Facilities)

CNL is the licence holder for three permanently shut down prototype CANDU® (CANada Deuterium Uranium) power reactors: NPD Waste Facility (NPD WF), Douglas Point Waste Facility (DP WF) and Gentilly-1 Waste Facility (G1WF). Each facility consists of a permanently shut down, partially decommissioned demonstration CANDU® reactor and associated structures and ancillaries.

1.3.4.1 Nuclear Power Demonstration Waste Facility (NPD WF)

NPD WF is located in the Town of Laurentian Hills, Renfrew County, Ontario, and is now an active site closure project. NPD was the first Canadian nuclear power reactor and the prototype for the CANDU® reactor design. NPD made history in 1962 when it generated electricity from nuclear power for the first time in Canada from a single 20 MWe pressurized heavy water reactor in what was then known as Rolphton, Ontario. The NPD reactor was the prototype and proving ground for research and development that led to commercial application of the CANDU® system for generating electric power from a nuclear plant using natural uranium fuel, heavy water moderator and coolant in a pressure tube configuration with on-power refuelling.

For 25 years NPD produced sustainable, clean energy and operated as a training centre for nuclear operators and engineers from Canada and around the world.

The NPD site is currently managed under a Waste Facility Decommissioning Licence (WFDL-W4-342.00/2034). Operations at NPD ended in 1987, after which the first stages of decommissioning were completed, including the removal of all nuclear fuel from the site and the draining of the systems. The site has been in a safe shutdown state for the last 30 years. CNL is currently undertaking an environmental assessment as part of the licence application to enable the full decommissioning of this facility.

1.3.4.2 Douglas Point Waste Facility (DPWF)

The Douglas Point Waste Facility is within the Bruce Power Site owned by Ontario Power Generation located on the east shore of Lake Huron in the Municipality of Kincardine, Bruce County, Ontario. The facility consists of the permanently shutdown, partially decommissioned prototype CANDU® reactor and associated structures and ancillaries.

Douglas Point was Canada’s first full-scale nuclear power plant, with a 200-megawatt (MW) prototype CANDU® reactor. It was known as the Douglas Point Nuclear Generating Station (DPNGS) and was a joint project between AECL as owner, and Ontario Hydro (currently Ontario Power Generation) as operator.

The reactor ran from 1968 to 1984 when it was permanently shut down, having achieved its prototype objectives. By 1986, the fuel had been removed and reactor coolant drained in accordance with regulatory requirements. The fuel was transferred to onsite dry storage by the end of 1987 and, since then, the facility has been in a safe shutdown state referred to as "Storage with Surveillance."

The Douglas Point site is currently managed under a Waste Facility Decommissioning Licence (WFDL-W4-332.03/2030). CNL is transitioning the facility, now known as the Douglas Point Waste Facility (DP WF) to the next phase of decommissioning. On March 15, 2021, the Canadian Nuclear Safety Commission announced its decision to amend the waste facility decommissioning licence for the DP WF to allow CNL to begin Phase 3 decommissioning activities, including the decommissioning and dismantlement of certain facilities and structures at the facility.

1.3.4.3 G-1 Waste Facility (G1WF)

The G-1 Waste Facility is on the Hydro-Quebec (HQ) site adjacent to the Gentilly-2 Nuclear Generating Station in Bécancour in the province of Quebec and is located on the St. Lawrence River between Montreal and Quebec City. The Gentilly-1 (G-1) prototype CANDU Boiling Water Reactor has been shut down for more than 40 years and is in a safe shutdown state: the reactor is not operating; the fuel has been removed from the facility and is being left in place to allow for radioactivity decay prior to shipment to CRL.

The Gentilly-1 site is currently managed under a Waste Facility Decommissioning Licence (WFDL-W4-331.00/2034). Maintenance activities are conducted on a regular basis to ensure the safety of the facility, the community, and the environment. The current schedule includes plans to secure the regulatory approvals required to permit full decommissioning of the site by 2060.

1.3.5 Former Heavy Water Plant Site

CNL manages the La Prade Heavy Water Plant Site in Bécancour, Québec. The site is not an active heavy water plant; however, heavy water (tritiated and virgin) is stored on the site, which is operated in accordance with the CNSC Nuclear Substance and Radiation Devices Licence 15193-4-26.2. The current licence expires 2026 September 30.

1.3.6 Port Hope Area Initiative (PHAI)

The Port Hope Area Initiative (PHAI) includes the planned cleanup of approximately 1,200 residential properties and involves tailored one-on-one communications with individual residents. As such, communications and engagement are covered by the *Port Hope Area Initiative Public Information Program*, which is executed in alignment with this CNL Public Information Program.

1.4 Scope

This document describes CNL's *Public Information Program* (PIP) and covers activities of public interest that occur at CNL. It has been prepared in accordance with the CNSC Regulatory Document REGDOC-3.2.1, *Public Information and Disclosure*. As noted above, the PHAI project has a separate public information program tailored to the specific needs of the communities in which the project is being implemented.

In the context of Environmental Assessments or Impact Assessments related to major projects and licencing activities, additional outreach may be undertaken that spans a larger geographic area than outlined in the PIP and may include additional Indigenous Nations, communities and organizations, municipalities and interest groups. For more information, please refer to the project-specific reporting in the Annual Compliance and Monitoring Reports or Indigenous Engagement Reports as relevant.

1.5 Regulatory Requirements and Guidance

The following sections describe how the Public Information Program meets regulatory requirements. Each section notes methods used for information dissemination; how information will address information needs related to the anticipated effects of CNL's operations; and how interactions will be tracked.

All parts of this program apply to each CNL site. However, strategies and tactics are customized to the target audiences at each CNL site.

The requirements for public information programs and disclosure protocols are derived from the stated objectives of the CNSC in the *Nuclear Safety and Control Act* (NSCA) (S.C. 1997, c.9) and associated regulations. The relevant provisions are as follows:

- Paragraph 3(j) of the *Class I Nuclear Facilities Regulations* (SOR/2000-204): "…the proposed program to inform persons living in the vicinity of the site of the general nature and characteristics of the anticipated effects on the environment and the health and safety of persons that may result from the activity to be licensed."
- Paragraph 3(r) of the *Class II Nuclear Facilities and Prescribed Equipment Regulations* (SOR/2000-205): "…the program to inform persons living in the vicinity of the site of the general nature and characteristics of the anticipated effects on the environment and the health and safety of persons that may result from the nuclear facility."

Additional regulations and guidance on public information programs are given in CNSC REGDOC-3.2.1, *Public Information and Disclosure*.

The Public Information Program outlines the ways in which the public receives communication from CNL, including the public disclosure protocol regarding events and developments involving facilities and activities. These specific elements include:

- Publication of documents describing the radiological and environmental impacts of CNL sites;
- Interactions with local communities and Indigenous Nations, communities and organizations to convey the specified information; and
- Publication of the results of CNL's monitoring programs on CNL's external website.

While CNL's Public Information Program is comprehensive, opportunities for improvement are continually considered. Public feedback is considered and addressed, and the program is modified when appropriate. In all instances, accessibility to timely information on CNL and its operations is maintained.

The discussion in the following sub-sections demonstrates CNL's compliance with CNSC REGDOC-3.2.1, *Public Information and Disclosure*.

2. PUBLIC INFORMATION PROGRAM

2.1 Purpose

CNL is committed to organizational transparency, ensuring that Indigenous peoples, the general public, local communities, elected and appointed government officials and industry members are properly informed about activities carried out at CNL sites.

This commitment is met through the company's Public Information Program (PIP), a communications program that was developed to build public awareness and trust, encourage transparent and proactive communication with interested parties, and ensure compliance with CNSC Regulatory Document REGDOC-3.2.1: Public Information and Disclosure, though sharing information related to routine activities, radiological and non-radiological emissions, and non-routine items or events at the different sites managed by CNL.

2.2 Objectives

The objectives of the program are to:

- Continue to sustain open and transparent communication about CNL's plans, activities and performance, and of any resulting related health or environmental risks by:
  - Creating opportunities to engage in transparent and proactive two-way dialogue with Indigenous peoples, community members and the general public.
  - Informing the public and Indigenous Nations, communities and organizations about events that have offsite effects or which may raise concern.
  - Positioning CNL as the source of accurate, timely information about its projects and activities.
- Raise public awareness, understanding and a supportive appreciation of CNL's value and relevance to Canadians by:
  - Demonstrating the positive impact of CNL on the community and the nation.
  - Nurturing existing and foster new relationships to advance CNL objectives.
- Provide an opportunity for community input to further enhance the effectiveness of the public information program.
- Meet regulatory requirements for a public information program.

2.3 Target Audiences

For the purpose of the PIP, CNL continues to focus primarily on the communities neighbouring CNL sites concentrated within a 50-kilometer radius of our operations. CNL routinely widens its communications to include interest groups in the S&T and academic communities, youth and education sectors, industry supply chain, and with others who have identified themselves as interested members of the public outside our standard catchment area.

2.3.1 Chalk River Laboratories

CNL specifically communicates with:

- CNL staff and CRL-based CNL employee unions
- Laurentian Hills-Deep River Nuclear Emergency Preparedness Committee
- Indigenous Nations, communities, and organizations:
  - Algonquins of Pikwàkanagàn First Nation (AOPFN)
  - Métis Nation of Ontario (MNO)
  - Kitigan Zibi Anishinabeg First Nation
  - Kebaowek First Nation
  - Williams Treaties First Nations
    - Alderville First Nation
    - Beausoleil First Nation
    - Georgina Island First Nation
    - Rama First Nation
    - Curve Lake First Nation
    - Hiawatha First Nation
    - Scugog Island First Nation
  - Anishinabek Nation
  - Algonquins of Barriere Lake First Nation
  - Temiskaming First Nation
  - Wolf Lake First Nation
  - Algonquin Nation Secretariat
  - Algonquin Anishinabeg Nation Tribal Council
- Algonquins of Ontario
- Universities and academia
- Nuclear industry and supply chain
- Public interest groups and environmentally focused organizations and agencies (e.g., Concerned Citizens of Renfrew County, Ottawa Riverkeeper, Ducks Unlimited)
- Local government officials and related committees:

- County of Renfrew
- Pontiac Regional County Municipality (MRC Pontiac)
- Town of Deep River
- Town of Laurentian Hills
- Town of Petawawa
- City of Pembroke
- Member of Parliament for Renfrew - Nipissing – Pembroke
- Member of Provincial Parliament for Renfrew - Nipissing – Pembroke
- Member of Parliament for Pontiac
- Local business partners (e.g., Upper Ottawa Valley Chamber of Commerce, Garrison Petawawa, etc.); and,
- The Environmental Stewardship Council (see Section 2.4.7), and Community Advisory Panel (see Section 2.4.8)

Refer to Appendix A for a map of CRL's primary audience located within a 50-kilometre radius of the Chalk River Laboratories. For practical purposes CNL maintains sharing of information with both regional municipalities of Renfrew and Pontiac Counties and as noted, CNL expands communication activities as necessary.

2.3.2 Whiteshell Laboratories (WL)

CNL specifically communicates with:

- WL-based CNL employee unions
- Indigenous Nations, communities, and organizations:
- Sagkeeng First Nation
- Black River First Nation
- Hollow Water First Nation
- Manitoba Métis Federation
- Brokenhead Ojibway Nation
- Wabaseemoong Independent Nations
- Grand Council of Treaty 3
- Public Liaison Committee (see section 2.4.9);
- Local business partners (e.g., Pinawa Chamber of Commerce and Lac du Bonnet and District Chamber of Commerce);
- Local government officials/committees:

- Local Government District (LGD) of Pinawa
- Town of Lac du Bonnet
- Rural Municipality of Lac du Bonnet
- Community of Whitemouth
- Town of Beausejour
- Town of Powerview Pine Falls
- Rural Municipality of Alexander
- Member of Parliament for Selkirk-Interlake-Eastman
- Member of Parliament for Provencher
- Member of Parliament for Churchill - Keewatinook Aski
- Member of Legislative Assembly for Lac du Bonnet
- Environmental Groups & Organizations (ENGOs) and citizens groups (eg. Concerned Citizens of Manitoba, Whiteshell Cottagers Association, Manitoba Cottagers Association, Eastman tourism
- Whiteshell Community Regeneration Partnership

Refer to Appendix B for a map of WL's primary audience located within a 50-kilometre radius of the WL site. For practical purposes CNL maintains sharing of information with regional municipalities and as noted, expands communication activities as necessary.

2.3.3 Prototype Reactors

As work proceeds with proposed decommissioning plans for the prototype reactor sites, the target audiences for these projects continue to be developed. Additional details are provided in the following subsections.

2.3.3.1 NPD Closure Project

See Section 2.3.1 Chalk River.

2.3.3.2 Douglas Point

CNL specifically communicates with:

- CNL employees and employee unions
- Bruce County Residents
- Public interest groups
- Local Government officials/committees:
- Municipality of Kincardine
- Town of Saugeen Shores

- County of Bruce
- Indigenous Nations, communities and organizations:
- Saugeen Ojibway Nation (Chippewas of the Saugeen First Nation and Chippewas of Nawash Unceded First Nation)
- Historic Métis of the Saugeen (HSM)
- Métis Nation of Ontario (MNO)
- Chippewas of Kettle and Stony Point First Nation

Refer to Appendix C for a map of Douglas Point's primary audience, which is reflective of Bruce Power's target audience. For practical purposes, CNL maintains sharing of information with regional municipalities and as noted, expands communication activities as necessary.

2.3.3.3 Gentilly-1

CNL specifically communicates with:

- CNL employees and employee unions
- Public interest groups and environmentally focused organizations and agencies (e.g. Société du parc industriel et portuaire de Bécancour, Chambre de commerce et d'industrie du Cœur-du-Québec).
- Local Government officials/committees, and residents in the following areas:
    - Bécancour-Nicolet-Saurel, Saint-Maurice-Champlain
    - Bécancour
    - Trois-Rivières
    - Gentilly District
- Member of National Assembly for Nicolet-Bécancour
- Member of Parliament for Bécancour-Nicolet-Saurel
- Member of Parliament for Saint-Maurice-Champlain
- Member of National Assembly for Trois-Rivières
- Minister responsible for the Centre-du-Québec region
- Indigenous Nations, communities and organizations:
    - Huron-Wendat Nation
    - Abenaki Band of Odanak
    - Abenaki Band of Wôlinak
    - W8banaki (formerly Grand Conseil de la Nation Waban-Aki)

Refer to Appendix D for a map of G-1's primary audience, which is reflective of Hydro Quebec's target audience. For practical purposes, CNL maintains sharing of information with regional municipalities and as noted, expands communication activities as necessary.

2.4 Audience Characterization

2.4.1 Employees

As ambassadors for the company, it is critical that CNL employees be kept fully apprised of CNL's business on an ongoing basis so they can also share information with their community contacts and professional networks in an informed and timely way. The tactics used to keep employees apprised include:

- Information updates via the President & CEO, and the Executive Committee
- Ongoing all-union/management meetings and Site Safety and Health Committee meetings
- Employee All Staff engagements
- Employee bulletins via the internal intranet and staff email
- Monthly employee newsletter, Voyageur
- Surveys to gauge employee awareness and measure messaging effectiveness
- New Employee Orientation program and tours for new employees
- Onsite electronic messaging boards for important safety messages (site specific)
- Onsite events and features activities (e.g. Safety Pause, Health & Wellness Fair, Building Openings)

2.4.2 Alumni

Former employees of CNL and AECL are both our strongest supporters and sometimes our toughest critics. Furthermore, they have a keen interest in the nuclear industry and in the operations of CNL sites, programs and projects. The Alumni Network was set up in 2011 as a simple email subscription service. Alumni receive a monthly package that includes electronic copies of the employee newsletter, Voyageur, as well as updates on key topics of interest and milestone accomplishments, invitations to events, and opportunities to provide feedback.

2.4.3 Elected Officials

Elected officials at the federal, provincial, county and municipal levels are notified of CNL activities through email and/or phone to ensure timely distribution of information. It is important that their awareness level be maintained so their offices can triage and quickly provide CNL with any concerns identified by their constituents. Tactics for the sharing information with elected officials include:

- Meetings and updates that promote information sharing and provide opportunities for officials to voice their opinions/concerns
- Topic-specific briefings
- Site tours
- Provision of reports, news releases and information related to daily operations, unplanned events and licensing activities
- Annual updates given to Regional Councils on CNL activities
- Invitations to join CNL at milestone events and project updates

2.4.4 Indigenous Peoples

CNL recognizes that the many Indigenous Nations, communities, and organizations with whom we engage have unique needs, resources and interests. The communications with these communities and nations reflect these unique needs and follow agreed-to protocols for information sharing as determined by each community.

Information sharing with Indigenous Nations, communities and organizations may include:

- Presenting information in a format that is easily understood through a variety of communications channels using targeted key messaging.
- Engaging technical experts to communicate information in various formats.
- Accomplishing all required activities in a timely manner; and
- Providing various means for Indigenous Nations, communities, and organizations to access information.

CNL proactively provides information regarding business activities and environmental remediation management projects. Notification is done through email, letter, community, and face-to-face meetings to ensure appropriate distribution of information.

Representatives of the Algonquins of Pikwakanagan First Nation, the Métis Nation of Ontario, and the Kitigan Zibi Anishinabeg First Nation are included in Chalk River Laboratories' Environmental Stewardship Council. Additionally, a representative of the Algonquins of Pikwakanagan First Nation participates in CNL's Community Advisory Panel.

CNL also engages Indigenous Nations, communities, and organizations in support of the Environment Assessment process, per CNSC REGDOC-3.2.2, *Indigenous Engagement*.

2.4.5 General Public

social media, our toll-free line, and through involvement in community events. Communications initiatives include:

- Manage the delivery of the Environmental Stewardship Council (CRL) or Public Liaison Committee (WL) by municipal officials;

- Community meetings and webinars where information on site operations, projects etc., is provided and opportunities to ask questions are encouraged;
- Evaluation of communications efforts, including web analytics and stakeholder feedback review;
- Opinion polling or similar community survey (no less than once every 5 years) to gauge community concerns;
- CNL's Nuclear Education and Outreach Program to school and youth;
- Maintenance of and timely updates to www.CNL.ca;
- Sponsorship and participation in industry events and conferences;
- Execution of tours and visits to the various site for interest groups, school, organizations; and,
- Distribution of a bilingual newsletter CONTACT and Kids CONTACT to residences and businesses in communities surrounding the Chalk River and Whiteshell Laboratories. The newsletter is also posted on CNL's external website.
- Sharing of information through CNL's social media pages; and
- Annual Community Update webinar.

Through participation in local events, fairs, tradeshows etc. CNL is recognized as a strong community partner and is actively involved in a wide range of local events and fundraising initiatives.

2.4.6 Public Interest Groups and Environmentally Focused Organizations and Agencies

CNL continues to proactively provide information to public interest groups and environmentally focused organizations and agencies. Operational announcements and unplanned events are shared; notification is predominantly done through email and via www.CNL.ca. Information on projects that seek public input is provided with letters of advance notification of community meeting dates, venues and times.

As noted previously, CNL respects that members of various agencies outside of the immediate area are also interested in CNL's operations. Where appropriate, a nomination will be facilitated for participation on the Environmental Stewardship Council or Public Liaison Committee.

2.4.7 Environmental Stewardship Council at CRL

To provide Indigenous peoples and the public opportunities for dialogue and feedback, CNL established the Environmental Stewardship Council (ESC) in 2006. The ESC is independently facilitated and comprised of members of public interest groups, Indigenous peoples, and members designated by local councils and representatives from CNL. The council openly discusses a broad range of matters of mutual interest to both CNL and the community, to seek input for solutions to remediate and/or continually improve CNL's environmental performance and provides ongoing and consistent two-way interactions with interested parties on CNL's business (not just environmental issues). The ESC meets three times a year. Membership, meeting notes and minutes are available to the public on www.cnl.ca.

A list of ESC members can be found in Appendix E.

2.4.8 Community Advisory Panel

The Chalk River Laboratories' Community Advisory Panel (CAP) objective is to bring new voices from the community into the dialogue between CNL and the Renfrew and Pontiac region. Through the CAP, CNL seeks to increase understanding, grow our appreciation of our communities' diverse perspectives, and enable members of the community to access first-hand knowledge about CNL activities. Discussions between CNL and the CAP will focus on the activities that are subject to licensing and environmental regulation as well as activities that may affect the social and economic life of the community.

The CAP consists of a diverse group of community members with varying backgrounds, most of whom are residents of Renfrew or Pontiac County.

CNL hosts regular meetings four times a calendar year. CAP meetings are facilitated by independent third-party facilitators. Meeting notes are taken at each meeting, recording all questions and actions that occurred.

Meeting notes and minutes are available to the public on www.cnl.ca.

2.4.9 Public Liaison Committee at Whiteshell

To provide Indigenous peoples and the public with opportunities for dialogue and feedback, CNL established the Public Liaison Committee (PLC) in 2003. Similarly referred to as a Community Advisory Group by nuclear utilities, the PLC is independently facilitated and comprised of members of public interest groups, members designated by local councils, and representatives from CNL. The council openly discusses a broad range of matters of mutual interest to both CNL and the community and provides ongoing and consistent two-way interactions with interested parties on the decommissioning activities of the Whiteshell Laboratories. The PLC meets two times a year.

A list of PLC members can be found in Appendix F. Information is shared with PLC members through:

2.4.10 Intervenors

CNL values the input from citizens received during regulatory processes (e.g., licensing hearings, Commission appearances, environmental assessments). In this regard, CNL undertakes to advise those intervenors (where contact information is available) of activities through:

- Personal response and an invitation to be added to the relevant projects' mailing list to receive ongoing information on CNL's operations; and,

- Invitations to community meetings that promote information sharing and provide opportunities for interested parties to voice their opinions/concerns.

2.4.11 Atomic Energy of Canada Limited

It is important that our client, Atomic Energy of Canada Limited (AECL), be kept apprised of CNL activities. Communication is ongoing and CNL engages with AECL to provide regular updates to AECL staff on the status of progress on CNL activities.

2.4.12 Canadian Nuclear Safey Commission

CNL recognizes the importance of keeping the CNSC informed on issues that may be important to the CNSC in terms of public communications. CNL is required to notify the CNSC of any public disclosures at the same time or prior to the disclosure.

The CNSC also maintains a site office located at CRL, which is staffed by full-time CNSC staff. This ongoing site presence affords CNSC staff with direct access to all site facilities and activities.

CNSC and CNL interactions are supplemented by regular meetings with regulatory, licensing, project and program staff.

2.4.13 Target Audience Development

There is an ongoing requirement to assess and grow appropriate relationships within all of the identified communities.

At sites where environmental remediation management projects are in their early stages, relationships with local elected officials and Indigenous peoples will continue to be strengthened.

The CNL Public Information Program and public disclosure protocol are proportionate with the public’s perception of risk and the level of public interest in the licensed activities as outlined in CNSC REGDOC-3.2.1, *Public Information and Disclosure*.

2.5 Public and Media Opinion

Ongoing and open communications with the media is an important component of CNL’s Public Information Program as the media offers a means for information dissemination to the public.

Through the PIP, CNL actively seeks to engage media to ensure access to information, and to provide a balance of information regarding CNL operations and projects. This includes media releases, direct contact, media monitoring, dedicated media visits and media participation in events as security requirements permit.

2.6 Public Information Strategy and Products

2.6.1 Dissemination of Information to the Public

Information is disseminated in a number of ways:

- CNL's corporate website: www.CNL.ca;
- Community Information Bulletins;
- Web postings and media releases;
- CONTACT newsletter (Chalk River and Whiteshell editions);
- Kids CONTACT newsletters (mailed to Port Hope, Chalk River, and Whiteshell catchments)
- Community meetings and events;
- Public engagement activities;
- Topical webinars, and;
- Social media (multiple platforms)
- Individual discussions by email, phone and in person
- Visits to the project sites and laboratories
- Paid advertisement in traditional and social media
- Speaking opportunities at conferences and trade events
- CNL's corporate website, www.CNL.ca is used to post specific environmental information:
- Reports on site environmental performance are posted quarterly in the Performance Report section of the external website; and,
- Event Reports for all CNL sites are posted quarterly in the Event Reports section of the external website.

2.6.2 Social Media

The role of social media as a vehicle for communicating with the general public has grown substantially in recent years. Use of social media greatly enhances CNL's ability to deliver against the commitments made in the Public Information Program: regular, open and honest communications with various interested parties.

In addition, CNL endeavours to present itself as a modern, technologically advanced organization. It is expected that organizations of this nature are active participants in social media.

With respect to social media use, Corporate Communications maintains an official Canadian Nuclear Laboratories presence through the following social media tools under the following identifiers:

1. Twitter: CNL_LNC (www.twitter.com/CNL_LNC)
2. LinkedIn: Canadian Nuclear Laboratories (EN) Laboratoires Nucléaires Canada (FR) (https://www.linkedin.com/company/9191967)

3. YouTube: Canadian Nuclear Laboratories / Laboratoires Nucléaires Canada (www.youtube.com/c/CNLCanada)
4. Flickr: Canadian Nuclear Laboratories (https://www.flickr.com/photos/cnl_lnc)
5. Facebook: Canadian Nuclear Laboratories (http://www.facebook.com/CanadianNuclearLaboratories)
6. Instagram: canadiannuclearlaboratories (https://www.instagram.com/canadiannuclearlaboratories/)

2.6.3 Education and Outreach

Since 2008 there has been a steady increase in the outreach activities that have been occurring between CNL and the education communities.

Yearly, CNL actively participates in Take Our Kids to Work Day. Over 100 students participate annually across CNL sites. There are information sessions as well as site visits that students participate in throughout the day.

Beginning in 2011 a concerted effort was made to invite local high school science classes to the Chalk River Laboratories to participate in a site visit. We endeavour to have two school visits per month of the academic year. CNL staff regularly participate as judges for local Science Fairs. This is further supplemented by in-class and online engagements, averaging two per month across a range of topics.

In 2021, CNL introduced a "Science Camp" targeting ages 9-12. During this week long session (offered twice annually), CNL hosts groups of 20 youth from local communities, introducing them to a range of scientific disciplines and providing them an opportunity to visit the laboratories and interact with the technical leads.

CNL routinely participates in national events such as Nuclear Science Week, International Day of Women and Girls in Science, Let's Talk Energy Week and Science Odyssey. When requested, CNL staff will make classroom presentations about CNL and about career options. CNL continues to actively grow and develop outreach activities directly related to support Science, Technology, Engineering and Mathematics (STEM) education.

CNL supports youth in exploring careers in the skilled trades and actively participates in activities such as the Renfrew County OPTIONS Skilled Trades Fair and supports local Women in Nuclear (WiN), North American Young Generation in Nuclear (NAYGN) as well as the Canadian Nuclear Society (CNS).

2.6.4 Supply Chain

CNL seeks to maintain a healthy supply base to undertake the diverse range of work the laboratories carry out. To improve line of sight on CNL supply chain opportunities a Vendor Portal and an Indigenous Vendor Portal are maintained.

The purpose of these portals is to provide potential or current suppliers to CNL, with information about how CNL plans and carries out procurement activities for goods, services, equipment, decommissioning and

2.6.5 Tracking of comments and feedback from the public

Comments and feedback are received and tracked in a number of ways. CNL receives comments and feedback through responses to CNL's active offer during in person, online and external announcements, publications, postings and events. These comments, questions and feedback are typically are related to the content as opposed to the PIP itself. These comments are delivered to CNL though:

- Emails to community email addresses
- Phone calls to the community toll free line
- Phone calls to the media line
- Emails to the media email address
- Paper letters through conventional mail
- Commentary posted to CNL's social media accounts
- Feedback forms collected following in person events
- Questions raised during community events (in person and on line)
- Letters and editorials published in news outlets
- Interventions at public hearings.

Comments received are assessed through a variety of methods, both qualitative and quantitative to identify trends and areas for increased focus. They are looked at in a temporal perspective and in totality to understand whether the comments are related to a specific event/moment or reflect a broader concern.

- Email and phone contacts are monitored daily, with automated notification included to ensure a rapid response if needed. This information is logged, and assessed on an ongoing basis.
- Notes are taken at community meetings and actions are tracked as appropriate;
- Community meetings include a feedback form assessing meeting effectiveness and providing comments on improvement;
- ESC, CAP, and PLC meetings include a feedback form assessing meeting effectiveness and providing comments on improvement;
- Newspaper articles and other media reports of CNL's operational and community-based activities are compiled through the assistance of media monitoring
- Website and social media analytics are examined for trends;

- Opinion polling, undertaken every five years; and,
- Social media analytics are examined

2.6.6 Public Information Strategy and Products Table

Table 1: Public Information Strategy and Products Table

Tactics	Products/Activities	Targeted Audiences
Online Communications • Provide information on CNL including descriptions of current and upcoming work, environmental monitoring reports, news releases and community involvement • Provide public disclosure of unplanned project events **Availability** • 24 hour a day access	• Website – www.cnl.ca • CNL Facebook account • CNL Twitter account • CNL YouTube channel • CNL LinkedIn account • CNL Instagram	All
Newsletters • Provide updates on currents projects, descriptions of upcoming work, highlights from ongoing work and community involvement **Availability** • CONTACT (3x per year) • Kids CONTACT (3x per year) • WL CONTACT published annually • Voyageur published monthly	• CRL CONTACT • Kids CONTACT • WL CONTACT • Voyageur	• CONTACT – Regional distribution to all households in surrounding area of both CRL and WL respectively. • Kids CONTACT is distributed to households in CRL, PH and WL regions • Voyageur is distributed across all CNL sites
Community Inquiries/Media Line • Provides direct line of communication • Provides follow-up for non-urgent inquiries	• 1-800 Community Line • 1-800 Media Line • Email address	• Public • Media

Tactics	Products/Activities	Targeted Audiences
Availability • 24 hour a day access to send emails/leave messages		
Presentations • Provide information on current and planned project activities, site operations and environmental programs • Provide an educational tool for schools on different areas of interest to the students **Availability** • Regularly scheduled for interested parties; upon request for others	• PowerPoint slide shows and related handouts • Information Poster Boards • Fact sheets • Interactive touch screens • Informational videos • Online webinars and live streamed sessions	• All
Site Visits • Led by Subject Matter Experts • Facilitate understanding and appreciation for complexity and importance of work at CNL and major projects • Educate about safety, environmental monitoring, and all aspects of how the site operates **Availability** • An Open House is held every five years • Two local school tours per month during school year • Additional upon request (average >40 per year)	• PowerPoint presentations • Guided tours of different facilities and projects • Interactive demonstrations	• All
Citizen Groups • Community Advisory	• Regularly scheduled meetings in their respective areas	• Local residents • Representatives from interest groups

Tactics	Products/Activities	Targeted Audiences
Panel • Environmental Stewardship Council • Public Liaison Committee	• PowerPoint presentations and discussions • Tours of sites and areas of interest • Question and answer periods	• Representatives from Municipalities • Representatives from Indigenous Nations, communities and organizations
Community Notifications • Provide notifications about activities at CNL and/or notable changes to schedules or work to residents and businesses located in close proximity to the site • Provide advance notifications of upcoming work or events that may affect the local community • Provide disclosures of unplanned events • Provide notification of public events and career opportunities **Availability** • Various	• Phone calls and emails to elected officials or community leaders • Website and social media postings • Advertising – print and/or radio	• Public • First responder organizations • Municipal staff
Information Sessions – Public • Inform community about upcoming projects and related monitoring, mitigation and health and safety measures in place to protect people and the environment • Provide updates on planned or changed project activity • Receive feedback from the public and discuss issues and areas of	• Informational Poster Boards • Presentations • Subject Matter Experts to discuss and answer questions • Fact sheets • Visual aids and displays • Fact sheets • Informational videos • Feedback forms	• Communities in close proximity to projects • Media • Elected Officials • Staff

Tactics	Products/Activities	Targeted Audiences
concern for those in proximity to the work sites **Availability** • As required to relay new information, developments and project updates to local communities and interested groups • Upon request		
Media Relations • Brief the media and leverage their reach to inform the community and broader audiences • Reinforce CNL as primary source of accurate, timely information • Demonstrate transparency by disclosing any unplanned events or occurrences **Availability** • Proactively on milestone achievements or major developments • Proactively when current events justify outreach • Upon request	• Media releases • Media engagements • Media interviews with CNL technical experts • Letters to the Editor • Detect and correct • Provision of footage and photography • Access to site for filming, walk downs and interviews	• Media • Public • Social Media
Participation in External Events • Provide broader public with information about CNL activities, projects and health and safety measures in place to protect people and the environment • Provide opportunity for CNL staff to act as ambassadors and broaden	**Events include:** • Local Home shows • Community Events • Educational events • Local agricultural fairs • Industry events • Career Fairs • School / In Class	• Public • Schools • Industry

Tactics	Products/Activities	Targeted Audiences
awareness of CNL **Availability** • Annually • Upon request		
CNL Attitude Study • Gain insights into public opinion and understanding of CNL • Gather feedback on effective/ineffective communications tools, areas of interest and areas to improve	• Delivered through recommendations of external polling firm • Internal staff surveys • Undertaken every 5 years.	• Local Residents (with no ties to CNL) • Local Residents (with ties to CNL) • Staff
County Day • Intensive one day visit to the Laboratories, with the extended elected officials and community councils • Annual event	• Mix of presentations and on site tours • Provides opportunity for updates, performance reporting, and dialogue	• Elected officials and extended council members (CRL)
Annual Community Update Webinar • Live stream through dedicated page, and through social media • Mix of presentations and moderated Q&A • Heavily promoted within the local community and industry members	• Shared opportunity for AECL and CNL to address progress, performance, and plans for the future • Bilingual, a French stream is available	• Chalk River Laboratories • Industry members • Interest groups • Alumni

2.6.7 Performance Reports

2.6.7.1 Environmental Performance

Through CNL's corporate website, information is regularly posted regarding CNL's environmental impact, including results from our environmental monitoring program.

Links can be found for the following policies and documents on www.CNL.ca:

- CNL Environment Policy;
- CRL Environmental Performance Reports (updated quarterly);
- WL Environmental Performance Reports (updated annually);
- CRL Environmental Risk Assessment (updated as required);
- WL Environmental Risk Assessment (updated as required);
- Douglas Point Environmental Risk Assessment (updated as required);
- G-1 Environmental Risk Assessment (updated as required);
- Executive Summary of CRL Annual Compliance and Monitoring Report (updated annually);
- Executive Summary of WL Annual Compliance and Monitoring Report (updated annually);
- Executive Summary of NPD Annual Compliance and Monitoring Report (updated annually);
- Executive Summary of Douglas Point Annual Compliance and Monitoring Report (updated annually);
- Executive Summary of G-1 Annual Compliance and Monitoring Report (updated annually); and
- Executive Summary of Near Surface Disposal Facility Environmental Assessment Follow-up Monitoring Program Report (updated annually).

In addition, CNL has achieved the ISO 14001 Environmental Management System certification, recognized internationally as a key to guiding organizations to environmental responsibility and continual improvement.

2.6.7.2 Event Reports

CNL is committed to providing to the public, through our external website, a consolidated quarterly list of the reportable events (as noted in previous sections) to include events at all CNL locations.

3. PUBLIC DISCLOSURE PROTOCOL

3.1 Public Information

Event Reports

CNL provides to the public an up-to-date list of events as reported to the Canadian Nuclear Safety Commission (CNSC). The listing is updated 60 days following the end of the preceding quarter.

Details on these events are available upon request to CNL.

In addition to general information on CNL activities, CNL also has Public Disclosure priorities that differ by locations, a site summary follows.

3.2 Public Disclosure

CNL is committed to maintaining a public information program that includes public access to information related to routine radiological and non-radiological emissions, and non-routine items or events at Chalk River Laboratories, NPD, Douglas Point, G-1 and Whiteshell Laboratories. CNL manages public disclosure related to the following licences:

- Nuclear Research and Test Establishment Operating Licence (Chalk River Laboratories),
- Nuclear Research and Test Establishment Decommissioning Licence (Whiteshell Laboratories),
- The Prototype Waste Facilities – Waste Facility Decommissioning Licence for Nuclear Power Demonstration,
- The Prototype Waste Facilities – Waste Facility Decommissioning Licence for Douglas Point
- The Prototype Waste Facilities – Waste Facility Decommissioning Licence for Gentilly-1

For all sites the primary means for reporting non-routine items or events is CNL's external website, www.CNL.ca, while CNL may elect to notify key local officials and interested parties through direct contact should the event have off-site or community impacts. The reporting timeframe for disclosure items is typically within four business days; however, CNL balances between securing reliable information and ensuring the public and interested parties are kept informed.

3.2.1 Public Disclosure at Chalk River Criteria for Public Disclosure

1. The licensee shall provide the following routine emissions information to the public:
   a) airborne emissions of Nitrogen Oxides (NOx) and Sulfur Oxides (SOx), updated annually;
   b) airborne emissions of tritium, updated quarterly; and
   c) waterborne emissions of tritium, updated quarterly.

Routine emissions information will be reported through CNL's external website, www.CNL.ca, and updated as necessary. Posting will have a one period lag to allow for processing of the samples, preparation of the information, and verification of the report.

2. The licensee shall periodically review and update the routine emissions report to reflect operational changes and feedback from interested parties.

3. The licensee shall provide information to the public regarding non-routine items or events as specified below:

   a) Exceeding an action level for any radiological emissions where it also exceeds 0.1% of the derived release limit.

   b) Loss of refrigerant as listed under the Federal Halocarbon Regulations greater than 100 kg;

   c) Other events that could have offsite effects or result in media attention including fires, earthquakes, serious vehicle or industrial accidents, and significant business developments.

   d) Quarterly updates of event reports to the public through website.

4. Environmental and Performance Reporting

Note: Licence Applications

Licence renewal applications to the Commission Registrar may be posted on the external CNL website as submitted to the CNSC, at the discretion of the applicable site licence holder.

In addition to quarterly reporting and posting of "routine emissions", noted in section one (1) above, CNL also prepares and posts an Annual Compliance Monitoring Report summarizing Effluent Verification and Environmental Monitoring for the Chalk River Laboratories.

This report reviews and summarizes the results of the Chalk River Laboratories (CRL) Environmental Monitoring Program (EMP) for a specified calendar year. CNL reports the monitoring results annually to the Canadian Nuclear Safety Commission (CNSC). The report is made available to the public.

These environmental performance reports are available via the Performance Reporting page found at www.CNL.ca.

3.2.2 Public Disclosure at Whiteshell Laboratories Criteria for Public Disclosure

1. The licensee shall provide the following routine emissions information to the public:

   a) airborne emissions, updated semi-annually;

   b) airborne emissions of NOx and SOx, updated annually.

2. The licensee shall periodically review and update the routine emissions report to reflect operational changes and feedback from interested parties.

3. The licensee shall provide information to the public regarding non-routine items or events as specified below:

   a) Loss of refrigerant as listed under the Federal Halocarbon Regulations greater than 100 kg;

   b) Other events that could have offsite effects or result in media attention including fires, serious vehicle or industrial accidents, and significant business developments;

4. Environmental and Performance Reporting

Note: Licence Applications

Licence renewal applications to the Commission Secretariat may be posted on the external CNL website as submitted to the CNSC, at the discretion of the applicable site licence holder.

In addition to reporting and posting of "routine emissions", noted in section one (1) above, CNL also prepares and posts an Annual Safety Report summarizing annual performance data for the Whiteshell Laboratories.

This report reviews and summarizes the results of the Whiteshell Laboratories' annual performance and environmental data for a specified calendar year. CNL reports the monitoring results annually to the Canadian Nuclear Safety Commission (CNSC). The report can be made available to the public.

These Whiteshell Laboratories' performance reports are available via Performance Reporting page found at www.CNL.ca.

3.2.3 Public Disclosure of Prototype Reactor Sites

Criteria for Public Disclosure:

1. The licensee shall provide information to the public regarding non-routine items or events where:

   a) Loss of refrigerant as listed under the Federal Halocarbon Regulations greater than 100 kg;

   b) Other events that could have offsite effects or result in media attention including fires, earthquakes, serious vehicle or industrial accidents, and significant site-related business developments.

   Public Disclosure for each Prototype Reactor site will be reviewed prior to starting any physical environmental remediation work.

2. Environmental and Performance Reporting

Annual Compliance Monitoring Reports are prepared for each site and summarize the present status of the Prototype Waste Facilities and notable activities conducted within these facilities for a specific calendar year. The report includes results of operations, the results of monitoring programs, changes made to key procedures, equipment, or structures, as well as a summary of reports made pursuant to Sections 29 and 30 of the General Nuclear Safety and Control Regulations.

Executive Summaries of the Annual Compliance Monitoring Reports for the Prototype Waste Facilities sites are available via the Performance Reporting page found at www.CNL.ca.

Note: Licence Applications

Licence renewal applications to the Commission Secretariat may be posted on the external CNL website as submitted to the CNSC, at the discretion of the applicable site licence holder.

3.3 CNL Emergency Preparedness

CNL is committed to providing the safest environment for our public and employees. CNL follows the industry and Canadian comprehensive all-hazards approach to safeguard the public from any potential incidents.

In the unlikely scenario that an event does occur, CNL has plans to ensure these events are properly managed and risks to people as well as the environment are minimized. Emergency preparedness is a highly integrated process. Documentation and plans are aligned and the Emergency Operations Centre (EOC) interfaces are clearly established between CNL, the municipalities, the provinces, and the federal government. These preparations include a trained emergency operation team and subject matter experts who are on-call and ready to respond.

3.3.1 Chalk River Laboratories

The primary zone is the areas in which extensive planning and response preparations for an incident or radiological event are required. The size of each primary zone is defined by the province and the response requirement for each zone is defined by our regulators. For CRL, the primary zone, in both Ontario and Quebec, is a nine-kilometre radius from the NRU reactor, which as of 2018 March 31 is no longer an operating reactor.

3.3.2 Whiteshell Laboratories

WL is currently undergoing decommissioning. WL operates an Emergency Preparedness program committed to ensuring the safety and security of our staff and the public. WL currently utilizes a variety of emergency signals for site-wide alerting and provides public alerting through their Emergency Operations Centre processes.

4. PROGRAM EVALUATION PROCESS

The Corporate Communications group coordinates activities and interactions with CNL's interested parties and Indigenous Nations, communities and organizations.

4.1 Questions and Issus Management

For the purposes of the Public Information Program, an issue is defined as something that could positively or negatively impact on CNL's operations, credibility or reputation.

Where questions and issues arise, CNL attempts to identify the issue, determine its basis or cause, assess its implications, and, if possible, identify means to inform on the issue to the satisfaction of the concerned parties and the public. CNL endeavours to acknowledge and address questions and issues within 30 working days.

4.2 Assessment and Evaluation

The Public Information Program is not static. The identified activities are carried out with full intent. The program is reviewed regularly as it progresses and its effectiveness measured, based on public input and other factors. Revisions to the program may be required to incorporate input from the public, to adapt to changing business needs or circumstances, to accommodate new information, or in response to other factors.

4.3 Documentation

The Public Information Program is available to the public in both official languages through www.cnl.ca. While day-to-day interactions with CNL's many audiences are not stored as records, given the nature of this program, documents which provide evidence of its delivery are widely available; for example, press releases, event listings, and public disclosures are posted online; copies of newsletters are archived on www.cnl.ca; webinars are published to our YouTube channel and available for viewing on demand; records of attendance at site visits are maintained; records of attendance at major public events are stored; records of key public and Indigenous engagements are recorded.

5. CONTACT INFORMATION

Corporate Communications
Canadian Nuclear Laboratories Chalk River Laboratories
286 Plant Road
Chalk River, ON K0J 1J0 Canada

Tel.: (613) 584-8811, ask for Corporate Communications
Fax: (613) 584-8272
Toll free: (800) 364-6989
Email: communications@cnl.ca
Web: www.CNL.ca

Appendix A MAP OF CRL AND NPD'S PRIMARY AUDIENCE

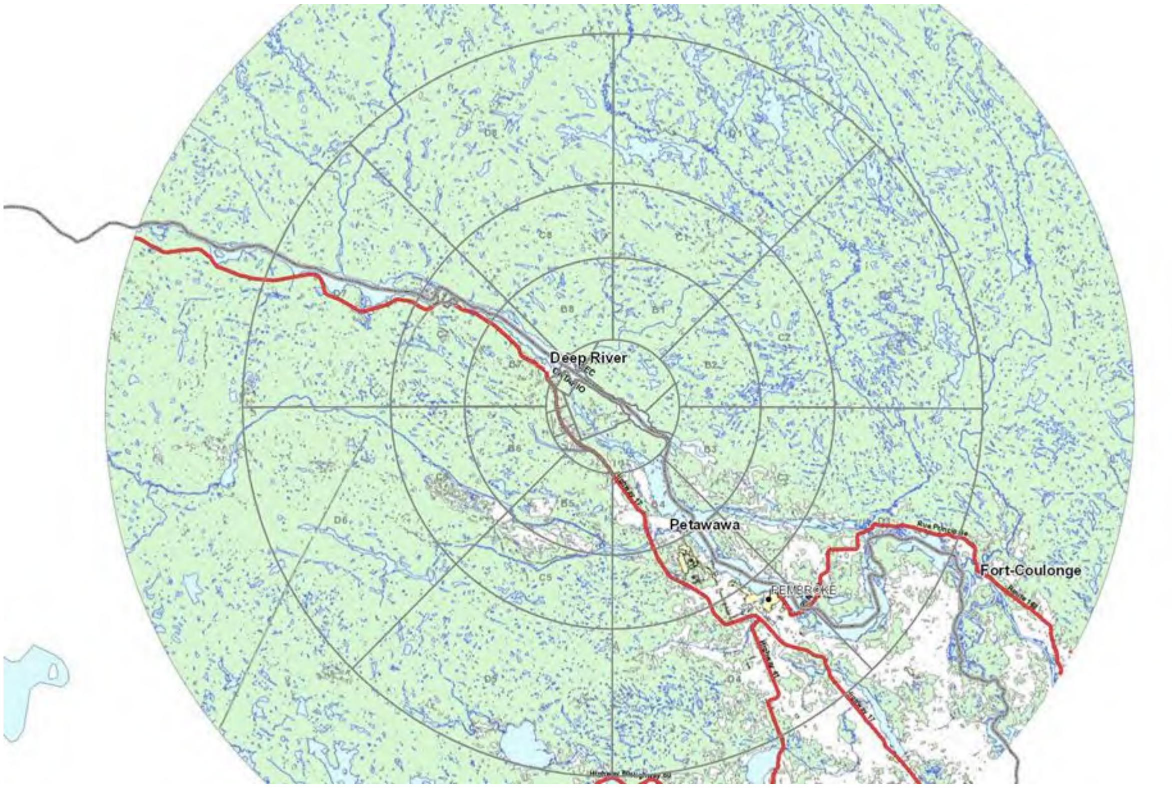

Figure 1: Map of CRL and NPD's Primary Audience

CRL and NPD's primary audience is located within a 50-kilometre radius of the Chalk River Laboratories. For practical purposes CNL maintains sharing of information with both regional municipalities of Renfrew and Pontiac Counties, and as noted previously CNL expands communication activities as necessary.

Appendix B MAP OF WL's PRIMARY AUDIENCE

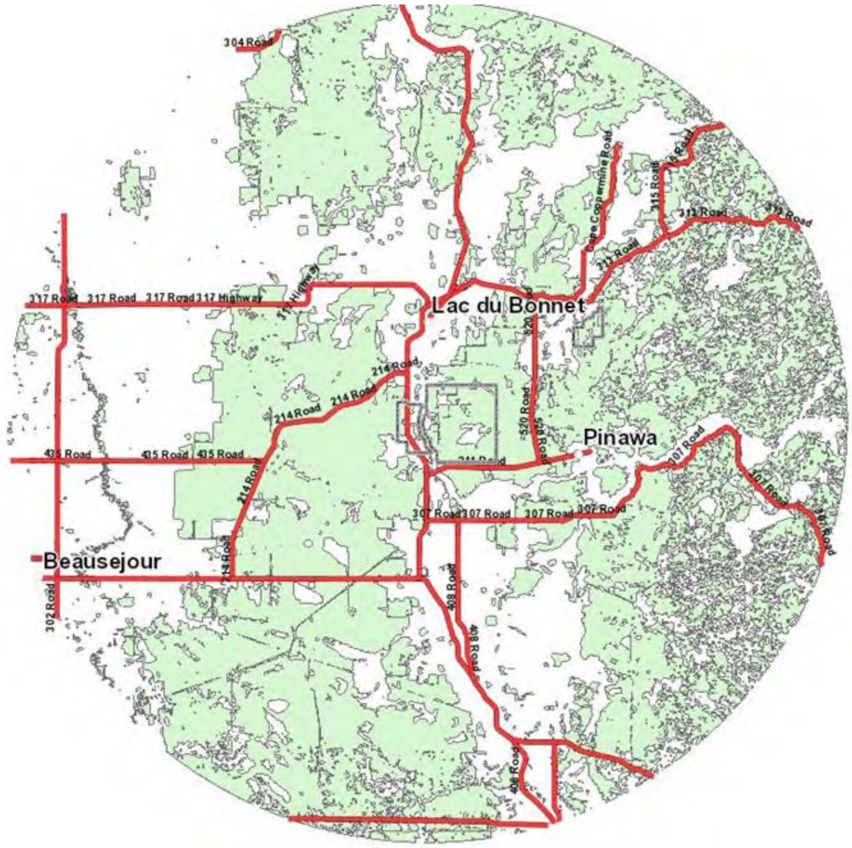

Figure 2: Map of WL's Primary Audience

WL's primary audience is located within a 50-kilometre radius of the Whiteshell Laboratories. For practical purposes CNL maintains sharing of information with regional municipalities and as noted previously CNL expands communication activities as necessary.

Appendix C MAP OF DOUGLAS POINT PRIMARY AUDIENCE

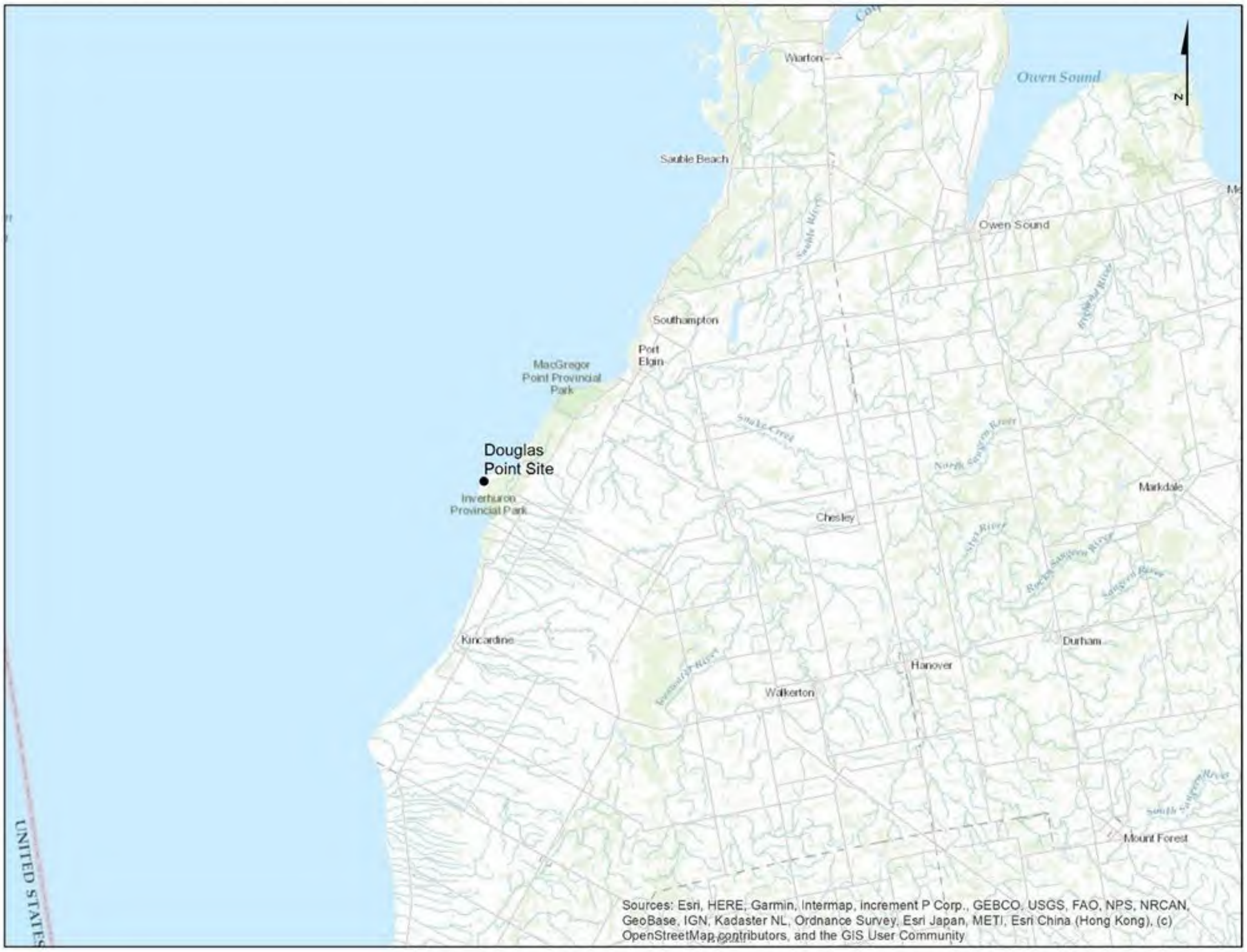

Figure 3: Map of Douglas Point Primary Audience

Douglas Point's primary audience is reflective of Bruce Power's target audience. For practical purposes CNL maintains sharing of information with regional municipalities and as noted previously CNL expands communication activities as necessary.

Appendix D MAP OF G-1'S PRIMARY AUDIENCE

Figure 4: Map of G-1's Primary Audience

G-1's primary audience is reflective of Hydro Quebec's target audience, which is made up of neighboring communities of the facilities in the regions of Centre-du-Québec and Mauricie. For practical purposes CNL maintains sharing of information with regional municipalities and as noted previously CNL expands communication activities as necessary.

Appendix E LIST OF EXTERNAL ORGANIZATIONS WHO ARE MEMBERS ON THE ENVIRONMENTAL STEWARDSHIP COUNCIL AS OF 2023 OCTOBER

- Facilitator – Innovation Works
- Member – Canadian Nuclear Laboratories
- Member – City of Pembroke
- Member – Concerned Citizens of Renfrew County
- Member – Deep River Horticultural Society
- Member – Four Seasons Conservancy
- Member – Garrison Petawawa
- Member – Métis Nation of Ontario
- Member – Municipalitié régionale de Comté de Pontiac (MRC)
- Member – Old Fort William Cottagers' Association
- Member – Ottawa River Keeper
- Member – Pembroke and Area Field Naturalists
- Member – Petawawa Research Forest
- Member – Renfrew County Council
- Member – Town of Deep River
- Member – Town of Laurentian Hills
- Member – Town of Petawawa
- Member – City of Ottawa
- Observer – Algonquins of Pikwakanagan (Note: Expected to move to Member status in 2024.)
- Observer – Atomic Energy of Canada Limited (AECL)
- Observer – Canadian Nuclear Safety Commission (CNCS)

Appendix F LIST OF EXTERNAL ORGANIZATIONS WHO ARE MEMBERS ON THE PUBLIC LIAISON COMMITTEE AS OF 2020 AUGUST

- Local Government District of Pinawa
- Rural Municipality of Lac du Bonnet
- Town of Lac du Bonnet
- Town of Beausejour
- Rural Municipality of Whitemouth
- Manitoba Sustainable Development
- Rural Municipality of Brokenhead
- Rural Municipality of Alexander
- Town of Powerview – Pinefalls
- Manitoba Department of Sustainable Development
- MLA Lac du Bonnet (Observer)
- MP Selkirk (Observer)
- Sagkeeng First Nation (Observer)
- MP Provencher (Observer)
- Canadian Nuclear Safety Commission (Observer)

[7] Canadian Nuclear Laboratories, Storage with Surveillance Plan for Whiteshell Laboratories Building 100 – Whiteshell Reactor 1, WLD-508330-SWS-000024, Revision 2, 2023 November

Canadian Nuclear Laboratories | Laboratoires Nucléaires Canadiens

Storage with Surveillance Plan for Whiteshell Laboratories Building 100 – Whiteshell Reactor 1 REV 2

WLD-508330-SWS-000024

Approved by	Title	Date
Jason Martino	Section Head, WR1/WMA Ops	2023/07/20
Bobby Gibson	CWK - Senior Manager, D&D	2023/07/20

Effective Date: 2023/11/15
Expiry Date: 2028/11/15

Refer to ATOM for current version. Printed copies should not be considered current without first consulting ATOM.

This page is for Content Controls that apply to this document. If no Content Controls apply, none will be listed.

Revision History

Rev. No.	Date	Details of Rev.	Prepared By	Reviewed By	Approved By
Revision History for WLD-508330-SWS-000024					
2	2023/07/20	Issued as "Approved for Use" Cancel and supersedes RC-1291. Major comments: Updated Table 7 Radiation Zone 3 frequency to "Annually".	S. Scott	R. Swartz	B. Gibson J. Martino
1	2023/05/23	Incorporated SRC comments.	B. Morrison	R. Swartz	B. Gibson J. Martino
0	2022/11/24	Issued as "Approved for Use"	B. Morrison	R. Swartz	B. Gibson J. Martino
D1	2022/09/12	Issued for "Review and Comment" Major changes include updating the document content to align with changes and new requirements of REGDOC 2.11.2 and CSA N294-19. Content was updated to the new template format. Storage with Surveillance plan update was completed to align with REGDOC-2.11.2 and CSA N294-19	B. Morrison	J. Gordon N. Peitsch R. Swartz B. Barber J. O'Connor T. Reimer G. Scharer T. Roche J. Martino C. Kitson	
Revision History for RC-1291					
1	1996/03/30	Issued as "Approved for Use" The original documents were signed off in 1994 through the SRC. This revision incorporates all comments and changes resulting from AECB review of the project.	R.A. Helbrecht	R.J. Lambert W. Dobush	P. Brazier

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1. Introduction

The Whiteshell Laboratories (WL) site at Pinawa, Manitoba was established in the 1960s by Atomic Energy of Canada Limited (AECL) to conduct nuclear research. Whiteshell Reactor 1 (WR-1) was placed in service in 1965 to demonstrate the organic cooled reactor concept using heavy water as the moderator [1]. The reactor design also provided a facility for engineering tests and scientific studies on alternative fuels, fuel channels, and reactor coolants. WR-1 operated from 1965 to 1985 accumulating 120,000 operating hours during its lifetime. The reactor was permanently shut down in 1985. A detailed description of the Whiteshell Reactor 1 (WR-1) interim end-state at the end of Phase 1 decommissioning is given in reference [2].

1.1 Purpose

This Storage with Surveillance (SWS) Plan details the surveillance, inspection, servicing, and maintenance activities required to maintain Building 100 (B100) that houses WR-1 in a safe configuration. The Storage with Surveillance plan update was completed to align with REGDOC-2.11.2 and CSA N294-19

1.2 Scope

This SWS Plan is specific to Whiteshell Laboratories (WL) B100 and WR-1, and does not apply to other buildings on the WL site or other Canadian Nuclear Laboratories (CNL) sites.

This SWS Plan has emphasized the inspection of the WR-1 Facility Restricted Access Area further explained in Section 8.3. However, the SWS plan depends on common ventilation, effluent monitoring and electrical systems which remain in operation to support activities in B100. Such systems are operated in accordance with currently approved operating procedures authorized by the Facility Manager.

1.3 Facility Description

Whiteshell Laboratories (WL) covers an area of approximately 4,375 ha near the towns of Lac du Bonnet, Seven Sisters Falls, and Pinawa (see Figure 1 below). The site is approximately 100 km northeast of the city of Winnipeg and is accessed via Provincial Highway 11 and Provincial Road 211. The main campus is located adjacent to the east bank of the Winnipeg River. The WL Decommissioning Project Comprehensive Study Report (CSR) [1] and the WR-1 Environmental Impact Statement (EIS) [3] describe the area in greater detail. Table 1 below contains a summary of systems within B100 and their status.

Table 1: WL B100 Systems, Structures and Components

System	Status	Is it Safety related?	Comments
Active Exhaust Ventilation	Operational	Yes	Alarms and administrative procedures are in place to limit exposure to personnel if the exhaust system is unavailable.
Active Liquid Waste	Operational	Yes	Off normal conditions are mitigated by the presence of liquid high level alarms, leak detectors in the spill trays surrounding the tanks, and administrative controls. Routine sampling and operating procedures reduce the potential for accidental discharge.
Building Heating, Cooling and Domestic Steam	Operational	No	Loss of heat over a long period in winter could impact other systems such as active liquid waste.
Building Plumbing (Domestic Hot & Cold Water, Sewer, Storm Drain, Inactive Drain)	Operational	No	No impact to safety other than water supply to sprinklers
Building Structures	Operational	No	Failure of this structure may compromise radiological zoning and control.
Class 3 Electrical Power	Operational	Yes	Provides power to systems important to safety within B100.
Class 4 Electrical Power	Operational	No	Loss of Class 4 power will only impact those systems identified as not being systems important to safety, which are backed up by Class 3 power
Cranes, Hoist, Slings and Tackle	Operational	No	B100 Operators and other users are required to have taken prescribed training prior to use of this equipment.

System	Status	Is it Safety related?	Comments
Emergency Lighting	Operational	No	In the event of Class 3 & 4 power failure, backup battery operated lighting is provided
Fire Protection	Operational	Yes	Testing and inspection of the system ensures that the safety function will be met if required. The fire alarm panel transmits alarms immediately to B100 Control Room and Site Monitoring Room (SMR) in B401.
Fire Water System	Operational	Yes	The Fire Water System is controlled and monitored from the Powerhouse. There are fire water flow alarms in the building
Personnel Hand and Foot Monitors	Operational	No	Monitoring on exit of Controlled Area 2 (CA2) areas. Failure to monitor may result in spread of radioactive contamination

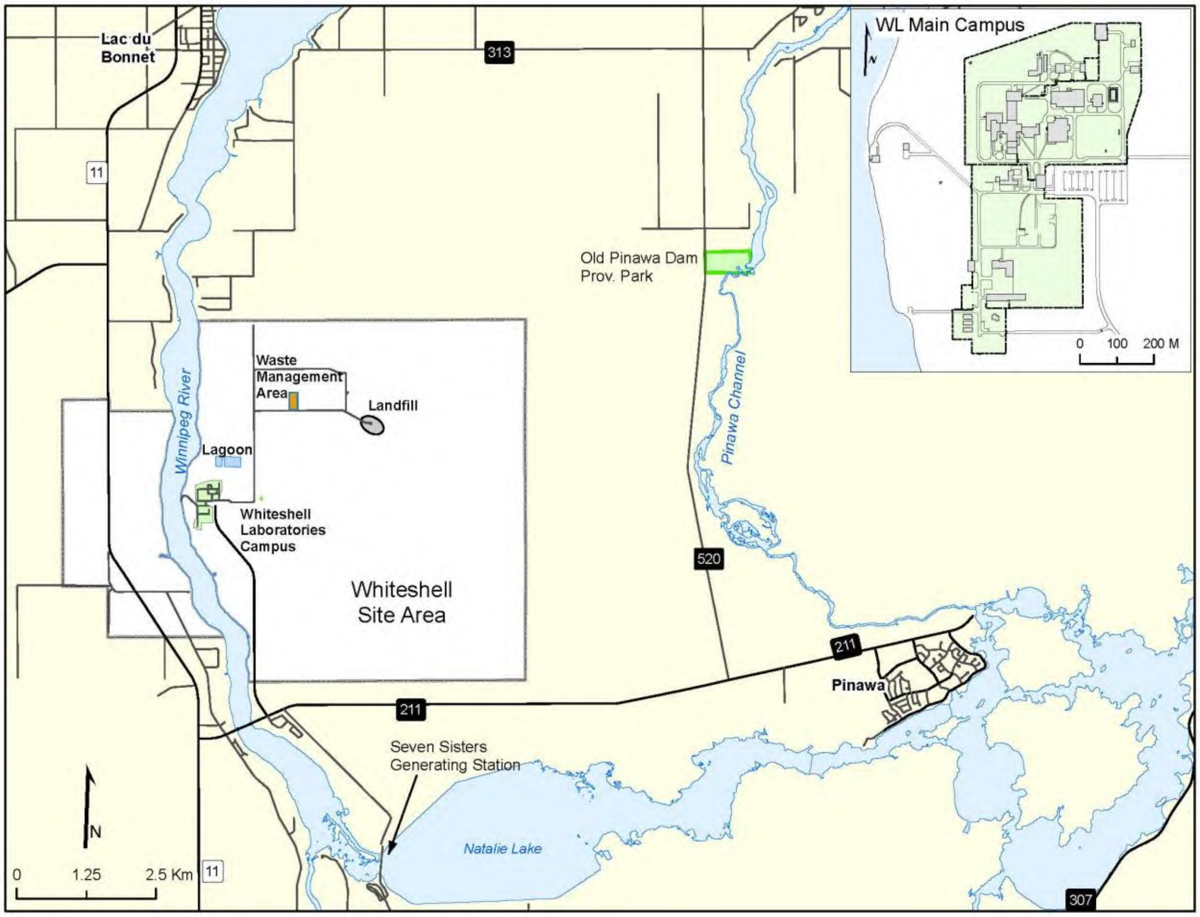

Figure 1: Location of Whiteshell Laboratories

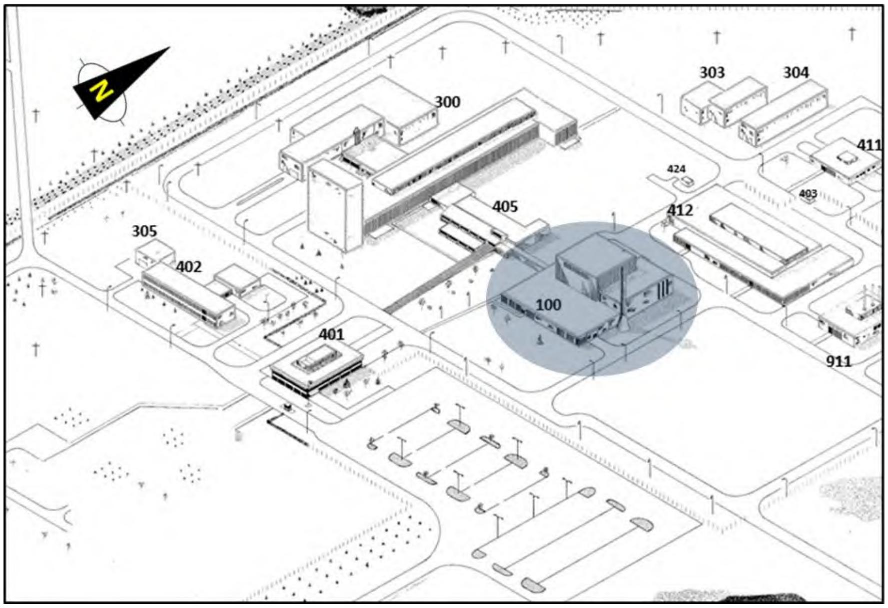

Figure 2: Location of Building 100

1.3.1 Building 100

B100 is divided into two main sections:

- Reactor Area (WR-1 Building)
- Auxiliary Area

The Reactor Area houses WR-1, an organic cooled, heavy water moderated test reactor. The Auxiliary Area can be further sub-divided into the East Annex (East Extension) and Service Wing (see Figure 3 below). A 2 MW SLOWPOKE Demonstration Reactor (SDR) was housed in the north portion of the Auxiliary Area [4] but it has been largely decommissioned with only the reactor pool liner, cover panels, support frame structure, and concrete curb remaining.

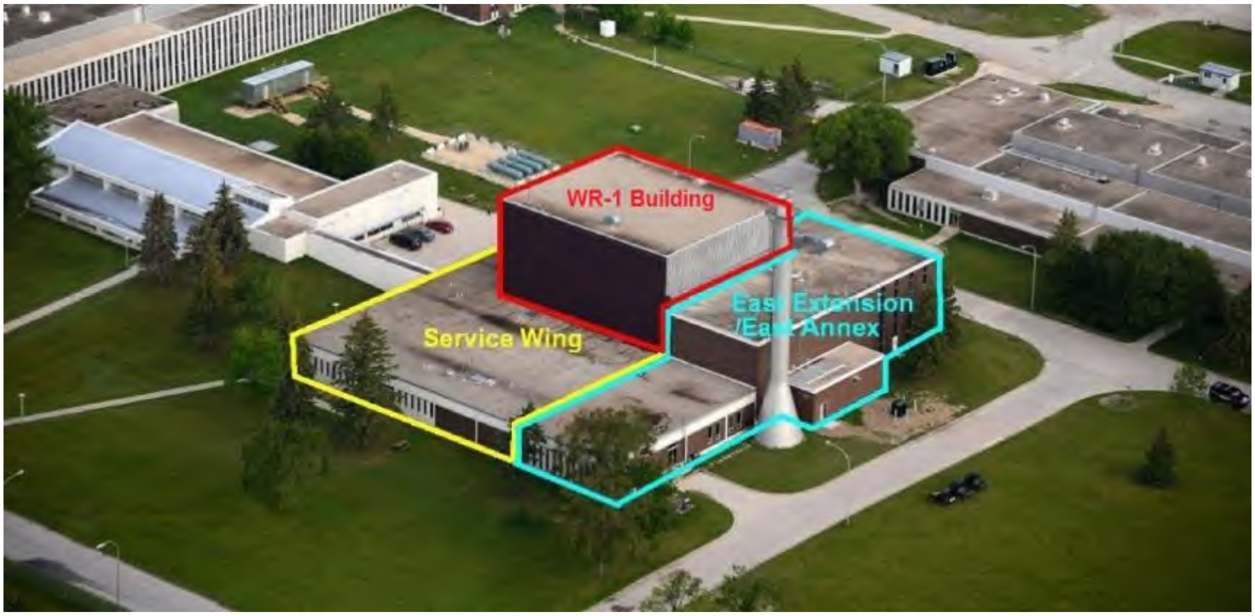

Figure 3: Areas of Building 100

The Reactor Area consists of seven floors: two above grade (600 and 700 Levels) and five below grade (100-500 Levels). The East Extension consists of four floors: two above grade (600 and 700 Levels) and two below grade (400 and 500 Levels). The Service Wing consists of three floors: one above grade (600 Level) and two below grade (400 and 500 Levels). Figure 4 below provides a cutaway model of the Reactor Area.

Figure 4: Cutaway Model of the Reactor Area (Viewed from the East)

1.3.2 Ventilation Stack

The purpose of the Stack is to discharge possible airborne contamination at a sufficient height and velocity in order to minimize atmospheric contamination at ground level [5]. Originally, the Stack was combined with an elevated emergency Standby Water (SW) supply to satisfy the minimum cooling water requirements of the reactor facility in the event of loss of the normal Process Water (PW) supply; however, the emergency SW supply tank was dismantled as part of Phase 1 decommissioning [6], [2] (see Section 1.5.1 for more information on Phase 1 decommissioning). Removing the emergency SW tank reduced the height of the structure from 45.7 m to 30.4 m [7], [2]. The Stack is located on the east side of B100 and is a ~2.0 m diameter, vertical, cylindrical, steel Stack [5]. Figure 5 below highlights the location of the Stack. The Stack remains operational.

Figure 5: Location of the Ventilation Stack (Viewed from the Southeast)

1.3.3 Rooms and Systems

The WR-1 Facility Decommissioning Hazards and Risks Overview document [7] provides a description of B100 rooms and the systems associated with these rooms. Figure 6 below illustrates the general location of select systems and components within B100 and subsections below describe the main areas or systems relevant to SWS. For more detail on the systems, see the WR-1 Reactor Handbook [8] and the WR-1 Design Manual [5].

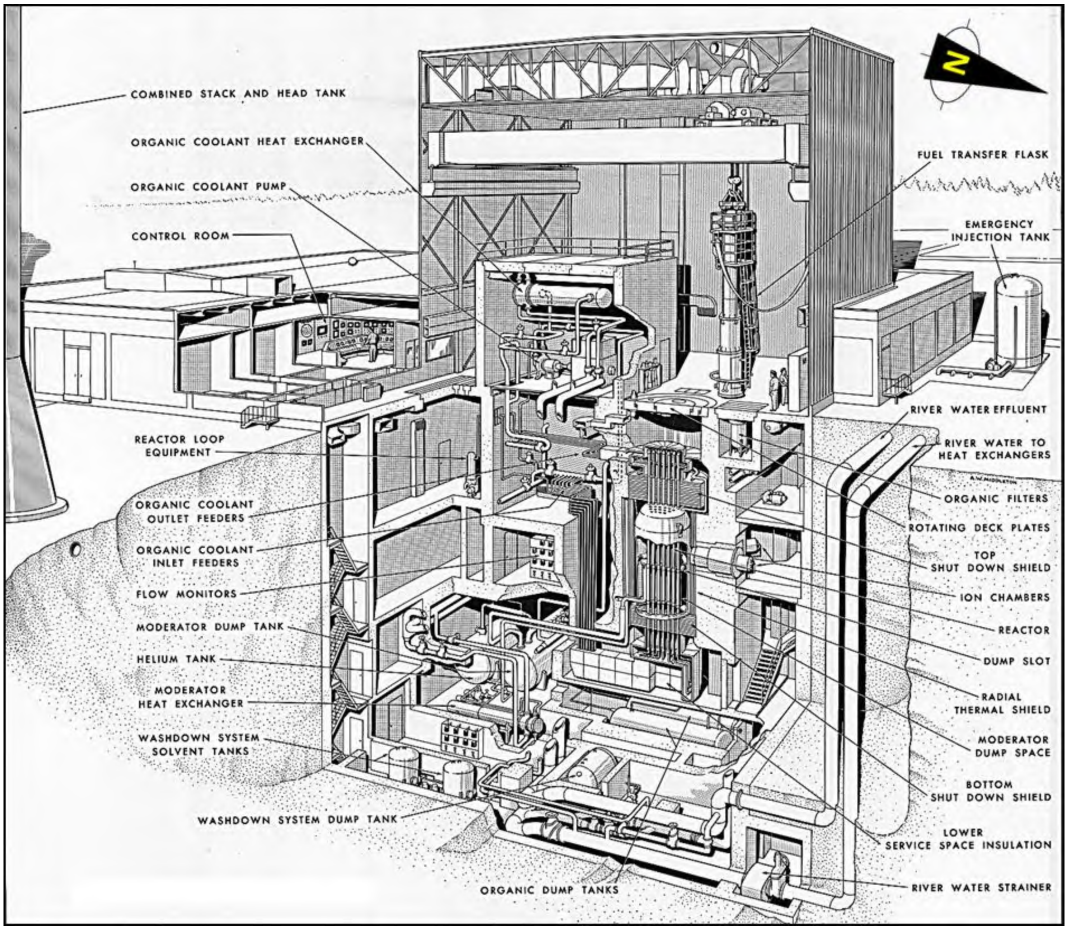

Figure 6: Diagram of Systems and Components within Building 100

1.3.3.1 Whiteshell Reactor 1

WR-1 was a 60 MW thermal (th) CANada Deuterium Uranium (CANDU), organic cooled, heavy water moderated, vertical pressure tube (fuel channel), thermal neutron reactor. It was designed and built by Canadian General Electric and on 1965 November 1 criticality was first attained. WR-1 was built to test the feasibility of using an organic liquid (oil) as the coolant media for the Primary Heat Transport (PHT) System. This oil allowed the PHT System to operate at lower pressures and correspondingly higher temperatures than a similarly constructed light water heat transport system. During its operation, the research reactor provided an engineering test bed for coolant materials, fuel channel materials and designs, fuel materials and designs, and fuel cladding materials and designs. WR-1 has been permanently shut down and its fuel has been removed.

1.3.3.2 Primary Heat Transport System

The PHT System, as highlighted in Figure 7 below, was designed to remove the heat produced in the reactor core. The system was divided into three circuits (A, B, and C circuits) of approximately 20 MW(th) heat removal capacity each. The heat removed was dissipated into the Winnipeg River through three conventional tube-and-shell heat exchangers using organic primary coolant and river water for the secondary coolant. The PHT System was primarily constructed from carbon steel. Each circuit was independent of the others and had its own coolant, circulation, and Degassing and Particulate Removal Systems. The A and B circuits have been permanently shut down and are in Rooms 506 and 602. The C circuit was dismantled as part of Phase 1 decommissioning [6], [2] and was in Rooms 528 and 647 of the East Annex. Figure 8 below provides a flow diagram of the PHT System.

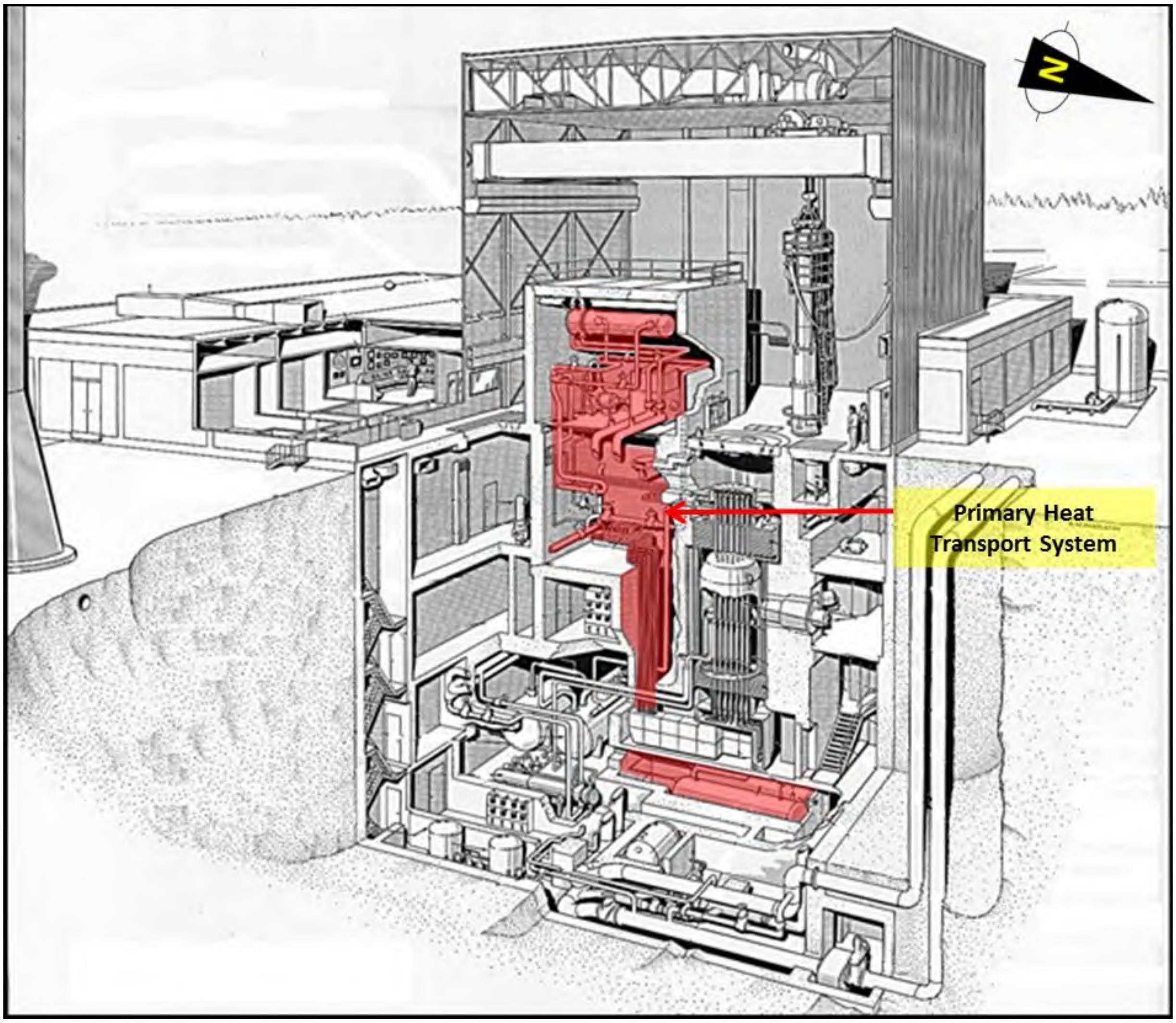

Figure 7: Location of the Primary Heat Transport System

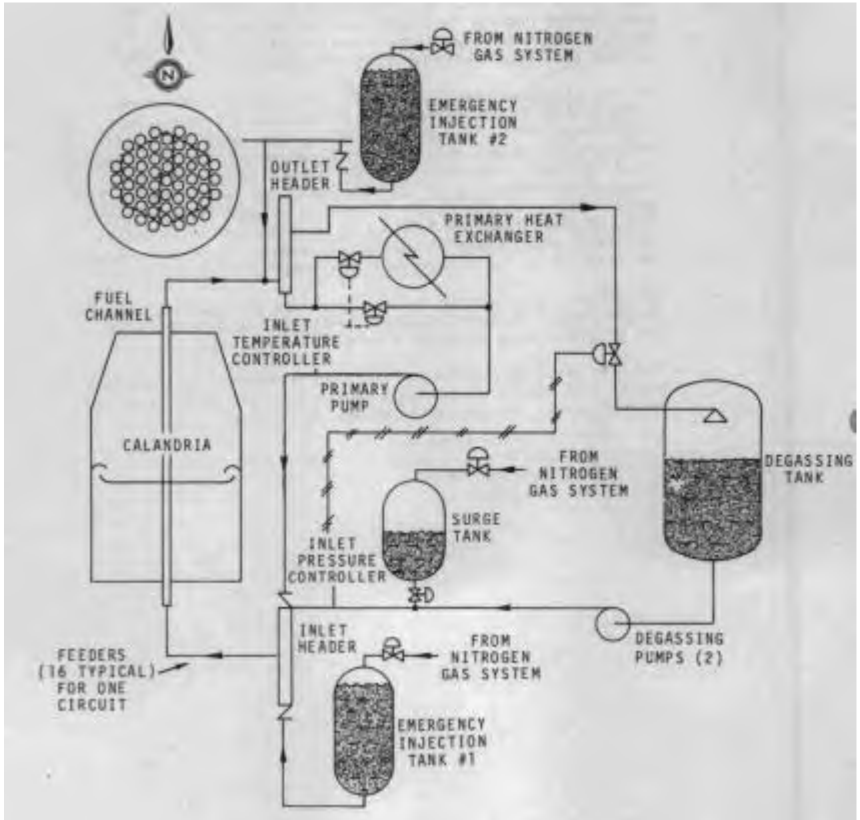

Figure 8: Flow Diagram of the Primary Heat Transport System

The coolant used in WR-1 was a complex mixture of organic compounds varying in molecular mass from 2 to over 1000amu. The feed coolant, Monsanto HB-40, renamed OS-84, was a mixture of terphenyls treated catalytically with hydrogen to produce 40% saturated hydrocarbons.

1.3.3.3 Auxiliary Organic and Gas Systems

The Auxiliary Organic and Gas Systems are those systems that were necessary for the operation and/or support of the PHT System and include:

- Degassing and Particulate Removal Systems
- Purification System
- Relief Exhaust System
- Organic Supply System
- Nitrogen Supply System

With the exception of portions of the Degassing and Particulate Removal Systems, these systems were largely dismantled as part of Phase 1 decommissioning [6], [2].

A Degassing System was provided for each of the PHT circuits. Each system consisted of two pressurizing pumps, a degassing tank, an off-gas condensing circuit, a volatile recycle circuit, and a particulate removal circuit. The A and B circuit Degassing Systems have been permanently shut down. The C circuit Degassing System has been dismantled.

1.3.3.4 Heavy Water and Helium Systems

Heavy water was used in WR-1 as a moderator/reflector and as a coolant for removal of the gamma and thermal heat picked up by the Calandria vessel and tubes. The moderator was supported in the core space by differential helium pressure between the core and dump spaces, provided by helium blowers in the Helium Gas System (HGS). Figure 9 below provides a flow diagram of the Heavy Water and Helium Systems. The main components of the Heavy Water System (HWS) were a dump tank, a helium accumulator tank, three circulation pumps, a heat exchanger, the Calandria vessel, piping, and instrumentation. All components, other than the Calandria, were located below the Calandria elevation in Room 107. The HGS consisted of two helium pumps, two helium control valves, six reactor dump valves, a helium accumulator tank, five heavy water vapour condensers, a recombination unit, oxygen and helium addition stations, a sampling station, system piping, and instrumentation. All components of the HGS were in Room 107 except the addition and sampling stations, which were in Room 606. As part of Phase 1 decommissioning [6], [2], the Heavy Water and Helium Systems were permanently shut down and the HWS was drained.

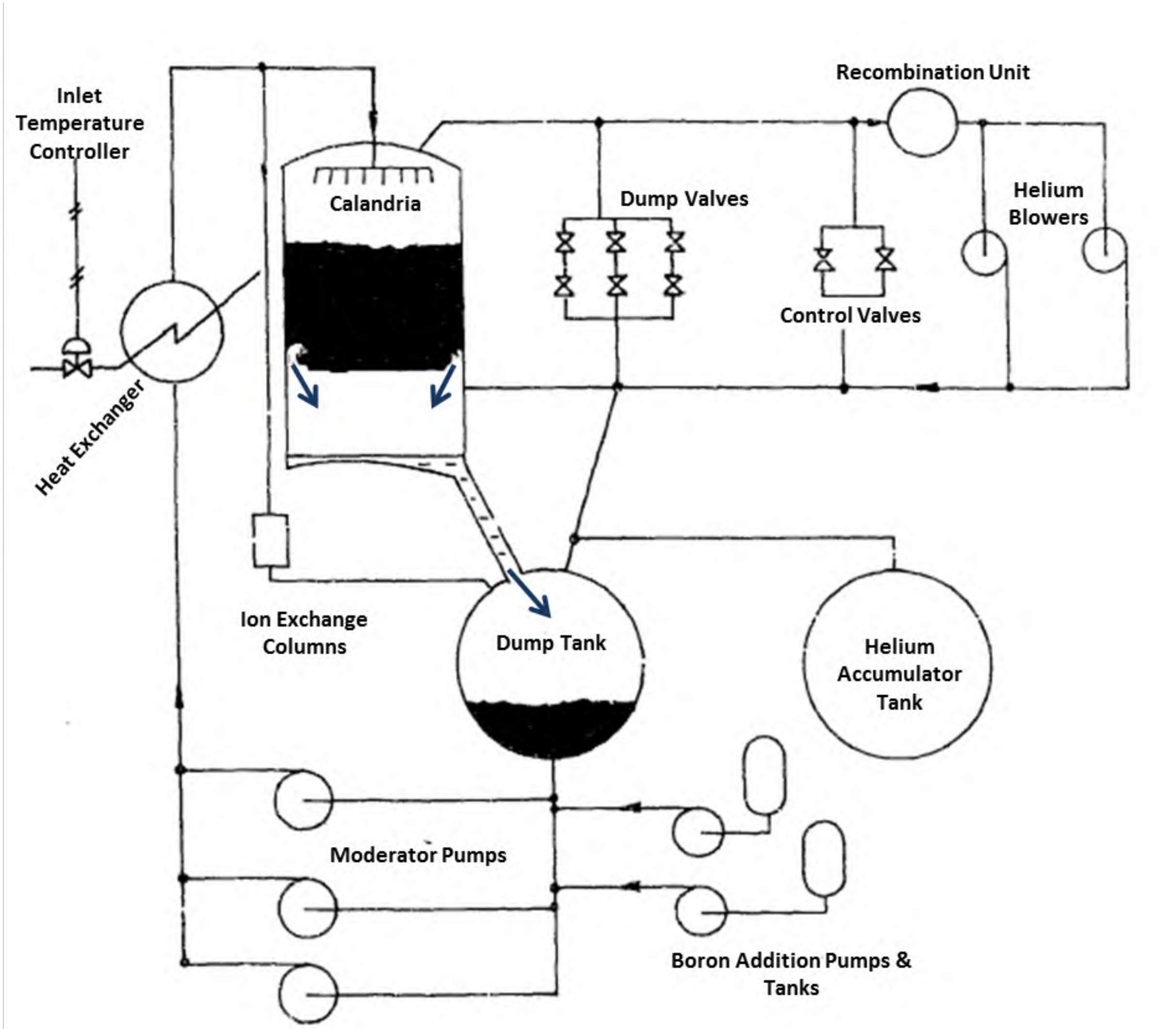

Figure 9: Flow Diagram of the Heavy Water and Helium Systems

1.3.3.5 Water Supply and Drainage Systems

A pumphouse facility, approximately 427 m west of WR-1 on the riverbank, provided the pumping requirements for the PW and SW Systems, the Firewater (FW) System, and the Domestic Water (DMW) System. PW and SW was returned to the Winnipeg River through the Process Drain (PD) System and the outfall station located to the northwest of WR-1.

1.3.3.5.1 Process Water and Drainage System

The PW System enters B100 in the strainer room (Room 113) and is divided into the SW and PW Systems shortly after. The return water is collected by the PD System, which leaves B100 from the service pipe trench room (Room 110). Figure 10 below provides a simplified flow diagram of the PW and SW Systems. The PW System remains operational[1]. The SW System was dismantled as part of Phase 1 decommissioning [6], [2]. The SW tank was removed from the stack and is no longer in service. SW piping is still located throughout B100; SW piping has been removed from the east extension primary and degas systems.

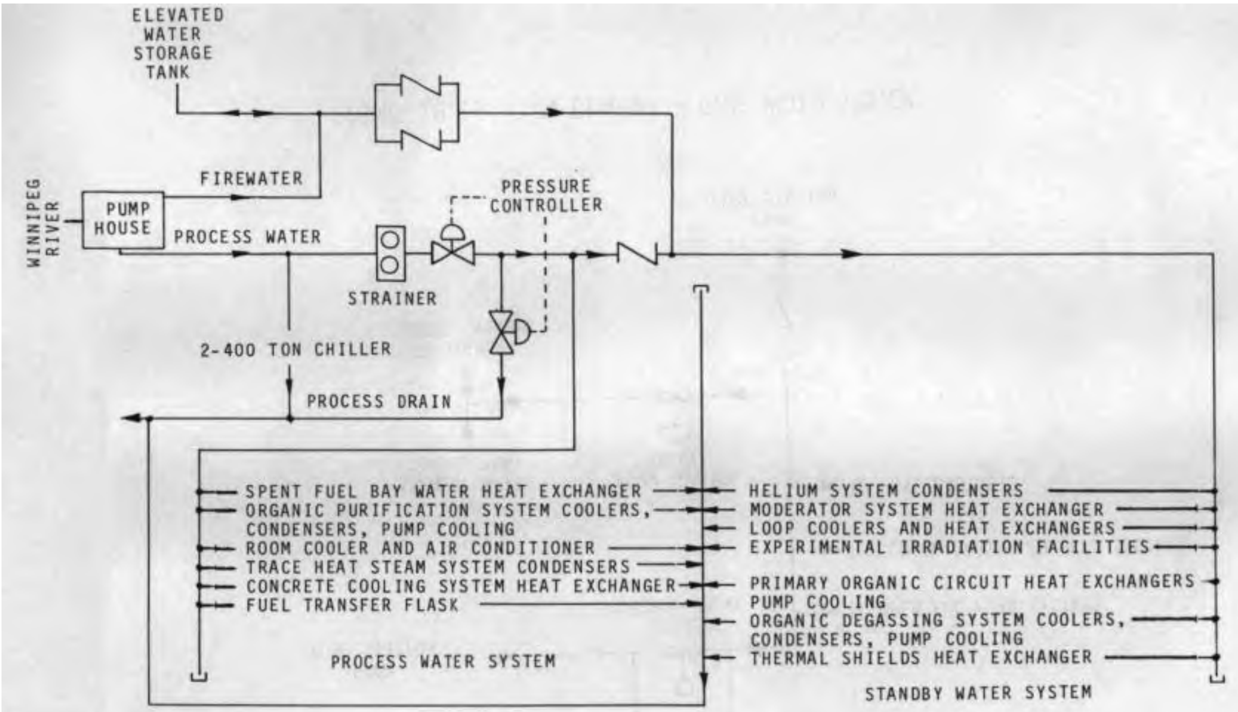

Figure 10: Flow Diagram of the Process and Standby Water Systems

1.3.3.5.2 Firewater System

The FW System is supplied from the pumphouse by two operational FW pumps (#5 electric and #6 diesel driven), which discharge into a common header. Two ~30 cm buried carbon steel FW mains distribute the water throughout the site. FW is supplied to B100 from the north FW main by a ~25 cm line, which enters B100 at the northwest end of the crawlspace (Room 414). An alternative backup FW supply is provided from the south FW main by a ~20 cm line that enters the B100 crawlspace (Room 415) in the southwest corner. Figure 11 below provides a flow diagram of the FW System. The FW System remains operational.

1 In 2003, it was recognized that a major component failure in the PW System could result in the release of a very large quantity of potentially contaminated water. It was decided that the PW System to the reactor should be bypassed [9]. PW was diverted and throttled down to provide just enough PW for the Building Cooling System and to maintain a minimum PD flow rate of 2,280 litres per minute at the outfall station.

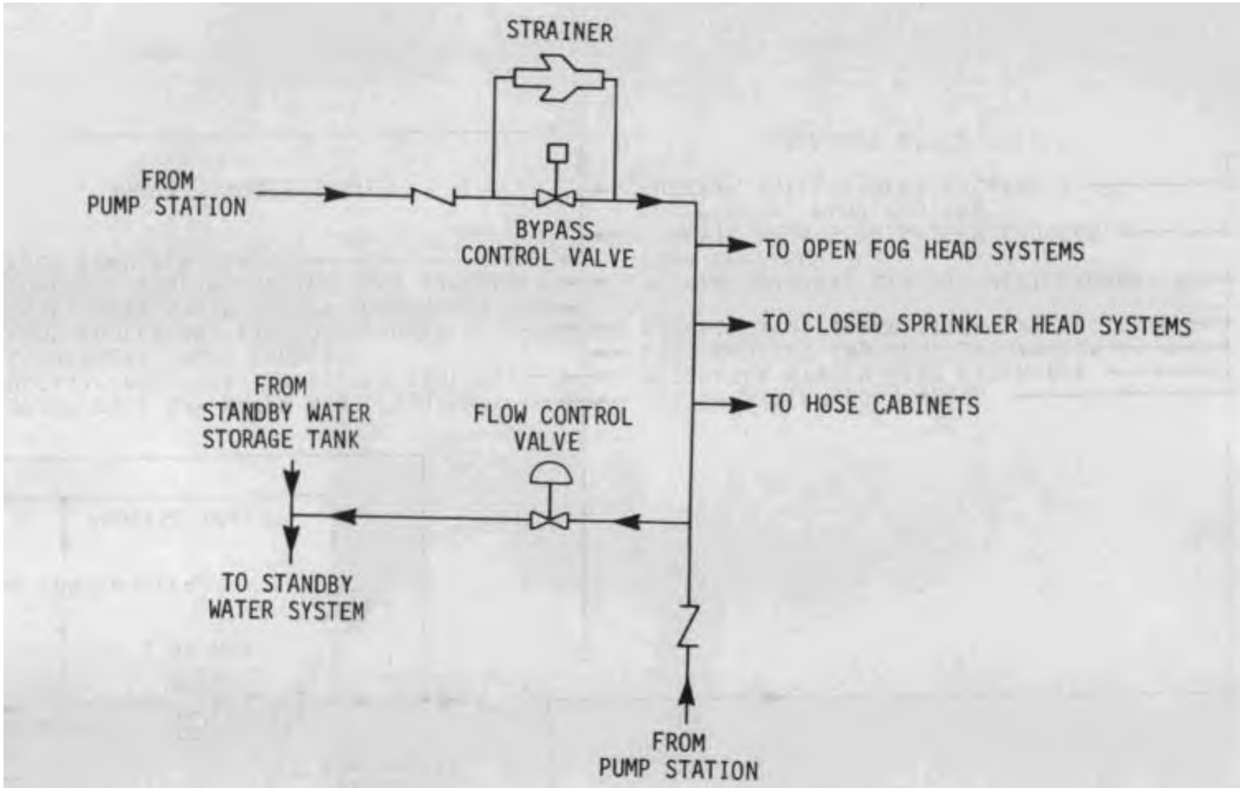

Figure 11: Flow Diagram of the Firewater System

1.3.3.5.3 Domestic Water System

The DMW System supplies B100 and the WL site with DMW for washrooms and showers. Two vertical turbine low head lift pumps supply raw water from the wet well in the pumphouse to a water treatment plant where it is filtered and chlorinated. Small distribution pumps distribute the DMW to the various buildings on site. The DMW System remains operational.

1.3.3.6 Cranes, Monorails and Hoists

WR-1 has several cranes remaining in operation for movement of materials during the Storage With Surveillance or kept in operational condition for future decommissioning work. The operational cranes are provided in Table 2.

Figure 12 below provides a photo of the 50 Ton Reactor Hall Crane. The 50 Ton Reactor Hall Crane remains operational. Associated with it on the same bridge is a five ton auxiliary crane that is also functional.

Table 2: WL B100 Operational Cranes

Crane Number	Location	Motive Method	Size
CR1	601	Motorized	50ton

Crane Number	Location	Motive Method	Size
CR2	646	Motorized	5 ton
CR3	603	Motorized	1 ton
CR4	607	Motorized	2 ton
CR5	113	Manual	1 ton
CR8	601	Motorized	5 ton
C11	690	Motorized	12 ton

Figure 12: Reactor Hall Crane

1.3.3.7 Active Drainage System

The Active Drainage (AD) System collects liquid from the various areas of B100 and the groundwater from around the building base. Figure 13 provides a flow diagram of the system, which remains operational. The system includes five sumps:

- Active Drainage Sump A – General Drainage
- Active Drainage Sump B – Heavy Water Drainage (out of service)
- Organic Drainage Sump A – Organic Coolant Leakage
- B100 Extension Sump – General Drainage B100 Extension
- Sub-Surface Drainage Sump – Groundwater around B100 Basement

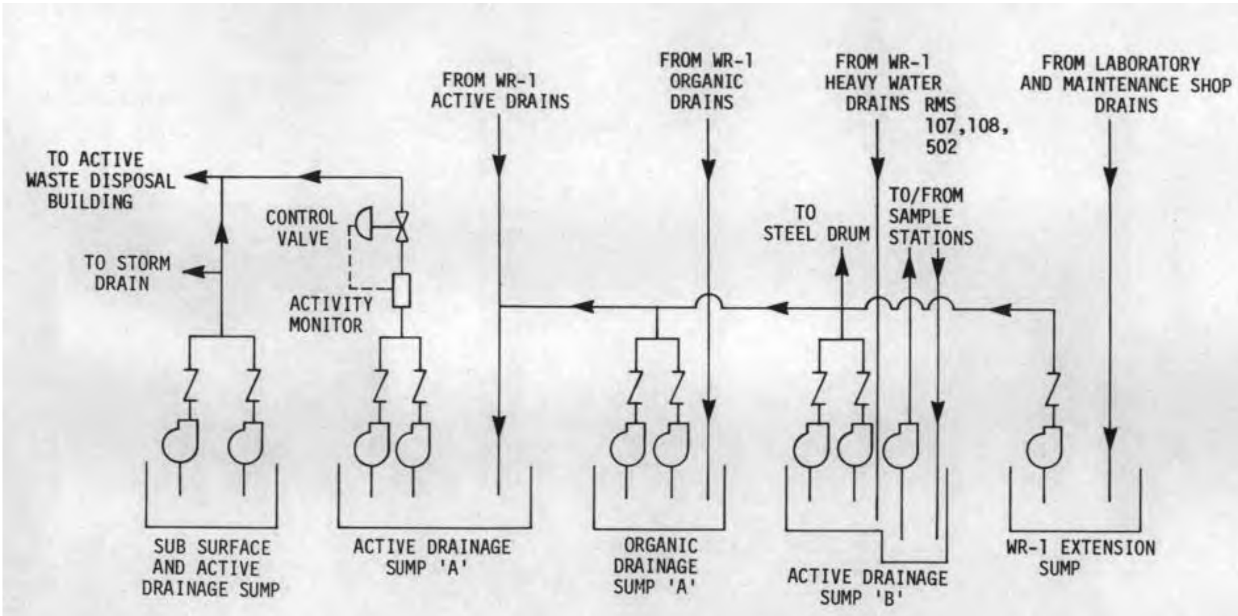

Figure 13: Flow Diagram of the Active Drainage System

The 202E370 drawings [10], [11] provide a more detailed flow diagram of the AD System with specific room numbers. Most of the AD piping is all welded, seamless, schedule 80, carbon steel pipe embedded in the walls and floors of B100. The floor traps are equipped with back-water valves, which provide a ventilation barrier to prevent the spread of airborne contamination throughout the building.

1.3.3.7.1 Active Drainage Sump A – General

The purpose of AD Sump A (located in Room 101) was to collect active and potentially active liquid wastes from the reactor area of B100, other than from the organic and heavy water equipment and piping rooms, for disposal at the ALWTC (B200). However, in 2017, a LLLW Treatment System was constructed in Room 690 and the AD System was reconfigured so that AD Sump A pumped to the LLLW Treatment System [17] (see Section 1.3.3.13 for more information on the LLLW Treatment System).

1.3.3.7.2 Active Drainage Sump B – Heavy Water

The purpose of AD Sump B (located in Room 105) was to collect effluent from the floor drains of heavy water rooms, providing a means for sampling and drumming of heavy water or discharging as active liquid waste. The floor drains in Room 107 (moderator room), Room 108 (boron addition room), and Room 502 (moderator demineralizer cavity) drained into a concrete tank, located in the floor of Room 107, holding of capacity 1,680 L. The effluent from AD Sump B could be pumped either to a drumming station in the reactor hall (Room 601) or to AD Sump A. This system has been decommissioned.

1.3.3.7.3 Organic Drainage Sump A

The purpose of the Organic Drainage Sump A (located in Room 102) was to collect and dispose of drainage liquids from areas in B100 where the effluent may have contained organic coolant. The upper and lower access rooms (Rooms 501 and 201, respectively) and the primary pump (Room 602) and header (Room 506) rooms are drained to Organic Drainage Sump A. The effluent from Organic Drainage Sump A could be pumped into AD Sump A, to drumming station C in Room 638, or formerly direct to B200, which has now been decommissioned.

1.3.3.7.4 Building 100 Extension Sump

The purpose of the B100 Extension Sump (located in Room 415) was to collect active or potentially active effluent from those areas in the B100 east extension other than the C circuit and WR-1L6 rooms. The sump is a 3,630 L concrete tank located below ground level in Room 415 (crawlspace). A centrifugal pump, automatically controlled by a sump level float switch, empties the sump contents into AD Sump A.

1.3.3.7.5 Sub-Surface Drainage Sump

The purpose of the Sub-Surface Drainage Sump (located in Room 112) was to collect effluent from the weeping tiles located under and around the periphery of the WR-1 Building and lower the water table in the vicinity of the building to reduce the hydrostatic pressure on the basement walls and floor.

The sump is a 15,200 L concrete structure located outside of the north wall of the WR-1 Building at an elevation of ~249 m above sea level. A network of ~15 cm diameter No-Co-Rode perforated pipe, embedded in free draining crushed stone covered with 10 oz burlap, drains the groundwater from beneath the 100 Level ground slab and from around the periphery of the basement walls into the sump. Collected effluent is pumped to the storm drainage system.

1.3.3.8 Ventilation System

The Ventilation System provides forced air circulation throughout B100 to provide:

- Contamination control.
- Environment control for personnel and equipment in conjunction with the building Heating and Cooling Systems.

The building is zoned according to the degree of radioactive contamination present. The Ventilation System was designed to ensure the air flows are always towards the zones having higher contamination levels to prevent the spread of contamination.

The Ventilation System is sub-divided into four systems:

- The Building Ventilation System
- The Cooling Ventilation System
- The Control and Relay Room Ventilation System

- The Building Extension Ventilation System

Each system has a fresh air supply, fans, filters, heating and cooling coils, and an exhaust system (see Figure 14 and Figure 15 below); however, select intakes, fans, filters, heating and cooling coils, and compressors have been taken out of service or permanently shut down. All systems normally exhaust to the Stack.

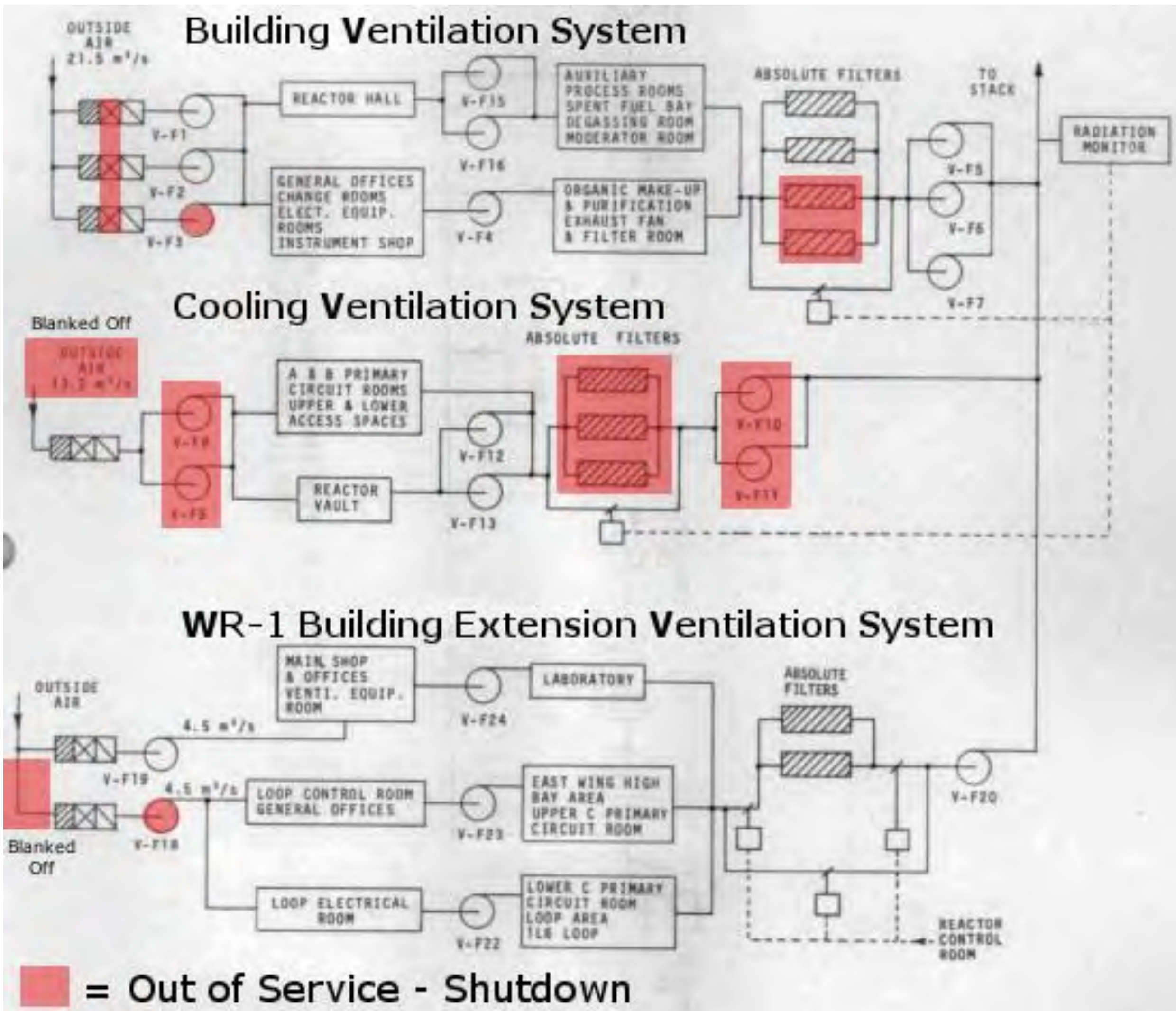

Figure 14: Flow Diagram of the Ventilation System

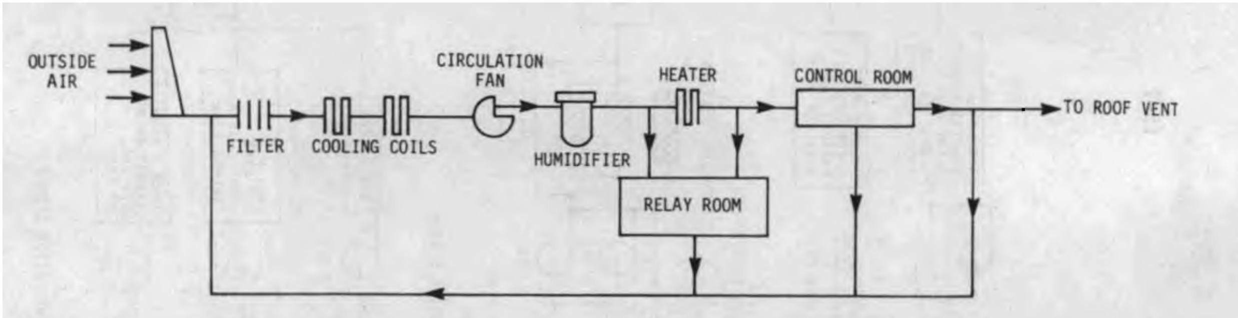

Figure 15: Flow Diagram of the Control and Relay Room Ventilation System

1.3.3.8.1 Building Ventilation System

The purpose of the Building Ventilation System is to provide forced air circulation throughout the WR-1 Building for proper working environment control for equipment and personnel, and to prevent the spread of airborne, radioactive contamination throughout the various rooms in the building. The Building Ventilation System provides air changes for the Reactor Building, excluding the reactor vault and the header areas.

The ventilation flows have been reduced due to the reactor being shut down and requiring less air flow. Some fans have been shut down as they are no longer required while still maintaining redundancy on the critical fans such as the exhausts fans V-F5 and V-F6. These changes do not alter the above listed purpose of the WR-1 building ventilation system. The building ventilation system is maintained through a preventative maintenance program.

1.3.3.8.2 Cooling Ventilation System

The purpose of the Cooling Ventilation System was to provide cooling ventilation for the reactor vault and the A and B circuit PHT System pump and header room areas. The Cooling Ventilation System circulated cooling air through the reactor vault and primary pump and header rooms to remove heat losses from the PHT System piping and equipment, and from the concrete and thermal shielding in the vault area. This system has been permanently shut down with the exception of the reactor vault fans (VF-12/13) located in Room 407.

1.3.3.8.3 Control and Relay Room Ventilation System

The purpose of the Control and Relay Room Ventilation System was to provide air conditioning for the instrumentation environment and for personnel comfort in the control and relay rooms, and the shift office. This system is still fully operational and maintained through a preventative maintenance program.

1.3.3.8.4 Building Extension Ventilation System

The purpose of the Building Extension Ventilation System was to provide forced air circulation throughout the B100 extension for proper working environment control and to prevent the spread of radioactive contamination. The Building Extension Ventilation System remains operational and is maintained through a preventative maintenance program. Flows are reduced to provide sufficient air flow for building occupants with Fan VF-18 permanently shutdown. As part of the early phase of decommissioning the C circuit PHT System pump and header room areas were removed and cleaned of contamination, thus reducing ventilation requirements in this area.

1.3.3.9 Heating and Cooling Systems

1.3.3.9.1 Process Heating System

The purpose of the Process Heating System was to:

- Provide heating for various systems in B100; and
- Provide condenser cooling water for the Auxiliary Organic Systems.

Pressurized High Temperature Hot Water (HHW) at approximately 200°C and 2.76 MPa was supplied to B100 from the Powerhouse (B911) through two mains. One main supplied heating for systems in the WR-1 Building and one supplied heating for systems in the building extension. HHW is no longer in use at WL, the Process Heating System was reconfigured in 2010 (see Section 1.3.3.9.2 below).

1.3.3.9.2 Building Heating Systems

The purpose of the Building Heating Systems was to:

- Supply heated glycol solution for heating the supply air to the Building and Building Extension Ventilation Systems;
- Supply heated water for auxiliary heating in the Service Wing and the East Extension by wall radiators and room heater units; and
- Provide heating for the emergency SW supply tank during winter operations.

The Building Heating Systems consisted of several closed loop systems circulating heated ethylene glycol solutions or water through the Ventilation System in-duct heater coils, room heater units, or wall convectors. The systems included:

- The Main Building Heating Water System
- The Main Building Glycol System
- The Building Extension Glycol Systems
- The Building Hot Water Heating System

In 2010, as part of the Site Utilities Reconfiguration, the HHW Heating System was shut down and replaced with electric boilers [12]. The removal of existing equipment was limited to abandoned equipment such as HHW converters and associated piping. A total of nine electric boilers were installed in Rooms 516, 530, and 606 [13], [14]. The Main Building Heating Water, Main Building Glycol, Building Extension Glycol, and Building Hot Water Heating Systems remain operational.

1.3.3.9.3 Building Cooling System

The purpose of the Building Cooling System was to:

- Reduce the air temperature and humidity in the various equipment and operating rooms in B100 during summer operation; and
- Air condition the office areas and some service areas of B100 and the WL library, which was located in B405. B100 provided cooling for B401 and B300 as well.

The Building Cooling System consisted of two refrigeration units, two condenser water pumps, two chilled water circulation pumps, piping, room coolers, and instrumentation. The Building Cooling System was contained within Room 516 with the PW, PD, and Building Cooling System supply and return lines passing through the Room 516 floor into the Room 414/415 crawlspace below to be routed throughout B100 [15], [10].

The new Building Cooling System consists of a single refrigeration unit [15], [16]. The new screw chiller and associated equipment was installed in Room 639 (electrical) and 640 (chiller). The New Building Cooling System, PW, and PD lines were connected to the original lines in the crawlspace and routed through the crawlspace to Room 640 to connect to the new system. The power supplies and some of the new system’s ancillary services were situated in the adjacent service room (Room 639). The new Building Cooling System was taken out of service for the site in spring 2022 in preparation of supplying standalone chiller for each of the affected buildings including B100.

1.3.3.10 Compressed Air Systems

Compressed air is currently supplied to WR-1 from the Powerhouse (B911) through a cathodic protected ~5 cm carbon steel underground main sheathed in a polyethylene protective coating; however, B100 is in the process of being made independent from the rest of the WL site. In the near future, B100 will be equipped with a standalone air compressor. Two air receiver tanks located in Room 509 of B100 provided a total reserve compressed air capacity of approximately 56.6 m^3 for the Instrument Air (IA), Service Air (SA), and Mask Air (MA) Systems; these tanks will be connected to the standalone air compressor.

1.3.3.10.1 Instrument Air System

The purpose of the IA System is to provide a reliable supply of compressed, dry, clean air for instrumentation usage in B100. Two receiver tanks, IA-TK1 and SA-TK1, provide a settling basin and reserve air storage capacity for emergencies. Normally, IA is supplied to the system through IA-TK1. When the air supply is lost, the air in SA-TK1 is also reserved for the IA System. The IA System remains operational.

1.3.3.10.2 Service Air System

The purpose of the SA System is to provide compressed air throughout B100 for general use and to those users where the equipment supplied does not require the reliability of the IA System. Compressed air from the SA receiver tank, SA-TK1, is distributed throughout the building at a pressure of approximately 0.689 MPa. The SA System remains operational.

1.3.3.10.3 Mask Air System

The purpose of the MA System was to distribute humidified, compressed air to personnel air mask stations located in all working areas of B100 where the probability of airborne contamination exists. MA was supplied from the IA receiver tank after it had been filtered. The humidity of the MA could be manually controlled by valving in three humidifiers as required. The MA System has been permanently shut down. Respirators run off of portable air supplies when needed.

1.3.3.11 Fire Protection Systems

Fire protection in B100 was provided by the following systems:

- Fire Detection and Alarm System
- Pressurized CO_2 Fire Prevention System
- Firewater System
- Organic Leak and Smoke Detection System

1.3.3.11.1 Fire Detection and Alarm System

The Fire Detection and Alarm System will detect and zone any fire that may occur in B100. All fire alarms in B100 annunciate on an annunciation panel showing the location of the fire by zone. The Security Monitoring Room receives a B100 alarm signal simultaneously. The Fire Detection and Alarm System remains operational.

1.3.3.11.2 Pressurized CO_2 Fire Prevention System

The Pressurized CO_2 Fire Prevention System detected any rapid temperature rise in the hot box areas in the upper and lower accesses, which could be indicative of an organic coolant leak and took the following safety precautions:

- Tripped the reactor;
- Lowered the temperature of the A, B, and C PHT circuits below the auto-ignition temperature of the vaporizing coolant; and
- Doused the hot box enclosure with CO_2 gas to create an inert atmosphere and reduce the possibility of an explosion or fire.

The Pressurized CO_2 Fire Prevention System has been permanently shut down and removed.

1.3.3.11.3 Firewater System

The FW System provides an automatic sprinkler system for all areas in B100 where a fire hazard exists and provides automatic sprinklers plus manual open-head or “fog nozzles” in areas where organic fires and/or organic vapour concentrations may have occurred during reactor operation. Activation of the sprinkler system actuates a fire alarm circuit, which is also annunciated in the Security Monitoring Room. The FW System remains operational.

1.3.3.11.4 Organic Leak and Smoke Detection System

The Organic Leak and Smoke Detection System consisted of photoelectric cell and light source units that monitor the exhaust air from the rooms in B100 where an organic fire hazard exists. An alarm was annunciated when obscurity in the ducts increased above a predetermined value. This system has been permanently shut down.

1.3.3.12 Experimental Loops

There were four Experimental Loops (EL) in WR-1 and one out-of-reactor hydraulic test loop in B100. Each in-reactor loop consisted of a fuelled test section in a reactor lattice position, and piping equipment and instrumentation in an adjacent loop room to maintain and monitor required operating conditions. A fuel position was converted to a loop by disconnecting the inlet and outlet feeders from the PHT System inlet and outlet headers, respectively, and connecting the feeders to the loop inlet and outlet piping.

The loops have been drained and electrical services shut down. There has been no decommissioning activities started in these areas.

1.3.3.13 Low Level Liquid Waste Treatment System

In 2017, a LLLW Treatment System (see Figure 16 below) was constructed in the SDR hall (Room 690) [17]. It is designed to handle LLLW only. The LLLW system was added to replace the function of the Active Liquid Waste Treatment Centre, which formerly handled low and intermediate level liquid waste before it was decommissioned. The working principle for the LLLW system is as follows:

1. The LLLW from B100 is routed to the LLLW Treatment System.
2. The LLLW is held in a tank until it is ready for sampling.
3. The LLLW is filtered as required to remove particulate matter.
4. The LLLW is sampled and pH adjustments are made as required to meet release criteria.
5. The treated waste is released to the Outfall and on to the Winnipeg River.

Figure 16: Low Level Liquid Waste Treatment System

The system consists of two 3,975 L high density polyethylene liquid storage tanks, a sampling station, and two filtering units. LLLW from B100 is collected in AD Sump A located in Room 103. Liquid waste is pumped from AD Sump A using pump AD-P1 or AD-P2 to the LLLW Treatment System via AD line AD-L67. Drawing A1-100-F-9 [18] provides a flow diagram of the LLLW Treatment System, which remains operational.

1.4 Facility History

1.4.1 Unplanned events

A review of the Unplanned Events[2] Reports and Annual Safety Reports show that some unusual events have occurred in B100 since WR-1 began operation. Table 3 below summarizes the events documented as unusual occurrences. All events listed were remediated at the time of the incident. Operator logbooks describe additional unusual events in B100 including a WR-1L5 accident and the resulting contamination of the loop equipment in 1978.

Table 3: Unusual Events in Building 100

Incident Report #	Date	Event	Description	Remediation/Impact
WR-1-66-5	21-Jun-66	Failure of control valve	Loss of organic coolant	Control valve replaced.

[2] Unplanned events were formerly known as Unusual Occurrences during the operational period of WR-1

Incident Report #	Date	Event	Description	Remediation/Impact
WR-1-67-1	05-Aug-67	Organic leak B100	1 1/2 drums of coolant entered the PW drainage lines before leak was found and isolated	Leak repaired.
WR-1-67-2	17-Sep-67	Uranium graphite experimental fuel rod failed	The gases were purged to the atmosphere. Organic coolant contaminated	Fuel rod removed.
WNRE-353	05-Mar-76	Failure of A PHT circuit throttling valve	Valve failed; majority of valve pieces recovered	Valve replaced with updated design; Similar valve in B circuit replaced.
WNRE-404	13-Jan-77	Freezing of heavy water	Heavy water froze in the moderator heat exchanger, stopping flow to the Calandria spray nozzles	Temperature controller left on manual following maintenance; heavy water was thawed; heat exchanger was checked for leaks; equipment placed back in service.
WR-1-77-2	22-Mar-77	Organic coolant leaked to Winnipeg River	WR-1L1 pump leak; release of organic coolant	Pump repaired.
WNRE-485	07-May-78	Operator error in pneumatic capsule facility	4.4 TBq of short-lived xenon and krypton released to the atmosphere	Improved administrative support and added gaseous effluent monitoring system.
WR-1-78-2	01-Nov-78	Organic coolant spill from WR-1L5	Severe failure of the WR-1L5 circulating pump seal assembly caused an extensive organic spill and a sharp increase in airborne radioactivity contamination (mainly short half-life fission product gases) during restoration activities as the fuel rod had failed ~2 weeks before the spill	Spill cleaned, fuel rod removed, and WR-1L5 equipment repaired.
WNRE-509	01-Feb-80	Capsule stuck in pneumatic capsule return line	An incorrectly installed cover cap was loosened, causing capsule to lodge in the line	Capsule and contents were retrieved, except for a 3.3 mg cobalt-aluminum flux wire; site returned to

Incident Report #	Date	Event	Description	Remediation/Impact
				service; procedures were updated.
WNRE-518	28-Feb-81	Failure of WR-1L6 emergency injection inlet isolation valve operating procedures	Valve was only partially opened after an earlier shutdown procedure	Control systems were updated to prevent recurrence.
OEA-82-20	17-May-82	Detection of organic coolant at WL outfall	Fisherman reported a black tarry substance on fishing line	Testing completed; minimal impact.
WNRE-590	Jun-84	Abnormal number of fuel failures during 1983 operations	~13 fuel assemblies failed in 1983 with several failing prematurely due to delayed hydride cracking	These failures contaminated the PHT System and the auxiliary systems in WR-1.
RC-388	Summer-89	Fuel Handling Incident	Four standard fuel bundles were damaged; became disassembled in the Fuel Storage Block	All 56 fuel elements were retrieved during water bay clean-up activities.
A-8357	20-Jul-93	Contamination, B100	Loading dock contaminated	Area cleaned up.
10-3547	06-Nov-96	Steam discharged to atmosphere, B100	Loss of control ability in high temperature water valve	Repaired valve.
RCA-D&WM-09-92927	15-Dec-09	Release of friable asbestos	Asbestos was released and spread when workers were moving, rigging, and lowering pipe in Room 601	Access to Room 601 was limited and a thorough clean-up of the room was completed, as confirmed with air monitoring.

1.4.2 Fuel Failures

Experimental fuels were subjected to high burn-ups and extreme operating conditions to study fuel failure modes and effects. This resulted in experimental fuel failures throughout the operating lifetime of WR-1. There were also several fuel failures of the reactor driver fuel; most notably, there were approximately 13 separate fuel failure events in 1983. Table 4 below summarizes the WR-1 fuel failures [19], [20], [21], [22], [23], [24]. Between 1966 and 1983, there were 150 documented fuel failures.

Table 4: Summary of the Whiteshell Reactor 1 Fuel Failures

Year	Number of Failures	Fuel Assemblies
1966	3	WN32, WS-4, EXP-WR1-906A
1967	2	EXP-WR1-912, EXP-WR1-906B
1968	7	WN31, EXP-WR1-951, EXP-WR1-911B, WN5, WN25, EXP-WR1-911A, EXP-WR1-902E
1969	2	LC033, EXP-WR1-954
1970	6	EXP-WR1-922F, EXP-WR1-920A, EXP-WR1-922A, EXP-WR1-919D, EXP-WR1-917B, EXP-WR1-922D
1971	12	EXP-WR1-933B, EXP-WR1-204, EXP-WR1-206, EXP-WR1-FNF02, EXP-WR1-936B, EXP-WR1-930, EXP-WR1-206, WZ3, EXP-WR1-945, EXP-WR1-203B, EXP-WR1-FNF05, EXP-WR1-925
1972	26	EXP-WR1-936A, EXP-WR1-947, EXP-WR1-929, EXP-WR1-928C, EXP-WR1-937A, EXP-WR1-936B/937B, EXP-WR1-930B, EXP-WR1-934A, EXP-WR1-925A, EXP-WR1-945B, EXP-WR1-934C, EXP-WR1-932, WN67, WN78, WR1-EXP-928C, WN63, WR1-EXP-945C, WR1-EXP-942D, WR1-EXP-942F, WN104, WR1-EXP-961E, WR1-EXP-940, WN74, WR1-EXP-961A, WR1-EXP-925B, WR1-EXP-925B
1973	12	WR1-EXP-935, WR1-EXP-942G, EXP-WR1-925C, EXP-WR1-925A, EXP-WR1-928D, WN102, EXP-WR1-979B, EXP-WR1-974B, WN151, EXP-WR1-FNF916, EXP-WR1-FNF08, EXP-WR1-FNF07
1974	17	EXP-WR1-FNF01, EXP-WR1-FNF04, WN078, FNF014, EXP-WR1-988A, EXP-WR1-979G, EXP-WR1-942L, WN154M, WN071, EXP-WR1-969B, WN086M, WN052, EXP-WR1-979D, WN155, WN127, EXP-WR1-979E, WN-119

Year	Number of Failures	Fuel Assemblies
1975	13	EXP-WR1-947A, WN114, WN116, WN120, EXP-WR1-937G, EXP-WR1-217A, WT13, WN163, WN170, WN131, WT16, EXP-WR1-979C, WN152M
1976	10	WN147, FN004A, WN202, WN208, CN044, WN198, WN204, CN068, WN133, WN158M
1977	3	EXP-WR1-603, EXP-WR1-1001A, EXP-WR1-221
1978	6	CN013A, EXP-WR1-1007D, EXP-WR1-1007E, EXP-WR1-1007B, FN028, EXP-WR1-1007B
1979	10	EXP-WR1-1007J, EXP-WR1-1007D, EXP-WR1-1007A, CN001A, EXP-WR1-1007H, EXP-WR1-223, EXP-WR1-1007J, EXP-WR1-1007E, EXP-WR1-1007F, EXP-WR1-1007G
1980	7	EXP-WR1-606, DN001A, EXP-WR1-1008, CN104A, CN031A, EXP-WR1-225, EXP-WR1-606
1982	1	CN138
1983	13	CN140, CN151, CN118A, CN148, CN139, CN124A, CN109A, CN120A, CN117A, CN137A, CN172, CN144A, CN140A
TOTAL	150	

The driver fuel failures released short-lived radioactive noble gases, gaseous fission products, and irradiated uranium fuel to piping and system components of either the A, B, or C circuit PHT Systems depending on the fuel location and testing being performed. The Degassing and Particulate Removal Systems removed most particulate radioactivity with some fraction of particulates being deposited on piping surfaces and trapped in pumps, valves, or system tank sludge.

1.5 Decommissioning Approach

1.5.1 Phase 1 Decommissioning

The decommissioning of WR-1 and B100 is being completed in two phases separated by a deferment period. Phase 1 commenced in 1989 and was completed in 1995. Phase 1 work focussed on the removal of easily mobilized radioactive materials (fuel, fluids, etc.) and decontamination of the main floor (600 Level) and the first sub-level (500 Level). The work removed some of the potential hazards from B100 (see the following discussion) and reduced the Storage with Surveillance requirements for the deferment period.

The main activities completed as part of Phase 1 decommissioning are summarized below and [6], [2] provide additional detail.

- Removal of Spent Reactor Fuel
  - All irradiated fuel stored in the fuel storage bays was transferred to storage at the WL Concrete Canister Storage Facility.
- Removal of System Fluids
  - Approximately 50,000 L of HB-40 was drained from system equipment and the Fuel Bays storage cans. It was then transferred to the WL WMA for incineration or solidification, and storage. However, not all system equipment was drained and some systems still contain HB-40. Flushing of drained systems was also not performed so some of these systems have residual HB-40 present.
  - Approximately 16 Mg of heavy water moderator, found to have a tritium concentration of approximately 335 GBq/L, was removed and transferred for storage at Chalk River Laboratories (CRL). Residual heavy water was drained from the systems by blowing back lines to system hold tanks and pumping out the system. Equipment was installed to recover residual heavy water by recirculating air through coolers. This system was purged to the Ventilation System at a controlled rate to achieve further dry out.
  - Approximately 20000 L of water remains in tubing within the bioshield concrete. This water has no drainage pathway associated with its system.
- Disposition of Unused Fuel
  - Unused UC fuel stored in Room 646 was first transferred to WL B418 for storage and then sold and shipped off-site.
  - Unused UO_2 fuel and unused highly enriched uranium recovered from the thorium fuel program were transferred to CRL.

- Removal of Fuel Channels and Fuel Hardware Stored in the Fuel Bays and Fuel Storage Block
    - When the reactor was shut down, 12 irradiated fuel channels and approximately 200 pieces of fuel hardware were stored in the fuel storage bays and Fuel Storage Block. This waste was segmented, packaged, and shipped to the WL WMA for storage.
- Draining and Decontamination of the Fuel Bays and Fuel Storage Blocks
- Dismantling and Decontamination on the Main Floor and First Sub-Level
    - Major dismantling areas were:
        - C Circuit Building Annex – Rooms 639, 640, 646, 647, 648, 530, 529, 528, 542, 544, 545, 551
        - Organic Supply System and Sampling Rooms – Rooms 605, 606, 607, 638, 518
        - Organic Purification System – Rooms 509, 512
        - Fuel Storage Bays and Fuel Storage Block – Rooms 303, 304, 305, 306
        - WR-1 Emergency Coolant Injection Tanks
- Dismantling of the Emergency Cooling Water Supply Tank
    - Located on top of the Ventilation Stack, the emergency cooling water supply tank was removed. Derived Release Limits were calculated for the reduced Stack height and release controls were established in accordance with the revised limits. Because of the low air effluent releases from WR-1, the impact of the reduced Stack height was negligible.
- Reduction in Ventilation Flows
    - Ventilation flows were reduced compared to the WR-1 operating period, but are maintained at an adequate level to serve building operational and zoning requirements, to keep the most negative pressure in the highest radiologically contaminated zone.

1.5.2 Phase 2 Decommissioning

Phase 2 commenced in 2015 with the issuing of Revision 3 of the WR-1 DDP [26] that described the complete decommissioning of WR-1 and B100. CNL was authorized to decommission WR-1 and B100 by means of dismantling and demolition under the approved CSR [1], the WL Decommissioning Licence [27], and Revision 3 of the WR-1 DDP [26].

A significant departure from the end-states defined in the CSR [1] and Revision 3 of the WR-1 DDP [26] is the proposed in situ decommissioning (also referred to as in situ disposal) of the WR-1 reactor. Work continues for an environmental assessment and regulatory approvals required for this proposed change. The draft EIS is currently in a 90 day technical review with the Federal Provincial Indigenous Review Team (FPIRT). Following this review, CNL will submit the Final EIS and proceed to public hearings if deemed complete by CNSC staff.

2. Acronyms

ACM	Asbestos Containing Material
AD	Active Drainage
AECL	Atomic Energy of Canada Limited
ALARA	As Low As Reasonably Achievable
ALWTC	Active Liquid Waste Treatment Centre
B###	Building ###
CANDU	CANada Deuterium Uranium
CA#	Controlled Area #
CNL	Canadian Nuclear Laboratories
CNSC	Canadian Nuclear Safety Commission
cpm	counts per minute
CRL	Chalk River Laboratories
CSA	Canadian Standards Association
CSR	Comprehensive Study Report
DDP	Detailed Decommissioning Plan
DMW	Domestic Water
DW	Distilled Water
EAMS	Enterprise Asset Management System
ECC	Engineering Change Control
EIS	Environmental Impact Statement
EnvP	Environmental Protection
EL	Experimental Loops
ESO	Emergency Services Operations
FTS	Fuel Transfer Systems
FW	Firewater
G1	Group 1
ha	hectare
HEPA	High-Efficiency Particulate Air
HGS	Helium Gas System

HHW	High Temperature Hot Water
HP	Health Physicist
HWS	Heavy Water System
IA	Instrument Air
LCH	Licence Conditions Handbook
LLLW	Low Level Liquid Waste
MW	megawatt
MW(th)	megawatt thermal
OSH	Occupational Safety and Health
PCB	Polychlorinated Biphenyl
PD	Process Drain
PHT	Primary Heat Transport
PPE&C	Personal Protective Equipment and Clothing
PW	Process Water
QA	Quality Assurance
RP	Radiation Protection
RSZ	Radiological Safety Zone
SA	Service Air
SDR	SLOWPOKE Demonstration Reactor
SME	Subject Matter Expert
SRC	Safety Review Committee
SSC	Structures, Systems and Components
SW	Standby Water
SWS	Storage With Surveillance
UC	Uranium Monocarbide
WL	Whiteshell Laboratories
WM	Waste Management
WMA	Waste Management Area
WNRE	Whiteshell Nuclear Research Establishment
WP	Work Plan

WR-1	Whiteshell Reactor 1
WR-1L#	Whiteshell Reactor 1 Loop #
wt%	percent by weight

3. Responsibilities

3.1 Safety and Administrative

CNL shall maintain the management and supervisory responsibilities for the operation of the Facility. The organization and the lines of authority within the Facility, which is managed by the WL Site and Nuclear Operations branch of the WL Closure Project organization, are shown in Figure 17 below.

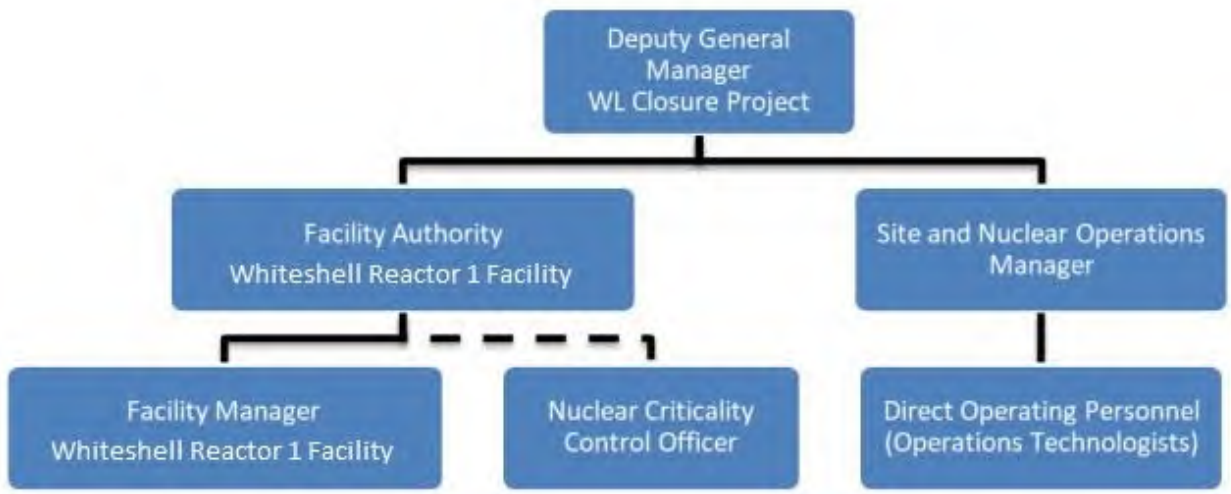

Figure 17: Facility Organization

Facility operation shall be subject to the requirements of the *Nuclear Safety and Control Act* [25] the regulations made pursuant to the Act, and the WL Decommissioning Licence [27]. To ensure compliance with these regulatory requirements, facility operation shall be subject to the requirements of CNL's Health, Safety, Security, and Environment, Engineering, and Environmental Remediation Management functional support area programs that encompass:

- Radiation Protection [28], see Section 7.4
- Environmental Protection [29], see Section 9
- Occupational Safety and Health [30], see Section 7
- Quality Assurance [31], see Section 14
- Security [32], see Section 3.3

- Emergency Preparedness [33], see Section 10
- Fire Protection [34], see Section 3.3
- Personnel Training Program [35], see Section 15
- Waste Management Program [36], see Section 13
- Engineering Change Control [39], see Section 12

3.1.1 Facility Authority

The Facility Authority retains overall responsibility for safety during the SWS stage. They are the official contact with the Safety Review Committee (SRC), the Canadian Nuclear Safety Commission (CNSC), and other applicable regulatory authorities in matters that relate to B100 SWS. Specific responsibilities include:

- The overall safe operation, maintenance and use of the Facility;
- The adherence to the requirements of all licenses, permits, regulations and any applicable federal and provincial legislation;
- The reporting to the CNSC of unplanned events as per the requirements of the licence;
- The authorization of non-routine work, experiments and facility modifications involving significant hazards;
- The authorization of Facility-specific procedures and ensuring their maintenance;
- The appointment of candidates for the Facility Manager and ensuring that they are fully qualified;
- Acting as Incident Authority or appointing an Incident Authority for incidents originating in or affecting the Facility;
- Ensuring that unplanned events are investigated and internally reported; and
- Ensuring that SWS documents are prepared and reviewed in accordance with the Quality Program requirements.
- Day to day operating responsibility may be designated to the Facility Manager.

3.1.2 Facility Manager

The Facility Manager's specific responsibilities include:

- Ensuring that maintenance, monitoring, and surveillance activities are performed in a safe and compliant manner;
- Ensuring adequate technical support for the Facility;
- The appointment, training, development and qualification of all direct personnel;
- Approving Facility procedures and work-control procedures;
- Ensuring that unplanned events are investigated and internally reported;

- Approving trip alarm Controller Permits [40];
- Approving staffing requirements in accordance with the needs of the work planned;
- Approving non-routine operations, experiments and Facility modifications;
- Managing the emergency response function within the Facility.

3.1.3 Facility Supervisor

The Facility Supervisor's specific responsibilities include:

- Ensuring the day-to-day safe operation, use and maintenance of the Facility is in accordance with established policies and procedures;
- Supervising the operating technicians and support staff for SWS activities and maintenance activities within the Facility;
- Providing the overall technical support for the Facility;
- Recommending staffing requirements for planned work;
- Establishing/confirming facility work schedules and assigning qualified personnel to work to meet approved plans and schedules;
- Preparing or reviewing manuals, working procedures and work plans; and
- Ensuring all logs and records are properly maintained and stored.

3.1.4 Operating Personnel

The Operating Personnel are responsible for:

- Performing operation and verification activities in accordance with Facility procedures, protocols, work plans, or work permits [41];
- Performing daily, weekly and monthly compliance checks, commonly called trip and alarm testing to confirm the function of equipment;
- Noting conditions in the building, this includes noting the presence of animal droppings. If droppings are noted traps are set in that area. Building conditions are noted including such items as gaps or damaged gaskets that could provide an entry route for animals;
- Performing inspection rounds along with radiation protection and fire protection personnel;
- Issuing service requests for corrective maintenance;
- Ensuring their work is done in a safe manner; and
- Entering Facility activities and events in the Facility Logbook.

3.2 Maintenance and Work Control Personnel

Maintenance and work control personnel are responsible for:

- Scheduling planned preventative maintenance;
- Performing inspections to check for the presence of wildlife in the facility
- Following the maintenance schedule described in the Facility Maintenance Plan [38] for impacts on the Facility Restricted Access Area; and
- Performing corrective maintenance based on service requests.

3.3 Security and Fire Protection

WL Emergency Service Operations (ESO) provides monthly building fire inspections and patrols to detect, report, track, and follow-up on conditions that constitute hazards to life, the environment, and property and that do not conform to the National Fire Code of Canada, the National Building Code of Canada, and CSA N393-13 [44] requirements as applicable. WL ESO also provides routine inspections of key security and protection systems according to the requirements of the CNL Physical Security Program.

4. Functional Services and Systems

4.1 Major Building Services

Table 5 below provides a list of operational systems/services and a brief description of their usage.

Table 5: Functional Systems/Services

System/Service	Usage
Ventilation System	Provides forced air circulation throughout B100 to provide contamination control and, environment control for personnel and equipment. Additionally, the HWS and HGS are purged to the Ventilation System at a controlled rate to achieve further heavy water dry out. See sections S1.3.3.8.1 to S1.3.3.8.4 for more details on each of the ventilation subsystems.
Ventilation Stack	Discharges possible airborne contamination at a sufficient height and velocity in order to minimize contamination at ground level. The Derived Release Limits depend on the ventilation exhaust velocity and height so if these parameters are modified, the Derived Release Limits will have to be recalculated and updated. Note that that the Derived Release

System/Service	Usage
	Limits were re-calculated in the latest revision of WL-509211-RRD-001 [42] for the reduced B100 stack height of 30 m
Process Water and Drainage System	In 2003, the PW System to the reactor was bypassed [9]. The PW enters the building at the 100 Level and is routed immediately back out of the building at the same point. The PW was diverted and throttled down to maintain a minimum PD flow rate of 2,280 litres per minute at the outfall station.
Firewater System	Provides fire protection for B100.
Domestic Water and Drainage System	Supplies B100 with DMW for washrooms and showers, and collects the DMW after use.
Building Cranes and Hoists	Support maintenance and decommissioning activities.
Active Drainage System	Collects liquid from the various areas of B100 and is treated in the LLLW system and pumped to the river. Groundwater from around the building perimeter is pumped through the outfall B422 to the river.
Building Heating Systems	Supply heated glycol for heating the supply air to the Building and Building Extension Ventilation Systems (HBY), and heated water (HBW) for auxiliary heating in the Service Wing and the East Extension by wall radiators and room heater units.
Instrument Air System	Provides a reliable supply of compressed, dry, clean air for instrumentation usage in B100.
Service Air System	Provides compressed air throughout B100 for general use and to those users where equipment supplied does not required the reliability of the Instrument Air System.
Fire Detection and Alarm System	Detects and locates any fire that may occur in B100.
Low Level Liquid Waste Treatment System	Allows for sampling, filtering, and pH adjustment of Low Level Liquid Waste from B100 as required to meet release criteria. Beta –Gamma activity daily

System/Service	Usage
	release less than 5.00 x 10^6 Bq and pH between 6.0 and 9.0.
Communication Systems	A Telephone System and a Public Address (announcement) System are available in B100.
Annunciation and Alarm Systems	Announce the “off normal” and “return to normal” of all important process variables and equipment in B100 and attract the control room operations attention.
Electrical Distribution System	Provides the electrical needs for Building 100 and its systems.
Continuous Air Monitors	There are three Continuous Air Monitors in B100 that were historically used to detect the presence of radioactive noble gases from fuel failures to help prevent the spread of contamination: one in the reactor hall (Room 601), one at the bottom of Stairs #1, and one in Corridor 507 near Room 540. These monitors are no longer required and going forward they will be use on an as needed basis to support decommissioning planning and eventual execution.

5. Maintenance, Inspection and Surveillance

5.1 Maintenance

Preventive maintenance is performed on facility systems and equipment to ensure they continue to function safely and in accordance with their design intent [38]. Appendix A of the *Facility Maintenance Plan* [38] lists facility components that require preventive maintenance and indicates what preventive maintenance is required for each component and the frequency.

Qualified Trades perform all maintenance work in accordance with approved maintenance procedures and standard Trades practices, and work permits are issued for all maintenance performed in B100.

5.2 Inspection

Operations personnel follow a series of daily, weekly, monthly and quarterly checks and inspections of the function of systems and alarms in the facility. Testing results are recorded on forms developed for that purpose. A logbook is also maintained for the building, that records general monitoring duties, unusual events and a record of work permits issued for maintenance and decommissioning activities in the building.

Housekeeping inspections are also conducted monthly as are fire safety inspections. An annual inspection is also performed by the Site Safety and Health committee.

5.3 Surveillance

Radiation and Contamination Workplace Monitoring Routines [45] sets the minimum routine radiological monitoring requirements for all CNL locations where employees have the potential to encounter radioactive contamination and radiation fields in workplaces. Routine monitoring and surveys of workplaces are performed at regular intervals to confirm and demonstrate that:

- Radiological hazards are identified and posted.
- Radiation and contamination levels are within permissible levels for the workplace's Radiological Safety Zone designation [46].
- Posting of radiological hazard information is complete and accurate [47].

Personnel completing the monitoring routines are Radiation Protection Group 1 or Group 2 qualified. Group 2 personnel do not provide radiation safety assessments for other workers. The minimum frequencies of confirmation surveys are provided in Table 6, Table 7, and Table 8 below as per [45]. Entry is not required for the sole purpose of completing a radiological survey. Where the zoning survey frequency is not met, the area is signed "Expired Survey. Contact RP prior to entry". With reference to survey frequencies, "as required" means confirmation of radiological conditions of these zones is conducted when there is a potential for radiological conditions to have changed when entry is required or initial entry has not been performed within a year.

Table 6: Hazard Signs Confirmation Survey Frequencies

Hazard Sign Type	Minimum Radiation Survey Frequencies
General Hazard Signs	Quarterly

Table 7: Radiation Zone Confirmation Survey Frequencies

Area	Radiation Zone	Minimum Radiation Survey Frequencies
Supervised	1	Biennial

Area	Radiation Zone	Minimum Radiation Survey Frequencies
	2	Annually
Controlled	1	Annually
	2	Annually
	3	Annually
	4	As Required
	5	As Required

Table 8: Contamination Zone Confirmation Survey Frequencies

Area	Contamination Zone	Room Type	Minimum Contamination Survey Frequencies
Supervised	1	All	Biennial
	2	All	Monthly
Controlled	1	Non-Specified	Annually
		Lunch Rooms	Daily
		Food Consumption Rooms	Weekly
		Beverage Preparation Rooms	Weekly
		Beverage Consumption Rooms	Annually
	2	All	Monthly
	3	All	Quarterly
	4	All	As Required

Area	Contamination Zone	Room Type	Minimum Contamination Survey Frequencies
	5	All	As Required

6. Building Hazard Identification

6.1 Radiological Hazards

Radiological hazard conditions in rooms and work areas within B100 are well documented in various comprehensive and systematic surveys performed including:

- Phase 1 decommissioning end-state final status surveys performed in the 1990s [49], [50]; and
- WR-1 room hazard surveys [7], [51] performed between 2013 and 2015.

These surveys obtained measurements for gamma radiation dose rates and removable surface contamination levels in accessible areas of the rooms. Appendix A provides a summary of measured radiation and contamination levels. Table 9 below highlights rooms with elevated radiological hazards. Removable surface contamination is limited to mixed fission products and actinides. All rooms are free of tritium surface contamination.

Radiological zoning is based on the general (accessible) whole body dose rates within the zone with average room gamma dose rates reflecting the typical average whole-body dose rate that a person may reasonably be expected to be exposed to during normal occupancy in the area. This is based on the average dose rate at 1 m distance from normally accessible locations in the room Localized elevated radiation fields are posted within the room that are significantly above the average dose rate but do not impact the overall average dose rate of the area. For Radiation Zone 2 these are whole-body dose rates exceed 25 μSv/h (2.5 mrem/) at 30 cm from a source and for Radiation Zone 3 and higher these are locations where the dose rates are 5 times the average.

Table 9: Rooms with Elevated Radiological Hazards

Room	Description	Zoning	Comments
103	Drain Tank Room: Primary Heat Transport System, Spent Fuel Handling and Storage Systems, Active Drainage System	R3C2	5 mrem/h (50 μSv/h) average room gamma dose rates with localized elevated fields ranging from 5-55 mrem/h (50-550 μSv/h). 200 mrem/h (2.0 mSv/h) near contact hot spot. Free of removable surface contamination.

Room	Description	Zoning	Comments
104	Degassing Room: Primary Heat Transport System, Heating and Cooling Systems	R3C3	5-10 mrem/h (50-100 μSv /h) average room gamma dose rates with localized elevated fields of 55 mrem/h (550 μSv/h). 20-1,000 mrem/h (0.2-10 mSv/h) near contact hot spots. Low level removable surface contamination.
201	Lower Access Room	R3C3	25 mrem/h (250 μSv/h) average room gamma dose rates. 100 mrem/h (1 mSv/h) near contact hot spot. Low level removable surface contamination.
301	Flask Maintenance Low Level Room	R4C3	100 mrem/h (1 mSv/h) average room gamma dose rates. 5 rem/h (50 mSv/h) near contact hot spot (stored waste can), however, there is a historical drum with highly radioactive material being stored which is the source of the elevated dose rates in the room. It is posted as a local elevated radiation dose rate because it is impacted the overall average dose rate in the room. Generally free of removable surface contamination.
302	Degassing Room: Primary Heat Transport System	R3C3	3-8 mrem/h (30-80 μSv/h) average room gamma dose rates with localized elevated fields of ~10 mrem/h (~100 μSv/h). 1,000 mrem/h (10 mSv/h) near contact hot spot. Generally free of removable surface contamination.
409	Surge Tank & Pipe Shaft Room: Primary Heat Transport System	R3C3	5 mrem/h (50 μSv/h) average room gamma dose rates. 40 mrem/h (400 μSv/h) near contact hot spot. Generally free of removable surface contamination.
410	WR-1L1 Loop Room: WR-1 1L1 Experimental Loop	R3C3	1 mrem/h (10 μSv/h) average room gamma dose rates with localized elevated fields ranging from 2-18 mrem/h (20-180 μSv/h). No hot spots. Generally free of removable surface contamination.
501	Upper Access Room	R3C3	5 mrem/h (50 μSv/h) average room gamma dose rates. 200 mrem/h (2 mSv/h) near contact hot spot. Low level removable surface contamination.
504	Auxiliaries Room: Thermal Shield Cooling System	R3C3	1-4 mrem/h (10-40 μSv/h) average room gamma dose rates. 20 mrem/h (200 μSv/h) near contact hot spot. Generally free of removable surface contamination.
506	Header Room: Primary Heat Transport System	R3C3	5 mrem/h (50 μSv/h) average room gamma dose rates with localized elevated fields ranging from 8-

Room	Description	Zoning	Comments
			16 mrem/h (80-160 μSv/h). 200-4,000 mrem/h (2-40 mSv/h) near contact hot spots. Low level removable surface contamination.
537	WR-1L5 Loop Room: Fast Neutron Loops	R3C3	1-5 mrem/h (10-50 μSv/h) average room gamma dose rates. 400 mrem/h (4 mSv/h) near contact hot spot. Generally free of removable surface contamination.
538	WR-1L4 Loop Room: Fast Neutron Loops	R3C3	1 mrem/h (10 μSv/h) average room gamma dose rates with localized elevated fields of 5 mrem/h (50 μSv/h). No hot spots. Low level removable surface contamination.
539	WR-1L2 Loop Room: WR-1L2 Experimental Loop Fast Neutron Loops	R3C3	10 mrem/h (100 μSv/h) average room gamma dose rates. 60 mrem/h (600 μSv/h) near contact hot spot. Moderate level removable surface contamination.
540	WR-1L2 Sample Station & Transmitter Room: WR-1L2 Experimental Loop	R2C3	0.2 mrem/h (2 μSv/h) average room gamma dose rates. 8 mrem/h (80 μSv/h) near contact hot spot. Low level removable surface contamination.
601	Caged Storage Area	R2C3	0.02-0.5 mrem/h (0.2-5 μSv/h) average room gamma dose rates. 5-80 mrem/h (50-800 μSv/h) near contact hot spots (on stored flasks). Generally free of removable surface contamination.
602	Primary Pump Room: Primary Heat Transport System A and B circuit main heat exchangers	R3C3	5-20 mrem/h (50-200 μSv/h) average room gamma dose rates with localized elevated fields of 120 mrem/h (1.2 mSv/h). 10 rem/h (100 mSv/h) near contact hot spot. Hot spot and local elevated fields associated with a stored waste can. The localized elevated dose rate is from the storage of a historical drum with highly radioactive material. However, because of the location of the drum and the size/configuration of Room 602, it is not impacting the overall average dose rate in the room. It is posted as a located elevated radiation dose rate area. Low level removable surface contamination.

Radiation dose rate hazards in most rooms range from minimal to low, with moderate hazards limited to only a few rooms. Rooms and areas with elevated gamma radiation levels are associated with the PHT System and components, the Experimental Loops, PD lines, and include the reactor core lower and upper access rooms. General area radiation fields in various rooms are typically less than 1 mrem/h (10 µSv/h). Some rooms have elevated fields ranging from 1 - 55 mrem/h (10 µSv/h - 550 µSv/h). Near contact gamma radiation dose rates on system components range from 30-1000 mrem/h (300 - 10000 µSv/h). Surface contamination hazards in most rooms range from minimal to low, with moderate hazards limited to a few rooms. Table 11provides more information on Rooms with Elevated Radiological Hazards. Appendix A provides a summary of measured radiation and contamination levels.

Facility hazard categorization is a CNL internal process that the SRC uses to determine the appropriate level of independent technical review

B100 has a facility hazard category[3] of 2, and this is not proposed to change.

6.2 Chemical Hazards

6.2.1 Asbestos

In 2014, select ACMs were removed from select non-restricted access areas of B100 [52], [53]. ACMs were removed from the following rooms: 509/510, 512, 513, 514, 516, 518, 519, 521, 529, 530 (Caged Area), 601 (lower level), 606, 702/703, Stair #1, Stair #2, Stair #7, Stair #8, and Stair #11. ACMs that were not removed include:

- Floor tiles on the 500 and 600 Levels;
- Floor tiles in any stairwell;
- All ventilation duct insulation;
- Transite boards located in or on fume hoods or in cabinetry;
- Insulation that was not accessible without introducing elevated risk to workers; and
- Inaccessible floor tiles in Room 703.

Several buildings on the WL site have been found to have asbestos containing mastic attached to the bricks of the exterior walls.

Room 602 and the rooms immediately below it (Rooms 506 and 538) are known to contain loose asbestos in hazardous quantities. These rooms are partially connected by a grated floor in Room 602. Exhaust ventilation ductwork is suspected of containing asbestos fibres and the High-Efficiency Particulate Air (HEPA) filters (located in Room 519) of the Ventilation System are labelled as asbestos containing.

6.2.2 Lead

As part of the Pinchin industrial characterization, lead-based paint was found in B100 [54]. Later, a more extensive examination was performed for lead [55]. This examination included a desktop review of documentation, analysis of paint, caulking, and other samples [56], [57], [58], [59], [60], and a thorough walkthrough of B100.

[3] Hazard categorization is a CNL internal process that the SRC uses to determine the appropriate level of independent technical review

6.2.3 Polychlorinated Biphenyls

As part of the Pinchin industrial characterization, light ballasts in fluorescent light fixtures suspected of containing PCBs were found in B100 [54]. The amount of PCB containing oil in ballasts is minor and is generally found in the capacitor portion of the ballast. PCB capacitors found in lamp ballasts constitute a special case because of their small size and relative inaccessibility. These capacitors are usually encapsulated in an asphalt type compound in a steel enclosure installed inside the lighting fixture. A typical capacitor within a fluorescent lamp ballast contains only about 25 g of PCBs. Since 1978, fluorescent lamp ballasts have been manufactured without PCB capacitors.

There were transformers in B100 that contained PCBs as well as some PCB containing capacitors. Over the years they have all been replaced with non-PCB containing replacements. There is no mention of breakers containing PCB.

Later, a more extensive examination was performed for PCB containing materials [56], [57], [58], [59], [60]. Table 10 below provides the locations where PCBs in concentrations above the solid exemption quantity of 50 mg/kg [62] or suspected of exceeding the solid exemption quantity were found.

Table 10: Polychlorinated Biphenyl Locations

Room	Description
414/601 - Crawlspace/Reactor Hall	Wire insulation in cable trays
516 - Heating & Air Conditioning Room	Flex duct
516 - Heating & Air Conditioning Room	Foam duct insulation
630 - Corridor	Caulking - outer window (glazing tape, black)
651 - Office (outside)	Caulking - outer doors/windows (white)

6.2.4 Other Hazardous Materials

During the operation of WR-1, various hazardous substances were used in B100. Table 11 below provides the expected locations of non-radiological contaminants within B100.

Table 11: Expected Location of Non-Radiological Contaminants

Contaminant	Expected Location	Description
Organic Coolant	Ventilation System; Drainage System, Equipment that was not drained, Drained equipment but not flushed[4]	HB-40 hydrogenated terphenyl used as reactor coolant.
Ozone Depleting Substances	Multiple Systems	Air conditioning and refrigeration systems.
Mercury	Drains of the Room 650 and 702 Laboratories, Thermostats and mercury switches	One fume hood in the Room 702 Laboratory contained a pail labelled mercury; it is assumed that all drains of the Room 650 and 702 laboratories may contain mercury.
Toluene	Nuclear Battery Vaporizer Test Loop (Room 5120 [61]	May have residual amounts of toluene as it was the working fluid of the loop.
Xylene	Fuel Storage Block - Wash Tube Facility	Used as a cleaning solvent.
Boron	Heavy Water System; Boron Addition System	Boric acid was added to the heavy water moderator to control reactor reactivity.
Palladium	Organic Supply System	Palladium bed absorption columns used in the system (columns have been removed, but other equipment may be contaminated).
	Helium Gas System	5% palladium on pelletized alumina used in a recombiner.
Potassium Hydroxide	Chemical Addition Tank of the Concrete Cooling System	Used for pH control of cooling water.
Platinum	Flux Detectors	Used for the wire in the detectors.

[4]During the initial decommissioning efforts in the late 1980's the directive to Operations was to draining those systems that are accessible. There was no flushing of these systems. Other systems were not drained. Systems lower in the building tended not be drained. Recent characterization work has found coating some of the crawlspace exhaust ducting an accumulation of liquid organic at lower points in the same ducting. This is thought to relate to cooling of the air resulting in disposition of aerially suspended organic.

Contaminant	Expected Location	Description
Magnesium Oxide	Flux Detectors	Used as an insulator.
Multiple Ion Exchange Resins	Heavy Water System; Distilled Water System; Spent Fuel Bay Circulation System; Thermal Shield Cooling System; Boron Addition System; WR-1L2; Fast Neutron Loops	Numerous ion exchange columns are incorporated in the systems of WR-1.

6.3 Industrial Safety Hazards

Industrial safety hazards that are associated with specific maintenance activities are identified and evaluated through the Work Permit process [63]. Personnel performing monitoring and surveillance activities should be aware of and take necessary precaution against possible hazardous energy sources (electrical, pneumatic, kinetic, pressurized lines, etc.) and industrial hazards such as tripping, falling, confined spaces, uneven surfaces, working at heights, and fire.

6.3.1 Hazardous Energy

Pressurized systems in B100 include the Water Supply and Drainage Systems, Compressed Air Systems, pneumatic lines for systems and doors, and undrained or partially drained tanks and pipes. Electrical sources in B100 include the Electrical Distribution System and the back-up DC power battery bank. The distribution panels (Room 513) are open at the top and present a significant electrical hazard to any SWS activity above them.

The building is in transition from a centralized powerhouse where power is routed through from the Provincial power grid substation on the main campus and a central set of back-up generators and compressors for supply of compressed air to a power island located adjacent to the building and connected directly the site substation. The newer equipment will provide a measure of increased safety as the equipment will be newer but will also locate higher voltage and fuel adjacent to the B100.

6.3.2 Fire Hazards

A summary of fire hazards in B100 Are identified in the Fire Hazard Analysis [67].

The rooms / spaces with the most ignition sources were the HVAC room, and the support system rooms with operating motors. The rest of the rooms in the building were mainly empty, where the ignition sources would be limited to electrical faults from lighting and low voltage electrical systems

The majority of the rooms in B100 have a low combustible loading (less than 300 MJ/m2), which supports the low hazard industrial occupancy classification. The transient combustibles and equipment within Building 100 have been reduced to negligible amounts and all hazardous materials such as flammable and combustible liquids have been removed.

Most of the areas in B100 were mainly empty with ignition sources limited to electrical faults in lighting and transient ignition sources by maintenance and repair activities that could take place. Most of the electrical equipment in the building has been de energized. Only equipment needed for the safety of the building, workers and the environment are operational.

The potential fire growth or size is attributed to many factors including but not limited to ventilation, transient equipment, and materials involved in a fire. Ventilation in Building 100 is mainly limited to the office spaces that continue to support occupancy and is provided by means of a mechanical HVAC system. Ventilation in old process areas is only turned on prior to personnel entry and is infrequent. Otherwise, ventilation in other areas is mainly by leakage or through openings as there is no mechanical supply or exhaust in the majority of the building. The building leakage for the compartments below level 600 is considered to be low to limited as the construction consists mainly of poured concrete walls, ceilings, and floors [2022 FHA]

Building 100 is located within a protected area (Main Campus) enclosed by security fences and is well cleared of vegetation. The space from the fence to the perimeter access road surrounding the buildings of the Main Campus is clear of most vegetation except for grass. The space between the road and the buildings is also clear of vegetation. There are no vegetative exposures around Building 100.
[66] [63] [67]Confined Spaces

Confined spaces are identified, assessed via Confined Space Hazard Assessment [68], and indicated with confined space warning signage at their entrances as per the Confined Space Management procedure [69]. Each confined space entry requires a minimum of:

- A Confined Space Hazard Assessment [68];
- An Attendant with Checklist and Monitoring Log [70];
- A Confined Space Entry Permit [71];
- Confined Space Emergency Rescue Plan [72]; and
- If entry by contractors with CNL staff, a Coordination Planning form [73].

Confined spaces in B100 are listed in Table 12 All confined spaces in B100 have a limited entry hazard.

Table 12: Confined Spaces in Building 100

Location	Description
Rm 101	Active Water Sump Pit
Rm 102	Organic Sump Pit
Rm 107	Moderator Room Heavy Water Tank Pit

Rm 112	Inactive Sump Pit
Rm 201 to Rm 506	Pipe Chase / Emergency Exit
Rm 306	Storage Pit
Rm 409	Room
	VF20
Rm414/415	Crawlspace
Rm414/415	Ventilation duct - Hatches 4 to 10
Rm 519	Ventilation duct - Hatches 1, 2, and 3
Rm 527	Storage Pit
Rm 531	Crawlspace
Rm 552	Crawlspace
Rm 601	Ventilation Fans FR1/FR2
Rm 653	Crawlspace
Rm 690	Historic SDR Tank
Rm 690	SDR Water Purification Pit
Stack	Lower Level

6.3.3 Working at Heights

The working at heights hazard is principally in the reactor hall and some rooms in the east annex. The configuration of supply fans and ducting has these components and their associated motors accessed through a fixed caged ladder way. The height from the reactor floor to the mezzanine (attic) is approximately 20 m. The area is enclosed with guard rails with gates to access the ladder and top of the cranes.

The 50 tonne and 5 tonne cranes are also located just below this attic space and as required the up surface of the crane is used for re-lamping of the reactor hall. Other at heights locations include the top of the A and B PHT circuits, which has a similar caged ladder access, the former C-circuit room in the east annex.

Periodic accessing of the roof of the reactor hall and west office area and east annex is required to inspect roof drains.

The stack on the east side of the building is accessed via a caged ladder as well.

7. Hazard Control Measures

7.1 General Principles

The safety of the public, the environment, workers, and the facility is of primary importance to CNL in the planning and implementation of work onsite.

Industrial hazards identified throughout this document and additional hazards that will be encountered during the field work will be controlled through the WL Integrated Work Control Process [74] and adherence to CNL Standards and Procedures. These are listed in the Occupational Safety and Health Program Requirements Document [30]. Various locations within the inner rooms of WR-1 require implementation of asbestos controls for entry and exit to ensure worker protection and contamination control due to historic damage to piping insulation. This piping insulation is not easily remediated due to the radiological hazards within these areas. Many locations within the facility have been impacted by hazardous materials from the historic processes completed within the facility and are likely to be encountered during routine work.

The facility and process design has also created many obstacles that workers will need to plan for with respect to confined spaces, working at heights, restricted spaces, and hazardous work areas. These hazards will all be controlled through the Integrated Work Control Process [74].

Radiation dose rate hazards in most rooms range from minimal to low, with moderate hazards limited to only a few rooms. Rooms and areas with elevated gamma radiation levels are associated with the PHT System and components, the Experimental Loops, PD lines, and include the reactor core lower and upper access rooms. General area radiation fields in various rooms are typically less than 1 mrem/h (10 µSv/h). Some rooms have elevated fields ranging from 1 - 55 mrem/h (10 µSv/h - 550 µSv/h). Near contact gamma radiation dose rates on system components range from 30-1000 mrem/h (300 - 10000 µSv/h). Surface contamination hazards in most rooms range from minimal to low, with moderate hazards limited to a few rooms. Table 9 provides more information on Rooms with Elevated Radiological Hazards. Appendix A provides a summary of measured radiation and contamination levels.

In general, safe storage of B100 is achieved by:

- Maintaining a Restricted Access area (Section 8.3);
- Controlling access to the Restricted Access area (by maintaining locked access under the control of Operations, see Section 8.3);
- Identifying upset conditions (any event or condition with the potential to cause or allow the mobilization of radiological or non-radiological hazards would be evaluated and subject to corrective and/or remedial actions as appropriate); and
- Continued reduction (or removal) of the hazard sources.

7.2 Workforce Protection

All work planning at CNL follows the hierarchy of control to plan for the hazards, where possible, eliminating the hazard will always be the first choice.

In general this hierarchy is as follows:

1. Elimination – remove the hazard;
2. Substitution – replace the hazard;

3. Engineering – isolate people from the hazard;
4. Administrative – change the way people work; and
5. PPE&C – protect the worker.

Many procedures and engineering and administrative controls already exist for B100 to ensure the public, the environment, workers, and facility are protected to the highest level possible. When required and all other options are exhausted, PPE&C will be used. Generally, a combination of all hazard controls levels is practiced on site.

Workers working with or around hazardous materials must also have training, knowledge and experience with the materials and area in question to be deemed qualified and be enrolled in medical monitoring programs that pertain to identified hazards as per the procedural and regulatory requirements. Workers that are expected to encounter industrial hazards during the identified work must be qualified through hazard training knowledge, and experience. When required, SMEs are available and will oversee the safe execution of the proposed work. An OSH branch is present at the WL site to provide support for conventional/industrial hazards related to SWS activities as per the Occupational Safety and Health program [30].

Workers performing SWS activities are nuclear energy workers, participate in the dosimetry monitoring program, and are required to adhere to PPE&C and monitoring requirements posted on the RP zoning signs at barriers. The Routine radiation and contamination monitoring is performed as per the stipulations of CNL's Radiation Protection Program [28]. Any hazards associated with specific maintenance activities are identified and evaluated through the *WL Integrated Work Control Process* [74], which may include the assignment of additional controls and protective equipment as needed to control potential exposures to hazards.

7.3 Alarms

The following signals denote an emergency condition; building personnel are to follow their building emergency procedure directions unless advised otherwise by appropriate authority.

Site Signals	
Stay in Alarm	Rising and Falling Signal
Hold and Secure	Tri-Tone Alarm (low-high-low)
Site Evacuation	Continuous Signal
All Clear	Series of Intermittent Blasts
Building Signals	
Fire/ Building Evacuation	Triple Buzzer

Airborne Contamination	High Pitched Sonar Alert

7.4 Radiological Hazard Control Measures

All personnel entering the Restricted Access area must obtain a valid work permit approved by a Work Permit Authorizer prior to entering the area and all work in the Restricted Access area must be supervised by a qualified Group 1 employee.

The Facility Restricted Access Area shall be treated as a Contamination Zone 3 area unless otherwise specified and contamination controls shall include protective clothing (such as rubbers, respirator, gloves or full ‘whites’), monitoring of all personnel and material leaving the area, and monitoring of the entrance area during and after the work is completed. Further radiation protection requirements are given in Radiation Protection PRD [28].

Portable radiation instruments are maintained in a properly calibrated state. Radiation Surveyor assistance is routinely available.

7.5 Chemical Hazard Control Measures

7.5.1 Asbestos Hazard Control Measures

The WL OSH department keeps an asbestos inventory of the buildings on the WL site that reflects the current state of asbestos material that has been previously identified through studies and historic knowledge. If renovation, demolition, or manipulation of the asbestos material is to take place, the material to be handled needs to be verified via sampling.

Workers who are trained to handle asbestos would perform the work or if scope is larger a contractor would be brought in for the scope of work who has training and personnel appropriate to the scope of the work to be done. Workers have baseline testing done before being approved to be able to work with asbestos. Training is provided for asbestos awareness of personnel working in the building.

When asbestos containing materials are generated as waste from the building the material is double bagged in bright yellow bags that state Asbestos and are dispositioned to the appropriate asbestos containing material waste stream [76].

7.5.2 Lead Hazard Control Measures

Locations of lead have been recorded and accessible locations are clearly marked as containing lead. If lead containing or lead materials need to be removed, they are appropriately packaged by personnel trained with knowledge of lead hazards.

7.5.3 Polychlorinated Biphenyls Hazard Control Measures

There were transformers in B100 that contained PCBs as well as some PCB containing capacitors. Over the years they have all been replaced with non-PCB containing replacements.

Locations of PCB in B100 are known, when there is a requirement to replace items such as lighting ballasts there are checked and if suspected as containing PCB are segregated. PCB materials are sent to a controlled PCB material holding area meeting Provincial handling requirements and shipped for destruction within the one-year mandated storage timeline. PCB handling and storage is done by personnel with training in PCB handling.

7.5.4 Other Hazardous Materials Hazard Control Measures

The locations of hazardous materials used during the operation of WR-1 are summarized in Table 11. Most of these materials are not easily accessible to workers perofrming duties associated with Storage With Survelliance activities. The entired of the former WR-1 reactor hall and associated support rooms are locked with keys controlled by Operations personnel familiar with the hazards and their locations. When and area is accessed to perform monitoring requirments PPE&C appropriate for the task is worn. Areas where organic coolant is held up in systems, as systems were drained but not flushed, and some areas have seen an accummulation of organic coolant due to slow movement of the remaining coolant, are marked and any leaks addressed by collection of the coolant.

7.6 Industrial Safety Hazards Hazard Control Measures

Industrial safety hazards that are associated with specific maintenance activities are identified and evaluated through the Work Permit process [63]. Personnel performing monitoring and surveillance activities should be aware of and take necessary precaution against possible hazardous energy sources (electrical, pneumatic, kinetic, pressurized lines, etc.) and industrial hazards such as tripping, falling, confined spaces, uneven surfaces, working at heights, and fire.

7.6.1 Hazardous Energy

Any identified sources of hazardous energy, including pressurized or electrical systems, present during SWS activities will be controlled using the CNL Hazardous Energy Control procedure [64]. Verification of hazardous energy control will be completed by CNL or with CNL oversight if contractors are included in the work. The Order to Operate Form [65] dictates the sequence of isolation steps that workers are required to follow to ensure safe access to areas where energized systems exist.

7.7 Fire Hazards Hazard Control Measures

Most of the areas in B100 are mainly empty with ignition sources limited to electrical faults in lighting and transient ignition sources by maintenance and repair activities that could take place. Most of the electrical equipment in the building has been de energized. Only equipment needed for the safety of the building, workers and the environment are operational.

B100 is connected to the site centralized fire detection system. Occupied and higher hazard rooms are equipped heat and/or smoke detectors that link to a fire system monitoring panel. This panel is part of the Horizon-based monitoring system that will automatically provide notification to onsite Emergency Services personnel in the site Security Monitoring Room (SMR) located in B401. The SMR is staffed 24 hours a day, seven days a week and ESO personnel also provide firefighting services utilizing on-site fire trucks.

Building 100 is located within a protected area (Main Campus) enclosed by security fences and is well cleared of vegetation. The space from the fence to the perimeter access road surrounding the buildings of the Main Campus is clear of most vegetation except for grass. The space between the road and the buildings is also clear of vegetation. There are no vegetative exposures around Building 100.

7.8 Confined Spaces Hazard Control Measures

Qualified personnel (OSH, IH, RP etc.) complete Confined Space Hazard Assessments (CSHAs) for the confined spaces in B100. Confined space warning signs are posted and maintained that are clearly visible to personnel at entrances of all confined spaces, and entry work or activities for all confined spaces are authorized through the WL Integrated Work Control Process [74] . Work is done following the requirements of [68] [69] [70] [71].

7.8.1 Working at Heights Control Measures

Access to the reactor hall is under the control of Operations and ladder access to the stack is locked. A rescue plan has been developed for each area of the working at heights by Emergency Services Operations. Activities for all spaces with a working at heights component are authorized through the WL Integrated Work Control Process [74]. Access is not granted unless Emergency Services Operations is available with sufficient personnel to perform a rescue if required.

8. Access Control and Zoning

8.1 Radiological Areas

B100 is divided into the following radiological areas.

- Supervised Areas -- Defined site areas in which the working conditions are kept under review by G1 qualified employees, but special Radiation Protection (RP) procedures are not normally needed. Access to a Supervised Area is controlled. Work with radiation sources or the storage of radioactive material is not permitted within a Supervised Area without authorization from a G1 qualified Radiation Surveyor or Health Physicist (HP). Annual radiation exposures for workers in the Supervised Area are not expected to exceed the regulatory normal operations annual dose limit for members of the public.
- Controlled Area 1 -- A defined area in which normal working conditions, including unplanned events, require personnel to follow well-established RP procedures and practices. Activities and facilities that pose predominantly an external radiation hazard are permitted and activities posing a low potential for contamination may be allowed on a case-by-case basis.

- Controlled Area 2 -- A defined area in which normal working conditions, including unplanned events, require personnel to follow well-established RP procedures and practices. Activities and facilities that pose a radiation and/or contamination exposure hazard are permitted in a CA2.

The Reactor Area of B100 is designated a CA2. The Auxiliary Area is a Supervised Area with designated CA1s where radiation sources or packages are handled and/or stored and designated CA2s for the radioisotope laboratories (Rooms 650 and 702) and SDR hall (housing the Low level liquid waste (LLLW) Treatment System) and associated rooms (Rooms 690, 689, and 688).

8.2 Radiological Safety Zoning

The Controlled Areas of B100 are further divided into RSZs. Figure 18 to Figure 24 below show the RSZs for B100. The five RSZs, based on dose rates and contamination levels, are as follows [79].

- Zone 1 is considered to be suitable for unrestricted occupancy and includes normal office areas, washrooms, normal access corridors, etc. The dose rate limit for Zone 1 is less than or equal to 0.5 µSv/h (50 µrem/h). Chronic radiation exposure will not typically result in a measurable external radiation dose above natural background ambient levels and the maximum dose received by an individual from external sources of radiation during continuous occupancy should not exceed 1 mSv (100 mrem) in one year.
- Zone 2 is considered to be suitable for normal continuing occupancy. The dose rate limit for Zone 2 is 0.5-10 µSv/h (50 µrem/h to 1 mrem/h). A Zone 2 is normally free of radioactive surface contamination, but may be subject to infrequent cross-contamination from higher numbered zones. Chronic removable surface contamination is not expected or tolerated in a Zone 2 and all removable contamination is removed when discovered. Within any CA2, a Zone 2 should normally be used as a buffer area between a higher numbered zone containing removable contamination and a Zone 1.
- Zone 3 is considered a zone of medium occupancy and such occupancy is subject to continuing review by Line Management and G1 qualified employees. The dose rate limit for Zone 3 is 10 µSv/h to 1 mSv (1-100 mrem/h). Activities generating removable surface contamination in localized areas for short periods of time may be permitted in a Contamination Zone 3. Any such activities should be within a CA2. Efforts should be made to eliminate removable contamination upon discovery or as soon as practicable based upon As Low As Reasonably Achievable (ALARA) considerations. If the removable contamination cannot be immediately eliminated, a hazard sign should be locally posted until cleaning is completed. Radiation Zone 3s are restricted to locations in a CA1 or CA2. A Contamination Zone 3 is typically restricted to locations in a CA2. Exceptions would be approved by the responsible RP Program Manager.
- Zone 4 is a zone of restricted occupancy with access and work controls enforced. The dose rate limit for Zone 4 is 1-100 mSv (100 mrem/h to 10 rem/h). Entry should be

infrequent and accomplished according to established procedures aimed at controlling doses. Such procedures should be reviewed and approved either in advance or at the time of entry by a G1 qualified employee. A Zone 4 should be in a CA2 and by exception, in a CA1 (radiation hazard only). Exceptions shall be reviewed and approved by the responsible RP Program Manager. G1 qualified employees should be involved for all entries into Zone 4 through either a review of work procedures or the conduct of radiological surveys.

- Zone 5 is a zone with a dose rate in excess of Zone 4 levels (> 100mSv/h [10 rem/h]). All entries into Zone 5 require a Work Permit in which the radiological assessments and RP measures are approved by a G1 qualified employee, preferably a HP. All such entries require the constant attention and direction of a G1 qualified employee throughout the duration of the entry. A Zone 5 should be in a CA2 and by exception, in a CA1 (radiation hazard only). Exceptions shall be reviewed and approved by the responsible RP Program Manager.

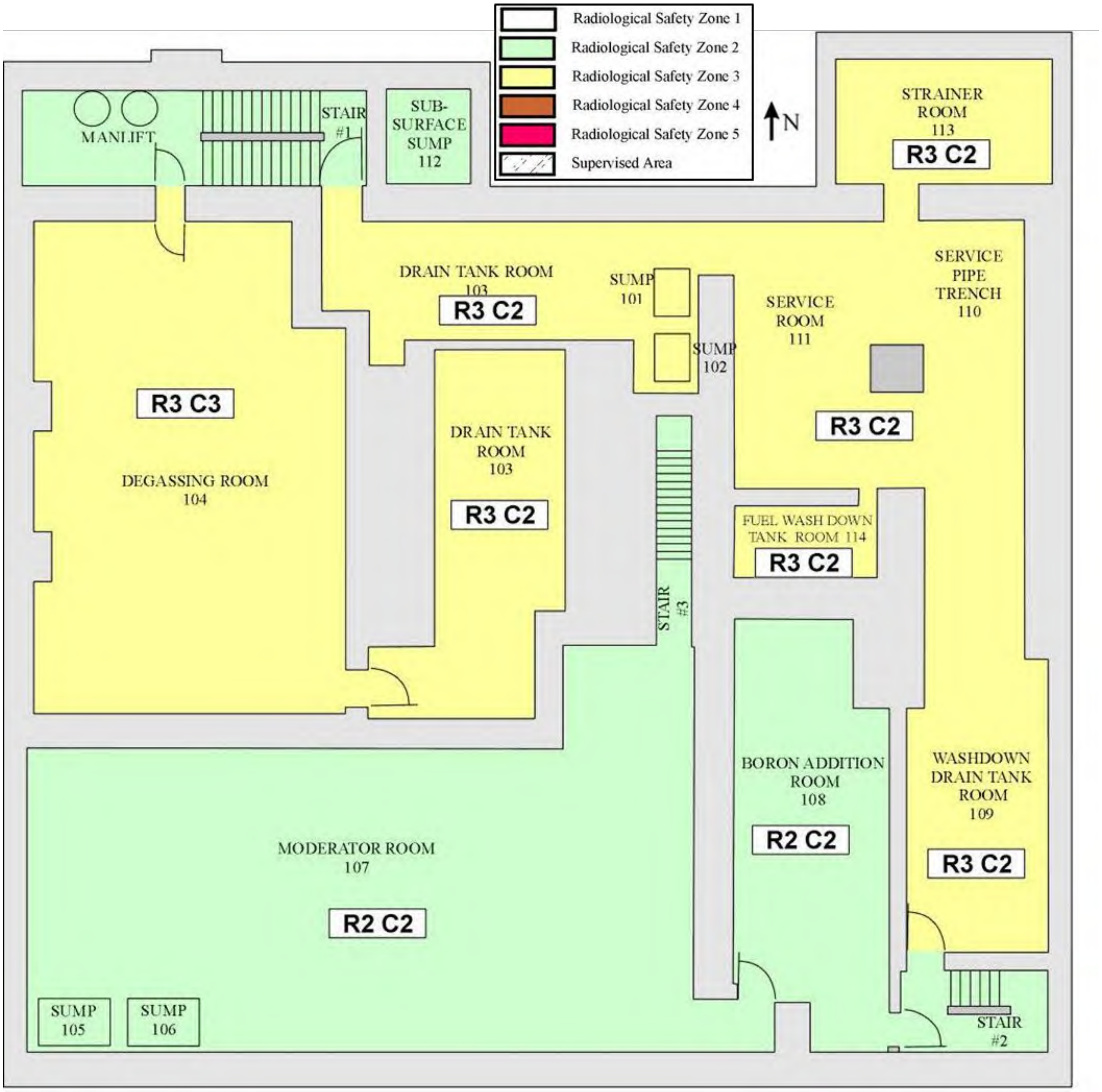

Figure 18: Radiological Safety Zones of the 100 Level

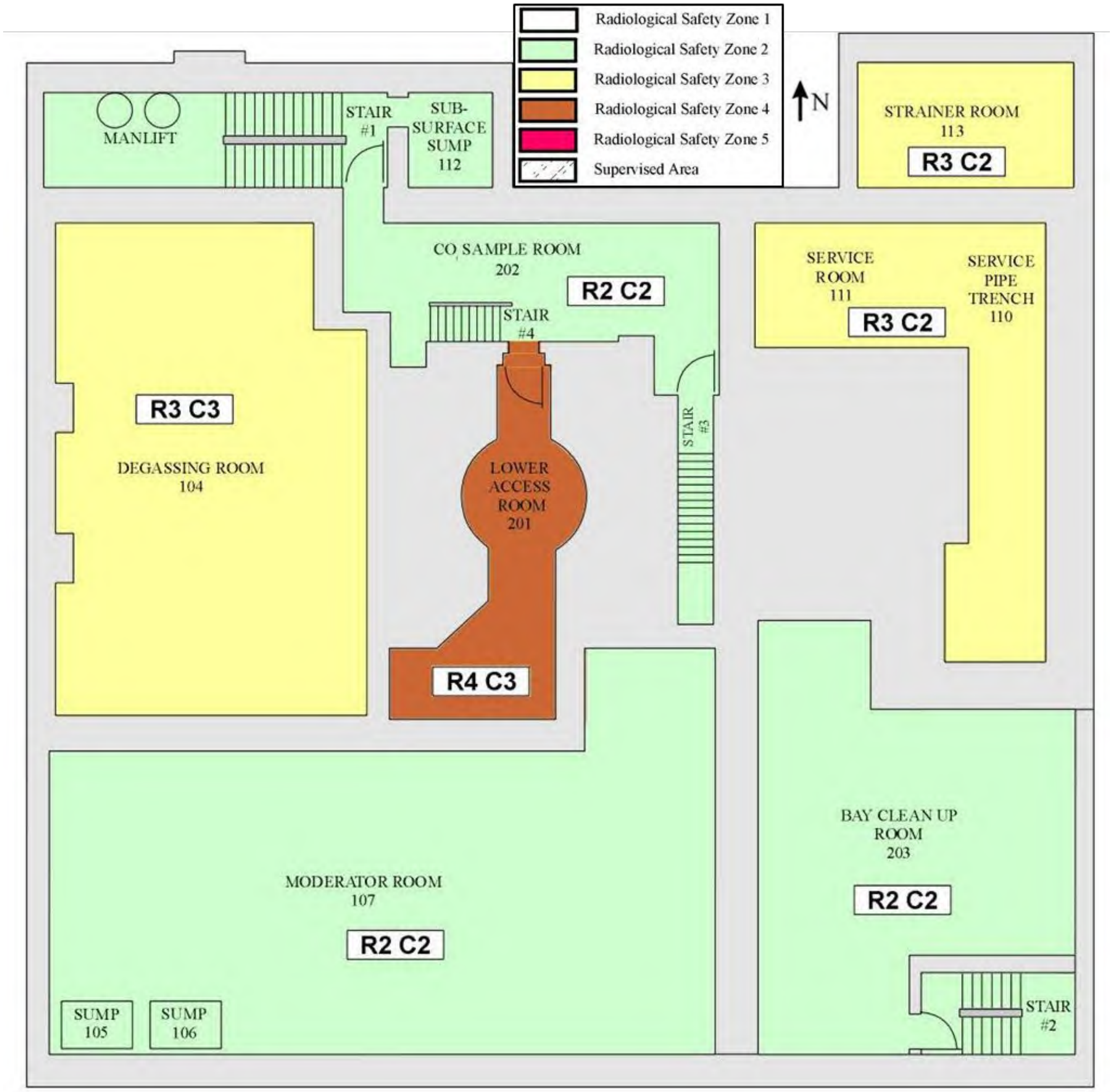

Figure 19: Radiological Safety Zones of the 200 Level

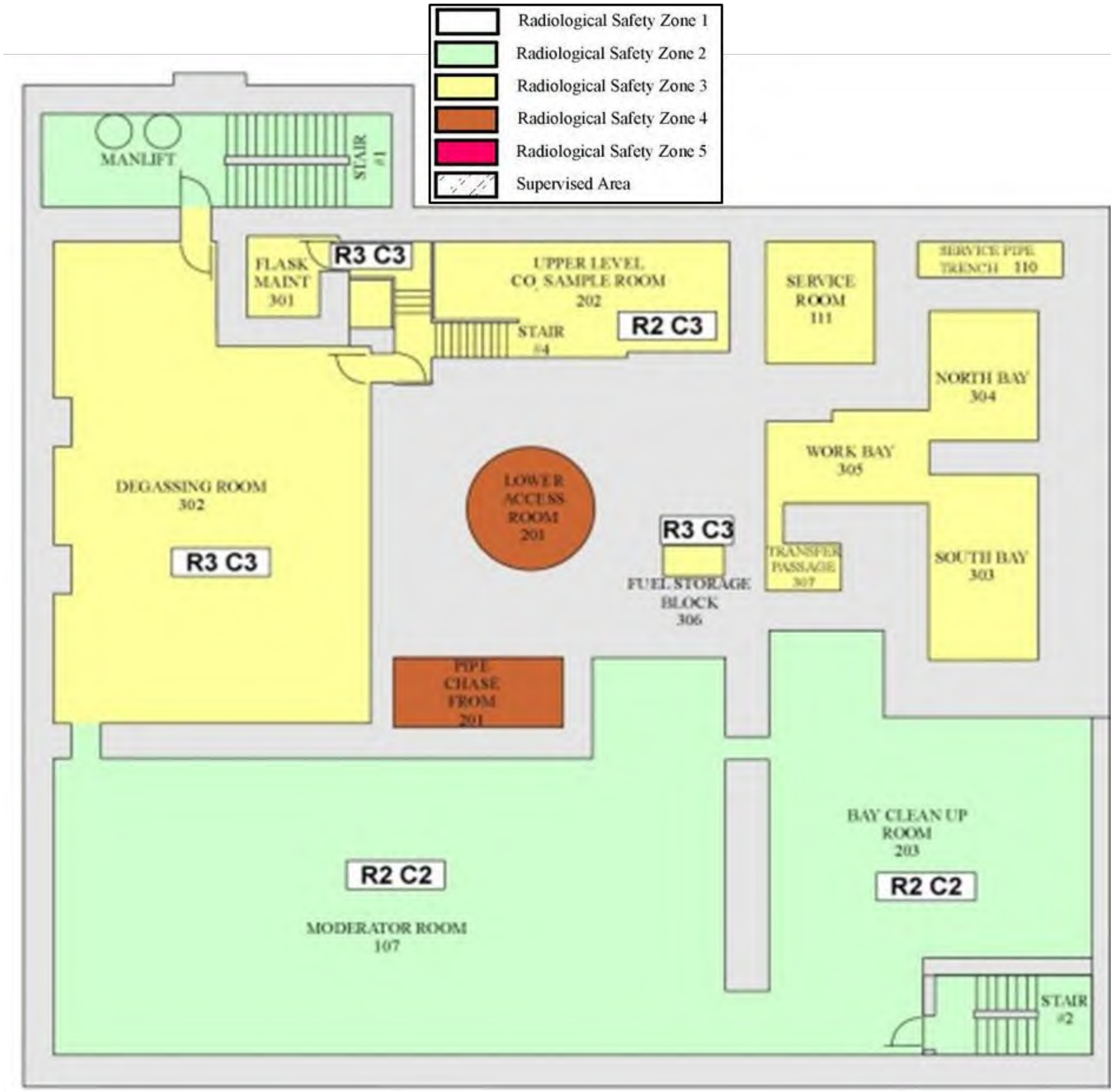

Figure 20: Radiological Safety Zones of the 300 Level

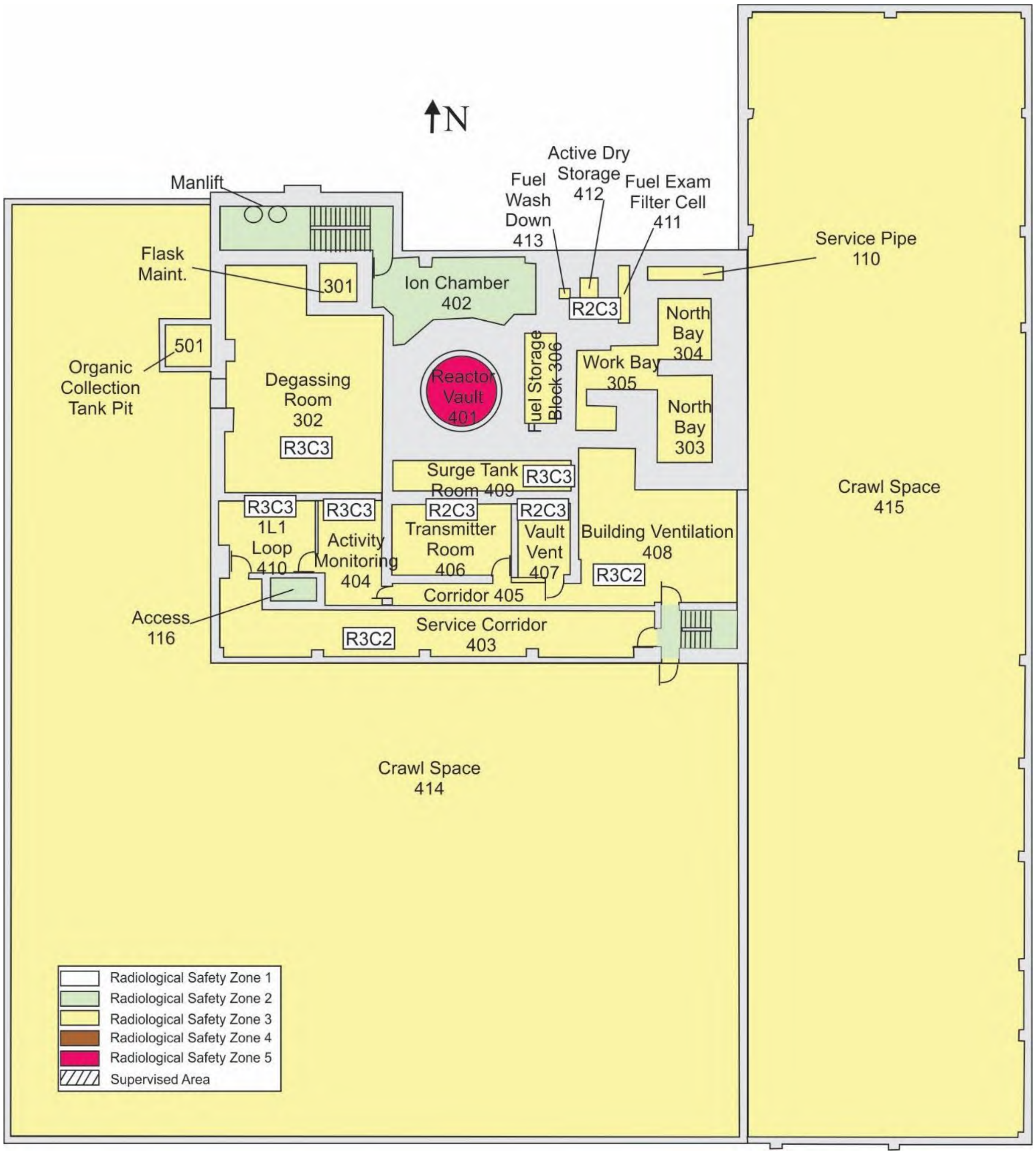

Figure 21: Radiological Safety Zones of the 400 Level

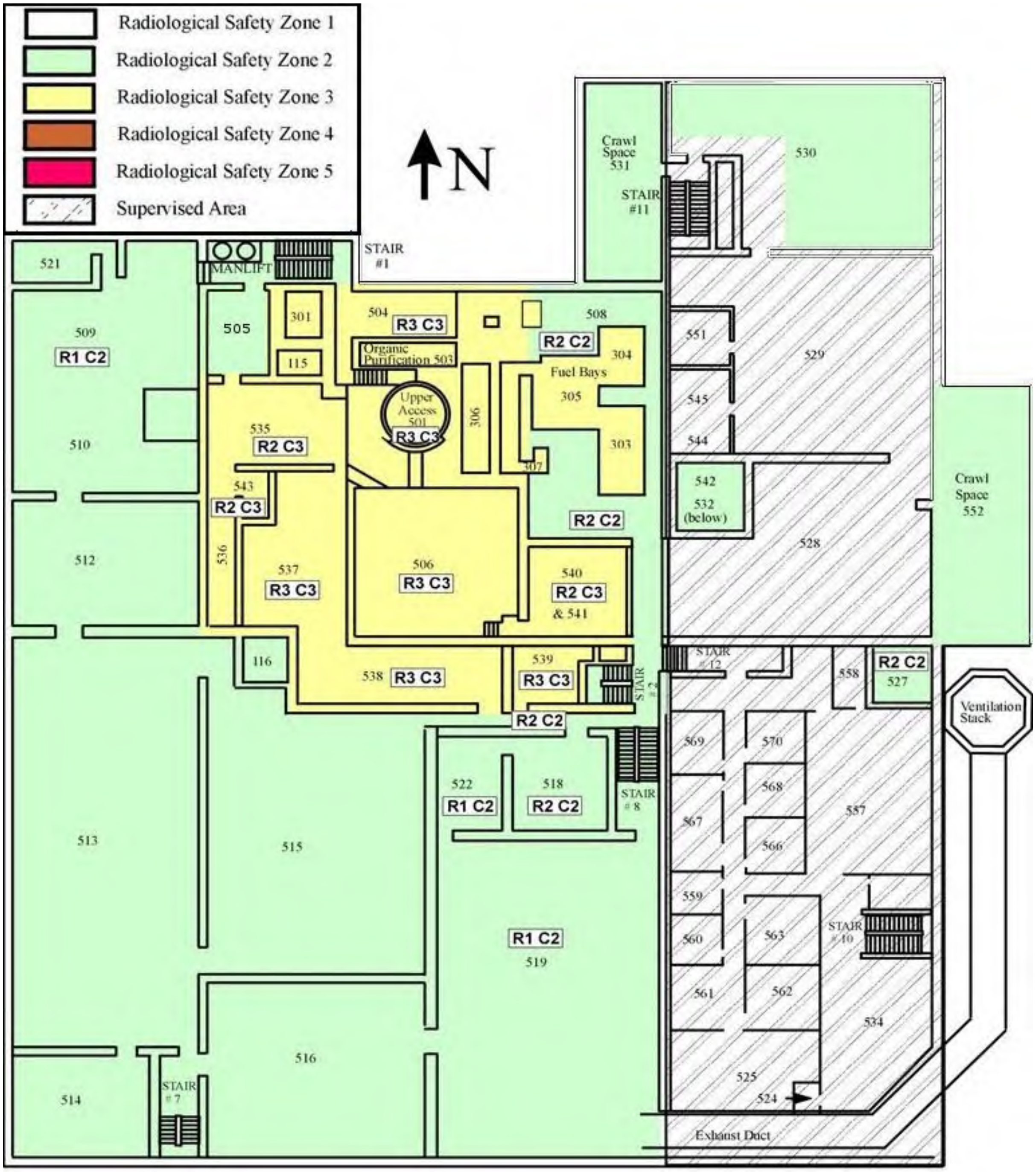

Figure 22: Radiological Safety Zones of the 500 Level

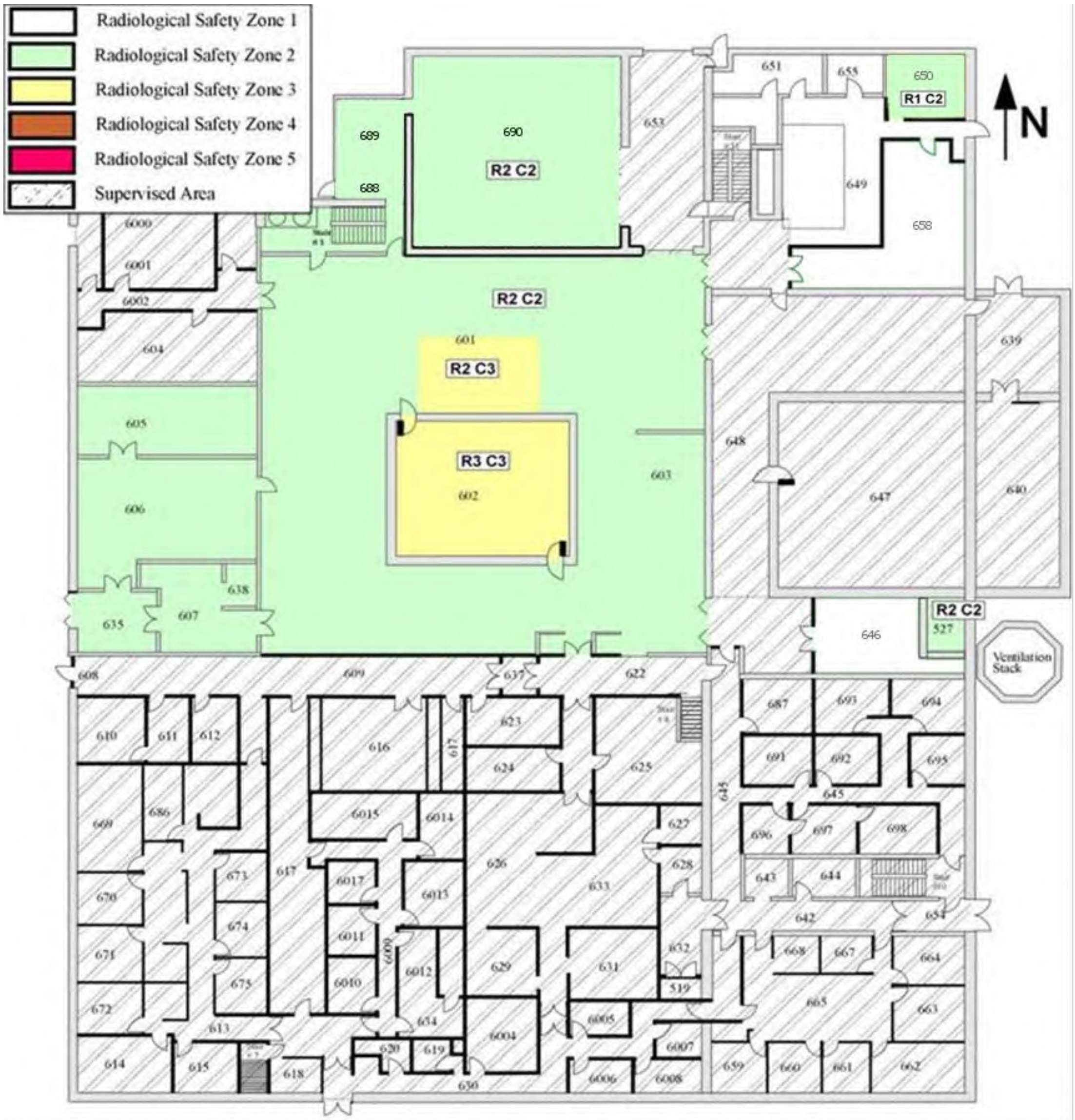

Figure 23: Radiological Safety Zones of the 600 Level

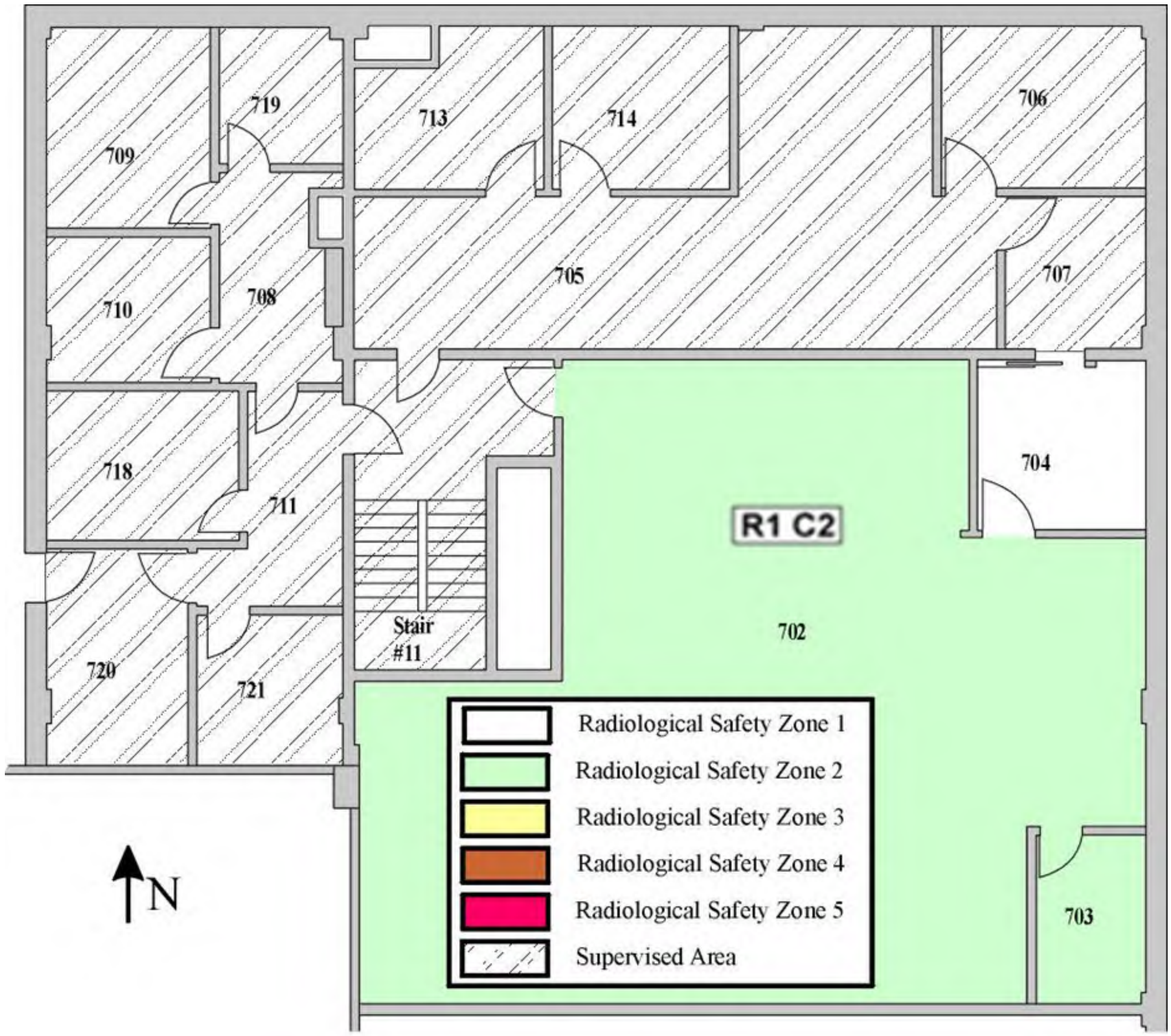

Figure 24: Radiological Safety Zones of the 700 Level

8.3 Restricted and Unrestricted Access Areas

Following the completion of Phase 1 decommissioning activities in 1985, WR-1 was divided into two general access areas:

- WR-1 Unrestricted Access; and
- WR-1 Restricted Access.

The WR-1 Unrestricted Access area consists of rooms that underwent decommissioning and decontamination under the Phase 1 decommissioning activities and had radiological hazards reduced to background or minimal levels meeting either RSZ 1 or 2 hazard conditions. This includes most of the rooms on the 700, 600, and 500 levels.

The WR-1 Restricted Access area consists of rooms that have not undergone any decommissioning activities, or only partial decommissioning and had remaining elevated radiological hazards following the completion of Phase 1 decommissioning. This includes rooms and areas on the 100 to 400 levels and some rooms on the 500 and 600 levels. These rooms are locked in addition to locks at the two main access points to the WR-1 Restricted Access area, which are the Reactor Hall south door and the top of central stairway.

All personnel entering the locked rooms in the Restricted Access area must obtain a valid work permit approved by a Work Permit Authorizer prior to entering the area and all work in the Restricted Access area must be supervised by a qualified Group 1 employee.

The locked rooms Restricted Access Area are treated as a Contamination Zone 3 area unless otherwise specified and contamination controls shall include protective clothing (such as rubbers, respirator, gloves or full 'whites'), monitoring of all personnel and material leaving the area, and monitoring of the entrance area during and after the work is completed. Further radiation protection requirements are given in Radiation Protection PRD [28].

9. Environmental Monitoring & Protection

WL maintains an EnvP Program and Management System with program requirements documents indicated in EnvP Program Requirements Document [29]. This program complies with Licence Condition 9.1 of the WL LCH [75].

10. Emergency Plan and Procedures

WL maintains an Emergency Preparedness Program in accordance with Licence Condition 10.1 in the WL LCH [75] and the CNL Emergency Preparedness Requirements [33]. The Emergency Preparedness Program comprises planning, exercises, and training to ensure processes are in place to control and mitigate the consequences of an emergency at WL and emergencies related to the transportation of nuclear materials.

WL maintains Emergency Procedure for B100 [77], which contains procedures to be used by B100 occupants and checklists to be used by building emergency personnel to respond to emergencies originating in or affecting B100.

11. Usage Boundaries during Storage with Surveillance

The main routine activities will be related to the surveillance, monitoring, testing of the facility and maintenance of systems and components needed to maintain the facility in its secured shut down state. Other activities that may be performed during the SWS phase are related to housekeeping and hazard reduction (for example: asbestos abatement). It is not intended to dismantle/remove any reactor systems from the site without prior notification of the SRC and the CNSC.

Non-routine activities may be performed to confirm configuration of Structures, Systems and Components (SSCs) and to obtain samples from SSCs to support decommissioning planning and SWS activities (characterization activities). Support systems may be installed, in accordance with the Engineering Change Control process, as needed to safely perform these activities.

12. Facility Change or Modification Process

All changes to the facility, structures or systems shall be done in accordance with the Engineering Change Control process [39]. The ECC process ensures modifications are adequately assessed, designed, reviewed, controlled, implemented, tested, and appropriately captured in compliance with relevant safety and configuration management requirements.

13. Waste Management

The Waste Management (WM) Program requirements for CNL are detailed in the program requirements documents [36].

Routine waste produced from regular monitoring and surveillance activities and maintenance follow one of the many waste streams as identified in the *WL Closure Project Waste Management Process Plan* [78].

Likely Clean Waste

All likely clean waste materials require suitable radiological clearance monitoring before they can be released from the WL site. Likely clean waste materials that have been confirmed to meet the unconditional clearance levels and have been approved for release by a Radiation Protection Leader[5] or qualified Health Physicist shall be managed as clean waste. Likely clean waste materials that are found to be contaminated or cannot be proven to satisfy unconditional or conditional clearance criteria shall be managed as radioactive waste.

Hazardous/Mixed Waste

The preferred option for managing hazardous waste materials is to send it to a licensed off-site hazardous waste management facility for processing and/or disposal. Prior to generating any hazardous waste, the Waste Generator shall confirm that WL has the means to disposition the waste and confirm the necessary packaging and labelling requirements.

Hazardous waste generated at WL also requires classification as clean, likely clean, or radioactive waste. Hazardous waste materials that have no potential of being impacted by site nuclear operations shall be managed as radiologically clean hazardous waste. Hazardous waste materials that are not expected to be contaminated or radioactive based on its history, location, and use, but have potential of being impacted by site nuclear operations shall be managed as likely clean hazardous waste and subject to the same radiological clearance monitoring process as likely clean waste. Hazardous waste materials that are determined to be radioactive shall be managed as mixed waste.

The management of mixed waste will be dependent upon the specific radiological and non-radiological hazards. The preferred management option is to disposition all mixed waste through an appropriately licensed off-site waste processing facility.

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[5] The Radiation Protection (RP) Leader is a senior RP surveyor, who provides direction and authoritative advice to the RP Surveyors, RP Assistants, Contamination Monitors and Decontamination Workers.

Radioactive Waste

The management of radioactive waste materials will be dependent on RP requirements and protocols. There are currently three broad disposition options for the management of radioactive waste materials generated at WL:

1. Decontamination or Remediation
2. Long-Term Storage
3. Off-Site Processing

The selected disposition option for radioactive waste materials will influence the characterization, segregation, packaging, processing, and transportation activities.

Waste Management Activities

The following activities are performed by the LLLW treatment system in support of the removal of waste and hazard reduction during SWS.

- An oil sock is used to remove oil form the LLLW holding tanks.
- Samples are taken when the holding tanks are full to determine if the contents are acceptable for release prior to discharge to storm drains.

14. Quality Assurance

All monitoring, surveillance, and maintenance duties will be conducted safely in accordance with the WL Decommissioning Quality Assurance Plan [80] and the Whiteshell Site Licence [27]. Quality is assured by the application of approved CNL management policies and procedures in the areas of staffing, training, documentation, procurement, supervision, work execution, and verification. Quality is verified by self-checking, independent verification, audits, inspections and environmental monitoring.

15. Qualifications and Training Program

WL maintains a Training Program in accordance with Licence Condition 2.2 in the WL LCH [75]. CNL maintains a list of positions and roles that require a Systematic Approach to Training (SAT) compliant program. CNL's Systematic Approach to Training (SAT) process provides a standardized approach to training and qualification used to ensure that CNL is in compliance with conditions in the applicable licence. It provides Management with the assurance that personnel are trained, competent and qualified for the work they are assigned to do.

During a recent assessment of positions, it was determined that WR-1 personnel were not ranked as requiring a full SAT approach to training, however, WR-1 Operators follow a training/mentoring program and receive training on procedures and processes such as the Low Level Liquid Waste system. An internal system of mentoring from Senior Operations Technicians is used along with sign off requirements on each learning area. The Facility Manager and Facility Authority are appointed following the same approach as other Nuclear Facilities in CNL [79].

16. Records

Records will be prepared, issued, and archived as per the procedures [81], and [82].

Records to be preserved include:

- Routine monitoring inspection records;
- Non-routine work procedures (Work Instruction Packages, Radiological Work Plan, or Operating Instruction);
- Testing results;
- Periodic inspections and safety inspections records;
- Daily logs;
- Radioactive and hazardous waste release records; and
- Work permits.

All maintenance work (routine and non-routine) will be performed, recorded, and filed using the Enterprise Asset Management System (EAMS). Records of facility changes are documented in accordance with Engineering Change Control requirements [39].

17. Summary

The SWS program outlined ensures control of the remaining hazards in WR-1 through early identification of abnormal operation. The plan may be revised periodically over the deferment period to address changes in administrative responsibility or in SWS requirements based on experience. At a minimum the SWS will be reviewed and revised on a 5 year cycle before being resubmitted to the CNSC.

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Appendix A Building 100 Rooms Radiological Hazards

Room	Description	System	Components	Gamma Radiation Hazards			Contamination Hazards				Last Survey Date/ Comments
				Radiation Zone	GA Dose Rates (mrem/h)	Maximum/ Elevated Dose Rates (mrem/h near contact)	Contamination Zone	Removable Surface Contamination (cpm on-swipe) Beta/Alpha	Contamination found on PPE after room entry (Ludlum 44-9 unless otherwise noted)	Gamma Analysis Results (Bq/cm²)	
103	Drain Tank Room	Primary Heat Transport Spent Fuel Handling and Storage System Active Drainage System	Circuit A and B Drain Tank Active Dry Storage/Fuel Wash Down System - Washing Cell Drain Filter Active drainage sump A - general drainage, Organic drainage sump A	3	6 PAD results from room characterization for Asbestos Abatement: Average dose rate: 3.46 Max average dose rate: 4.95 Max dose rate: 56.0 Average max dose rate: 36.40	200	2	300/cos 9 of 10 swipes COS (Asbestos characterization)	No Activity Detected (NAD)	3 swipes, max values: Cs-137: 0.03 Asbestos characterization campaign: 10 swipes, max values: Cs-137: 0.004	Feb 2015 Chain of Custody: Room 104-103-302-WR1-Scoping-2014-01-20-CB-001 COC WR1-2015-06-29
103	Corridor to Room 111			3	0.05-0.2	16 mrem/h nc, 8 mrem/h @ 30 cm, 2 mrem/h @ 1 m, opening to drain tank room	2	COS/COS is in relation to beta/alpha, i.e. no alpha or beta activity detected on swipe. As indicated in the row below where we have 2000 cpm beta but no alpha on swipe.	-	Organic sludge from APO PM2 Cs-137: 169 Bq/sample Am-241: 15 Bq/sample Co-60: 0.42 Bq/sample Eu-154: 1.8 Bq/sample	Feb 2016 (dose rate) Chain of Custody: B100-Rm 103-WR-1 Scoping-2014-01-14-CB-001 B100-Rm 103-WR-1 Scoping-2014-01-14-CB-003 Lowest Cs-137: Am-241 Ratio: 11:1
104	Degassing	Primary Heat Transport	Circuit A &B Degassing tanks; Circuit A&B	3	4-9 PAD results from room	40: AD0-P1 and AD0-P2 motor	3	2k/cos	NAD	9 swipes, max values: Cs-137: 0.6	Feb 2015 Chain of Custody:

Room	Description	System	Components	Gamma Radiation Hazards: Radiation Zone	GA Dose Rates (mrem/h)	Maximum/ Elevated Dose Rates (mrem/h near contact)	Contamination Hazards: Contamination Zone	Removable Surface Contamination (cpm on-swipe) Beta/Alpha	Contamination found on PPE after room entry (Ludlum 44-9 unless otherwise noted)	Gamma Analysis Results (Bq/cm²)	Last Survey Date/ Comments
		Heating and Cooling System	Volatiles/Water Collection Tanks; Circuit A&B Seal Drain Tanks COW Tanks, Condensers		characterization for Asbestos Abatement: Average dose rate: 3.46 Max average dose rate: 4.95 Max dose rate: 56.0 Average max dose rate: 36.40	600: D0-TK1 bottom north 60: AD0-P1 pump 40: B standpipe 300: AD0-ST1 25: BD0-ST2 20: BD0-P2 55: AD0-P2 pump 25: BD0-P1 motor 150: AD0-ST2 80: between A/BDO-TK1 at floor level 15: BD0-P2 motor 1000: AD0-TK1 bottom south 60: BD0-ST1 200: AD0-TK1 underneath at 1 m height 80: A standpipe 50: BD0-TK1 bottom 30: BD0-P2 pump				Am-241: 0.02 Eu-154: 0.003 1 organic sludge sample: 10 Bq/sample Activity balance on some swipes indicates a pure beta emitter present Asbestos characterization campaign: 27 swipes, max values: Cs-137: 0.03 Am-241: 0.001	Room 104-103-302-WR1-Scoping-2014-01-20-CB-001 WR1-2015-06-29-AW001 Max Cs-137: Am-241 ratio: 30:1
107	Moderator	Heavy Water System Helium System AO&GS	Dump tank, Helium Accumulator tank, Moderator Heat Exchanger, Moderator Demineralizer	2	0.05-0.2	10 mrem/h nc, 0.3 mrem/h @ 30 cm check valve at MH V6 13 mrem/h nc, 3 mrem/h @ 30 cm, 0.06 @	2	200 cpm β bench/cos 15 swipes COS (Asbestos characterization)	-		Jan 2015 Feb 2016 (dose rate) Chain of Custody:

Room	Description	System	Components	Gamma Radiation Hazards			Contamination Hazards				Last Survey Date/ Comments
				Radiation Zone	GA Dose Rates (mrem/h)	Maximum/ Elevated Dose Rates (mrem/h near contact)	Contamination Zone	Removable Surface Contamination (cpm on-swipe) Beta/Alpha	Contamination found on PPE after room entry (Ludlum 44-9 unless otherwise noted)	Gamma Analysis Results (Bq/cm²)	
		Active Drainage System	System; Heavy Water Priming Flow Cooler Helium Condenser, Organic Supply System – Dechlorination Hold Tank Active drainage sump B - heavy water drainage			1 m, at waist height bottom of valve, above and right of drip tray 2 mrem/h nc, 0.2 mrem/h @ 30 cm, 0.1 @ 1 m, between two tanks 1.3 mrem/h nc, 1.1 mrem/h @ 30 cm, 0..05 mrem/h @ 1m, far right upon entry, just before stairs.					WR1-107-Tritium-2015-05-28-TB-02 WR1-107-Tritium-2015-06-01-TB-001 WR1-107-Tritium-2015-06-02-TB-001 WR1-107-Tritium-2015-06-03-TB-001 WR1-107-Tritium-2015-06-04-TB-001 WR1-107-Tritium-2015-06-05-TB-001 (2) WR1-107-Tritium-2015-06-10-TB 02 WR1-107-Tritium-2015-06-10-TB-03 WR1-107-Tritium-2015-06-15-TB 01 WR1-107-Tritium-2015-06-16-TB-01 WR1-107-Tritium-2015-06-16-TB-02 WR1-107-tritium-2015-06-17-TB-002

Room	Description	System	Components	Gamma Radiation Hazards			Contamination Hazards				Last Survey Date/ Comments
				Radiation Zone	GA Dose Rates (mrem/h)	Maximum/ Elevated Dose Rates (mrem/h near contact)	Contamination Zone	Removable Surface Contamination (cpm on-swipe) Beta/Alpha	Contamination found on PPE after room entry (Ludlum 44-9 unless otherwise noted)	Gamma Analysis Results (Bq/cm²)	
											WR1-107-Tritium-2015-06-18-TB-001 WR1-107-Tritium-2015-06-18-TB-002 WR1-107-tritium-2015-06-22-TB-002 WR1-107-tritium-2015-06-22-tb-003 WR1-107-Tritium-2015-06-24-TB-001 WR1-107-Tritium-2015-07-06-TB-001 WR1-107-Tritium-2015-07-06-TB-002 WR1-Tritium-2015-06-17-TB-01 WR-107-tritium-2015-05-28-TB-001 WR-107-tritium-2015-05-28-TB-003
108	Boron Addition Room	Heavy Water and Helium System	Boron Addition	2	0.05-0.2	30 mrem/h nc, 10 mrem/h @ 30 cm, 4 @ 1m, process drain	2	COS/COS 6 swipes COS (Asbestos characterization)	-		Jan 2015 Feb 2016 (dose rate)
109	Fuel Wash Down Drain Tank Room	Spent Fuel Handling and	Fuel Wash down Systems Heaters	3	0.5	30 mrem/h nc, 10 mrem/h @ 30 cm, 1.5 @	2	COS/COS 24 swipes COS (Asbestos	-		Jan 2015 Feb 2016 (dose rate)

Room	Description	System	Components	Gamma Radiation Hazards			Contamination Hazards				Last Survey Date/ Comments
				Radiation Zone	GA Dose Rates (mrem/h)	Maximum/ Elevated Dose Rates (mrem/h near contact)	Contamination Zone	Removable Surface Contamination (cpm on-swipe) Beta/Alpha	Contamination found on PPE after room entry (Ludlum 44-9 unless otherwise noted)	Gamma Analysis Results (Bq/cm²)	
		Storage System Active Dry Storage/Fuel Wash Down System				1m, process drain and under TK-3		characterization)			
110	Service Pipe Trench			3	0.5-2.0	30 mrem/h nc, 10 mrem/h @ 30 cm, 1.5 @ 1m, process drain	2	1k/COS 26 swipes COS (Asbestos characterization)	-	1 Swipe: Cs-137: 0.23	Jan 2015 Feb 2016 (dose rate) Chain of Custody: B100-Rm 110-WR-1 Scoping-2014-01-14-CB-002
111	Active Solvent	Spent Fuel Handling and Storage System Active Dry Storage/Fuel Wash Down System Heating and Cooling System	Fuel Wash down Systems Dump Tank, Storage Tank COW Tanks, Condenser	3	0.2	5 mrem/h nc, 0.5 mrem/h @ 30 cm, 0.25 mrem/h @ 1m along piping, from AD NV19 overhead north to AD-V5 west (active drain)	2	500 cpm β 7 swipes COS (Asbestos characterization)	-		Jan 2015 Feb 2016 (dose rate)
113	Strainer Room			3	0.05	0.05	2	COS/COS 4 swipes COS (Asbestos characterization)	-		Jan 2015
114	Fuel Wash Down Drain Tank (Upper Extension)	Spent Fuel Handling and Storage System	Fuel Wash down Systems	3	1	6 mrem/h nc, 2 mrem/h @ 30 cm washdown tank	2	COS/COS 5 swipes COS (Asbestos characterization)	-		Jan 2015

Room	Description	System	Components	Gamma Radiation Hazards			Contamination Hazards				Last Survey Date/ Comments
				Radiation Zone	GA Dose Rates (mrem/h)	Maximum/ Elevated Dose Rates (mrem/h near contact)	Contamination Zone	Removable Surface Contamination (cpm on-swipe) Beta/Alpha	Contamination found on PPE after room entry (Ludlum 44-9 unless otherwise noted)	Gamma Analysis Results (Bq/cm²)	
115	Access Shaft (NW Corner of RM 601 to NE corner of RM 302 and 104)			--	--	Unable to enter	--	Unable to enter	-		No ACM Inaccessible area
116	Access Shaft (SW corner of Rm 601 to SW corner of Rm 107)			--	--	Unable to enter	--	Unable to enter	-		No ACM Inaccessible area
201	Lower Access			3	Restricted access room survey completed Jan 2023 indicated general fields of 5.5 mrem/h with a maximum of 5000 mrem/h 7	5000	3	366 cpm alpha and 82872 cpm beta	500 cpm on rubbers through 2 layers of plastic bags	Asbestos characterization campaign: COC WR1-2015-07-14-AW-001: 1000 cm², 3 swipes with 0.008 to 0.04 Bq/cm² Cs-137, 3 swipes with 0.002 to 0.004 Bq/cm² Co-60, 1 swipe with 0.002 Bq/cm² Am-241	Jan 2023
202	CO2 Sample Room – Lower Level			2	0.05	8 mrem/h nc, 0.5 mrem/h @ 30 cm, 0.15 @ 1 m, G8, copper pipe near door to Rm 201 43 mrem/h nc,25 mrem/h @ 30 cm, 5 @ 1 m, at 301	2	COS/COS Asbestos Characterization: Lower: Direct: 500 to 1k cpm Loose: COS (5 swipes) Upper: Direct: NA	NAD	21 swipes, max values: Cs-137: 0.15 Am-241: 0.005 Co-60: 0.07 Activity balance on some swipes indicates a pure beta emitter present	Jan 2015 No ACM Feb 2016 (dose rate) Chain of Custody: B100-WR-1-Scoping-2014-02-11-CB-001

Room	Description	System	Components	Gamma Radiation Hazards			Contamination Hazards				Last Survey Date/ Comments
				Radiation Zone	GA Dose Rates (mrem/h)	Maximum/ Elevated Dose Rates (mrem/h near contact)	Contamination Zone	Removable Surface Contamination (cpm on-swipe) Beta/Alpha	Contamination found on PPE after room entry (Ludlum 44-9 unless otherwise noted)	Gamma Analysis Results (Bq/cm²)	
						door, upper floor		Loose: COS (5 swipes on pipes and elbows)			Lowest Cs-137: Am-241 Ratio: 30:1
203	Bay Clean-Up	Spent Fuel Bay Circulation System	Change Volume Tank, Bay Water Heat Exchanger, Sand Bed Filter, Ion Exchange Column	2	0.5	40 mrem/h nc, 3 mrem/h @ 30 cm, 0.2 @ 1 m, BYW TK1 pipe at bottom left 1.5 mrem/h nc, 0.6 mrem/h @ 30 cm, 0.5 @ 1 m, Process Drain line, far right upon entry	2	450/COS Asbestos Characterization: Direct: NAD/NA Loose: COS (18 swipes)	NAD (upper and lower level)	1 swipe: Cs-137: 0.06	Jan 2015 Feb 2016 (dose rate) Chain of Custody: B100-2014-01-15-TR-001
301	Flask Maintenance – Upper Level			3	3	3	3	500/COS	-	6 swipes, max values: Cs-137: 19.1 Am-241: 0.92 Eu-154: 0.21 Activity balance on some swipes indicates a pure beta emitter present	Jan 2014 No ACM Chain of Custody: B100-WR-1-Scoping-2014-01-31-CB-001 Lowest Cs-137: Am-241 Ratio: 20:1
301	Flask Maintenance – Lower Level			3	100	5000: stored radioactive source	3	500/COS	-		July 2011
302	Degassing	Primary Heat Transport	Circuit A&B Degassing Tanks; Circuit A&B Primary and Secondary	3	3-8 PAD results from room characterization	1000	3	150/COS Asbestos Characterization: Direct: NA	NAD through 2 layers of plastic bags	9 swipes, max values: Cs-137: 0.02	Feb 2015 Chain of Custody: Room 104-103-302-WR1-

Room	Description	System	Components	Gamma Radiation Hazards			Contamination Hazards				Last Survey Date/ Comments
				Radiation Zone	GA Dose Rates (mrem/h)	Maximum/ Elevated Dose Rates (mrem/h near contact)	Contamination Zone	Removable Surface Contamination (cpm on-swipe) Beta/Alpha	Contamination found on PPE after room entry (Ludlum 44-9 unless otherwise noted)	Gamma Analysis Results (Bq/cm²)	
			Condensers; Circuit A&B Low Boiler Condensers		for Asbestos Abatement: Average dose rate: 1.86 Max average dose rate: 2.13 Max dose rate: 12.6 Average max dose rate: 10.85			Loose: COS (23 swipes)			Scoping-2014-01-20-CB-001
303	Spent Fuel Bay South										Inaccessible area
304	Spent Fuel Bay North										Inaccessible area
305	Spent Fuel Work Bay										Inaccessible area
306	Fuel Storage Block			3			3			10 swipes, max values: Cs-137:5.72 Am-241:0.05 Eu-154: 0.002 Co-60: 0.006 Activity balance on some swipes indicates a pure beta emitter present	Jan 2014 Chain of Custody: B100-WR-1-Scoping-2014-01-31-CB-001 Lowest Cs-137: Am-241 Ratio: 25:1
402	Ion Chamber	Neutron Power System		2	0.05-0.2	6 mrem/h nc, 2 mrem/h @ 30 cm, 0.4 mrem/h @ 1 m, 6 feet up wall in front of door	2	Up to 60k β on lip of hatch Asbestos Characterization: Direct: NAD (north wall), NA (south wall)	-	3 swipes taken, max values: Cs-137: 80.5 Am-241: 1.9 Pa-234: 0.05 Eu-154: 0.04 Co-60: 0.006	Jan 2015 Feb 2016 (dose rate) Chain of Custody: B100-2014-01-09-JL-001 B100-2014-01-10-JL-001

Room	Description	System	Components	Gamma Radiation Hazards			Contamination Hazards				Last Survey Date/ Comments
				Radiation Zone	GA Dose Rates (mrem/h)	Maximum/ Elevated Dose Rates (mrem/h near contact)	Contamination Zone	Removable Surface Contamination (cpm on-swipe) Beta/Alpha	Contamination found on PPE after room entry (Ludlum 44-9 unless otherwise noted)	Gamma Analysis Results (Bq/cm²)	
								Loose: COS (10 swipes)			Lowest Cs-137:Am-241 ratio 42:1
403	Service Corridor			3	0.1	0.1	2	25k (on swiffer) /cos Asbestos Characterization: Direct: NAD Loose: COS (1 swipe)	NAD on low rubbers	5 swipes taken Cs-137: 3.68	Feb 2016 Chain of Custody: B100-WR-1-SCOPING-2014-02-20-CB-001 B100-RM 403-2014-05-16-TB-001
404	Activity Monitoring			3	10 PAD results from room characterization for Asbestos Abatement: Average dose rate: 2.35 Max average dose rate: 4.40 Max dose rate: 17.5 Average max dose rate: 10.30	150: Activity monitoring lines – east side 250: Header overhead 40: Activity monitoring lines – west side	3	COS/COS Asbestos Characterization: Direct: NA Loose: COS (10 swipes)	NAD	10 swipes, max values: Cs-137: 0.001 Co-60: 0.0007	July 2012 Chain of Custody: RM 538-404-410-WR1-Scoping-2014-03-10-CB-001
406	Transmitter Room			2	0.1	8	3	COS/COS Asbestos Characterization: Direct: NA Loose: COS (11 swipes on ACM, 1 swipe of floor drain)	NAD on low rubbers		Feb 2015

Room	Description	System	Components	Gamma Radiation Hazards			Contamination Hazards				Last Survey Date/ Comments
				Radiation Zone	GA Dose Rates (mrem/h)	Maximum/ Elevated Dose Rates (mrem/h near contact)	Contamination Zone	Removable Surface Contamination (cpm on-swipe) Beta/Alpha	Contamination found on PPE after room entry (Ludlum 44-9 unless otherwise noted)	Gamma Analysis Results (Bq/cm²)	
407	Vault Ventilation			2	0.1	0.5	3	COS/COS Asbestos Characterization: COS (1 swipes on pipe and 2 on surrounding ducting)	NAD on rubbers		Feb 2015 Chain of Custody: B100-RM 407-WR-1-Scoping-2014-02-07-CB-001
408	Reactor Building Ventilation	Heating and Cooling System	Condenser	3	0.2-0.5	60 mrem/h nc, 7 mrem/h @ 30 cm, 2 mrem/h at 1 m, process drain line far back left upon entry. 2-5 mrem/h nc, 1.2 mrem/h @ 30 cm, 0.3 mrem/h at 1 m, PD lie, east/west overhead upon entry, entire length of PD line	2	COS/COS Asbestos Characterization: Direct: NAD/ NA Loose: COS (15 swipes)	-		Jan 2015 Feb 2016 (dose rate)
409	Surge Tank & Pipe Shaft	Primary Heat Transport	Circuit A and B Surge Tank	3	5	40	3	Asbestos Characterization: Direct: NA Loose: COS (11 swipes)	NAD		July 2012
410	1L1 Loop	WR-1L1 Experimental Loop	Make-Up Tank, Loop Cooler	3	1	2-18	3	COS/COS	NAD	10 swipes, max values: Cs-137: 0.001 Co-60: 0.0007	Jan 2023

Room	Description	System	Components	Gamma Radiation Hazards			Contamination Hazards				Last Survey Date/ Comments
				Radiation Zone	GA Dose Rates (mrem/h)	Maximum/ Elevated Dose Rates (mrem/h near contact)	Contamination Zone	Removable Surface Contamination (cpm on-swipe) Beta/Alpha	Contamination found on PPE after room entry (Ludlum 44-9 unless otherwise noted)	Gamma Analysis Results (Bq/cm²)	
412	Active Dry Storage Pit			2			3				Inaccessible area
413	Fuel Wash-down Pit										Inaccessible area
414/ 415	Crawl space	WR-1L2 Experimental Loop Active Drainage System	Loop Catch Tank WR-1 extension sump - general drainage	1	0.05	14 mrem/h nc, 5 mrem/h @ 30 cm, 0.2 mrem/h at 1 m, right of stairwell upon entry	3	2k β	NAD on rubbers	Asbestos characterization campaign: 100 Swipes taken in 414, max values: Cs-137: 0.306 46 swipes taken in 415: COS	Jan 2015 Feb 2016 (dose rate) Removable contamination on lid of Sump 415 pit and cables Chain of Custody: COC: WR1-2015-07-06-JG-001
501	Upper Access			3	5	200	3	1.5k/20	NAD	15 swipes, max values: Cs-137: 0.35 Am-241: 0.02 Nb-94: 0.02 Eu-154: 0.002 Co-60: 0.01 Activity balance on some swipes indicates a pure beta emitter present Asbestos characterization campaign: 10 swipes, max values: Cs-137: 0.04	Feb 2015 Chain of Custody: B100-WR-1-Scoping-2014-01-31-CB-001 WR1-2015-07-09-AW001 WR1-2015-07-09-AW001 COC Lowest Cs-137: Am-241 Ratio: 20:1

Room	Description	System	Components	Gamma Radiation Hazards			Contamination Hazards				Last Survey Date/ Comments
				Radiation Zone	GA Dose Rates (mrem/h)	Maximum/ Elevated Dose Rates (mrem/h near contact)	Contamination Zone	Removable Surface Contamination (cpm on-swipe) Beta/Alpha	Contamination found on PPE after room entry (Ludlum 44-9 unless otherwise noted)	Gamma Analysis Results (Bq/cm²)	
										Am-241: 0.002 Co-60: 0.08 Nb-94: 0.002	
502	Moderator Ion Exchange Pit	Heavy Water System	Ion Exchange Columns	--	--	Sealed – unable to enter	--	--	-		No ACM Inaccessible area
503	Organic Purification Pit	Primary Heat Transport	Circuit A&B Absorption Columns; Circuit A&B Filters	--	--	Sealed – unable to enter	--	--	-		No ACM Inaccessible area
504	Auxiliaries	Thermal Shield Cooling System	Head Tank, Chemical Addition Tank, Head Tank, Chemical Addition Tank, Heat Exchanger	3	1-4 PAD results from room characterization for Asbestos Abatement: Average dose rate: 0.34 Max average dose rate: 0.34 Max dose rate: 3.5 Average max dose rate: 2.63	20	3	2k β Asbestos Characterization: Direct: N/A Loose: COS (10 swipes)	500 cpm beta/gamma on low rubbers through 2 layers of plastic bags		Nov 2011
506	Header	Primary Heat Transport	Circuit A and B Inlet Header; Circuit A and B Outlet Header	3	8-16	4000 300: AP0-V25 300: BP0-V25 200: A Header return 4000: AP0-V5	3	2k β Asbestos Abatement Upper Header: Direct: NA Loose: COS (8 swipes) Asbestos Abatement Lower Header: Direct: N/A	NAD	Asbestos characterization campaign: 15 swipes taken in Lower Header, max value: Cs-137: 0.01 8 Swipes of Upper Header: COS	Jan 2023 J

Room	Description	System	Components	Gamma Radiation Hazards			Contamination Hazards				Last Survey Date/ Comments
				Radiation Zone	GA Dose Rates (mrem/h)	Maximum/ Elevated Dose Rates (mrem/h near contact)	Contamination Zone	Removable Surface Contamination (cpm on-swipe) Beta/Alpha	Contamination found on PPE after room entry (Ludlum 44-9 unless otherwise noted)	Gamma Analysis Results (Bq/cm²)	
								Loose: 1 biased swipe with 10 cpm alpha, 400 cpm beta/gamma 14 biased swipes COS			
508	Spent Fuel Storage	Spent Fuel Handling and Storage System		2	0.02-0.05	2 mrem/h nc active drain, 1 mrem/h nc B200 pump out line	2	10k/200 Asbestos Abatement: Direct: NAD/NA Loose: COS (15 swipes)	-	8 swipes taken: Cs-137: 2.47 Am-241: 0.01 Co-60: 0.001 Activity balance on some swipes indicates a pure beta emitter present	Jan 2015 Chain of Custody: B100-2014-01-13-JH-001 B100-2014-01-14-JH-001 Lowest Cs-137: Am-241 Ratio: 7:1
535	Vented Fuel Facility	Primary Heat Transport	Circuit A&B Heat Exchangers - Particulate Removal Circuit Cooler	2	0.1	2	3	500 β Asbestos Abatement: Direct: NAD Loose: COS (10 swipes)	NAD	3 swipes, max values: Cs-137: 2.9 Co-60: 0.002	Feb 2015 Chain of Custody: B100-WR-1-Scoping-2014-02-12-CB-001
536	Loop Transmitter Room	Fast Neutron Loops		2	0.2	0.4	3	COS/COS Asbestos Abatement: Direct: NAD Loose: COS (10 swipes)	NAD		Feb 2015
537	1L5 Loop	Fast Neutron Loops	Surge Tanks, Eductor Tank	3	1-5 PAD results from room characterization for Asbestos Abatement: Average dose rate:	400: pipe elbow HMV6-1L5	3	200 β Asbestos Abatement: Direct: NA Loose: COS (10 swipes)	NAD	11 swipes, max values: Cs-137: 051 Co-60: 0.95	Feb 2015 Chain of Custody: B100-WR-1-Scoping-2014-01-31-CB-001

Room	Description	System	Components	Gamma Radiation Hazards			Contamination Hazards				Last Survey Date/ Comments
				Radiation Zone	GA Dose Rates (mrem/h)	Maximum/ Elevated Dose Rates (mrem/h near contact)	Contamination Zone	Removable Surface Contamination (cpm on-swipe) Beta/Alpha	Contamination found on PPE after room entry (Ludlum 44-9 unless otherwise noted)	Gamma Analysis Results (Bq/cm²)	
					0.31 Max average dose rate: 0.40 Max dose rate: 2.2 Average max dose rate: 2.08						
538	1L4 Loop	Fast Neutron Loops	Reflux Boiler, Boiler	3	1 PAD results from room characterization for Asbestos Abatement: Average dose rate: 5.38 Max average dose rate: 0.51 Max dose rate: 4.8 Average max dose rate: 4.80	5	3	500 β	500 on low rubbers through 2 layers of plastic bags	10 swipes, max values: Cs-137: 0.3 Co-60: 0.0007 Asbestos characterization campaign: 20 Swipes, Max values: Cs-137: 0.03 Am-241: 0.0001	Feb 2015 Chain of Custody: RM 538-404-410-WR1-Scoping-2014-03-10-CB-001 WR1-Asbestos Abatement-2015-07-07-AW-001 Lowest Cs-137: Am-241 ratio: 300:1
539	1L2 Loop	WR-1L2 Experimental Loop Fast Neutron Loops	Surge Tank, Loop Degas, Steam/Water Separator Vessel, Heat Exchangers and Coolers Boiler	3	10 PAD results from room characterization for Asbestos Abatement: Average dose rate: 0.61 Max average dose rate: 0.70 Max dose rate: 4.8 Average max dose rate: 3.65	60	3	80k/400	20k cpm on low rubbers through 2 layers of plastic bags. 1.5 kcpm on waste through 3 layers of plastic bags	12 swipes, max values: Cs-137: 10.3 Am-241: 0.16 Pa-234: 0.05 Eu-154: 0.04 Co-60: 0.006 Asbestos characterization campaign: 8 swipes, max values: Cs-137:0.9 Am-241: 0.005 Co-60: 0.2	Jan 2014 Chain of Custody: B100-WR-1-Scoping-2014-01-31-CB-001 WR1-Asbestos Abatement-2015-07-07-AW-001 Lowest Cs-137: Am-241 Ratio: 50:1

Room	Description	System	Components	Gamma Radiation Hazards			Contamination Hazards				Last Survey Date/ Comments
				Radiation Zone	GA Dose Rates (mrem/h)	Maximum/ Elevated Dose Rates (mrem/h near contact)	Contamination Zone	Removable Surface Contamination (cpm on-swipe) Beta/Alpha	Contamination found on PPE after room entry (Ludlum 44-9 unless otherwise noted)	Gamma Analysis Results (Bq/cm²)	
540	1L2 Sample Station & Transmitter	WR-1L2 Experimental Loop	Chemical Addition Tank	2	0.2	8: fumehood drain	3	25k/cos	NAD	6 swipes taken, max values: Cs-137: 18.5 Co-60: 0.06 Activity balance on some swipes indicates a pure beta emitter present Asbestos characterization campaign: 10 swipes, max values: Cs-137:0.4	Feb 2015 Chain of Custody: B100-2014-01-17-JH-001 WR1-2015-07-14-AW-001
541	1L2 Auxiliary	WR-1L2 Experimental Loop	Surge Tank, Heat Exchangers and Coolers	2	0.05	1.5	3	200 β	NAD	6 swipes taken, max values: Cs-137:1.42 Asbestos characterization campaign: 8 swipes, max value: Cs-137:0.03	Feb 2015 Chain of Custody: B100-2014-01-17-JH-001 WR1-2015-07-14-AW001
543				2			3			1 swipe taken Activity balance on some swipes indicates a pure beta emitter present	Feb 2014 Chain of Custody: B100-WR-1-Scoping-2014-02-12-CB-001
601	Caged Area			2	0.02-0.5	80 mrem/h nc, 3 mrem/h @ 30 cm, 0.5 mrem/h at 1 m, west end of flask (shielded) 5 mrem/h nc,	3	COS/COS Asbestos Abatement: Direct: NA Loose: COS (4 swipes)		Asbestos characterization campaign: 5 swipes taken, max values: Cs-137: 0.04 Am-241: 0.001	Feb 2016 (dose rate) Chain of Custody: WR1-2015-07-06-JG-002

Room	Description	System	Components	Gamma Radiation Hazards			Contamination Hazards				Last Survey Date/ Comments
				Radiation Zone	GA Dose Rates (mrem/h)	Maximum/ Elevated Dose Rates (mrem/h near contact)	Contamination Zone	Removable Surface Contamination (cpm on-swipe) Beta/Alpha	Contamination found on PPE after room entry (Ludlum 44-9 unless otherwise noted)	Gamma Analysis Results (Bq/cm²)	
						0.8 mrem/h @ 30 cm, 0.5 mrem/h at 1 m, east end of flask					Lowest Cs-137: Am-241 ratio: 40:1
601	50 Ton Crane			1	0.02	0.2	2	COS/COS	-		Feb 2015
602	A & B Primary Pumps	Primary Heat Transport	Circuit A, B, C main heat exchangers	3	5-20 PAD results from room characterization for Asbestos Abatement: Average dose rate: 2.30 Max average dose rate: 3.94 Max dose rate: 121.0 Average max dose rate: 33.01	10 rem/h	3	200 β	NAD	18 swipes, max values: Cs-137: 0.016	Feb 2015 Chain of Custody: RM 602-WR1-Scoping-2014-03-12-CB-001 Should remove garbage can in south west corner prior to doing any work in 602 or the upper area of 506, as most dose rates in this room are coming from there.

Application

[4] CNL Letter, B. Wilcox (CNL) to D. Saumure (CNSC), Application for Renewal of the Nuclear Research and Test Establishment Decommissioning Licence for the Whiteshell Laboratories, WLD-CNNO-23-0051-L (e-Doc 7171551), 2023 November 21

Canadian Nuclear Laboratories | Laboratoires Nucléaires Canadiens

2023 November 21

WHITESHELL LABORATORIES RESTORATION PROJECT

Commission Registry
Denis Saumure, Commission Registrar
Canadian Nuclear Safety Commission
280 Slater Street
P.O. Box 1046, Station B
OTTAWA, Ontario K1P 5S9

Dear Mr. Denis Saumure:

APPLICATION FOR RENEWAL OF THE NUCLEAR RESEARCH AND TEST ESTABLISHMENT DECOMMISSIONING LICENCE FOR THE WHITESHELL LABORATORIES

On behalf of Canadian Nuclear Laboratories (CNL), I hereby make application for the renewal of the Nuclear Research and Test Establishment Decommissioning Licence for Whiteshell Laboratories (WL) (current licence – NRTEDL-W5-8.00/2024 expires 2024 December 31) [1]. This application is made in accordance with the requirements of the *Nuclear Safety and Control Act* [2] (hereafter – the Act) and the *General Nuclear Safety and Control Regulations* [3].

This application is submitted for consideration by Commission members for a three-year licence renewal period to commence on 2025 January 01, following expiry of licence NRTEDL-W5-8.00/2024 [1].

CNL is and has always been committed to the protection of the environment, the health and safety of persons, and safe operation will always be the utmost priority for CNL. CNL will continue to maintain national security and implement international obligations, to which Canada has agreed.

The activities at the site over the proposed licence period are consistent with the current licence period activities per the current WL Licence [1] and Licence Conditions Handbook [4]. Attachment A provides a clause-by-clause statement for relevant excerpts from the Act and relevant CNSC Regulations and describes how CNL meets these requirements as per the compliance verification criteria prescribed by CNSC in the current WL Licence Conditions Handbook [4].

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Laboratoires de Whiteshell
1, Ara Mooradian Way
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Sans frais: 1-866-513-2325

CNL will submit a separate licence amendment application related to the In Situ Decommissioning of the Whiteshell Reactor #1 when appropriate, based on determination by CNSC staff that the final Environmental Impact Statement and all licensing application documents are acceptable.

CNL looks forward to hearing from the Commission with respect to this application. Should you require any further information please contact me at 204-340-3044.

Yours sincerely,

Brian Wilcox
General Manager and Whiteshell Laboratories Site Licence Holder

Attachments (1)

REFERENCES:

[1] Canadian Nuclear Safety Commission*, Whiteshell Laboratories, Nuclear Research and Test Establishment Decommissioning Licence*, NRTEDL-W5-8.00/2024, Expiry Date: 2024 December 31.

[2] *Nuclear Safety and Control Act*, S.C. 1997, c. 9, Canada.

[3] *General Nuclear Safety and Control Regulations* SOR/2000-202, Canada.

[4] Canadian Nuclear Safety Commission, *Licence Conditions Handbook for Whiteshell Laboratories*, NRTEDL-W5-8.00/2024, Revision 1, 2023 April 03.

[5] *Whiteshell Laboratories Decommissioning Project Comprehensive Study Report, Volume 1: Main Report, Volume 2: Appendices, Volume 3: Addendum*, WLDP-03702-041-000, 2001.

c:

K. Campbell (CNSC)	S. Brewer	K. Schruder	A. Tisler
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K. Ross (CNSC)	G. Kaufmann	P. Stalker	>CR Export Import
	J. McBrearty	M. Steedman	Forms/Formulaires (CNSC/CCSN)
	K. Rod	R. Swartz	Registry/Greffe (CNSC/CCSN)

ATTACHMENT A. INFORMATION REQUIRED FOR LICENCE RENEWAL APPLICATION

Canadian Nuclear Laboratories (CNL) makes an application for the renewal of the Nuclear Research and Test Establishment Decommissioning Licence for Whiteshell Laboratories (WL), NRTEDL-W5-8.00/2024 [A-1] (the licence) which expires on 2024 December 31.

This attachment presents the information required by the *Nuclear Safety and Control Act* (the Act) [A-2] and CNSC Regulations made pursuant to the Act, to be included in an application for the renewal of a licence. Specifically, this Attachment provides clause-by-clause statements for relevant excerpts from the Act and CNSC Regulations and describes how CNL meets the requirements of the compliance verification criteria prescribed by CNSC in the current WL Licence Conditions Handbook (LCH) [A-3].

A.1 Nuclear Safety and Control Act

Section	Requirement	CNL Response
Nuclear Safety and Control Act		
24(2)	The Commission may issue, renew, suspend in whole or in part, amend, revoke, or replace a licence on receipt of an application (a) in the prescribed form;	This attachment with the letter provides the information required by the Act [A-2] and CNSC Regulations made pursuant to the Act and constitute, in part, an application by CNL to renew its licence [A-1].
24(2)	(b) containing the prescribed information and undertakings and accompanied by the prescribed documents; and	See response to item 24(2) (a) above.
24(2)	(c) accompanied by the prescribed fee.	CNL is in good standing with respect to the provision of CNSC licensing fees and will provide any additional fees, as and when required.
24(4)	No licence may be issued, renewed, amended or replaced unless, in the opinion of the Commission, the applicant (a) is qualified to carry on the activity that the licence will authorize the licensee to carry on; and	CNL understands that qualification will be determined through consideration by the Commission of this application and the associated supporting material as well as deliberation through the Commission hearing process.

Section	Requirement	CNL Response
24(4)	(b) will, in carrying on that activity, make adequate provision for the protection of the environment, the health and safety of persons and the maintenance of national security and measures required to implement international obligations to which Canada has agreed.	CNL understands that adequate provision will be determined through consideration by the Commission of this application and the associated supporting material as well as deliberation through the Commission public hearing process.
24(5)	A licence may contain any term or condition that the Commission considers necessary for the purposes of this Act, including a condition that the applicant provide a financial guarantee in a form that is acceptable to the Commission.	CNL understands the requirement for an acceptable financial guarantee. While ownership of CNL has transferred to the Canadian National Energy Alliance, Atomic Energy of Canada Ltd. (AECL) retains ownership of the lands, assets and liabilities associated with CNL's licences. These liabilities have been officially recognized by the Minister of Natural Resources in a letter dated 2015 July 31 [A-4], and this recognition was reaffirmed by AECL to CNL on 2020 August 12 [A-5].
25	The Commission may, on its own motion, renew, suspend in whole or in part, amend, revoke or replace a licence under the prescribed conditions.	CNL understands the clause and no response is required.

A.2 General Nuclear Safety and Control Regulations

Section	Requirement	CNL Response
General Nuclear Safety and Control Regulations		
3(1)	An application for a licence shall contain the following information: (a) the applicant's name and business address	No change to name or business address as listed under Section II of the current licence. The applicant's name: Canadian Nuclear Laboratories Ltd. Business address: Canadian Nuclear Laboratories Ltd. Chalk River Laboratories 286 Plant Road Chalk River, Ontario K0J 1J0 Contact Person, Signing Authority and Site Licence Holder: Name: Brian Wilcox General Manager and Whiteshell Laboratories Site Licence Holder Canadian Nuclear Laboratories Ltd. Whiteshell Laboratories 1 Ara Mooradian Way Pinawa, Manitoba, R0E 1L0 Phone 204-340-3044 Official Language of Application: English
3(1)	(b) the activity to be licensed and its purpose	Throughout the proposed period of the renewed licence, CNL intends to continue to conduct the licensed activities as outlined in the current Whiteshell Laboratories licence [A-1]: a) operate and decommission the Whiteshell Laboratories located in Pinawa, Province of Manitoba as further described in the WL LCH [A-3],

Section	Requirement	CNL Response
General Nuclear Safety and Control Regulations		
		b) produce, possess, process, refine, transfer, use, package, manage, and store the nuclear substances that are required for, associated with or arise from the activities described in a), c) possess, use, produce and transfer prescribed equipment that is required for, associated with, or arises from the activities described in a), d) possess, use and transfer prescribed information that is required for, associated with, or arises from the activities described in a) e) carry out the site preparation, construction or construction modification or undertaking that is required for, associated with, or arise from the activities described in a).
3(1)	(c) the name, maximum quantity and form of any nuclear substance to be encompassed by the licence	No change to nuclear substances to be encompassed by the Whiteshell Laboratories licence [A-1]. Three principal types of nuclear substances exist at WL: • Heavy Water (Deuterium compounds and derivatives). Small residual amounts within WR-1 Moderator System. • Fissionable and Fertile Materials. Quantities of irradiated fissionable and fertile materials (e.g., thorium) are stored at WL, in solid forms. Small quantities of unirradiated waste materials are also stored at WL, in solid form. The maximum quantity of fissionable plus fertile materials encompassed by the site licence is 30 mega grams. • Sealed Sources. A sealed source registry is maintained at WL and is provided annually to the CNSC. The name, maximum quantity and form of nuclear substances permitted in each nuclear facility (Concrete Canister Storage Facility, Shielded Facilities, and Waste Management Area), or in components thereof, are given in the safety analysis reports.

Section	Requirement	CNL Response
General Nuclear Safety and Control Regulations		
3(1)	(d) a description of any nuclear facility, prescribed equipment or prescribed information to be encompassed by the licence	Relevant information on the nuclear facilities and prescribed equipment is presented in the CNL safety analysis reports for the following WL facilities: Concrete Canister Storage Facility, Shielded Facilities, and Waste Management Area (through the documents referenced in Safety Control Area (SCA) "Safety Analysis", Licence Condition 4.1 of the current WL LCH [A-3]. Any specific required information that may be prescribed information will be provided to the Commission under separate cover, consistent with clause 21 (2) of the *General Nuclear Safety and Control Regulations* [A-6], which states that information made public is not prescribed information for the purposes of the Act [A-2].
3(1)	(e) the proposed measures to ensure compliance with the *Radiation Protection Regulations*, the *Nuclear Security Regulations* and the *Packaging and Transport of Nuclear Substances Regulations*, 2015	Compliance with the *Radiation Protection Regulations* [A-7] at WL is ensured through implementation of the CNL Radiation Protection Program, through the documents referenced in SCA "Radiation Protection", Licence Condition 7.1 of the current WL LCH [A-3], and through implementation of the Environmental Protection Program, through the documents referenced in SCA "Environmental Protection", Licence Condition 9.1 of the current WL LCH [A-3]. Compliance with the *Nuclear Security Regulations* [A-7] is ensured through implementation of the CNL Security Program and the CNL Cyber Security Program, through the documents referenced in SCA "Security", Licence Condition 12.1 of the current WL LCH [A-3]. Compliance with the *Packaging and Transport of Nuclear Substances Regulations* [A-9] is ensured through implementation of the Transportation of Dangerous Goods Program, through the documents referenced in SCA "Packaging and Transport", Licence Condition 14.1 of the current WL LCH [A-3].

Section	Requirement	CNL Response
General Nuclear Safety and Control Regulations		
3(1)	(f) any proposed action level for the purpose of section 6 of the *Radiation Protection Regulations*	Action levels for the WL site are defined under the Environmental Protection Program for air and liquid radioactive effluents, through the documents referenced in SCA "Environmental Protection" Licence Condition 9.1 of the current WL LCH [A-3], and the Radiation Protection Program, through the documents referenced in SCA "Radiation Protection" Licence Condition 7.1 of the current WL LCH [A-3].
3(1)	(g) the proposed measures to control access to the site of the activity to be licensed and the nuclear substance, prescribed equipment or prescribed information (h) the proposed measures to prevent loss or illegal use, possession or removal of the nuclear substance, prescribed equipment or prescribed information	Compliance with the *Nuclear Security Regulations* [A-7] is ensured through implementation the CNL Security Program and the CNL Cyber Security Program, through the documents referenced in SCA "Security", Licence Condition 12.1 of the current WL LCH [A-3].
3(1)	(i) a description and the results of any test, analysis or calculation performed to substantiate the information included in the application;	Substantiation of the information included with this application is demonstrated through the implementation of annual reporting requirements as defined in Licence Condition 3.2 of the current WL LCH [A-3]. Annual reports are prepared, as required, to cover both nuclear facility and program performance areas.
3(1)	(j) the name, quantity, form, origin and volume of any radioactive waste or hazardous waste that may result from the activity to be licensed, including waste that may be stored, managed, processed or disposed of at the site of the activity to be licensed, and the proposed method for managing and disposing of that waste;	Specific information on radioactive and hazardous wastes is presented in the annual reports prepared to meet the requirement of SCA "Operating Performance" Licence Condition 3.2 of the current WL LCH [A-3]. Relevant requirements for managing and disposing of radioactive and hazardous waste at the WL site are addressed in the Waste Management Program (through the documents referenced in SCA "Waste Management" Licence Condition 11.1 of the current WL LCH [A-3].

Section	Requirement	CNL Response
General Nuclear Safety and Control Regulations		
3(1)	(k) the applicant's organizational management structure insofar as it may bear on the applicant's compliance with the Act and the regulations made under the Act, including the internal allocation of functions, responsibilities and authority;	CNL's senior management organizational structure for the operation of WL is documented in the Management System manual [A-10]. Further relevant information regarding responsibilities and authority at the WL site is provided in lower tier Management System documents. As per the requirements of SCA "Management System" Licence Condition 1.1 of the WL LCH [A-3], further relevant information regarding the responsibilities and authority at the WL site is provided in *Site Licences, Certificates, Permits, Building/Facility Contacts, & Licence Representatives* [A-11].
3(1)	(l) a description of any proposed financial guarantee relating to the activity to be licensed; and	CNL understands the requirement for an acceptable financial guarantee. While ownership of CNL has transferred to Canadian National Energy Alliance, AECL retains ownership of the lands, assets and liabilities associated with CNL's licences. These liabilities have been officially recognized by the Minister of Natural Resources in a letter dated 2015 July 31 [A-4] and reaffirmed in 2020 [A-5], as per Licence Condition G.3 of the current WL LCH [A-3].
3(1)	(m) any other information required by the Act or the regulations made under the Act for the activity to be licensed and the nuclear substance, nuclear facility, prescribed equipment or prescribed information to be encompassed by the licence.	An annual summary report of compliance monitoring and operational performance is submitted to CNSC staff, to meet the requirement of SCA "Operating Performance" Licence Condition 3.2 of the current WL LCH [A-3]. This report provides information on operational practices, maintenance of the facilities and the laboratories, and presents a summary of performance for each of the Safety and Control Areas.
5	An application for the renewal of a licence shall contain: (a) The information required to be contained in an application for that licence by the applicable regulations made under the Act	The information is provided under Section 3(1) (please see above) of the *General Nuclear Safety and Control Regulations* [A-6].

Section	Requirement	CNL Response
General Nuclear Safety and Control Regulations		
5	(b) a statement identifying the changes in the information that was previously submitted.	No changes to the existing terms and conditions of the current WL Licence [A-1] or to the associated WL LCH [A-3] are being requested.
7	An application for a licence or for the renewal, suspension in whole or in part, amendment, revocation or replacement of a licence may incorporate by reference any information that is included in a valid, expired or revoked licence.	The licensed activities from the current WL licence [A-1] are expected to continue throughout the proposed period of the new licence as listed in the response above to clause 3 (b). Additionally, the system of programs and processes that are effective for the current licence [A-1] is maintained to meet the requirements of the 14 various Safety and Control Areas, as prescribed in the current WL LCH [A-3]. These constitute the licensing basis for the current licence [A-1], and will continue to be implemented throughout the term of the proposed renewed licence in order to assure the continuation of safe practices at the WL site. The establishment, maintenance (including continuous improvement) and functional support requirements of these programs and processes are governed by the Management System as per the Management System manual [A-10] and lower tier documents.
15	Every applicant for a licence and every licensee shall notify the Commission of: (a) the persons who have authority to act for them in their dealings with the Commission (b) the names and position titles of the persons who are responsible for the management and control of the licensed activity and the nuclear substance, nuclear facility, prescribed equipment or prescribed information encompassed by the licence	CNL's senior management organizational structure for the operation of WL is documented in the Management System manual [A-10]. Further relevant information regarding responsibilities and authority at the WL site is provided in lower tier Management System documents.

Section	Requirement	CNL Response
General Nuclear Safety and Control Regulations		
15	(c) any change in the information referred to in paragraphs (a) and (b), within 15 days after the change occurs.	The Clause is understood, and no response is required.

A.3 Class I Nuclear Facilities Regulations

Section	Requirement	CNL Response
Class I Nuclear Facilities Regulations		
3	An application for a licence in respect of a Class I nuclear facility, other than a licence to abandon, shall contain the following information in addition to the information required by section 3 of the *General Nuclear Safety and Control Regulations*: (a) a description of the site of the activity to be licensed, including the location of any exclusion zone and any structures within that zone;	Relevant information for the Class I nuclear facilities is provided in the annual reports prepared to meet the requirement of SCA “Operating Performance” Licence Condition 3.2 of the current WL LCH [A-3], in the Facility Authorization documents for the following WL nuclear facilities: Concrete Canister Storage Facility, Shielded Facilities, and Waste Management Area (through the Facility Authorization documents referenced in Licence Condition 3.1 of the current WL LCH [A-3]), and facility-specific safety analysis reports for the same WL facilities (through documents referenced in SCA “Safety Analysis”, Licence Condition 4.1 of the current WL LCH [A-3]). Information on the site characteristics is presented in the individual safety analysis reports.
3	(b) plans showing the location, perimeter, areas, structures and systems of the nuclear facility;	Relevant information for the Class I nuclear facilities is provided in the annual reports prepared to meet the requirement of SCA “Operating Performance” Licence Condition 3.2 of the current WL LCH [A-3], and in the safety analysis reports for the following WL facilities: Concrete Canister Storage Facility, Shielded Facilities, and Waste Management Area (through the documents referenced in SCA “Safety Analysis”, Licence Condition 4.1 of the current WL LCH [A-3]).
3	(c) evidence that the applicant is the owner of the site or has authority from the owner of the site to carry on the activity to be licensed;	As identified in the letter [A-12], AECL maintains the ownership of the WL property and authorizes CNL to conduct licensed activities at the site.
3	(d) the proposed management system for the activity to be licensed, including measures to promote and support safety culture;	CNL’s Management System program is documented in the CNL Management System manual [A-10] and lower tier documents through the documents referenced in SCA “Management System” Licence Condition 1.1 of the current WL LCH [A-3] and complies with the *Class I Nuclear Facilities Regulations* [A-13].

Section	Requirement	CNL Response
Class I Nuclear Facilities Regulations		
3	(d.1) the proposed human performance program for the activity to be licensed, including measures to ensure workers' fitness for duty.	Compliance with the requirements for human performance at WL is ensured through implementation of the Performance Assurance Program through the documents referenced in SCA "Human Performance Management", Licence Condition 2.1: Human Performance Program of the WL LCH [A-3].
3	(e) the name, form, characteristics and quantity of any hazardous substances that may be on the site while the activity to be licensed is carried on;	Hazardous substances that are on the WL site include: • Asbestos–Containing Materials (ACM) (e.g., pipe insulation, parging, vermiculite, vinyl-asbestos floor tiles, asbestos cement ceiling tiles, asbestos cement pipes); • Polychlorinated Biphenyls (PCBs) (e.g., fluorescent light ballasts, residuals from transformers, capacitors, etc.); • Lead (e.g., elemental lead shielding, lead-based paints, spent bullets in security guard firing ranges, batteries); • Mercury (e.g., elemental residuals from laboratories or as stored wastes, in fluorescent light tubes, electrical switches or thermostats); • Mould (e.g., in poorly ventilated crawl spaces and basements); • Hydrocarbons (e.g., from historical fuelling spills or tank residuals); • Organic reactor coolant (HB-40 also known as OS-84) (e.g., residual liquid or tar-like residues, coatings on piping, structures, etc.); • Hanta-virus-containing animal droppings (e.g., from deer mice); • Chlorine gas or residuals from water treatment systems; • Glycol, freons and other ozone-depleting substances (ODS) from chillers, air-conditioning systems, etc.; • Quantities of DDT, arsenic, metallic beryllium, (wet) uranium carbide reactor fuel, various ion-exchange column resins, etc. and traces of several toxic metals are located in various waste management structures; and • Tritium, xylene, gadolinium nitrates, and boron-containing substances, located throughout the WR-1 reactor building. More detailed information on these hazardous substances in a specific facility or building is captured in the WL Detailed Decommissioning Plan

Section	Requirement	CNL Response
Class I Nuclear Facilities Regulations		
		(DDP), Volume 1 - Program Overview [A-14], in DDP Volumes 2 through 12 as documented in the Program Overview DDP [A-14], and in lower-level decommissioning documentation. It is also to be noted that most of these hazardous substances have been encountered in previous decommissioning projects at WL and have all been safely dealt with through existing or specially created handling procedures.
3	(f) the proposed worker health and safety policies and procedures;	Compliance with the requirements for worker health and safety at WL is ensured through implementation of the Occupational Safety and Health Program, through the documents referenced in SCA “Conventional Health and Safety” Licence Condition 8.1 of the current WL LCH [A-3].
3	(g) the proposed environmental protection policies and procedures;	Compliance with the requirements for environmental protection at WL is ensured through implementation of the Environmental Protection Program, through the documents referenced in SCA “Environmental Protection”, Licence Condition 9.1 of the current WL LCH [A-3].
3	(h) the proposed effluent and environmental monitoring programs;	See response to clause 3(g) above.
3	(i) if the application is in respect of a nuclear facility referred to in paragraph 2(b) of the *Nuclear Security Regulations*, the information required by section 3 of those Regulations;	Not applicable.
3	(j) the proposed program to inform persons living in the vicinity of the site of the general nature and characteristics of the anticipated effects on the environment and the health and safety of persons that may result from the activity to be licensed; and	Compliance with the requirements for notification to local residents and associated activities is ensured through implementation of the Public Information Program, through the documents referenced in Licence Condition G.4 of the current WL LCH [A-3]. Additional compliance is ensured through the Emergency Preparedness Program, through the documents referenced in SCA “Emergency Management and Fire Protection” Licence Condition 10.1 of the current WL LCH [A-3].

Section	Requirement	CNL Response
Class I Nuclear Facilities Regulations		
3	(k) the proposed plan for the decommissioning of the nuclear facility or of the site.	The plan for the decommissioning of the site is captured in the WL Detailed Decommissioning Plan, Volume 1 – Program Overview [A-14] and DDP Volumes 2 through 12 as documented in the Program Overview DDP [A-14].
7	An application for a licence to decommission a Class I nuclear facility shall contain the following information in addition to the information required by section 3 (CINFR): (a) a description of and the proposed schedule for the decommissioning, including the proposed starting date and the expected completion date of the decommissioning and the rationale for the schedule; (b) the nuclear substances, hazardous substances, land, buildings, structures, systems and equipment that will be affected by the decommissioning; (c) the proposed measures, methods and procedures for carrying on the decommissioning;	The proposed plan for the decommissioning of the site is captured in the WL Detailed Decommissioning Plan, Volume 1 – Program Overview [A-14], and DDP Volumes 2 through 12 as documented in the Program Overview DDP.
7	(d) the proposed measures to facilitate Canada's compliance with any applicable safeguards agreement;	Compliance with the requirements for safeguards at WL is ensured through implementation of the Nuclear Materials and Safeguards Management Program, through the documents referenced in SCA "Safeguards and Non-Proliferation" Licence Condition 13.1 of the current WL LCH [A-3].
7	(e) the nature and extent of any radioactive contamination at the nuclear facility;	This information is presented in the WL Detailed Decommissioning Plan, Volume 1 – Program Overview [A-14].

Section	Requirement	CNL Response
Class I Nuclear Facilities Regulations		
7	(f) the effects on the environment and the health and safety of persons that may result from the decommissioning, and the measures that will be taken to prevent or mitigate those effects;	The required information is provided in the Comprehensive Study Report [A-15] on the decommissioning of Whiteshell Laboratories. The measures that will be taken to prevent or mitigate these effects are described within the Environmental Protection Program, through the documents referenced in SCA "Environmental Protection" Licence Condition 9.1 of the current WL LCH [A-3], and within the Occupational Safety and Health Program, through the documents referenced in SCA "Conventional Health and Safety" Licence Condition 8.1 of the current WL LCH [A-3].
7	(g) the proposed location of points of release, the proposed maximum quantities and concentrations, and the anticipated volume and flow rate of releases of nuclear substances and hazardous substances into the environment, including their physical, chemical and radiological characteristics;	Compliance is ensured through implementation of the Environmental Protection Program, through the documents referenced in SCA "Environmental Protection" Licence Condition 9.1 of the current WL LCH [A-3].
7	(h) the proposed measures to control releases of nuclear substances and hazardous substances into the environment;	Compliance is ensured through implementation of the Environmental Protection Program, through the documents referenced in SCA "Environmental Protection" Licence Condition 9.1 of the current WL LCH [A-3].

<table>
<tr><th>Section</th><th>Requirement</th><th>CNL Response</th></tr>
<tr><td colspan="3">Class I Nuclear Facilities Regulations</td></tr>
<tr><td>7</td><td>(i) the proposed measures to prevent or mitigate the effects of accidental releases of nuclear substances and hazardous substances on the environment, the health and safety of persons and the maintenance of national security, including an emergency response plan;</td><td>The required information is provided in the Comprehensive Study Report on the decommissioning of Whiteshell Laboratories [A-15] and in the annual reports prepared to meet the requirement of SCA “Operating Performance” Licence Condition 3.2 of the current WL LCH [A-3].
Information on these topics is also provided in relevant aspects of the following:
• Environmental Protection Program, through the documents referenced in SCA “Environmental Protection” Licence Condition 9.1 of the current WL LCH [A-3].
• Occupational Safety and Health Program, through the documents referenced in SCA “Conventional Health and Safety” Licence Condition 8.1 of the current WL LCH [A-3].
• Physical Security Program, through the documents referenced in SCA “Security” Licence Condition 12.1 of the current WL LCH [A-3].
• Emergency Preparedness Program, through the documents referenced in SCA “Emergency Management and Fire Protection” Licence Condition 10.1 of the current WL LCH [A-3].</td></tr>
<tr><td>7</td><td>(j) the proposed qualification requirements and training program for workers; and</td><td>Compliance with the requirements for training and qualification at WL is ensured through implementation of SCA “Human Performance Management” Licence Conditions 2.1 and 2.2 of the WL LCH [A-3].</td></tr>
<tr><td>7</td><td>(k) a description of the planned state of the site on completion of the decommissioning.</td><td>The CNL plans to decommission all of WL to its final end-state as documented in the WL Detailed Decommissioning Plan, Volume 1 – Program Overview [A-14], with further details to be documented in the Land-Use and End-State Plan, planned to be finalized in the next licence period.</td></tr>
</table>

A.4 Nuclear Security Regulations

Section	Requirement	CNL Response
Nuclear Security Regulations		
3	An application for a licence in respect of Category I or II nuclear material, other than a licence to transport, and an application for a licence in respect of a nuclear facility referred to in paragraph 2(b) shall contain the following information in addition to the information required by section 3 of the Nuclear Substances and *Radiation Devices Regulations* or sections 3 to 8 of the *Class I Nuclear Facilities Regulations*, as applicable: (a) a copy of the arrangements referred to in section 35; (b) the site plan referred to in section 16; (c) a description of the proposed security equipment, systems and procedures; (d) a description of the proposed on-site and off-site communications equipment, systems and procedures; (e) a description of the proposed structure and organization of the nuclear security officer service, including the duties, responsibilities and training of nuclear security officers; (f) the proposed plan and procedures to assess and respond to breaches of security; and (g) the current threat and risk assessment.	Compliance with the requirements regarding security of Category I or II nuclear material or nuclear facilities is ensured through implementation of the: • Physical Security Program, through the documents referenced in SCA “Security” Licence Condition 12.1 of the current WL LCH [A-3]. • Radiation Protection Program, through the documents referenced in SCA “Radiation Protection” Licence Condition 7.1 of the current WL LCH [A-3]. • Nuclear Materials and Safeguards Management Program, through the documents referenced in SCA “Safeguards and Non-Proliferation” Licence Condition 13.1 of the current WL LCH [A-3]. Any applicable material would be considered as prescribed information for the purposes of the act and no specific details are provided in this document. Note: There is no Category I nuclear material at the WL site.

Section	Requirement	CNL Response
Nuclear Security Regulations		
4	An application for a licence in respect of Category III nuclear material, other than a licence to transport, shall contain, in addition to the information required by section 3 of the *Nuclear Substances and Radiation Devices Regulations*, a description of the measures to be taken to ensure compliance with subsection 7(3) and sections 7.1 and 7.2.	Compliance with the requirements regarding security of Category III nuclear material is ensured through implementation of the: • Physical Security Program, through the documents referenced in SCA "Security" Licence Condition 12.1 of the current WL LCH [A-3]. • Radiation Protection Program, through the documents referenced in SCA "Radiation Protection" Licence Condition 7.1 of the current WL LCH [A-3]. • Nuclear Materials and Safeguards Management Program, through the documents referenced in SCA "Safeguards and Non-Proliferation" Licence Condition 13.1 of the current WL LCH [A-3]. Any applicable material would be considered as prescribed information for the purposes of the Act and no specific details are provided in this document.
41	An application for a licence in respect of a nuclear facility shall contain, in addition to the information required by sections 3 to 8 of the *Class I Nuclear Facilities Regulations*, a description of the physical protection measures to be taken to ensure compliance with sections 42 to 48.	Compliance with the requirements for the provision of an off-site response force is ensured through implementation of the Physical Security Program, through the documents referenced in SCA "Security" Licence Condition 12.1 of the current WL LCH [A-3], and the Emergency Preparedness Program, through the documents referenced in SCA "Emergency Management and Fire Protection" Licence Condition 10.1 of the current WL LCH [A-3].

A.1 REFERENCES

[A-1] Canadian Nuclear Safety Commission, Whiteshell Laboratories, *Nuclear Research and Test Establishment Decommissioning Licence*, NRTEDL-W5-8.00/2024, Expiry Date: 2024 December 31.

[A-2] *Nuclear Safety and Control Act*, S.C. 1997, c. 9, Canada.

[A-3] Canadian Nuclear Safety Commission, Licence Conditions Handbook for Whiteshell Laboratories, NRTEDL-W5-8.00/2024, Revision 1, 2023 April 03.

[A-4] Rickford, G. (NRCan), Letter to Binder, M., (CNSC), untitled, relating to provision of financial guarantees for CNL sites in Canada, 145-NRCANNO-15-0001-L, 2015 July 31

[A-5] Boyle, P. (CNL), Letter to Murthy, K. (CNSC), *Submission of Information Regarding Financial Guarantees for All Atomic Energy of Canada Limited Sites Operated by Canadian Nuclear Laboratories*, 145-CNNO-20-0028-L, 2020 August 25.

[A-6] *General Nuclear Safety and Control Regulations,* SOR/2000-202, Canada.

[A-7] *Radiation Protection Regulations*, SOR/2000-203, Canada.

[A-8] *Nuclear Security Regulations*, SOR/2000-209, Canada.

[A-9] *Packaging and Transport of Nuclear Substances Regulations*, SOR/2015-145, Canada.

[A-10] *Management System* – Manual, 900-514100-MAN-001, 12489834.

[A-11] *Site Licences, Certificates, Permits, Building/Facility Contacts, & Licence Representatives*, 900-514300-LST-001, 49255143.

[A-12] Amrouni, J.-C. (AECL), Letter to Howden, B.D. (Atomic Energy Control Board), *WL Deed*, JCA-00-034, 2000 May 02.

[A-13] *Class I Nuclear Facilities Regulations*, SOR/2000-204, Canada.

[A-14] *Whiteshell Laboratories Detailed Decommissioning Plan – Volume 1 – Program Overview*, WLDP-02000-DDP-001, Revision 2, 2021 (Revision 3, 2023 October, has been submitted to CNSC staff for acceptance).

[A-15] *Whiteshell Laboratories Decommissioning Project Comprehensive Study Report, Volume 1: Main Report, Volume 2: Appendices, Volume 3: Addendum*, WLDP-03702-041-000, 2001.

Application

[5] CNSC Letter, K. Campbell (CNSC) to B. Wilcox (CNL), CNSC Staff Review of CNL Application for Renewal of the Nuclear Research and Test Establishment Decommissioning Licence for the Whiteshell Laboratories (NRTEDL-W5-8.00/2024), WLD-NOCN-24-0001-L (e-Doc 7191956), 2024 January 05

Directorate of Nuclear Cycle and Facilities Regulation

e-Doc 7191956
File 2.14
RIB 31301

January 5, 2024

VIA EMAIL

Mr. Brian Wilcox
General Manager and Whiteshell Laboratories Site Licence Holder
Canadian Nuclear Laboratories Ltd.
1 Ara Mooradian Way
Pinawa, MB
R0E 1L0

Subject: **CNSC Staff Review of CNL Application for Renewal of the Nuclear Research and Test Establishment Decommissioning Licence for the Whiteshell Laboratories (NRTEDL-W5-8.00/2024)**

Dear Mr. Wilcox:

Canadian Nuclear Safety Commission (CNSC) staff reviewed Canadian Nuclear Laboratories' (CNL) application for the renewal of the Nuclear Research and Test Establishment Decommissioning licence for Whiteshell Laboratories (WL) (NRTEDL-W5-8.00/2024) [1] submitted on November 21, 2023 [2].

CNSC staff performed a sufficiency check of CNL's licence renewal application against licence renewal requirements outlined in sections 24(2), 24(3), 24(5), 25 of the *Nuclear Safety and Control Act* [3], sections 3(1), 5, 7, 15 of the *General Nuclear Safety and Control Regulations* [4], sections 3 and 7 of the *Class I Nuclear Facilities Regulations* [5], and sections 3, 4, 41 of the *Nuclear Substances and Devices Regulations* [6].

CNSC staff comments are provided in the attachment to this letter.

CNL is requested to provide a response to the comments along with an amended licence application by **February 5, 2024**.

Should you have any questions, please do not hesitate to contact me.

Yours sincerely,

Wasif Islam, on behalf of Kim Campbell
Acting Director
Canadian Nuclear Laboratories Regulatory Program Division
Canadian Nuclear Safety Commission
613-325-9897
wasif.islam@cnsc-ccsn.gc.ca

c.c.: CNL – A. Tisler, S. Brewer, C. Gallagher, P. Stalker, R. Swartz, K. Rod, S. Faught, M. Steedman, K. Schruder, A. Caron, G. Kaufman, J. McBrearty, B Scott, U. Senaratne, G. Snell, J. Willman, A. Stelko, >CR Licensing, >SRC, >ERM Correspondence

CNSC – K. Campbell, A. Stewart, B. Nguyen, >CNLRPD Site Office

Attachment: (1)

References:

[1] Canadian Nuclear Safety Commission, *Nuclear Research and Test Establishment Decommissioning Licence, Whiteshell Laboratories, Licence No. NRTEDL-W5-8.00/2024*, Expiry Date: December 31, 2024 (e-Doc 5962032)

[2] CNL Letter, B. Wilcox (CNL) to D. Saumure (CNSC), *Application for Renewal of the Nuclear Research and Test Establishment Decommissioning Licence for the Whiteshell Laboratories*, WLD-CNNO-23-0051-L, November 21, 2023, (e-Doc 7171551)

[3] *Nuclear Safety and Control Act*, S.C. 1997, c. 9, Current to November 27, 2023, Last amended on January 1, 2017

[4] *General Nuclear Safety and Control Regulations*, SOR/2000-202, Current to November 27, 2023, Last amended on June 12, 2015

[5] *Class I Nuclear Facilities Regulations*, SOR/2000-204, Current to November 27, 2023, Last amended on September 22, 2017

[6] *Nuclear Substances and Devices Regulations*, SOR/2000-207, Current to November 27, 2023, Last amended on March 13, 2015

[7] REGDOC-2.4.3, *Nuclear Criticality Safety*, Version 1.1, September 2020 (Publication)

[8] CNSC LCH, *Whiteshell Laboratories Nuclear Research and Test Establishment Decommissioning Licence NRTEDL-W5-8.00/2024*, NRTEDL-LCH-08.00/2024, Revision 1, issued April 3, 2023 (e-Doc 6997735)

[9] CNL Supplier Document, *Environmental Risk Assessment Lagoon and Landfill Areas Whiteshell Laboratories, Pinawa, Manitoba*, WLD-509220-REPT-001, March 8, 2021, (e-Doc 6556311)

[10] CNSC Letter, K. Ross (CNSC) to R. Swartz (CNL), *CNSC Staff Assessment of Environmental Risk Assessment Lagoon and Landfill Whiteshell Laboratories*, *Pinawa Manitoba*, October 21, 2021, (e-Doc 6661784)

[11] CNL Document, 2022 Progress Report on the Environmental Assessment Follow-Up Program for Whiteshell Laboratories, WL-509246-ACMR-2022; Rev. 0, June 6, 2023 (Approved), (e-Doc 7192307)

Attachment

#	Application Section	Requirement	CNL Response [2]	CNSC Comment	CNSC Expectations and Recommendations to Address Comment
1.	General Nuclear Safety and Control Regulations Section 3(1) [4]	c) the name, maximum quantity and form of any nuclear substance to be encompassed by the licence	*No change to nuclear substances to be encompassed by the Whiteshell Laboratories licence [A-1].* *Three principal types of nuclear substances exist at WL:* • *Heavy Water (Deuterium compounds and derivatives).* *Small residual amounts within WR-1 Moderator System.* • *Fissionable and Fertile Materials.* *Quantities of irradiated fissionable and fertile materials (e.g., thorium) are stored at WL, in solid forms. Small quantities of unirradiated waste materials are also stored at WL, in solid form. The maximum quantity of fissionable plus fertile materials encompassed by the site licence is 30 mega grams.*	CNL's use of terminology "*small quantities of unirradiated waste*…" is not consistent with the definition of "small quantities" provided in REGDOC-2.4.3, Section 2.3.1.2 [7] or small with respect to the maximum quantity of fissionable plus fertile materials stated (i.e., 30 mega grams).	**Expectations:** CNL must clarify and maintain language and definitions consistent with REGDOC-2.4.3 [7] requirements.

#	Application Section	Requirement	CNL Response [2]	CNSC Comment	CNSC Expectations and Recommendations to Address Comment
			• *Sealed Sources.* *A sealed source registry is maintained at WL and is provided annually to the CNSC.* *The name, maximum quantity and form of nuclear substances permitted in each nuclear facility (Concrete Canister Storage Facility, Shielded Facilities, and Waste Management Area), or in components thereof, are given in the safety analysis reports.*		
2.	Class I Nuclear Facilities Regulations Section 7 [5]	(i) the proposed measures to prevent or mitigate the effects of accidental releases of nuclear substances and hazardous substances on the environment, the health and safety of persons and the maintenance of national security, including an emergency response plan;	*The required information is provided in the Comprehensive Study Report on the decommissioning of Whiteshell Laboratories [A-15] and in the annual reports prepared to meet the requirement of SCA "Operating Performance" Licence Condition 3.2 of the current WL LCH [A-3].* *Information on these topics is also provided in relevant aspects of the following:* • *Environmental Protection Program, through the documents referenced in SCA "Environmental Protection" Licence Condition 9.1 of the current WLLCH [A-3].*	Elements that apply to this requirement are also found in Safety Analysis SCA, Licence Condition 4.1, Safety Analysis and Licence Condition 4.2, Nuclear Criticality safety of the current WL LCH [8], thus these also need to be referenced here.	**<u>Expectations:</u>** Safety Analysis SCA, Licence Condition 4.2, Nuclear Criticality Safety of the current WL LCH [8] needs to be referenced in CNL's licence application, along with LC 4.1.

#	Application Section	Requirement	CNL Response [2]	CNSC Comment	CNSC Expectations and Recommendations to Address Comment
			• *Occupational Safety and Health Program, through the documents referenced in SCA "Conventional Health and Safety" Licence Condition 8.1of the current WL LCH [A-3].* • *Physical Security Program, through the documents referenced in SCA "Security" Licence Condition 12.1 of the current WL LCH [A-3].* • *Emergency Preparedness Program, through the documents referenced in SCA "Emergency Management and Fire Protection" Licence Condition10.1 of the current WL LCH [A-3].*		

#	Application Section	Requirement	CNL Response [2]	CNSC Comment	CNSC Expectations and Recommendations to Address Comment
3.	Class I Nuclear Facilities Regulations Section 3 [5]	(d.1) the proposed human performance program for the activity to be licensed, including measures to ensure workers' fitness for duty	*Compliance with the requirements for human performance at WL is ensured through implementation of the Performance Assurance Program through the documents referenced in SCA "Human Performance Management", Licence Condition 2.1: Human Performance Program of the WL LCH [A-3].*	REGDOC 2.2.4, *Fitness for Duty* volumes which are licensing basis publications under the current WL LCH under LC 2.1 [8], are not all explicitly mapped in a CNL document that requires notification of change under LC 2.1 with respect to its requirements, such as in a CNL program requirements document (PRD). CNSC staff acknowledge that not all requirements are listed in a CNL PRD. Some volumes of REGDOC 2.2.4 are listed under LC 2.2 in CNL's Training and Development PRD, however the requirements are listed in the context of training and development and not human performance. Nonetheless, CNL is required to implement the licensing basis publication requirements in its management system.	<u>**Recommendation:**</u> Though CNL has implemented the licencing basis documents, CNSC staff recommend that CNL map where licensing basis requirements are implemented in CNL's management system within a PRD (i.e., CNL document 900-510000-STD-013, Rev 1 – *Fitness for Duty*), consistent with CNL's other PRDs under other WL LCs. This is to encourage standardization and clarity as to how and where regulatory requirements are implemented in CNL's management system.

Application

[6] CNL Letter, B. Wilcox (CNL) to K. Campbell (CNSC), Canadian Nuclear Laboratories Response to CNSC Staff Comments on the Application for Renewal of the Nuclear Research and Test Establishment Decommissioning Licence for the Whiteshell Laboratories, WLD-CNNO-24-0004-L (e-Doc 7202949), 2024 January 15

Canadian Nuclear Laboratories | Laboratoires Nucléaires Canadiens

2024 January 15

WHITESHELL LABORATORIES RESTORATION PROJECT

Kimberley Campbell, Director
Canadian Nuclear Laboratories Regulatory Program Division
Canadian Nuclear Safety Commission
280 Slater Street
P.O. Box 1046, Station B
OTTAWA, Ontario K1P 5S9

Dear Ms. Campbell:

CANADIAN NUCLEAR LABORATORIES RESPONSE TO CNSC STAFF COMMENTS ON THE APPLICATION FOR RENEWAL OF THE NUCLEAR RESEARCH AND TEST ESTABLISHMENT DECOMMISSIONING LICENCE FOR THE WHITESHELL LABORATORIES

The purpose of this letter is to respond to CNSC staff comments [1] on Canadian Nuclear Laboratories' (CNL) application [2] for the renewal of the Nuclear Research and Test Establishment Decommissioning Licence for Whiteshell Laboratories (WL) (current licence – NRTEDL-W5-8.00/2024 expires on 2024 December 31) [3]. The application was made in accordance with the requirements of the *Nuclear Safety and Control Act* [4] (hereafter – the Act) and the *General Nuclear Safety and Control Regulations* [5].

The application for a three-year licence renewal period to commence on 2025 January 01, following expiry of licence NRTEDL-W5-8.00/2024 [3], was submitted for consideration by the Commission on 2023 November 21 [2]. CNSC staff performed a sufficiency check of CNL's licence renewal application against licence renewal requirements and provided their comments on 2024 January 05 [1].

Attachment A provides CNL's responses to CNSC staff comments.

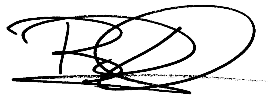
Attachment B provides the updated clause-by-clause statements for relevant excerpts from the Act and relevant CNSC Regulations and describes how CNL meets these requirements as per the compliance verification criteria prescribed by CNSC in the current WL Licence Conditions Handbook [6]. The activities at the site over the proposed licence period are consistent with the current licence period activities per the current WL Licence [3] and Licence Conditions Handbook [6].

Whiteshell Laboratories
1 Ara Mooradian Way
Pinawa, Manitoba
Canada R0E 1L0
Telephone: 204-753-2311
Fax: 204-753-2455
Toll Free: 1-866-513-2325

Laboratoires de Whiteshell
1, Ara Mooradian Way
Pinawa (Manitoba) R0E 1L0
Canada
Téléphone: 204-753-2311
Fax: 204-753-2455
Sans frais: 1-866-513-2325

Should you require any further information please contact me at 204-340-3044.

Yours sincerely,



Brian Wilcox
General Manager and Whiteshell Laboratories Site Licence Holder

Attachments (2)

REFERENCES:

[1] CNSC Letter, K. Campbell (CNSC) to B. Wilcox (CNL), *CNSC Staff Review of CNL Application for Renewal of the Nuclear Research and Test Establishment Decommissioning Licence for the Whiteshell Laboratories (NRTEDL-W5-8.00/2024)*, WLD-NOCN-24-0001-L (e-Doc 7191956), 2024 January 05.

[2] CNL Letter, B. Wilcox (CNL) to D. Saumure (CNSC), *Application for Renewal of the Nuclear Research and Test Establishment Decommissioning Licence for the Whiteshell Laboratories*, WLD-CNNO-23-0051-L (e-Doc 7171551), 2023 November 21.

[3] Canadian Nuclear Safety Commission*, Whiteshell Laboratories, Nuclear Research and Test Establishment Decommissioning Licence*, NRTEDL-W5-8.00/2024, Expiry Date: 2024 December 31.

[4] *Nuclear Safety and Control Act*, S.C. 1997, c. 9, Canada.

[5] *General Nuclear Safety and Control Regulations* SOR/2000-202, Canada.

[6] Canadian Nuclear Safety Commission, *Licence Conditions Handbook for Whiteshell Laboratories*, NRTEDL-LCH-08.00/2024, Revision 1, 2023 April 03.

c:

W. Islam (CNSC)	S. Brewer	K. Schruder	A. Tisler
B. Nguyen (CNSC)	A. Caron	B. Scott	J. Willman
A. Stewart (CNSC)	S. Faught	U. Senaratne	>CR Licensing
	C. Gallagher	G. Snell	>CR CNSC Site Office
	G. Kaufmann	P. Stalker	>CR Export Import
	J. McBrearty	M. Steedman	Forms/Formulaires (CNSC/CCSN)
	K. Rod	R. Swartz	

ATTACHMENT A. CNL RESPONSE TO CNSC STAFF REVIEW

#	Application Section	Comment	CNL Response
1	General Nuclear Safety and Control Regulations Section 3(1) [A-1]	**Requirement:** c) the name, maximum quantity and form of any nuclear substance to be encompassed by the licence **CNSC Comment:** CNL's use of terminology "small quantities of unirradiated waste…" is not consistent with the definition of "small quantities" provided in REGDOC-2.4.3, Section 2.3.1.2 [A-2] or small with respect to the maximum quantity of fissionable plus fertile materials stated (i.e., 30 mega grams). **Expectations:** CNL must clarify and maintain language and definitions consistent with REGDOC-2.4.3 [A-2] requirements.	The word "small" was deleted (see Attachment B, Item 3(1)(c)).
2	Class I Nuclear Facilities Regulations Section 7 [A-3]	**Requirement:** (i) the proposed measures to prevent or mitigate the effects of accidental releases of nuclear substances and hazardous substances on the environment, the health and safety of persons and the maintenance of national security, including an emergency response plan; **CNSC Comment:** Elements that apply to this requirement are also found in Safety Analysis SCA, Licence Condition 4.1, Safety Analysis and Licence Condition 4.2, Nuclear Criticality Safety of the current WL LCH [A-4], thus these also need to be referenced here.	Safety Analysis SCA, Licence Condition 4.2, Nuclear Criticality Safety of the current WL LCH [A-4] has been added (see Attachment B, Item 7(i)).

		Expectations: Safety Analysis SCA, Licence Condition 4.2, Nuclear Criticality Safety of the current WL LCH [A-4] needs to be referenced in CNL's licence application, along with LC 4.1.	
3	Class I Nuclear Facilities Regulations Section 3 [A-3]	**Requirement:** (d.1) the proposed human performance program for the activity to be licensed, including measures to ensure workers' fitness for duty **CNSC Comment:** REGDOC 2.2.4, Fitness for Duty volumes, which are licensing basis publications under the current WL LCH under LC 2.1 [A-4], are not all explicitly mapped in a CNL document that requires notification of change under LC 2.1 with respect to its requirements, such as in a CNL program requirements document (PRD). CNSC staff acknowledge that not all requirements are listed in a CNL PRD. Some volumes of REGDOC 2.2.4 are listed under LC 2.2 in CNL's Training and Development PRD, however the requirements are listed in the context of training and development and not human performance. Nonetheless, CNL is required to implement the licensing basis publication requirements in its management system. **Recommendation:** Though CNL has implemented the licencing basis documents, CNSC staff recommend that CNL map where licensing basis requirements are implemented in CNL's management system within a PRD (i.e., CNL document 900-510000-STD-013, Rev 1 – Fitness for Duty), consistent with CNL's other PRDs under other WL LCs. This is to encourage standardization and clarity as to how and where regulatory requirements are implemented in CNL's management system.	CNL will take this recommendation under consideration.

REFERENCES

[A-1] *General Nuclear Safety and Control Regulations,* SOR/2000-202.

[A-2] Canadian Nuclear Safety Commission, REGDOC-2.4.3, *Nuclear Criticality Safety*, Version 1.1, 2020 September.

[A-3] *Class I Nuclear Facilities Regulations*, SOR/2000-204.

[A-4] Canadian Nuclear Safety Commission, *Licence Conditions Handbook for Whiteshell Laboratories*, NRTEDL-LCH-08.00/2024, Revision 1, 2023 April 03.

ATTACHMENT B. INFORMATION REQUIRED FOR LICENCE RENEWAL APPLICATION

Canadian Nuclear Laboratories (CNL) makes an application for the renewal of the Nuclear Research and Test Establishment Decommissioning Licence for Whiteshell Laboratories (WL), NRTEDL-W5-8.00/2024 [B-1] (the licence) which expires on 2024 December 31.

This attachment presents the information required by the *Nuclear Safety and Control Act* (the Act) [B-2] and CNSC Regulations made pursuant to the Act, to be included in an application for the renewal of a licence. Specifically, this Attachment provides clause-by-clause statements for relevant excerpts from the Act and CNSC Regulations and describes how CNL meets the requirements of the compliance verification criteria prescribed by CNSC in the current WL Licence Conditions Handbook (LCH) [B-3].

B.1 Nuclear Safety and Control Act

Section	Requirement	CNL Response
Nuclear Safety and Control Act		
24(2)	The Commission may issue, renew, suspend in whole or in part, amend, revoke, or replace a licence on receipt of an application (a) in the prescribed form;	This attachment with the letter provides the information required by the Act [B-2] and CNSC Regulations made pursuant to the Act and constitute, in part, an application by CNL to renew its licence [B-1].
24(2)	(b) containing the prescribed information and undertakings and accompanied by the prescribed documents; and	See response to item 24(2) (a) above.
24(2)	(c) accompanied by the prescribed fee.	CNL is in good standing with respect to the provision of CNSC licensing fees and will provide any additional fees, as and when required.
24(4)	No licence may be issued, renewed, amended or replaced unless, in the opinion of the Commission, the applicant (a) is qualified to carry on the activity that the licence will authorize the licensee to carry on; and	CNL understands that qualification will be determined through consideration by the Commission of this application and the associated supporting material as well as deliberation through the Commission hearing process.

Section	Requirement	CNL Response
24(4)	(b) will, in carrying on that activity, make adequate provision for the protection of the environment, the health and safety of persons and the maintenance of national security and measures required to implement international obligations to which Canada has agreed.	CNL understands that adequate provision will be determined through consideration by the Commission of this application and the associated supporting material as well as deliberation through the Commission public hearing process.
24(5)	A licence may contain any term or condition that the Commission considers necessary for the purposes of this Act, including a condition that the applicant provide a financial guarantee in a form that is acceptable to the Commission.	CNL understands the requirement for an acceptable financial guarantee. While ownership of CNL has transferred to the Canadian National Energy Alliance, Atomic Energy of Canada Ltd. (AECL) retains ownership of the lands, assets and liabilities associated with CNL's licences. These liabilities have been officially recognized by the Minister of Natural Resources in a letter dated 2015 July 31 [B-4], and this recognition was reaffirmed by AECL to CNL on 2020 August 12 [B-5].
25	The Commission may, on its own motion, renew, suspend in whole or in part, amend, revoke or replace a licence under the prescribed conditions.	CNL understands the clause and no response is required.

B.2 General Nuclear Safety and Control Regulations

Section	Requirement	CNL Response
General Nuclear Safety and Control Regulations		
3(1)	An application for a licence shall contain the following information: (a) the applicant's name and business address	No change to name or business address as listed under Section II of the current licence. The applicant's name: Canadian Nuclear Laboratories Ltd. Business address: Canadian Nuclear Laboratories Ltd. Chalk River Laboratories 286 Plant Road Chalk River, Ontario K0J 1J0 Contact Person, Signing Authority and Site Licence Holder: Name: Brian Wilcox General Manager and Whiteshell Laboratories Site Licence Holder Canadian Nuclear Laboratories Ltd. Whiteshell Laboratories 1 Ara Mooradian Way Pinawa, Manitoba, R0E 1L0 Phone 204-340-3044 Official Language of Application: English
3(1)	(b) the activity to be licensed and its purpose	Throughout the proposed period of the renewed licence, CNL intends to continue to conduct the licensed activities as outlined in the current Whiteshell Laboratories licence [B-1]: a) operate and decommission the Whiteshell Laboratories located in Pinawa, Province of Manitoba as further described in the WL LCH [B-3],

Section	Requirement	CNL Response
General Nuclear Safety and Control Regulations		
		b) produce, possess, process, refine, transfer, use, package, manage, and store the nuclear substances that are required for, associated with or arise from the activities described in a), c) possess, use, produce, and transfer prescribed equipment that is required for, associated with, or arises from the activities described in a), d) possess, use, and transfer prescribed information that is required for, associated with, or arises from the activities described in a), e) carry out the site preparation, construction, or construction modification or undertaking that is required for, associated with, or arise from the activities described in a).
3(1)	(c) the name, maximum quantity and form of any nuclear substance to be encompassed by the licence	No change to nuclear substances to be encompassed by the Whiteshell Laboratories licence [B-1]. Three principal types of nuclear substances exist at WL: • Heavy Water (Deuterium compounds and derivatives). Small residual amounts within WR-1 Moderator System. • Fissionable and Fertile Materials. Quantities of irradiated fissionable and fertile materials (e.g., thorium) are stored at WL, in solid forms. Solid unirradiated waste materials are also stored at WL. The maximum quantity of fissionable plus fertile materials encompassed by the site licence is 30 mega grams. • Sealed Sources. A sealed source registry is maintained at WL and is provided annually to the CNSC. The name, maximum quantity, and form of nuclear substances permitted in each nuclear facility (Concrete Canister Storage Facility, Shielded Facilities, and Waste Management Area), or in components thereof, are given in the safety analysis reports.

Section	Requirement	CNL Response
General Nuclear Safety and Control Regulations		
3(1)	(d) a description of any nuclear facility, prescribed equipment or prescribed information to be encompassed by the licence	Relevant information on the nuclear facilities and prescribed equipment is presented in the CNL safety analysis reports for the following WL facilities: Concrete Canister Storage Facility, Shielded Facilities, and Waste Management Area (through the documents referenced in Safety Control Area (SCA) "Safety Analysis", Licence Condition 4.1 of the current WL LCH [B-3]. Any specific required information that may be prescribed information will be provided to the Commission under separate cover, consistent with clause 21 (2) of the *General Nuclear Safety and Control Regulations* [B-6], which states that information made public is not prescribed information for the purposes of the Act [B-2].
3(1)	(e) the proposed measures to ensure compliance with the *Radiation Protection Regulations*, the *Nuclear Security Regulations* and the *Packaging and Transport of Nuclear Substances Regulations*, 2015	Compliance with the *Radiation Protection Regulations* [B-7] at WL is ensured through implementation of the CNL Radiation Protection Program, through the documents referenced in SCA "Radiation Protection", Licence Condition 7.1 of the current WL LCH [B-3], and through implementation of the Environmental Protection Program, through the documents referenced in SCA "Environmental Protection", Licence Condition 9.1 of the current WL LCH [B-3]. Compliance with the *Nuclear Security Regulations* [B-7] is ensured through implementation of the CNL Security Program and the CNL Cyber Security Program, through the documents referenced in SCA "Security", Licence Condition 12.1 of the current WL LCH [B-3]. Compliance with the *Packaging and Transport of Nuclear Substances Regulations* [B-9] is ensured through implementation of the Transportation of Dangerous Goods Program, through the documents referenced in SCA "Packaging and Transport", Licence Condition 14.1 of the current WL LCH [B-3].
3(1)	(f) any proposed action level for the purpose of section 6 of the *Radiation Protection Regulations*	Action levels for the WL site are defined under the Environmental Protection Program for air and liquid radioactive effluents, through the documents referenced in SCA "Environmental Protection"

Section	Requirement	CNL Response
General Nuclear Safety and Control Regulations		
		Licence Condition 9.1 of the current WL LCH [B-3], and the Radiation Protection Program, through the documents referenced in SCA “Radiation Protection” Licence Condition 7.1 of the current WL LCH [B-3].
3(1)	(g) the proposed measures to control access to the site of the activity to be licensed and the nuclear substance, prescribed equipment or prescribed information (h) the proposed measures to prevent loss or illegal use, possession or removal of the nuclear substance, prescribed equipment or prescribed information	Compliance with the *Nuclear Security Regulations* [B-7] is ensured through implementation the CNL Security Program and the CNL Cyber Security Program, through the documents referenced in SCA “Security”, Licence Condition 12.1 of the current WL LCH [B-3].
3(1)	(i) a description and the results of any test, analysis or calculation performed to substantiate the information included in the application;	Substantiation of the information included with this application is demonstrated through the implementation of annual reporting requirements as defined in Licence Condition 3.2 of the current WL LCH [B-3]. Annual reports are prepared, as required, to cover both nuclear facility and program performance areas.
3(1)	(j) the name, quantity, form, origin and volume of any radioactive waste or hazardous waste that may result from the activity to be licensed, including waste that may be stored, managed, processed or disposed of at the site of the activity to be licensed, and the proposed method for managing and disposing of that waste;	Specific information on radioactive and hazardous wastes is presented in the annual reports prepared to meet the requirement of SCA “Operating Performance” Licence Condition 3.2 of the current WL LCH [B-3]. Relevant requirements for managing and disposing of radioactive and hazardous waste at the WL site are addressed in the Waste Management Program (through the documents referenced in SCA “Waste Management” Licence Condition 11.1 of the current WL LCH [B-3].
3(1)	(k) the applicant’s organizational management structure insofar as it may bear on the applicant’s compliance with the Act and the	CNL’s senior management organizational structure for the operation of WL is documented in the Management System manual [B-10].

Section	Requirement	CNL Response
General Nuclear Safety and Control Regulations		
	regulations made under the Act, including the internal allocation of functions, responsibilities and authority;	Further relevant information regarding responsibilities and authority at the WL site is provided in lower tier Management System documents. As per the requirements of SCA "Management System" Licence Condition 1.1 of the WL LCH [B-3], further relevant information regarding the responsibilities and authority at the WL site is provided in *Site Licences, Certificates, Permits, Building/Facility Contacts, & Licence Representatives* [B-11].
3(1)	(l) a description of any proposed financial guarantee relating to the activity to be licensed; and	CNL understands the requirement for an acceptable financial guarantee. While ownership of CNL has transferred to Canadian National Energy Alliance, AECL retains ownership of the lands, assets and liabilities associated with CNL's licences. These liabilities have been officially recognized by the Minister of Natural Resources in a letter dated 2015 July 31 [B-4] and reaffirmed in 2020 [B-5], as per Licence Condition G.3 of the current WL LCH [B-3].
3(1)	(m) any other information required by the Act or the regulations made under the Act for the activity to be licensed and the nuclear substance, nuclear facility, prescribed equipment or prescribed information to be encompassed by the licence.	An annual summary report of compliance monitoring and operational performance is submitted to CNSC staff, to meet the requirement of SCA "Operating Performance" Licence Condition 3.2 of the current WL LCH [B-3]. This report provides information on operational practices, maintenance of the facilities and the laboratories, and presents a summary of performance for each of the Safety and Control Areas.
5	An application for the renewal of a licence shall contain: (a) The information required to be contained in an application for that licence by the applicable regulations made under the Act	The information is provided under Section 3(1) (please see above) of the *General Nuclear Safety and Control Regulations* [B-6].
5	(b) a statement identifying the changes in the information that was previously submitted.	No changes to the existing terms and conditions of the current WL Licence [B-1] or to the associated WL LCH [B-3] are being requested.

Section	Requirement	CNL Response
General Nuclear Safety and Control Regulations		
7	An application for a licence or for the renewal, suspension in whole or in part, amendment, revocation or replacement of a licence may incorporate by reference any information that is included in a valid, expired or revoked licence.	The licensed activities from the current WL licence [B-1] are expected to continue throughout the proposed period of the new licence as listed in the response above to clause 3 (b). Additionally, the system of programs and processes that are effective for the current licence [B-1] is maintained to meet the requirements of the 14 various Safety and Control Areas, as prescribed in the current WL LCH [B-3]. These constitute the licensing basis for the current licence [B-1], and will continue to be implemented throughout the term of the proposed renewed licence in order to assure the continuation of safe practices at the WL site. The establishment, maintenance (including continuous improvement) and functional support requirements of these programs and processes are governed by the Management System as per the Management System manual [B-10] and lower tier documents.
15	Every applicant for a licence and every licensee shall notify the Commission of: (a) the persons who have authority to act for them in their dealings with the Commission (b) the names and position titles of the persons who are responsible for the management and control of the licensed activity and the nuclear substance, nuclear facility, prescribed equipment or prescribed information encompassed by the licence	CNL's senior management organizational structure for the operation of WL is documented in the Management System manual [B-10]. Further relevant information regarding responsibilities and authority at the WL site is provided in lower tier Management System documents.
15	(c) any change in the information referred to in paragraphs (a) and (b), within 15 days after the change occurs.	The Clause is understood, and no response is required.

B.3 Class I Nuclear Facilities Regulations

Section	Requirement	CNL Response
Class I Nuclear Facilities Regulations		
3	An application for a licence in respect of a Class I nuclear facility, other than a licence to abandon, shall contain the following information in addition to the information required by section 3 of the *General Nuclear Safety and Control Regulations*: (a) a description of the site of the activity to be licensed, including the location of any exclusion zone and any structures within that zone;	Relevant information for the Class I nuclear facilities is provided in the annual reports prepared to meet the requirement of SCA “Operating Performance” Licence Condition 3.2 of the current WL LCH [B-3], in the Facility Authorization documents for the following WL nuclear facilities: Concrete Canister Storage Facility, Shielded Facilities, and Waste Management Area (through the Facility Authorization documents referenced in Licence Condition 3.1 of the current WL LCH [B-3]), and facility-specific safety analysis reports for the same WL facilities (through documents referenced in SCA “Safety Analysis”, Licence Condition 4.1 of the current WL LCH [B-3]). Information on the site characteristics is presented in the individual safety analysis reports.
3	(b) plans showing the location, perimeter, areas, structures and systems of the nuclear facility;	Relevant information for the Class I nuclear facilities is provided in the annual reports prepared to meet the requirement of SCA “Operating Performance” Licence Condition 3.2 of the current WL LCH [B-3], and in the safety analysis reports for the following WL facilities: Concrete Canister Storage Facility, Shielded Facilities, and Waste Management Area (through the documents referenced in SCA “Safety Analysis”, Licence Condition 4.1 of the current WL LCH [B-3]).
3	(c) evidence that the applicant is the owner of the site or has authority from the owner of the site to carry on the activity to be licensed;	As identified in the letter [B-12], AECL maintains the ownership of the WL property and authorizes CNL to conduct licensed activities at the site.
3	(d) the proposed management system for the activity to be licensed, including measures to promote and support safety culture;	CNL’s Management System program is documented in the CNL Management System manual [B-10] and lower tier documents through the documents referenced in SCA “Management System” Licence Condition 1.1 of the current WL LCH [B-3] and complies with the *Class I Nuclear Facilities Regulations* [B-13].

Section	Requirement	CNL Response
Class I Nuclear Facilities Regulations		
3	(d.1) the proposed human performance program for the activity to be licensed, including measures to ensure workers' fitness for duty.	Compliance with the requirements for human performance at WL is ensured through implementation of the Performance Assurance Program through the documents referenced in SCA "Human Performance Management", Licence Condition 2.1: Human Performance Program of the WL LCH [B-3].
3	(e) the name, form, characteristics and quantity of any hazardous substances that may be on the site while the activity to be licensed is carried on;	Hazardous substances that are on the WL site include: • Asbestos–Containing Materials (ACM) (e.g., pipe insulation, parging, vermiculite, vinyl-asbestos floor tiles, asbestos cement ceiling tiles, asbestos cement pipes); • Polychlorinated Biphenyls (PCBs) (e.g., fluorescent light ballasts, residuals from transformers, capacitors, etc.); • Lead (e.g., elemental lead shielding, lead-based paints, spent bullets in security guard firing ranges, batteries); • Mercury (e.g., elemental residuals from laboratories or as stored wastes, in fluorescent light tubes, electrical switches or thermostats); • Mould (e.g., in poorly ventilated crawl spaces and basements); • Hydrocarbons (e.g., from historical fuelling spills or tank residuals); • Organic reactor coolant (HB-40 also known as OS-84) (e.g., residual liquid or tar-like residues, coatings on piping, structures, etc.); • Hanta-virus-containing animal droppings (e.g., from deer mice); • Chlorine gas or residuals from water treatment systems; • Glycol, freons and other ozone-depleting substances (ODS) from chillers, air-conditioning systems, etc.; • Quantities of DDT, arsenic, metallic beryllium, (wet) uranium carbide reactor fuel, various ion-exchange column resins, etc. and traces of several toxic metals are located in various waste management structures; and • Tritium, xylene, gadolinium nitrates, and boron-containing substances, located throughout the WR-1 reactor building. More detailed information on these hazardous substances in a specific facility or building is captured in the WL Detailed Decommissioning Plan

Section	Requirement	CNL Response
Class I Nuclear Facilities Regulations		
		(DDP), Volume 1 - Program Overview [B-14], in DDP Volumes 2 through 12 as documented in the Program Overview DDP [B-14], and in lower-level decommissioning documentation. It is also to be noted that most of these hazardous substances have been encountered in previous decommissioning projects at WL and have all been safely dealt with through existing or specially created handling procedures.
3	(f) the proposed worker health and safety policies and procedures;	Compliance with the requirements for worker health and safety at WL is ensured through implementation of the Occupational Safety and Health Program, through the documents referenced in SCA "Conventional Health and Safety" Licence Condition 8.1 of the current WL LCH [B-3].
3	(g) the proposed environmental protection policies and procedures;	Compliance with the requirements for environmental protection at WL is ensured through implementation of the Environmental Protection Program, through the documents referenced in SCA "Environmental Protection", Licence Condition 9.1 of the current WL LCH [B-3].
3	(h) the proposed effluent and environmental monitoring programs;	See response to clause 3(g) above.
3	(i) if the application is in respect of a nuclear facility referred to in paragraph 2(b) of the *Nuclear Security Regulations*, the information required by section 3 of those Regulations;	Not applicable.
3	(j) the proposed program to inform persons living in the vicinity of the site of the general nature and characteristics of the anticipated effects on the environment and the health and safety of persons that may result from the activity to be licensed; and	Compliance with the requirements for notification to local residents and associated activities is ensured through implementation of the Public Information Program, through the documents referenced in Licence Condition G.4 of the current WL LCH [B-3]. Additional compliance is ensured through the Emergency Preparedness Program, through the documents referenced in SCA "Emergency Management and Fire Protection" Licence Condition 10.1 of the current WL LCH [B-3].

Section	Requirement	CNL Response
Class I Nuclear Facilities Regulations		
3	(k) the proposed plan for the decommissioning of the nuclear facility or of the site.	The plan for the decommissioning of the site is captured in the WL Detailed Decommissioning Plan, Volume 1 – Program Overview [B-14] and DDP Volumes 2 through 12 as documented in the Program Overview DDP [B-14].
7	An application for a licence to decommission a Class I nuclear facility shall contain the following information in addition to the information required by section 3 (CINFR): (a) a description of and the proposed schedule for the decommissioning, including the proposed starting date and the expected completion date of the decommissioning and the rationale for the schedule; (b) the nuclear substances, hazardous substances, land, buildings, structures, systems and equipment that will be affected by the decommissioning; (c) the proposed measures, methods and procedures for carrying on the decommissioning;	The proposed plan for the decommissioning of the site is captured in the WL Detailed Decommissioning Plan, Volume 1 – Program Overview [B-14], and DDP Volumes 2 through 12 as documented in the Program Overview DDP [B-14].
7	(d) the proposed measures to facilitate Canada's compliance with any applicable safeguards agreement;	Compliance with the requirements for safeguards at WL is ensured through implementation of the Nuclear Materials and Safeguards Management Program, through the documents referenced in SCA “Safeguards and Non-Proliferation” Licence Condition 13.1 of the current WL LCH [B-3].
7	(e) the nature and extent of any radioactive contamination at the nuclear facility;	This information is presented in the WL Detailed Decommissioning Plan, Volume 1 – Program Overview [B-14].

Section	Requirement	CNL Response
Class I Nuclear Facilities Regulations		
7	(f) the effects on the environment and the health and safety of persons that may result from the decommissioning, and the measures that will be taken to prevent or mitigate those effects;	The required information is provided in the Comprehensive Study Report [B-15] on the decommissioning of Whiteshell Laboratories. The measures that will be taken to prevent or mitigate these effects are described within the Environmental Protection Program, through the documents referenced in SCA “Environmental Protection” Licence Condition 9.1 of the current WL LCH [B-3], and within the Occupational Safety and Health Program, through the documents referenced in SCA “Conventional Health and Safety” Licence Condition 8.1 of the current WL LCH [B-3].
7	(g) the proposed location of points of release, the proposed maximum quantities and concentrations, and the anticipated volume and flow rate of releases of nuclear substances and hazardous substances into the environment, including their physical, chemical and radiological characteristics;	Compliance is ensured through implementation of the Environmental Protection Program, through the documents referenced in SCA “Environmental Protection” Licence Condition 9.1 of the current WL LCH [B-3].
7	(h) the proposed measures to control releases of nuclear substances and hazardous substances into the environment;	Compliance is ensured through implementation of the Environmental Protection Program, through the documents referenced in SCA “Environmental Protection” Licence Condition 9.1 of the current WL LCH [B-3].

Section	Requirement	CNL Response
Class I Nuclear Facilities Regulations		
7	(i) the proposed measures to prevent or mitigate the effects of accidental releases of nuclear substances and hazardous substances on the environment, the health and safety of persons and the maintenance of national security, including an emergency response plan;	The required information is provided in the Comprehensive Study Report on the decommissioning of Whiteshell Laboratories [B-15] and in the annual reports prepared to meet the requirement of SCA “Operating Performance” Licence Condition 3.2 of the current WL LCH [B-3]. Information on these topics is also provided in relevant aspects of the following: • Environmental Protection Program, through the documents referenced in SCA “Environmental Protection” Licence Condition 9.1 of the current WL LCH [B-3]. • Occupational Safety and Health Program, through the documents referenced in SCA “Conventional Health and Safety” Licence Condition 8.1 of the current WL LCH [B-3]. • Physical Security Program, through the documents referenced in SCA “Security” Licence Condition 12.1 of the current WL LCH [B-3]. • Emergency Preparedness Program, through the documents referenced in SCA “Emergency Management and Fire Protection” Licence Condition 10.1 of the current WL LCH [B-3]. • Safety Analysis Program, through the documents referenced in SCA “Safety Analysis” Licence Condition 4.1 of the current WL LCH [B-3]. • Nuclear Criticality Safety Program, through the documents referenced in SCA “Safety Analysis” Licence Condition 4.2 of the current WL LCH [B-3].
7	(j) the proposed qualification requirements and training program for workers; and	Compliance with the requirements for training and qualification at WL is ensured through implementation of SCA “Human Performance Management” Licence Conditions 2.1 and 2.2 of the WL LCH [B-3].
7	(k) a description of the planned state of the site on completion of the decommissioning.	The CNL plans to decommission all of WL to its final end-state as documented in the WL Detailed Decommissioning Plan, Volume 1 – Program Overview [B-14], with further details to be documented in the Land-Use and End-State Plan, are planned to be finalized in the next licence period.

B.4 Nuclear Security Regulations

Section	Requirement	CNL Response
Nuclear Security Regulations		
3	An application for a licence in respect of Category I or II nuclear material, other than a licence to transport, and an application for a licence in respect of a nuclear facility referred to in paragraph 2(b) shall contain the following information in addition to the information required by section 3 of the Nuclear Substances and *Radiation Devices Regulations* or sections 3 to 8 of the *Class I Nuclear Facilities Regulations*, as applicable: (a) a copy of the arrangements referred to in section 35; (b) the site plan referred to in section 16; (c) a description of the proposed security equipment, systems and procedures; (d) a description of the proposed on-site and off-site communications equipment, systems and procedures; (e) a description of the proposed structure and organization of the nuclear security officer service, including the duties, responsibilities and training of nuclear security officers; (f) the proposed plan and procedures to assess and respond to breaches of security; and (g) the current threat and risk assessment.	Compliance with the requirements regarding security of Category I or II nuclear material or nuclear facilities is ensured through implementation of the: • Physical Security Program, through the documents referenced in SCA “Security” Licence Condition 12.1 of the current WL LCH [B-3]. • Radiation Protection Program, through the documents referenced in SCA “Radiation Protection” Licence Condition 7.1 of the current WL LCH [B-3]. • Nuclear Materials and Safeguards Management Program, through the documents referenced in SCA “Safeguards and Non-Proliferation” Licence Condition 13.1 of the current WL LCH [B-3]. Any applicable material would be considered as prescribed information for the purposes of the act and no specific details are provided in this document. Note: There is no Category I nuclear material at the WL site.

Section	Requirement	CNL Response
Nuclear Security Regulations		
4	An application for a licence in respect of Category III nuclear material, other than a licence to transport, shall contain, in addition to the information required by section 3 of the *Nuclear Substances and Radiation Devices Regulations*, a description of the measures to be taken to ensure compliance with subsection 7(3) and sections 7.1 and 7.2.	Compliance with the requirements regarding security of Category III nuclear material is ensured through implementation of the: • Physical Security Program, through the documents referenced in SCA "Security" Licence Condition 12.1 of the current WL LCH [B-3]. • Radiation Protection Program, through the documents referenced in SCA "Radiation Protection" Licence Condition 7.1 of the current WL LCH [B-3]. • Nuclear Materials and Safeguards Management Program, through the documents referenced in SCA "Safeguards and Non-Proliferation" Licence Condition 13.1 of the current WL LCH [B-3]. Any applicable material would be considered as prescribed information for the purposes of the Act and no specific details are provided in this document.
41	An application for a licence in respect of a nuclear facility shall contain, in addition to the information required by sections 3 to 8 of the *Class I Nuclear Facilities Regulations*, a description of the physical protection measures to be taken to ensure compliance with sections 42 to 48.	Compliance with the requirements for the provision of an off-site response force is ensured through implementation of the Physical Security Program, through the documents referenced in SCA "Security" Licence Condition 12.1 of the current WL LCH [B-3], and the Emergency Preparedness Program, through the documents referenced in SCA "Emergency Management and Fire Protection" Licence Condition 10.1 of the current WL LCH [B-3].

REFERENCES

[B-1] Canadian Nuclear Safety Commission, *Whiteshell Laboratories, Nuclear Research and Test Establishment Decommissioning Licence*, NRTEDL-W5-8.00/2024, Expiry Date: 2024 December 31.

[B-2] *Nuclear Safety and Control Act*, S.C. 1997, c. 9, Canada.

[B-3] Canadian Nuclear Safety Commission, *Licence Conditions Handbook for Whiteshell Laboratories*, NRTEDL-LCH-08.00/2024, Revision 1, 2023 April 03.

[B-4] Letter, G. Rickford (NRCan) to M. Binder (CNSC), untitled, relating to provision of financial guarantees for CNL sites in Canada, 145-NRCANNO-15-0001-L, 2015 July 31.

[B-5] Letter, P. Boyle (CNL) to K. Murthy (CNSC), *Submission of Information Regarding Financial Guarantees for All Atomic Energy of Canada Limited Sites Operated by Canadian Nuclear Laboratories*, 145-CNNO-20-0028-L, 2020 August 25.

[B-6] *General Nuclear Safety and Control Regulations,* SOR/2000-202, Canada.

[B-7] *Radiation Protection Regulations*, SOR/2000-203, Canada.

[B-8] *Nuclear Security Regulations*, SOR/2000-209, Canada.

[B-9] *Packaging and Transport of Nuclear Substances Regulations*, SOR/2015-145, Canada.

[B-10] *Management System* – Manual, 900-514100-MAN-001, 12489834.

[B-11] *Site Licences, Certificates, Permits, Building/Facility Contacts, & Licence Representatives*, 900-514300-LST-001, 49255143.

[B-12] Amrouni, J.-C. (AECL), Letter to Howden, B.D. (Atomic Energy Control Board), *WL Deed*, JCA-00-034, 2000 May 02.

[B-13] *Class I Nuclear Facilities Regulations*, SOR/2000-204, Canada.

[B-14] *Whiteshell Laboratories Detailed Decommissioning Plan – Volume 1 – Program Overview*, WLDP-02000-DDP-001, Revision 2, 2021 (Revision 3, 2023 October, has been submitted to CNSC staff for acceptance).

[B-15] *Whiteshell Laboratories Decommissioning Project Comprehensive Study Report, Volume 1: Main Report, Volume 2: Appendices, Volume 3: Addendum*, WLDP-03702-041-000, 2001.

Application

[7] CNSC Letter, K. Campbell (CNSC) to B. Wilcox (CNL), CNSC Staff Review of CNL Response Regarding Application for Renewal of the Nuclear Research and Test Establishment Decommissioning Licence for the Whiteshell Laboratories (NRTEDL-W5-8.00/2024), WLD-NOCN-24-0009-L (e-Doc 7217298), 2024 February 09

Directorate of Nuclear Cycle and Facilities Regulation

e-Doc 7217298
File 2.14
RIB 31301

February 9, 2024

VIA EMAIL

Mr. Brian Wilcox
General Manager and Whiteshell Laboratories Site Licence Holder
Canadian Nuclear Laboratories Ltd.
1 Ara Mooradian Way
Pinawa, MB
R0E 1L0

Subject: CNSC Staff Review of CNL Response Regarding Application for Renewal of the Nuclear Research and Test Establishment Decommissioning Licence for the Whiteshell Laboratories (NRTEDL-W5-8.00/2024)

Dear Mr. Wilcox:

Canadian Nuclear Safety Commission (CNSC) staff reviewed Canadian Nuclear Laboratories' (CNL) response submission [1] to CNSC staff comments [2] regarding its application for the renewal of the Nuclear Research and Test Establishment Decommissioning licence for Whiteshell Laboratories (WL) (NRTEDL-W5-8.00/2024) [3] submitted on November 21, 2023 [4].

CNSC staff performed a sufficiency check of CNL's licence renewal application against licence renewal requirements outlined in sections 24(2), 24(3), 24(5), 25 of the *Nuclear Safety and Control Act* [5], sections 3(1), 5, 7, 15 of the *General Nuclear Safety and Control Regulations* [6], sections 3 and 7 of the *Class I Nuclear Facilities Regulations* [7], and sections 3, 4, 41 of the *Nuclear Substances and Devices Regulations* [8]. CNSC staff review resulted in comments which were provided to CNL on January 5, 2024 [2].

CNSC staff have concluded that the submitted amended application [1] adequately addresses CNSC staff comments previously provided [2].

CNL is requested to resubmit its amended application for the renewal of the Nuclear Research and Test Establishment Decommissioning licence for Whiteshell Laboratories (WL) (NRTEDL-W5-8.00/2024) under a new application cover letter to the CNSC Commission Registrar by **February 27, 2024**.

Should you have any questions, please do not hesitate to contact me.

Yours sincerely,

Wasif Islam *On behalf of* Kim Campbell
Director
Canadian Nuclear Laboratories Regulatory Program Division
Canadian Nuclear Safety Commission
613-295-6143
kimberley.campbell@cnsc-ccsn.gc.ca

c.c.: CNL – A. Tisler, S. Brewer, C. Gallagher, P. Stalker, R. Swartz, K. Rod, S. Faught, M. Steedman, K. Schruder, A. Caron, G. Kaufman, J. McBrearty, B Scott, U. Senaratne, G. Snell, J. Willman, A. Stelko, >CR Licensing, >SRC, >ERM Correspondence

CNSC – K. Campbell, A. Stewart, B. Nguyen, >CNLRPD Site Office

Attachment: (1)

References:

[1] CNL Letter, B. Wilcox (CNL) to K. Campbell (CNSC), *Canadian Nuclear Laboratories Response to CNSC Staff Comments on the Application for Renewal of the Nuclear Research and Test Establishment Decommissioning Licence for the Whiteshell Laboratories*, WLD-CNNO-24-0004-L, January 15, 2024, (e-Doc 7202949)

[2] CNSC Letter, K. Campbell (CNSC) to B. Wilcox (CNL), *CNSC Staff Review of CNL Application for Renewal of the Nuclear Research and Test Establishment Decommissioning Licence for the Whiteshell Laboratories (NRTEDL-W5-8.00/2024)*, January 5, 2024, WLD-NOCN-24-0001-L, (e-Doc 7191956)

[3] Canadian Nuclear Safety Commission, *Nuclear Research and Test Establishment Decommissioning Licence, Whiteshell Laboratories, Licence No. NRTEDL-W5-8.00/2024*, Expiry Date: December 31, 2024 (e-Doc 5962032)

[4] CNL Letter, B. Wilcox (CNL) to D. Saumure (CNSC), *Application for Renewal of the Nuclear Research and Test Establishment Decommissioning Licence for the Whiteshell Laboratories*, WLD-CNNO-23-0051-L, November 21, 2023, (e-Doc 7171551)

[5] *Nuclear Safety and Control Act*, S.C. 1997, c. 9, Current to November 27, 2023, Last amended on January 1, 2017

[6] *General Nuclear Safety and Control Regulations*, SOR/2000-202, Current to November 27, 2023, Last amended on June 12, 2015

[7] *Class I Nuclear Facilities Regulations*, SOR/2000-204, Current to November 27, 2023, Last amended on September 22, 2017

[8] *Nuclear Substances and Devices Regulations*, SOR/2000-207, Current to November 27, 2023, Last amended on March 13, 2015

[9] REGDOC-2.4.3, *Nuclear Criticality Safety*, Version 1.1, September 2020 (Publication)

[10] CNSC LCH, *Whiteshell Laboratories Nuclear Research and Test Establishment Decommissioning Licence NRTEDL-W5-8.00/2024*, NRTEDL-LCH-08.00/2024, Revision 1, issued April 3, 2023 (e-Doc 6997735)

Attachment

#	Application Section	Requirement	CNL Response [3]	CNSC Comments, Expectations and Recommendations to Address Comments [2]	CNL Response [1] CNSC Staff Comments and CNSC Staff Review of CNL Response
1.	General Nuclear Safety and Control Regulations Section 3(1) [6]	c) the name, maximum quantity and form of any nuclear substance to be encompassed by the licence	*No change to nuclear substances to be encompassed by the Whiteshell Laboratories licence [A-1].* *Three principal types of nuclear substances exist at WL:* • *Heavy Water (Deuterium compounds and derivatives).* *Small residual amounts within WR-1 Moderator System.* • *Fissionable and Fertile Materials.* *Quantities of irradiated fissionable and fertile materials (e.g., thorium) are stored at WL, in solid forms. Small quantities of unirradiated waste materials are also stored at WL, in solid form. The maximum quantity of fissionable plus fertile materials encompassed by the site licence is 30 mega grams.* • *Sealed Sources.* *A sealed source registry is maintained at WL and is provided annually to the CNSC.* *The name, maximum quantity and form of nuclear substances permitted in each nuclear facility (Concrete Canister*	CNL's use of terminology "*small quantities of unirradiated waste…*" is not consistent with the definition of "small quantities" provided in REGDOC-2.4.3, Section 2.3.1.2 [9] or small with respect to the maximum quantity of fissionable plus fertile materials stated (i.e., 30 mega grams). **Expectations:** CNL must clarify and maintain language and definitions consistent with REGDOC-2.4.3 [9] requirements.	**CNL Response to CNSC Staff Comments:** *The word "small" was deleted (see Attachment B, Item 3(1)(c))* **CNSC Staff Review of CNL Response:** Acceptable.

#	Application Section	Requirement	CNL Response [3]	CNSC Comments, Expectations and Recommendations to Address Comments [2]	CNL Response [1] CNSC Staff Comments and CNSC Staff Review of CNL Response
			Storage Facility, Shielded Facilities, and Waste Management Area), or in components thereof, are given in the safety analysis reports.		
2.	Class I Nuclear Facilities Regulations Section 7 [7]	(i) the proposed measures to prevent or mitigate the effects of accidental releases of nuclear substances and hazardous substances on the environment, the health and safety of persons and the maintenance of national security, including an emergency response plan;	*The required information is provided in the Comprehensive Study Report on the decommissioning of Whiteshell Laboratories [A-15] and in the annual reports prepared to meet the requirement of SCA "Operating Performance" Licence Condition 3.2 of the current WL LCH [A-3].* *Information on these topics is also provided in relevant aspects of the following:* *• Environmental Protection Program, through the documents referenced in SCA "Environmental Protection" Licence Condition 9.1 of the current WLLCH [A-3].* *• Occupational Safety and Health Program, through the documents referenced in SCA "Conventional Health and Safety" Licence Condition 8.1of the current WL LCH [A-3].* *• Physical Security Program, through the documents referenced in SCA "Security" Licence Condition 12.1 of the current WL LCH [A-3].* *• Emergency Preparedness Program,*	Elements that apply to this requirement are also found in Safety Analysis SCA, Licence Condition 4.1, Safety Analysis and Licence Condition 4.2, Nuclear Criticality safety of the current WL LCH [10], thus these also need to be referenced here. **<u>Expectations:</u>** Safety Analysis SCA, Licence Condition 4.2, Nuclear Criticality Safety of the current WL LCH [10] needs to be referenced in CNL's licence application, along with LC 4.1.	**<u>CNL Response to CNSC Staff Comments:</u>** *Safety Analysis SCA, Licence Condition 4.2, Nuclear Criticality Safety of the current WL LCH [A-4] has been added (see Attachment B, Item 7(i)).* **<u>CNSC Staff Review of CNL Response:</u>** Acceptable.

#	Application Section	Requirement	CNL Response [3]	CNSC Comments, Expectations and Recommendations to Address Comments [2]	CNL Response [1] CNSC Staff Comments and CNSC Staff Review of CNL Response
			through the documents referenced in SCA "Emergency Management and Fire Protection" Licence Condition10.1 of the current WL LCH [A-3].		
3.	Class I Nuclear Facilities Regulations Section 3 [7]	(d.1) the proposed human performance program for the activity to be licensed, including measures to ensure workers' fitness for duty	*Compliance with the requirements for human performance at WL is ensured through implementation of the Performance Assurance Program through the documents referenced in SCA "Human Performance Management", Licence Condition 2.1: Human Performance Program of the WL LCH [A-3].*	REGDOC 2.2.4, *Fitness for Duty* volumes which are licensing basis publications under the current WL LCH under LC 2.1 [10], are not all explicitly mapped in a CNL document that requires notification of change under LC 2.1 with respect to its requirements, such as in a CNL program requirements document (PRD). CNSC staff acknowledge that not all requirements are listed in a CNL PRD. Some volumes of REGDOC 2.2.4 are listed under LC 2.2 in CNL's Training and Development PRD, however the requirements are listed in the context of training and development and not human performance. Nonetheless, CNL is required to implement the licensing basis publication requirements in its management system. **<u>Recommendation:</u>** Though CNL has implemented the licencing basis documents, CNSC staff recommend that CNL map where	**<u>CNL Response to CNSC Staff Comments:</u>** *CNL will take this recommendation under consideration.* **<u>CNSC Staff Review of CNL Response:</u>** Acceptable.

#	Application Section	Requirement	CNL Response [3]	CNSC Comments, Expectations and Recommendations to Address Comments [2]	CNL Response [1] CNSC Staff Comments and CNSC Staff Review of CNL Response
				licensing basis requirements are implemented in CNL's management system within a PRD (i.e., CNL document 900-510000-STD-013, Rev 1 – *Fitness for Duty*), consistent with CNL's other PRDs under other WL LCs. This is to encourage standardization and clarity as to how and where regulatory requirements are implemented in CNL's management system.	

Application Attachment A

[A-4] Letter, G. Rickford (NRCan) to M. Binder (CNSC), untitled, relating to provision of financial guarantees for CNL sites in Canada, 145-NRCANNO-15-0001-L, 2015 July 31

Minister of Natural Resources | Ministre des Ressources naturelles

Ottawa, Canada K1A 0E4

JUIL JUL 3 1 2015

Dr. Michael Binder
President and Chief Executive Officer
Canadian Nuclear Safety Commission
P.O. Box 1046, Station B
Ottawa, Ontario K1P 5S9

Dear Dr. Binder:

I am writing in response to your letter of July 15, 2015, with respect to the Canadian Nuclear Safety Commission's (CNSC) requirement for all of its licensees to establish sufficient funds for the decommissioning of their nuclear facilities, i.e. financial guarantees under paragraph 3(1)(l) of the *General Nuclear Safety and Control Regulations* made pursuant to the *Nuclear Safety and Control Act*.

Atomic Energy of Canada Limited (AECL) is a Schedule III, Part I Crown corporation under the *Financial Administration Act* and an agent of Her Majesty in Right of Canada. As an agent of Her Majesty in Right of Canada, AECL's liabilities are ultimately liabilities of Her Majesty in Right of Canada.

While the restructuring of AECL will see the ownership of Canadian Nuclear Laboratories Limited (CNL) transferred to a private-sector contractor, AECL will retain ownership of the lands, assets and liabilities associated with CNL's licences. Specifically, this letter addresses the licences held by CNL for the Chalk River Laboratories, the Whiteshell Laboratories, the Port Hope project, the Port Granby project, and the following three prototype power reactors: Nuclear Power Demonstration, Douglas Point and Gentilly-1.

Consistent with the policy of the Government of Canada that Her Majesty need not restate her commitment in the form of a guarantee, I trust that this letter will serve to address the requirement of the Commission.

Sincerely,

The Honourable Greg Rickford, P.C., M.P.
Minister of Natural Resources and Minister for the
Federal Economic Development Initiative for Northern Ontario

c.c.: Mr. Jon Lundy, Chief Transition Officer, Atomic Energy of Canada Limited
Mr. Ramzi Jammal, Executive Vice-President and Chief Regulatory Operations Officer, Canadian Nuclear Safety Commission

Canada

Application Attachment A

[A-5] Letter, P. Boyle (CNL) to K. Murthy (CNSC), Submission of Information Regarding Financial Guarantees for All Atomic Energy of Canada Limited Sites Operated by Canadian Nuclear Laboratories, 145-CNNO-20-0028-L, 2020 August 25

2020 AUGUST 25

145-CNNO-20-0028-L

OPERATIONS
Office of the Vice-President & CNO

Kavita Murthy, Director General
Directorate of Nuclear Cycle and Facilities Regulation
Canadian Nuclear Safety Commission
280 Slater Street
P.O. Box 1046, Station B
OTTAWA, Ontario K1P 5S9

Submission of Information Regarding Financial Guarantees for all Atomic Energy of Canada Limited Sites Operated by Canadian Nuclear Laboratories

Dear Ms. Murthy:

The purpose of this letter is to submit to Canadian Nuclear Safety Commission (CNSC) staff information recently received [1] by Canadian Nuclear Laboratories (CNL) from Atomic Energy of Canada Limited (AECL) regarding the requirements under the *Nuclear Safety and Control Act* to make funding provisions for decommissioning financial guarantees. The information received relates specifically to liabilities associated with the nuclear licensed sites that are owned by AECL, and operated by CNL under a Government owned – Contractor operated (GoCo) contract.

Accordingly, please find enclosed the letter received from AECL [1], which explicitly confirms that the provisions of financial guarantees previously stated in 2015 [2], by the then Minister of Natural Resources, are reaffirmed as remaining valid.

CNL trusts that the submission of references [1] and [2] will be satisfactory for the purposes of CNSC staff, in their consideration of AECL's liabilities and for providing decommissioning financial guarantees for the sites that are managed by CNL on behalf of AECL under the GoCo contract.

If you should have any questions with respect to the foregoing, please contact me directly or Mr. Shaun Cotnam, CNL's Chief Regulatory Officer at 613-639-1353.

Yours sincerely,

Phillip Boyle
Vice-President, Operations
Chief Nuclear Officer
Site Licence Holder – Chalk River Laboratories
Phone: 613-584-3311, ext. 42408
Email: Phillip.boyle@cnl.ca

Enclosures – (2)

References:

[1] Letter, R.J. Sexton to J. McBrearty, *Financial Guarantee for all AECL Sites*, DWM-401676415-1638, 2020 August 12.

[2] Letter, G. Rickford to M. Binder, 'Untitled', 145-NRCANNO-15-0001-L, 2015 July 31.

c.

R.J. Sexton (AECL)	S. Quinn (AECL)	A. MacDonald (AECL)	
R. Velshi (CNSC)	R. Jammal (CNSC)	C. Cianci (CNSC)	
S. Brewer	S. Cotnam	J. Gilbert	J. Griffin
M. Gull	S. Karivelil	J. McBrearty	D. McIntyre
S. Parnell	F.P. Quinn	L. Riccoboni	K. Schruder
M. Steedman	C. Williams	D. Wood	

2020 August 12 Record Number: DWM-401676415-1638

Mr. Joseph McBrearty
President and CEO
Canadian Nuclear Laboratories
286 Plant Road
Chalk River, ON K0J 1J0

Re: Financial Guarantee for all AECL Sites

References:
[1] Letter from the Minister of Natural Resources dated 2015 July 31

Dear Mr ~~McBrearty~~, Joe

I am writing with respect to the Canadian Nuclear Safety Commission's (CNSC) requirement for all of its licensees to establish sufficient funds for the decommissioning of their nuclear facilities (Ref.: Regulatory document G-206, Financial Guarantees for the Decommissioning of Licensed Activities, which sets out requirements and guidance for the establishment and maintenance of funding for the decommissioning of facilities and termination of activities licensed by the CNSC).

In July 2015, the then Minister of Natural Resources sent the attached correspondence to the CNSC which confirmed the Government of Canada's ultimate responsibility for AECL's liabilities, including post-restructuring. In particular, the Minister (i) noted that AECL is a Schedule III, Part I Crown corporation under the *Financial Administration Act* and an agent of Her Majesty in Right of Canada; and (ii) confirmed that AECL's liabilities are ultimately liabilities of Her Majesty in Right of Canada. As such, these liabilities represent the Government of Canada's responsibility for AECL's decommissioning and waste management sites.

While CNL, as the CNSC licensee, manages and operates AECL's sites and projects under a Government-owned, Contractor-operated contract, AECL continues to be the owner of the lands, assets and liabilities associated with CNL's licences. For clarity and as noted by the Minister, this applies to licences held by CNL for the Chalk River Laboratories, the Whiteshell Laboratories, the Port Hope Project, the Port Granby Project, and the three prototype power reactors: Nuclear Power Demonstration, Douglas Point and Gentilly-1.

The correspondence provided by the Minister in 2015 satisfied the CNSC requirements for provision of a financial guarantee for all liabilities at AECL sites. By way of this letter, I wish to reaffirm the statements provided in the 2015 correspondence and confirm that the financial guarantee remains valid.

Yours truly,

Richard J. Sexton
President & Chief Executive Officer
Atomic Energy of Canada Limited

Enclosure:
Letter from the Minister of Natural Resources dated 2015 July 31

Cc:

S. Tupper, NRCan	J. Delaney, NRCan	R. Velshi, CNSC
J. Ramzi, CNSC	M. Gull, CNL	S. Cotnam, CNL

Minister of Natural Resources | Ministre des Ressources naturelles

Ottawa, Canada K1A 0E4

JUIL JUL 3 1 2015

Dr. Michael Binder
President and Chief Executive Officer
Canadian Nuclear Safety Commission
P.O. Box 1046, Station B
Ottawa, Ontario K1P 5S9

Dear Dr. Binder:

I am writing in response to your letter of July 15, 2015, with respect to the Canadian Nuclear Safety Commission's (CNSC) requirement for all of its licensees to establish sufficient funds for the decommissioning of their nuclear facilities, i.e. financial guarantees under paragraph 3(1)(l) of the *General Nuclear Safety and Control Regulations* made pursuant to the *Nuclear Safety and Control Act*.

Atomic Energy of Canada Limited (AECL) is a Schedule III, Part I Crown corporation under the *Financial Administration Act* and an agent of Her Majesty in Right of Canada. As an agent of Her Majesty in Right of Canada, AECL's liabilities are ultimately liabilities of Her Majesty in Right of Canada.

While the restructuring of AECL will see the ownership of Canadian Nuclear Laboratories Limited (CNL) transferred to a private-sector contractor, AECL will retain ownership of the lands, assets and liabilities associated with CNL's licences. Specifically, this letter addresses the licences held by CNL for the Chalk River Laboratories, the Whiteshell Laboratories, the Port Hope project, the Port Granby project, and the following three prototype power reactors: Nuclear Power Demonstration, Douglas Point and Gentilly-1.

Consistent with the policy of the Government of Canada that Her Majesty need not restate her commitment in the form of a guarantee, I trust that this letter will serve to address the requirement of the Commission.

Sincerely,

The Honourable Greg Rickford, P.C., M.P.
Minister of Natural Resources and Minister for the
Federal Economic Development Initiative for Northern Ontario

c.c.: Mr. Jon Lundy, Chief Transition Officer, Atomic Energy of Canada Limited
Mr. Ramzi Jammal, Executive Vice-President and Chief Regulatory Operations Officer, Canadian Nuclear Safety Commission

Canada

Application Attachment A

[A-10] Management System – Manual, 900-514100-MAN-001, 12489834

CNL Management System Manual
REV 3.1

900-514100-MAN-001

Information Use

Approved by	Title	Date
Peter Stalker	Chief Operating Officer	2023/07/07

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Management Commitment

As members of the Executive Team, we commit Canadian Nuclear Laboratories' management and staff to adhere to, implement, and continually improve the Management System described in this manual.

J. Griffin
Vice-President, Science & Technology

M. Steedman
Vice-President, Environmental Remediation Management and Stewardship and Renewal Group

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Chief Operating Officer

J. McBrearty
President and Chief Executive Officer

Revision History

Rev. No.	Date	Details of Rev.	Prepared By	Reviewed By	Approved By
3.1	2023/06/07	Issued as “Approved for Use”. Minor revision to: 1) Address comments from CNSC letter 145-NOCN-22-0013-L 2) 2) Moved Grading and Risk Management to Section 7.1 and 7.2	A. Dash	A. Coulas P. Stalker	P. Stalker on behalf of J. McBrearty
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		rewriting of the CAS section.			
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2	2021/07/20	Issued as “Approved for Use”. Minor revision to incorporate: 1) The three phase organizational structure transformation; 2) Adoption of new language from Vision 2030; 3) Clarification of roles and responsibilities in Section 4.3.3; and 4) Removal of Appendix B	A. Coulas	P. Boyle D. McIntyre J. Willman D. Wood	J. McBrearty
2D1	2021/06/14	Issued for “Review and Comment”.	A. Coulas	P. Boyle T. Gazerek M. Gull D. McIntyre L. Riccoboni M. Steedman D. Wood T. Cook J. Griffin J. McBrearty R. Mullur B. Savage J. Willman K. York	
1	2020/07/01	Issued as “Approved for Use”. 1) Minor revision to incorporate:	A. Coulas	P. Boyle	J. McBrearty

		2) Organizational changes to CNL Leadership Team; 3) Capturing improvements made to governance (updating the four part vision and updates to parent companies); and , 4) External audit observations (regarding alignment to requirements associated with grading, risk management, and principles).			
1D1	2020/02/14	Issued for “Review and Comment”.	A. Coulas	P. Boyle M. Lesinski J. McBrearty M. Steedman K. McCarthy C. Williams B. Savage M. Gull D. Wood	
0	2016/12/16	Issued as “Approved for Use”. Replaces Management System Manual, CW-514100-MAN-001, Rev 3	A. Coulas	K. Daniels	M. Lesinski
D1	2016/11/25	Issued for “Review and Comment”.	A. Coulas	F. Abulfazl C. Charbonneau F. Cowan K. Daniels A. Drom C. Fisher G. Garrett J. Gibb K. Leroux K. Lundie D. McIntyre D. Murphy P. Quinn D. Campbell S. Cotnam S. D’Eon G. Dolinar Y. Dubé L. Fleury D. Garrick L. Korkukluoglu M. Lesinski N. Mantifel B. Mumford T. Purcell	

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1. Introduction

Canadian Nuclear Laboratories Ltd. (CNL) has a management system comprised of an integrated set of documented policies, expectations, standards, procedures and responsibilities through which CNL is governed and managed, from the setting of direction through to day-to-day operations, all within a coherent control and accountability framework.

CNL's integrated management system demonstrates and documents commitment to maintaining a high-level of quality, strong customer service, and excellence in management within an environment that has safety as a first priority, is focused on the customers, and fosters continual improvement.

The management system provides the framework of processes, procedures and practices used to ensure that CNL can fulfill all tasks required to achieve our objectives safely and consistently. This foundational framework delivers quality in research & development; design engineering; procurement; manufacturing; qualification testing; construction; commissioning; operations; decommissioning; demolition; waste management; inspection; maintenance and plant life management; and project management; for nuclear power plants, research reactors, nuclear/non-nuclear facilities and installations.

A core prerequisite for CNL's success in consistently bringing high value to its customers and stakeholders is the effective and efficient governance and management. CNL is committed to excellence in management, thereby providing the foundation on which the Company and our employees can thrive.

1.1 Purpose

The CNL Management System Manual (Manual) sets the framework of policies, processes, and practices used to ensure that CNL can fulfill our mission and achieve our objectives. The top-tier reference document is this Manual. The Manual is complemented by learning materials, tools, and web-based products, which are accessible through the CNL intranet and Learning Management System. The Manual describes the relevant statutory, regulatory, contractual, and corporate frameworks within which CNL exists and operates. CNL's Management System is based on and complies to the requirements of CSA N286-12, ISO 9001:2015 and ISO 14001:2015; details of additional requirements informing the management system are identified in *Codes, Regulations, Standards, and Other Documents* [1].

1.2 Scope

The management system applies to all CNL management and execution activities. Management activities include setting expectations, enabling, planning and budgeting, and assessing all aspects of business, thereby ensuring delivery against commitments within appropriate accountabilities and controls. Execution activities include the safe, effective, and efficient conduct of work across all CNL lines of business.

The management system applies to all work performed by CNL employees, contractors and sub-contractors, as well as third parties engaged through external partnerships or collaborations that perform work for and/or on behalf of CNL. It is expected that they are trained and competent, and have sufficient knowledge of the management system in order to conduct work according to CNL's expectations and requirements as reflected in policies and procedures. For more specific information regarding contractors and sub-contracts see *Supply Chain* [2].

CNL is comprised of organizational units at the following sites across several provinces of Canada:

- Chalk River Laboratories and Deep River offices (Chalk River and Deep River, Ontario);
- Historic Waste Program Management Office (Port Hope, Ontario);
- Nuclear Power Demonstration Reactor Waste Facility (Rolphton, Ontario);
- Douglas Point Waste Facility (Tiverton, Ontario);
- CNL Ottawa Office, (Ottawa, Ontario);
- Whiteshell Laboratories, (Pinawa, Manitoba);
- CNL Site Offices (Fredericton, New Brunswick);
- La Prade Heavy Water Storage Facility (Bécancour, Québec); and
- Gentilly-1 Waste Facility (Bécancour, Québec).

1.3 Principles

The CNL management system ensures that the following principles, as provided in Canadian Standards Association standard, *Management System Requirements for Nuclear facilities* [3], are applied and considered when executing all CNL work:

- Safety is the paramount consideration guiding decisions and actions;
- The business is defined, planned, and controlled;
- The organization is defined and understood;
- Resources are managed;
- Communication is effective;
- Information is managed;
- Work is managed;
- Problems are identified and resolved;
- Changes are controlled;
- Assessments are performed;
- Experience is sought, shared, and used; and
- The management system is continually improved.

2. Corporate Profile- Who We Are

2.1 Purpose

Advancing nuclear science and technology for a clean and secure world.

2.2 Vision 2030

At the heart of Vision 2030 is more than 70 years of pioneering research in nuclear science and technology. In planning its future, CNL has developed a strategy that harnesses this expertise, and realigns our priorities to match real-world opportunities. At CNL, we fulfill three strategic priorities on behalf of the Government of Canada – restoring and protecting the environment, clean energy for today and tomorrow, and contributing to the health of Canadians. That work is critically important to the future of this country, and to the health and well-being of Canadian citizens.

To achieve success in our current priorities for energy, health and environment, we work with our partners by applying CNL's world-class capability in managing the full-life cycle of nuclear materials. We underpin our core capability by integrating across a wide range of scientific and technical disciplines that include materials science, engineering, process modelling, robotics, artificial intelligence (AI), cyber security, biology, environmental science, and detection and forensics. Recognizing that science and technology are not static we continually invest in expanding and modernizing our capabilities while also exploring their application to new and emergent problem sets that are important to the safety and prosperity of Canadians.

Vision 2030 is enabled through a revitalized Chalk River Laboratories. The campus is being carefully restored through an integrated strategy of facility decommissioning and waste disposal, which are, in turn, coupled with the construction of new state-of–the-art research facilities. The decommissioning and waste disposal activities improve accessibility to the site and ensure the protection of the environment, our workforce and the public. These activities also create the space needed to accommodate cutting-edge research facilities and provide CNL with the necessary waste management, disposal and processing facilities to enable its scientific missions into the future. This process of renewal also extends to CNL's people. CNL has transformed its workplace policies and organizational structure to establish an innovative work environment that embraces flexibility. These changes will not only improve how our employees interact with one another, collaborate and innovate as a company – both in-person and remotely – but they will revitalize the tools, technologies and environment that we use to do so.

2.3 Mission

We will provide the world with sustainable energy solutions, including the extension of reactor operating lifetimes, hydrogen energy technologies and fuel development for the reactor designs of tomorrow.

We will restore and protect Canada's environment by reducing and effectively managing nuclear liabilities.

Together with partners, we will demonstrate the commercial viability of advanced reactor designs, including small modular reactors.

We will work collaboratively with medical/educational institutions and pharmaceutical companies to pioneer new Alpha therapies for cancer treatments that save countless lives.

We will leverage all of our capabilities for commercial success in Canadian and international markets.

2.4 Core Values- What We Believe In

An integrated framework of values set out the ethical standards, behaviours and foundations expected of every employee across the company. These values inform CNL's policies, processes, and practices, the conduct of work, and the professional conduct of all.

Safety - Safety is freedom from harm, danger, injury or loss to people and the environment. It is the foundation on which our decision-making stands. It is our primary focus, with no compromise.

Teamwork - Teamwork is the ability to work together, in a collaborative way, toward a common goal.

Accountability - Accountability is both an attitude and a set of actions that affect how we impact people, situations and results in a positive way.

Integrity - Integrity is adhering to high ethical standards and strong moral principles, even under pressure.

Respect - Respect is placing a high value on others, treating them fairly, and empathizing with their needs. It is the foundation of building relationships and trust.

Excellence - Excellence is striving to achieve an ever-rising standard of quality through continual improvement and innovation.

2.5 Vivid Description

CNL stands proud as a global leader advancing nuclear science and technology. The world comes to CNL to solve the toughest technological challenges. CNL has the most effective industrial partnerships of any national laboratory. Our campuses are home to a vibrant community of the world's brightest innovators. Our people know they are making a difference in the lives of people around the world. CNL is valued by the Canadian government and customers in industry.

2.6 Corporate Policies

CNL's corporate policies provide intentions and expectations to management and employees that inform all that we do and how we do it. The following corporate policies have been authorized by the Board of Directors and approved by the President and Chief Executive Officer (CEO).

Table 1: Corporate Policies

Corporate Policy	Functional Support Area
Nuclear Safety [4]	Conduct of Operations
Safety and Health [5]	Occupational Safety & Health
Environment [6]	Environmental Protection
Ethics and Business Conduct [7]	Legal Services
Quality [8]	Quality
People [9]	Human Resources
Security [10]	Security
Supply Chain [11]	Supply Chain
Asset Management [12]	Property (Asset) Management
Intellectual Property [13]	Legal Services

2.7 Strategic Overview and Funding

CNL is Canada's premier nuclear science and technology organization. CNL delivers science and technology solutions to meet current, and future, Canadian Government, public, and private commercial priorities in four program areas: Energy, Health, Environment, and Safety & Security. CNL is transforming its Chalk River Laboratories (CRL) through the revitalization of essential site infrastructure, the decommissioning of aging infrastructure, and a significant investment in new, world-class science facilities. This transformation will position CNL to remain a leader in developing peaceful and innovative solutions.

To achieve the strategic objective of a world-class, sustainable national nuclear laboratory, CNL will continue to transform into a high performing organization. CNL will build upon existing strengths, continuously improve delivery, and pursue new capabilities in response to Canada's and the world's challenges. Our diversified workforce will enable the safe and efficient execution of the missions in a constantly changing, competitive world. Further details can be found in *10-Year Integrated Plan Summary 2020-2030* [14].

2.7.1 Environmental Remediation Management

The Environmental Remediation Management mission supports a commitment to a clean and healthy environment for Canadians. Innovative technologies, modern facilities and technical expertise are provided in support of the safe storage and long-term management of radioactive waste. Redundant buildings and infrastructure are decommissioned in a prioritized manner reducing the legacy liability and associated risks and site operating costs. Environmental remediation processes apply systematic risk assessments, based on sound science and remediation solutions that help ensure all activities are protective of the environment and human health. Activities focus on addressing and managing health, safety, security, environment and quality risks.

2.7.2 Science and Technology

CNL is known and respected nationally and internationally for its scientific capabilities, which are used to progress Science and Technology (S&T) priorities. The expertise of staff, when coupled with our unique S&T facilities, positions CNL well to meet customers' current and emerging needs. CNL has been able to meet the needs of customers through collaborations with national and international companies and universities. CNL's reputation is a significant factor for attracting commercial customers who recognize that we can solve industry's toughest challenges.

Additionally, CNL is performing a broad program of work aimed at meeting the nuclear S&T needs of federal government departments and maintaining nuclear S&T capabilities. Under this program, CNL serves both individual federal departments and agencies and, as a whole, national priorities that meet the needs of Canadian citizens.

Alignment of this mission with federal needs is further enhanced through the recent establishment of the Federal Nuclear S&T Interdepartmental Committee that oversees the federally-funded S&T program.

2.7.3 Capital

As Canada's premier nuclear laboratories, infrastructure is being modernized and capabilities enhanced to provide vibrant, safe, and world class nuclear S&T facilities and supporting infrastructure that will support Canada's needs well into the future. Currently, priority is given to infrastructure upgrades that address immediate safety, environmental and regulatory requirements, and to new projects that will provide a high return on investment. These early investments at CNL's site at Chalk River will enable implementation of new infrastructure projects that will further enhance CNL's capabilities.

Chalk River Laboratories (CRL) assets include more than 50 unique facilities and laboratories. These facilities are enabled by radioactive material handling, processing and storage facilities; conventional municipal infrastructure as well as maintenance, manufacturing and engineering programs tailored to CNL's diverse needs.

2.7.4 General Services

CNL's General Services create the conditions that are required to achieve strong organizational performance, and management excellence in the delivery of effective programs and services. CNL's General Services include the programs and activities capturing corporate governance and management oversight, in Health, Safety, Security, and Environment (HSSE), Central Technical Authority, Business Management, Human Resources, Legal, Corporate Affairs, Infrastructure Development Group, and Business Development.

3. Corporate Governance- How We Are Controlled

CNL is a private corporation that exists for the purpose of performing work and other obligations under contract to Atomic Energy of Canada Limited (AECL). CNL's shares are wholly owned by Canadian National Energy Alliance Limited (CNEA) as part of a Government Owner Contractor Operated arrangement. CNL is obliged to operate lawfully as a Canadian corporation; comply with applicable licenses, registrations, certificates and permits; submit to the governance of the shareholder (CNEA), and fulfill obligations to AECL under the Prime Contracts.

The Corporate Governance Model is depicted in Figure 1: CNL Corporate Governance Model. Board of Directors membership is documented in an organizational chart (available on CNL intranet).

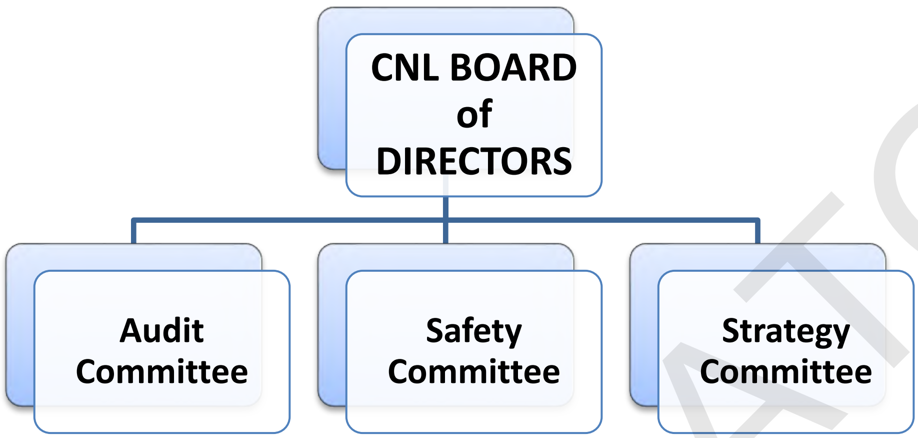

Figure 1: CNL Corporate Governance Model

The Board governance model provides active assurance to CNEA of the performance of CNL and is consistent with the requirements of the *CNEA Shareholder Declaration* [15]. The CNEA Board appoints from its members the Chair and two Directors of the CNL Board of Directors. This provides CNEA with direct involvement at the Board level of CNL. CNEA also appoints the directors, officers, and specific management positions of CNL. The CNL President & CEO and Chief Financial Officer (CFO) attend the CNEA Board meetings and report matters of interest to the Board, such as corporate performance and progress against the Annual Program of Work and Budget (APWB).

3.1 Integrated Decision Making

Without exercising any element of control in relation to the discharge of CNL's obligations as a nuclear site licence holder, the *CNEA Shareholder Declaration* [15] identifies:

- Those matters which the CNL Board of Directors need to refer to the CNEA Board for approval including those decisions to be taken unanimously by the CNEA Board; and
- Those decisions that are reserved to the CNEA Shareholders themselves.

This mechanism provides transparency, oversight and an integrated flow of information to the shareholder.

3.2 Contract and Corporate Governance

The CNL governance model is principally contained in the following documents:

- CNEA Governance: The *CNEA Shareholder Declaration* [15];
- The Prime Contracts [16], [17], [18], [19]; and

- CNL Governance: The constating documents, including Articles of incorporation and CNL By Law 1 and the Terms of Reference of the CNL Board of Directors [20] and Committees of the Board [21], [22], [23].

3.3 Licences and Regulatory Governance

CNL operates in a highly regulated environment, particularly with respect to its licensed nuclear activities. External regulators grant CNL licences that authorize the licence holder to undertake certain activities in accordance with defined expectations. These licences define reporting accountabilities and subject CNL to periodic regulatory inspections to confirm compliance with conditions imposed by the licence. These include the following licensed nuclear activities and are documented in *Site Licences, Certificates, Permits, Building/Facility Contacts, & Licence Representatives* [24], and authorized by the Canadian Nuclear Safety Commission (CNSC):

- Operate, wholly or in part, any nuclear facility;
- Maintain in storage with surveillance any nuclear facility, or any parts thereof;
- Decommission any nuclear facility, or any parts thereof;
- Construct, modify or abandon any nuclear facility;
- Produce, possess, process, refine, transfer, use, package, manage, store, dispose or abandon nuclear substances;
- Produce, possess, use, service, transfer or abandon prescribed equipment;
- Possess, use, transfer or abandon prescribed information;
- Operate dosimetry services;
- Export and import nuclear substances and prescribed equipment and information;
- Process, store or dispose of waste received from off-site clients; and
- Receive, repair, modify, store and return contaminated equipment from off-site clients.

A list of other Regulatory drivers can be found in *Codes, Regulations, Standards, and Other Documents* [1]. Licensing support and general regulatory compliance oversight of Canadian Nuclear Safety Commission (CNSC), Technical Standards and Safety Authority (TSSA), Environment and Climate Change Canada (ECCC), and Employment and Social Development Canada (ESDC) are managed according to the processes documented in *Compliance* [25].

4. Organizational Structure- How We Are Structured

CNL's organizational structure is approved by the CNL Board of Directors on recommendation of CNL's President & CEO. Responsibility for the management and operations of each element of its structure is assigned to executives and senior management reporting to the President & CEO. CNL's current organizational structure is depicted in Figure 2.

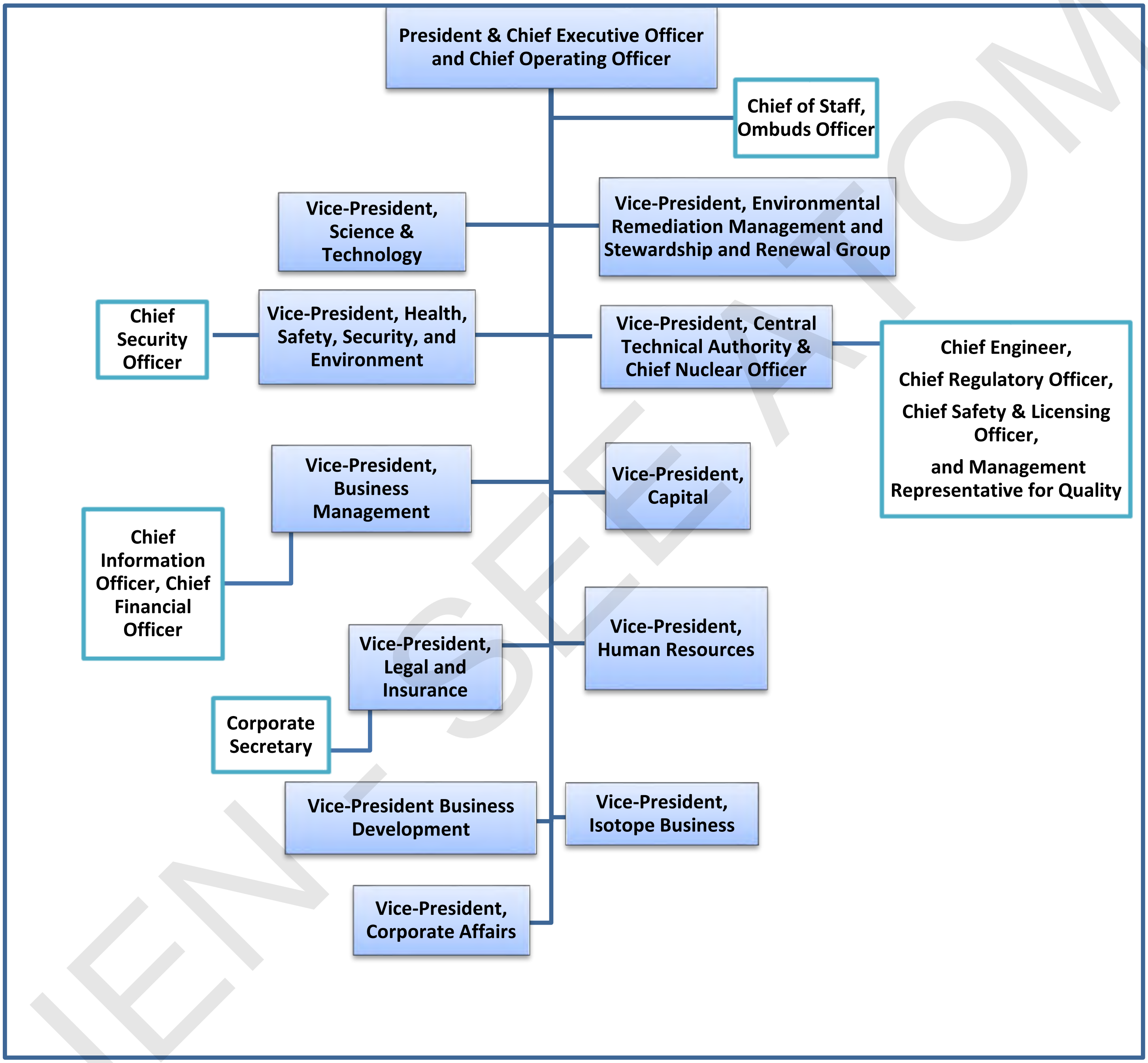

Figure 2: CNL Executive Team and Corporate Functional Authorities

Each member of CNL's Executive Team is accountable to the President & CEO for specific areas of CNL business and operations as recorded in Appendix A, individual position descriptions and current assignments are tracked in *Functional Authorities* [26].

CNL's organizational structure combines line management and functional authority designed to deliver work safely, ethically, and in compliance with requirements and in pursuit of achieving company goals.

All of CNL resources are assigned primarily as line management. Line management is any management level within the organization, which is responsible and accountable for directing and conducting work. The line management structure consists of the following hierarchical levels:

- Company: CNL as an entity comprised of all organizational units, divisions and departments. The President & CEO is responsible for the Company.
- Organizational Unit: The 2nd level within CNL's hierarchical structure. A Vice-President is responsible for the management of an organizational unit. An organizational unit is made-up of departments.
- Department: Sub-structures within an organization unit.

The line management structure is controlled, subject to *Organizational Change Control* [27], to ensure that any organizational changes are evaluated for impacts to CNL and is reflected in Appendix A.

A selected group of individuals are then, in addition to their line management role, assigned a functional authority role. A corporate functional authority spans horizontally across all organizations, and is an authority assigned by the President & CEO. This authority, operating on behalf of the President & CEO, includes providing associated direction and guidance, assessing whether activities meet expectations, and identifying gaps requiring further action.

Functional authorities have responsibility for defining, interpreting, and maintaining functional requirements, ensuring implementation of requirements are consistent company-wide, and for supporting line management in their implementation.

The functional authority structure is controlled, subject to *Functional Requirements and Framework Management* [28] to ensure that any changes are evaluated for impacts to CNL and reflected in Appendix B (which describes the functional authority structure), and *Functional Authorities* [26] (which describes the role assignment).

Figure 3 depicts how line management and functional authority interact.

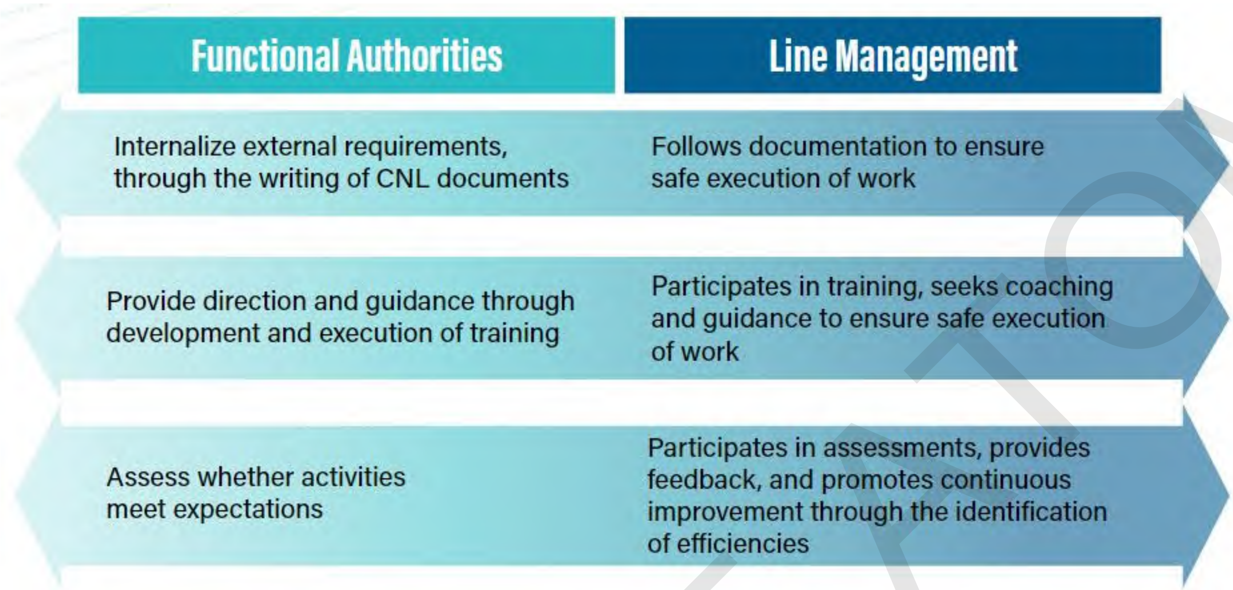

Figure 3: Examples of Interface between Line Management and Functional Authority

4.1 Line Management Structure

Line management consists of the CNL President & CEO, Line Management Executives, Department Managers, and First Line Supervisors.

4.1.1 Line Management Executives

Line Management Executives include job titles such as Vice-Presidents and Deputy Vice-Presidents. A Line Management Executive is assigned to organizational units as directed by the President & CEO. Line Management Executives are responsible for selecting and prioritizing projects within their assignments, defining the scope, establishing priorities, and requesting the funding to accomplish the scope in a safe, secure, cost effective, and compliant manner. In this capacity, Line Management Executives are responsible to:

- Be accountable and responsive to the President & CEO and CNL Board of Directors;
- Be appropriately knowledgeable of CNL’s requirements, policies, processes, and practices;
- Support the company vision, strategic outcome and actions as defined in the 10 Year Strategic Plan;
- Establish an effective, balanced and transparent oversight framework to provide line of sight to important and emergent issues;
- Intervene to manage risks in their area of responsibility;
- Act as a role model for leadership and management excellence consistent with management system expectations;

- Provide strategic direction, leadership, and support to staff;
- Manage the assets, capabilities and human resources within their respective organizational unit;
- Contribute to the development and continual improvement of CNL's management system;
- Maintain effective communications and working relationships with all levels of line management and functional authority;
- Ensure, and take full accountability for, compliance with CNL policies and procedures and required legislations;
- Safely and compliantly complete activities within the approved scope, schedule, and budget;
- Ensure consideration for functional resource needs when establishing or changing budgets;
- Act as safety champions encouraging worker involvement in company safety programs;
- Ensure excellence in project team communication;
- Establish and maintain detailed work plans and the lifecycle baseline;
- Contribute to maximum operating efficiency through effective financial planning and monitoring, and the resolution of departmental issues to ensure responsible fiscal stewardship;
- Review and approve business cases for staff hiring, equipment, and facilities within the bounds of the budget;
- Support and maintain positive interactions with customers, stakeholders, and the public;
- Support and participate in continuous improvement and corrective action initiatives;
- Obtain and integrate feedback from employees concerning quality, health, safety, and environmental issues into facility and company lessons learned;
- Ensure that employees under their direction have requisite training and access to professional development opportunities consistent with corporate objectives and management system expectations;
- Ensure defined roles, responsibilities, and oversight are provided for workers;
- Functionally accountable to the Site Licence Holder for ensuring safety and compliance with all applicable codes, standards, legislation, regulations and site licence conditions when assigned responsibilities that directly or indirectly impact or involve the

management and/or execution of licensed activities. This includes the operation, maintenance and use of nuclear facilities, radioisotope laboratories and supporting facilities, as well as the provision of supporting corporate services;

- Support and implement assessment plans to evaluate implementation of programs appropriate to the projects; and
- Utilize appropriate project metrics to monitor, evaluate, and improve area project performance.

4.1.2 Department Managers

Department Managers implement the CNL goals and expectations for achieving safe, compliant, and efficient operations. Department Managers encompasses titles such as General Manager, Head of Directorates, Director, and Manager. Department Managers are responsible for ensuring that work is performed safely by implementing and ensuring operations are conducted within CNL's requirements (such as safety basis, rules, regulations and permits) in their respective department and facilities.

Principal responsibilities of the Department Manager include:

- Ensure work, performed by CNL employee or contractors, is done safely within the assigned area of responsibility;
- Manage the assets, capabilities and human resources within their respective department;
- Understand the full scope of accountabilities, authorities, and the associated expectations;
- Ensure effective implementation of the management system, including consistent adherence to functional support area requirements and procedures across assigned area of responsibility;
- Ensure that equipment is safe, meets all regulatory requirements and is suitable for the work, and that all necessary periodic inspections have been undertaken prior to use;
- Ensure work is directed through the appropriate department;
- Develop integrated schedules to accomplish the work according to project priorities and resolve priority conflicts between sub-projects;
- Ensure work, including that of subcontractors, is defined, hazards identified and analysed, controls developed and implemented, work executed within controls, and feedback provided and used to continuously improve;
- Ensure that commitments related to work are maintained and communicated regularly;

- Ensure that operations are conducted in compliance with facility requirements such as the authorization basis, license-required conditions, and environmental regulations and permits;
- Communicate risks to employees and ensure that appropriate controls are in place to mitigate and protect the worker from harm;
- Ensure that investigations are held for unusual events and near misses so that feedback is given to workers and lessons learned are captured and shared;
- Actively participate or lead required investigations; document root causes and findings; and implement corrective actions in a timely manner, securing the needed budget and resources;
- Obtain feedback from employees concerning issues and incorporate into lessons learned;
- Actively promote and support process improvement initiatives;
- Perform periodic monitoring and self-assessment of work and take action as needed to address issues and correct nonconformities;
- Prepare and manage business/project plans and supporting scorecards and metrics;
- Support the accomplishment of work and remove unnecessary obstacles;
- Interface with matrixed and embedded personnel to ensure all requirements are met within assigned area of responsibility;
- Ensure that training requirements are defined and implemented for each employee and support training as necessary;
- Participate in integration discussions and activities—as a team effort—to enhance the effectiveness of the organizational structures and processes in support of CNL goals;
- Foster an environment of respect, diversity, equity and inclusion, and overall engagement;
- Demonstrate appropriate workplace behaviour aligned to the code of conduct and workplace values and managing complaints and resolutions;
- Demonstrate due diligence to applicable laws, regulations and changing mandates;
- Functionally accountable to the Site Licence Holder for ensuring safety and compliance with all applicable codes, standards, legislation, regulations and site licence conditions when assigned responsibilities that directly or indirectly impact or involve the management and/or execution of licensed activities. This includes the operation, maintenance and use of nuclear facilities, radioisotope laboratories and supporting facilities, as well as the provision of supporting corporate services;

- Identify resource needs, and obtain and manage resources to accomplish project milestones and objectives;
- Manage resources, including recruiting, assigning, redeploying, and terminating; and
- Manage the performance of their employees by:
  - Ensuring that their employees understand their responsibilities under the CNL management system;
  - Ensuring their employees have the requisite competence, objectivity, knowledge and training to safely and effectively exercise their assigned roles and responsibilities;
  - Setting and reinforcing expectations and managing employee performance;
  - Evaluating overall performance of employees, and providing timely performance feedback;
  - Managing hours of work and attendance requirements, taking into consideration remote working arrangements;
  - Respecting collective agreements and terms and conditions of employment;
  - Providing professional development opportunities as part of succession planning; and
  - Providing specific feedback and assessing employee performance against expectations to develop and sustain performance.

4.1.3 First Line Supervisors

First Line Supervisors include titles such as Shift Supervisors, Foreperson, and Facility Managers. First Line Supervisors have direct authority over other workers or a specific work location. First Line Supervisors have the following responsibilities:

- Exercise departmental authorities that have been delegated to them;
- Carry out their activities with due regard for all areas of authority and any corresponding direction;
- Conduct all work consistently with CNL's processes and procedures;
- Promote safety as a priority throughout all work activities;
- Provide daily instruction and direction to workers;
- Serve as role models for employees under their supervision;
- Encourage workers to report violations, wrongdoings, and issues; and
- Resolve issues as they arise or escalate to departmental management for resolution.

4.1.4 Employees

In addition to items listed in sections 4.1.1, 4.1.2, and 4.1.3, Line Management Executives, Department Managers, and First Line Supervisors are also Employees and this section is applicable to them. All Employees are accountable to their management and supervision for the following:

- Perform duties safely, and to the expected level of quality, in accordance with instructions and training;
- Know their individual responsibilities and their employment expectations;
- Know and abide by requirements that include the Code of Conduct, workplace values how to work safely, rules regarding leave, procedures, and reporting;
- Know their collective agreements, if applicable;
- Monitor their employment information and immediately report changes, errors or concerns including personal information (e.g., pay matches salary, leave matches entitlement);
- Be compliant with all required training and attend training as scheduled;
- Support, operate, and maintain nuclear and non-nuclear facilities with a profound respect for safety and with an over-arching charge to preserve the health and safety of the general public and fellow employees as well as the environment;
- Adhere to CNL management system policies, process requirements and procedures, including safety protocols, in all activities;
- Report problems, deficiencies, incidents, accidents, and unsafe conditions immediately to supervisor or manager;
- Cooperate with investigations and with company processes;
- Understand their specific role and how it aligns with the overall mission;
- Understand how performance will be measured and expect and solicit feedback;
- Actively participate in the effort to develop and improve skills and performance;
- Carry out their duties ethically and with integrity, consistent with corporate policies; and
- Safeguard company information and assets.

4.2 Functional Authority Structure

The functional authority structure consists of Responsible Executives, Functional Support Managers, and Functional Support Manager Designates as listed in *Functional Authorities* [26].

4.2.1 Responsible Executives

Responsible Executives are appointed by, and accountable to, the President & CEO and are responsible for one or more Functional Support Area(s). Responsible Executives also identify Functional Support Managers and Functional Support Manager Designate(s) as needed to manage Functional Support Areas.

The role of the Responsible Executive is to ensure that the Functional Support Areas within their scope, meets external requirements; protects workers, the public, and the environment; and adequately addresses other vulnerabilities (e.g., financial, legal, reputational, or security). Responsible Executives ensure implementation of requirements of CNL as described in Program Requirements Documents for the Functional Support Area(s) within their scope.

Principal responsibilities common to all Responsible Executives include:

- Define and serve as ultimate CNL authority for applicable requirements for their grouping of Functional Support Areas;
- Approve any changes affecting the composition of the Functional Support Area(s) such as transfer or creation of new Functional Support Areas; and assignment or re-assignment of Functional Support Managers and Functional Support Manager Designate(s) (as per *Functional Requirements and Framework Management* [28] and *Authority Management* [29]);
- Establish programs and maintain effective systems, policies, and procedures in the assigned Functional Support Area(s);
- Ensure that commitments related to CNL projects are maintained and the status of the commitments is communicated regularly to employees;
- Promote a positive, collaborative work environment;
- Ensure effective and consistent implementation of functional programs across CNL;
- Interface with line management to improve processes through application of lessons learned and feedback;
- Ensure that assigned functional support workers are trained and qualified to perform their scope;
- Develop and implement a programmatic assessment plan to evaluate implementation of program elements in accordance with *Integrated Assessment Plan* [30];
- Perform assessments and oversight as per management review [31];
- Provide initiatives as part of continuous improvement; and
- Oversee and ensure compliance within other Functional Support Areas to the CNL management system.

4.2.2 Functional Support Managers

Functional Support Managers (FSM) are appointed by, and accountable to, their respective Responsible Executive, and are the single point of contact for their individual area of responsibility. Functional Support Managers are the document owners for documents listed in their respective Governing Document Index (GDI) which implement the requirements of their specific Functional Support Area(s). Additional responsibilities of Functional Support Managers include:

- Ensure that applicable requirements are implemented in an appropriate implementing document;
- Act as final authority for interpretation and applicability of their functional requirements to line management;
- Perform applicability reviews on new and revised requirements, including identification of required resources, impacts, and implementation schedules and strategies;
- Establish and implement the discipline-specific technical attributes and training expectations for the training and qualification of affected personnel;
- Ensure that the quality of standard equipment, hardware, software, and documentation that is under the direct purview of the Functional Support Area meets company and facility requirements;
- Establish and maintain effective relationships and coordination of CNL interfaces with AECL, regulators, and oversight organizations;
- Maintain effective communication and working relationships with line management and other Functional Support Managers; and
- Develop and perform programmatic assessment plan in accordance with *Integrated Assessment Plan* [30], to evaluate implementation of program elements to verify that Functional Support Area requirements have been adequately implemented across CNL.

4.2.3 Functional Support Manager Designate(s)

Functional Support Manager Designate(s) are accountable to a Functional Support Manager. Responsibilities of Functional Support Manager Designate(s) include:

- Assist Functional Support Managers to fulfill responsibilities listed above;
- Maintain effective communication and working relationships with line management and other Functional Support Manager Designates;
- Interface with facilities, projects, and other support organizations to ensure that the quality of standard equipment, hardware, software, and documentation meets site and facility requirements;

- Maintain proficient knowledge of assigned Functional Support Area requirements;
- Provide support to line management by identifying and interpreting the Functional Support Area requirements in assigned laws and regulations, contract clauses and language, and other contractual language as they apply to current contract work scope;
- Develop and submit documentation for implementation of the requirements of assigned Functional Support Area;
- Support and monitor training and qualification programs to ensure that requirements are implemented effectively and workers are trained and qualified to perform work;
- Participate in operational readiness reviews, readiness assessments, management assessments, third party audits, or other assessments and reviews, as requested;
- Be familiar with events and issues within facilities, projects, and other support organizations, assisting in developing corrective plans and lessons learned; and
- Support Functional Support Area programmatic assessment plan to evaluate implementation of program elements.

4.3 Interfaces

4.3.1 Line Management and Line Management Interface

To achieve objectives, line management will utilize resources from other line management organizations. Assignment on temporary basis of the employees to the work can be managed utilizing a variety of existing processes that clarify agreement between the management teams on topics such as safety of workers, budget, scope, timecard approvals, and work assignment. Project execution plans [32] are utilized to cover programmatic responsibility for work authorization and execution, notification and reporting, emergency preparedness, scope of work, budget and document control. Meanwhile, *Integrated Work Control* [33] process is utilized to manage the same topics for activity specific field work, with the fundamental principle of the line management responsible for authorizing the work is also responsible for safety of the workers.

4.3.2 Line Management and Functional Authority Interface

The success of the CNL management system depends on the integration and collaboration between line management and functional authority counterparts. Both must work together to develop and implement processes and procedures for the safe, compliant, and efficient conduct of work. Figure 3 above illustrates this interface.

Specifically, the following general expectations must be met:

- Line personnel are accountable for safety. This includes accomplishing work in a safe and compliant manner and being responsive to / complying with functional authority direction and guidance.
- Functional personnel define, interpret, and maintain functional requirements that support line personnel in consistent implementation company-wide, while at the same time assessing whether activities are meeting those expectations.
- All personnel will adhere to processes and procedures as written.
- When revisions to procedures are needed, the document owner will engage all relevant stakeholders for review and comment. The document may not be issued until all comments have been resolved per the guidance in *Creation, Capture, and Use of Information Assets* [34].
- Both line and functional personnel work together as a team to resolve implementation issues as they arise and in a timely manner.
- If timely resolution cannot be achieved at the working level, the issue is escalated to management. If necessary, respective Responsible Executive and Line Management Executive may be requested to support resolution.
- Both line and functional personnel are held accountable for their role in safely accomplishing the missions of CNL.

4.3.3 Functional Support Personnel Embedded Versus Matrixed within Line Management Structure

Functional personnel can either be 'embedded' or 'matrixed' to a line management structure as shown in Figure 4.

The responsibilities of both embedded and matrixed functional personnel include:

- Interface with the appropriate corporate functional authority on lessons learned, process initiatives, and technical difficulties.
- Implement the training and qualification process required by the Functional Support Area for functional personnel.
- Participate in the assessment process to ensure effective implementation.
- Implement procedures from respective Functional Support Area associated with the assigned work.

When functional support personnel are matrixed to a line organization they report directly (or hard lined) to their functional authority, while reporting (or dotted lined) to line management in support of the work. Matrixed functional personnel work in areas such as occupational safety and health, radiation protection, supply chain, and quality, and are responsible for implementing functional requirements, in a support role for a line organization. Matrixed personnel report to the functional authority and are responsible to implement functional authority requirements and standards. The line organization provides work assignment direction to matrixed personnel to support achievement of mission objectives. Line management provides input to performance evaluations and job rotations which are led by functional authority.

When functional support personnel are embedded within a line management, they are part of the line management organization, and report directly (hard lined) to line management. Embedded functional support personnel work in areas such as engineering and maintenance. Line management directs the day-to-day work of embedded functional support personnel to support achievement of mission objectives. Functional authority provides technical direction, guidance and technical training for embedded functional support personnel to achieve mission objectives. Both the line management and the embedded functional personnel are required to comply with functional requirements specified in the management system by the functional authority. Functional authority provides input to performance evaluations and job rotation which are led by line management.

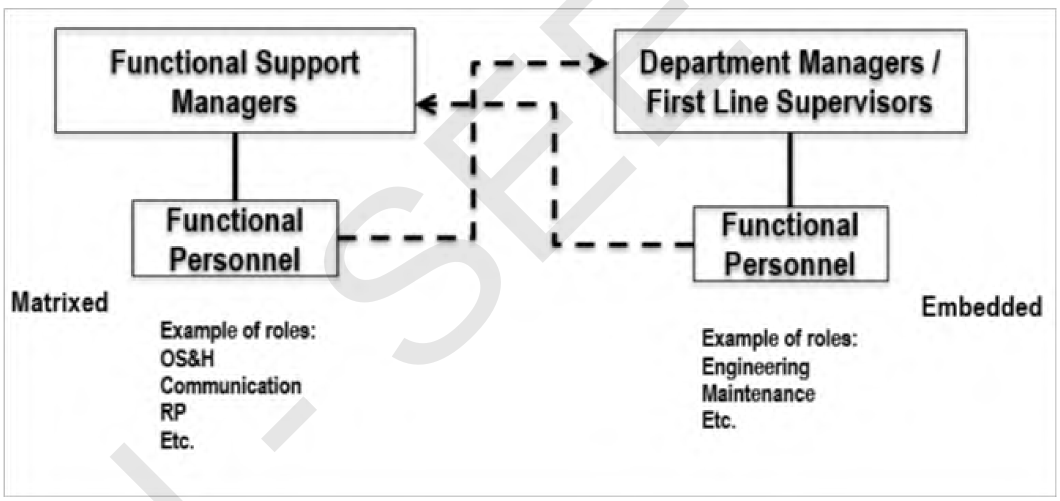

Figure 4: Reporting relationships of matrixed and embedded functional personnel

4.4 General Expectations

CNL recognizes leadership, safety, and collaborative teamwork expectations as important benchmarks to enable safety, execution, and innovation. The following behavioural expectations apply to all levels of CNL.

4.4.1 Leadership Expectations

The impact of management behavior on organizational performance is extensive. Compliance with CNL's *Code of Conduct* [35] is mandatory. The following leadership behaviors are critical to organizational success:

- Regularly communicate, model, and reinforce the CNL vision, values, standards, expectations, and strategies to align the organization to achieve excellence;
- Be visible, active, and engaged at job sites;
- Seek out and act on worker feedback;
- Demonstrate a firm and unwavering commitment to nuclear, radiological, industrial, and environmental safety; event-free conduct of work; and, effective emergency response;
- Demonstrate commitment to organizational learning and professional growth;
- Demonstrate a self-critical approach;
- Demonstrate a questioning attitude;
- Demonstrate ownership of requirements implementation;
- Demonstrate insistence on high standards;
- Hold themselves and employees accountable for performance; and
- Utilize employee recognition programs to increase desired behaviors.

4.4.2 Safety Expectations

Prevention of dangerous or hazardous situations and appropriate proactive strategies to positively impact and continuously improve all aspects of safety and health, are considered fundamental in everything CNL does. As such, the following safety behaviors are critical:

- Establish safety as an organizational value and a prerequisite for all work;
- Through processes such as assessment, worker feedback, and personal observation, ensure that a safe work environment is established and maintained;
- Take pre-emptive actions in response to degrading conditions. While prompt response to adverse occurrences and conditions is expected, management will ensure that processes such as critical assessment, performance metrics collection, and direct field observation of processes in progress, are available to aid in forming and executing pre-emptive actions; and
- Utilize response to adverse events for overall performance improvement. The emphasis in this response is on accurately determining causes, then properly responding, including response to underlying causes in management system processes. Management must ensure that adequate extent of condition considerations are utilized to preclude similar events elsewhere in the organization. Similarly, evaluation of information obtained from adverse events occurring in other organizations is required to preclude similar events.

4.4.3 Collaborative Teamwork

CNL promotes the overall successful accomplishment of mission objectives by sharing the same vision, trusting that all areas are capable of completing their portion of the mission, and being able to coordinate and communicate effectively across departments. The following behaviors are critical to ensuring that departmental goals align with the overall mission of CNL:

- Acknowledge collaboration as part of the value of teamwork and a prerequisite for all work;
- Actively sponsor teamwork and integration;
- Strive to eliminate the formation of silos within the organization;
- Encourage all departments to share information and knowledge to increase efficiency of the organization as a whole; and
- Promote a culture of coordination to achieve common goals for the organization.

4.5 Delegation of Authority

Authority may be delegated downward from the President & CEO, however, overall responsibility remains with the delegating individual. Accountability flows upwards from the working level to President & CEO. Authority is assigned throughout the CNL management system utilising management system documents such as job descriptions, controlled lists or processes like the *Financial Approvals and Delegation of Authority* standard [36]. The process for establishing or revoking temporary or permanent authority is in accordance with *Delegation of Authority* [37].

Those personnel with departmental or corporate functional authority may:

- Delegate to others the execution of duties associated with delegated authorities,
- Give direction on how those authorities are to be exercised, and;
- Hold delegates accountable for the exercise of these delegated authorities.

If delegation of authority is not documented/communicated, by default, authority will always revert upward.

5. Management System Document Hierarchy

CNL's document hierarchy is depicted in Figure 5 and is applicable company-wide. Site-specific nuisances related to scope or applicability of a process or document (based on graded approach or differing license conditions) is clearly defined within the applicable management system document. The management system documentation hierarchy cascades from the top downward. The Corporate Policies provide the direction and expectation to management and employees. The Manual defines the vision, mission, expectations, core values, roles, responsibilities, authorities, and accountabilities, the associated programs and processes, and interfaces.

Individual program description, requirements, and governing indices form the foundation of the management system internal control components and are referred to as “interpretation” documents.

The implementing documents flow from the interpretation documents. They describe the controlling activities required to implement the business processes and employees’ day-to-day activities identifying the expectations and relevant procedural actions.

A complete list of functional areas and corresponding GDIs is available in *Functional Authorities* [26]. This document hierarchy serves to ensure that CNL policies and applicable program requirements are effectively implemented company-wide.

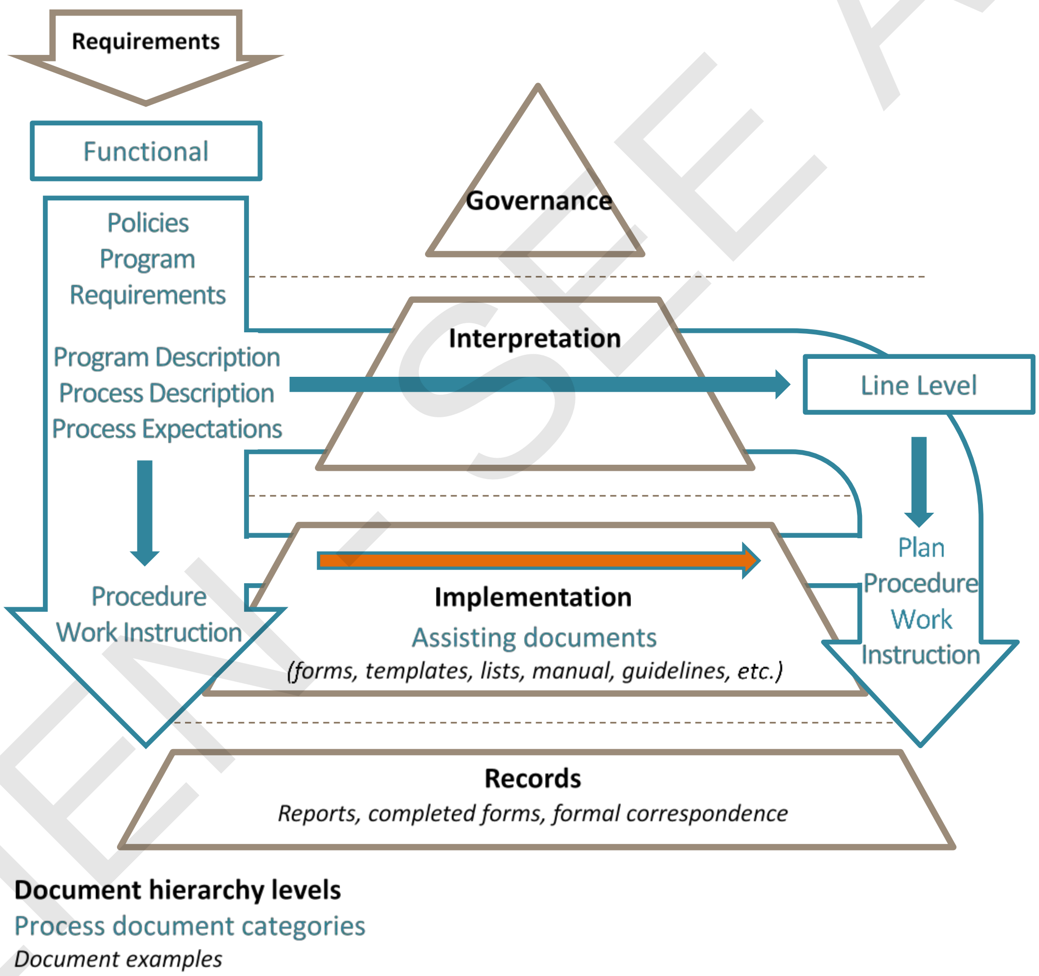

Figure 5: CNL Management System Document Hierarchy

These processes and procedures are concise, accessible, understood, and applied in a graded approach. The documents utilize best industry practices, leverage and integrate technology, and provide the basis for consistent implementation.

CNL's Management System is based on documentation, roles, responsibilities and authorities originated from CNL's predecessor AECL. Employees are responsible to ensure they are utilizing the most recent revision of implementing documents available within the electronic document records management system.

For more detailed information on the management system documentation hierarchy, see *Creation, Capture, and Use of Information Assets* [34].

6. Contractor Assurance System (CAS)

A *Contractor Assurance System* [38] is an integrated framework of assessment and oversight mechanisms employed to manage performance consistent with the Prime Contracts. It is used as a framework to assess performance, provide data to CNL's management decision-making process, and allows CNL to effectively manage processes, resources and outcomes. The system provides transparency between CNL, CNEA, and AECL to ensure alignment across the enterprise and to accomplish mission needs.

Integral elements of the CAS include assessment, management review, worker feedback, issue management, risk management, operating experience, continual improvement and performance measures. These programs and processes provide the means to identify and address program or performance deficiencies and opportunities for improvement. The CAS is implemented through operational and business systems using a graded approach based on risk, hazard and experience. This is done in accordance with requirements to ensure that CNL satisfies it's legal and contractual obligations, and to ensure that it is able to operate safely, securely, cost effectively and efficiently.

7. How We Operate

7.1 Risk Management

Risk (corporate, project, work package [39], task) management is the identification of barriers to achieving the corporation's strategic goals and objectives. By highlighting enterprise level risks [40], senior management can strategically position resources and funding to manage potential or upcoming risk events. Project and program risk management, as well as the management of safety risks, are embedded in the management system.

7.2 Grading

One objective of the management system is to ensure that the work being performed to meet requirements is both consistent and predictable. Where appropriate, the degree and level of rigor applied to program elements, items, or activities is based on a graded approach that takes into account the complexity of work to be performed and the magnitude of the hazards to maintain an acceptable level of risk. The level of analysis, extent of documentation, and degree of rigor of process control is applied commensurate with their significance; importance to safety; consequence of error; design complexity; process complexity; service characteristics; service conditions; or economics. The graded approach applies to both internal CNL activities as well as procurement of external products and services, and is documented within the associated procedural documents, or embedded in supporting forms and templates.

8. Ombuds Service

The leadership at CNL aims to engage in transparent communications and has created an independent mechanism – the Ombuds Service – through which stakeholders such as individuals, organizations, and leadership can share their concerns about a particular issue or provide general feedback and recommendations for improving the workplace at CNL. The Ombuds Service provides CNL stakeholders with an outlet to raise issues while encouraging positive dialogue and culture.

The mission of the Ombuds Service is to offer an informal, impartial and independent approach to conflicts raised by CNL stakeholders, providing a neutral and, to the extent permitted by law, confidential resource while advocating for fair, efficient, and transparent policies and procedures.

9. Definitions and Acronyms

9.1 Definitions

This document relies primarily on word meaning as found in common dictionaries. The current *Glossary of Controlled Terms and Acronyms* [41] contains specific meanings for those words that require further clarification.

Accountability	The state of being responsible and answerable for an activity.
Authority	The degree of power vested in a worker by virtue of their role to demand performance and/or make decisions.
Functional authority	Management that has responsibility for defining, interpreting, and maintaining functional requirements, and for supporting the line management in their implementation.
Functional support area	A set of interrelated or interacting processes or programs that are characterized by a set of inputs and value added tasks that assure specific business outputs, products and services. The FSA's are a critical part of CNL's Management System Framework, and are driven by requirements to meet the objectives and goals of the

	organization such as safe workers, products, profit, good brand, customer satisfaction, industry leadership.
Line management	Any management level within the organization, which is responsible and accountable for directing and conducting work.
Position	A position is identified by a business title and is a worker's primary line job for which they were hired to perform.
Responsibility	A thing one is required to do as part of a job, role, or legal obligation.
Role	Functional duties and assignments, in addition to their existing position, that any CNL employee performs in order to facilitate delivery of a process.
Safety	The condition of being protected from or unlikely to cause danger, risk, or injury.
Worker	Someone who performs an occupational duty. Occupational duty is a term that describes the responsibilities that are a regular part of a person's job.

9.2 Acronyms and Abbreviations

AECL	Atomic Energy of Canada Limited
APWB	Annual Program of Work and Budget
CAS	Contractor Assurance System
CEO	Chief Executive Officer
CFO	Chief Financial Officer
CNEA	Canadian National Energy Alliance Limited
CNL	Canadian Nuclear Laboratories Limited
CNO	Chief Nuclear Officer
CNSC	Canadian Nuclear Safety Commission
COG	CANDU Owners' Group
COO	Chief Operating Officer

CRL	Chalk River Laboratories
CTA	Central Technical Authority
ERM & SRG	Environmental Remediation Management and Stewardship and Renewal Group
FSA	Functional Support Area
FSM	Functional Support Manager
HSSE	Health, Safety, Security, and Environment
NPD	Nuclear Power Demonstration
S&T	Science & Technology
WL	Whiteshell

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Appendix A Roles, Responsibilities, Accountabilities, and Authorities

This appendix describes the role and responsibilities of the CNL Executive Team. The Executive Team of the Company comprise the following:

- President and Chief Executive Officer (CEO)
- Chief Operating Officer (COO)
- Vice-President, Science & Technology (S&T)
- Vice-President, Environmental Remediation Management and Stewardship and Renewal Group
- Vice-President, Capital
- Vice-President, Business Management
- Vice-President, Central Technical Authority (CTA) and Chief Nuclear Officer (CNO)
- Vice-President, Health, Safety, Security and Environment (HSSE)
- Vice-President, Human Resources
- Vice-President, Legal and Insurance
- Vice-President, Corporate Affairs
- Vice-President, Business Development
- Vice-President, Isotope Business

A.1 President and Chief Executive Officer (CEO)

The CNL President & Chief Executive Officer (CEO) provides overall leadership and direction. The President & CEO sets the mission, vision, direction, and strategy that create a cost-effective accomplishment of the scope of work. The President & CEO obtains the funding, manages the execution of work within the defined cost, scope, and schedule by ensuring the development of the integrated work schedule, and is ultimately responsible for the safe completion of work. The President & CEO maintains strategic relationships with regulatory agencies and oversight organizations, and with stakeholders and the public. The President & CEO is specifically responsible for:

- Ensuring high standards for HSSE and quality are clearly established and supported by a robust infrastructure of people, practices, and oversight mechanisms;
- Ensuring the scientific, technological and product developments necessary to enable CNL to serve Canada's objectives in nuclear and related areas while maximizing the return on the funds invested in S&T;
- Meeting CNL's policy objectives, commercial objectives, and financial targets;
- Ensuring the implementation and continual improvement of the management system;
- Developing the organization's managerial competence and culture with a view to continually improving CNL's performance;

- Maintaining and improving the credibility and support of CNL with the public, including creating public awareness of the value of the nuclear industry to Canada's future sustainable economic development;
- Meeting CNL's responsibilities for managing legacy liabilities; and
- Designating, in conjunction with the Site Licence Holder, Emergency Operations Centre Commanders for managing CNL and site emergency responses.

A.2 Chief Operating Officer (COO)

The Chief Operating Officer (COO) is the primary delegate of the President & CEO and supports the Executive Team in safe execution of the CNL mission, while being specifically responsible for:

- Executing CNL's Strategy on behalf of the President & CEO (internal facing);
- Developing operational plans as appropriate, setting out objectives and priorities for the Company;
- Developing and influencing corporate strategies, in particular transformational activities;
- Developing policies, processes, practices and strategies working with the relevant areas of the business;
- Building organizational competence and capacity;
- Briefing the President & CEO on performance, risk and opportunities for the Company gleaned from line and functional authority;
- Leading the organizational unit of Chief Operating Officer with the following departments: Site Planning and Asset Management, and Ombuds Service;
- Establishing, maintaining, assessing, and continuously improving the company-wide processes and programs for the following Functional Support Areas: Management System and Property (Asset) Management; and
- Acting as a key advisor to the President & CEO.

A.3 Vice-President, Science & Technology

The Vice-President, Science & Technology is responsible for:

- Ensuring the safe conduct of licensed activities associated with the nuclear facilities, and radioisotope laboratories at the LaPrade site;
- Ensuring the safe conduct of licensed activities associated with the operation of the radioisotope laboratories and nuclear facilities within Science & Technology;

- Ensuring the quality and effective, efficient and economical delivery of the products and services developed and delivered by S&T;
- Administering contracts between CNL and CANDU Owners' Group (COG), including the COG budget, business planning for COG programs, and related policy issues;
- Overseeing the development and management of the following technological areas: fuel channels, reactor chemistry and systems, hydrogen and heavy water technology, safety technology, fuel and fuel cycles, environmental technologies, health physics, software performance, and reactor core technology;
- Leading the organizational unit of Science & Technology with the following departments: Chief Scientist, and Deputy Vice-President Office S&T (S&T Business Management Office, S&T Facilities Operations Division, Reactor Fleet Sustainability Division, Isotopes, Radiobiology & Environment, Advanced Reactors Directorate, Safety & Security Directorate, Hydrogen & Tritium Technologies, Small Modular Reactors Project, and S&T Isotope Production Project); and,
- Establishing, maintaining, assessing, and continuously improving the company-wide processes and programs for the Conduct of Research Functional Support Area.

A.4 Vice-President, Environmental Remediation Management and Stewardship and Renewal Group (ERM & SRG)

The Vice-President, Environmental Remediation Management and Stewardship and Renewal Group is responsible for:

- Ensuring the safe conduct of licensed activities associated with the nuclear facilities, and radioisotope laboratories at Chalk River (under ERM control), Nuclear Power Demonstration, Douglas Point, Gentilly-1, Whiteshell Laboratories, and the Historic Waste Programme (HWP) at Port Hope;
- Managing decommissioning, waste management, and environmental remediation facilities and services, and related projects at company sites;
- Overseeing of the Liability Cost Estimate, which is the funding provided to address legacy responsibilities associated with the Government of Canada and CNL's operations;
- Overseeing the Low-Level Radioactive Waste Management Office, funded by the Government of Canada, to address historic wastes at specific sites in Canada;
- Overseeing the Port Hope Area Initiative Management Office, the federal operating agency declared by the Government of Canada to implement the Legal Agreement of the Port Hope Area Initiative on its behalf;
- Providing associated support resources to the CRL site, including maintenance trades, planning and assessment services, logistics, and fleet;

- Delivering site maintenance services that ensures high reliability and availability of nuclear facilities and site infrastructure facilities;
- Managing commercial waste management and decommissioning undertakings;
- Leading the organizational unit of Environmental Remediation Management and Stewardship and Renewal Group with the following departments: Historic Waste Program Management (HWP Health, Safety, Security, Environment & Quality, HWP Business Operations, HWP Major Sites, HWP Small-Scale Sites, and HWP Waste Management Operations), WL Restoration Project (WL Site & Nuclear Operations, WL Business Operations, WL Engineering, WL End-State Strategy , WL Decommissioning and Demolition, Waste Management Area Decommissioning and Demolition, WL Waste Management, WL Project Controls and Report), and Stewardship and Renewal Group (Fuel Programme & Project Division, ERM Program Management, Decommissioning & Environmental Remediation, Near Surface Disposal Facility, ERM Integrated Functional Support Services, Contractor Management, Waste Services, and Infrastructure Development Group); and
- Establishing, maintaining, assessing, and continuously improving the company-wide processes and programs for the following Functional Support Areas: Cleanup, Transportation of Dangerous Goods, and Waste Management.

A.5 Vice-President, Capital

The Vice-President, Capital, is responsible for:

- Leading the development, performance and management of capital infrastructure projects which includes operational plans, budgets, and schedules to ensure projects are within budget and on time, establishing challenging performance metrics, conducting operational reviews to ensure targets are being met;
- Delivering required budget documents to the Chief Financial Officer, the Executive Team and our shareholder (this includes key information to support the budget funding obligations);
- Serving as the intermediary among Finance, Executive Team and other stakeholders on all budget matters associated with capital investment;
- Evaluating overall APWB integration with project delivery, long and near-term strategies, and processes while continuing to deploy innovative enhancements and upgrades to improve efficiency and effectiveness;
- Leading the organizational unit of Capital with the following departments: New Builds, Capital Projects, and Capital Project Program;
- Establishing, maintaining, assessing, and continuously improving the company-wide processes and programs for the Construction Functional Support Area.

A.6 Vice-President, Business Management

The Vice-President, Business Management is responsible for the following:

- Developing and executing supply chain strategies and plans;
- Providing financial review, reporting, business decision support, business advice/strategies, financial modelling, negotiation support, billing, and routine project/product accounting activities for CNL;
- Overseeing the development and execution of a Business Continuity Program;
- Monitoring and controlling the APWB, planning and budget guidance, strategy development, associated risks, assumptions for future spending and use of performance measures to assess program performance;
- Managing processes to protect, manage, and safeguard records and information assets;
- Advising the CNL Board on Financial, IT and Supply Chain matters, and significant project investment justifications;
- Leading the organizational unit of Business Management with the following departments: Supply Chain, Program Management Office, Prime Contracts, Integrated Services, and Information Management and Technology;
- Establishing, maintaining, assessing, and continuously improving the company-wide processes and programs for the following Functional Support Areas: Supply Chain, Prime Contract, Information Management, Project Management Office, Information Technology, Nuclear Cyber Security, and Finance.

A.7 Vice-President, Central Technical Authority (CTA) and Chief Nuclear Officer (CNO)

In the role of Vice-President, Central Technical Authority, is responsible for the following:

- Setting and applying the standards necessary to achieve technical excellence in all aspects of the work performed by CNL;
- Providing CNL-wide processes and services to support the missions' tasks and to recognize when, for whatever reason, CNL is falling short of technical excellence;
- Developing and implementing plans to address strategic business issues;
- Ensuring awareness of customer requirements are promoted throughout CNL;
- Promoting, measuring, and providing continual improvement for the site safety and security cultures;
- Reporting to the Executive Team on performance of the Management System and any need for improvement;

- Performing assessments of the implementation of regulatory requirements to ensure that they are being appropriately implemented in accordance with the graded approach allowed by the implementing documents;
- Ensuring the independent assessment program maintains its independence and is adequately performing its intended function;
- Leading the organizational unit of Central Technical Authority with the following departments: CTA Deputy VP, Engineering, Compliance, Quality and Operational Excellence; and
- Establishing, maintaining, assessing, and continuously improving the company-wide processes and programs for the following Functional Support Areas: Conduct of Operations, Fitness for Service, Design Authority and Design Engineering, Configuration Management, Pressure Boundary, Electrical Safety, Safety Analysis, Training & Development, Commissioning, Quality, Performance Assurance, Compliance, Nuclear Criticality Safety and Nuclear Materials & Safeguards Management.

In the role of CNO, is responsible for:

- Ensuring nuclear safety is an overriding priority at all CNL sites;
- Ensuring conditions and requirements of licences and certificates granted by the CNSC are communicated to CNL Management (for site licences, this is the responsibility of the site licence holder);
- Authorizing, where required, changes to programs and processes that support the site licences where such changes affect safe or compliant operation at more than one site;
- Representing CNL at CNSC meetings on matters relating to organization-wide licensing matters;
- Acting for CNL in dealings with the CNSC;
- Providing oversight of all CNL nuclear facilities and programs to ensure performance meets and/or exceeds regulatory expectations and industry best practices; and
- Ultimately responsible to ensure compliance with CNSC license requirements at all CNL sites. This does not relieve the individual site license holder from their responsibility as separately described in this Manual.

A.8 Vice-President, Health, Safety, Security and Environment (HSSE)

The Vice-President for Health, Safety, Security and Environment provides strategic direction and oversight to HSSE functional programs and services that meet site licence requirements, business operational needs and reflect industry best practices for CNL, and is responsible for:

- Promoting integration of HSSE requirements into all work activities, and assessing integration;

- Working with line organizations to implement actions to improve HSSE integration;
- Supporting and promoting worker involvement in CNL safety processes;
- Ensuring regulatory requirements for HSSE functions are properly documented, controlled and implemented;
- Interfacing with regulators and stakeholders on HSSE matters;
- Providing direction and guidance for proper implementation and improvement of the Radiation Protection program, Dosimetry program, Wellness program and Environmental Protection program;
- Leading the organizational unit of Health, Safety, Security and Environment with the following departments: Corporate Radiation Protection, Corporate Occupational Safety and Health, HSSE Business Operations, Corporate Environmental Protection, Deputy VP Office, Corporate Fire and Emergency Management, and Corporate Security; and
- Establishing, maintaining, assessing, and continuously improving the company-wide processes and programs for the following Functional Support Areas: Environmental Protection, Radiation Protection, Occupational Safety & Health, Health Centre, Emergency Preparedness, Fire Protection, and Security.

A.9 Vice-President, Human Resources

The Vice-President, Human Resources is responsible for:

- Providing overall strategic human resources and labour relations direction and leadership to the organization;
- Overseeing the development, implementation and administration of human resource policies, programs and services, including employee and labour relations, employment practices, prevention of harassment and violence process, diversity, equity and inclusion program, compensation, benefits and pension, recruitment and orientation, talent management including engagement, retention and succession planning; and legislative and regulatory compliance relative to human resources and labour relations;
- Engaging in the strategic planning process by supporting the execution of organizational unit strategies and plans through the implementation of Human Resource and labour relations strategies and solutions that support short and long-term business objectives;
- Leading the organizational unit of Human Resources with the following departments: Talent Management, Labour Relations, and Total Rewards; and
- Establishing, maintaining, assessing, and continuously improving the company-wide processes and programs for the Human Resources Functional Support Area.

A.10 Vice-President, Legal & Insurance

The Vice-President, Legal & Insurance is responsible for:

- Providing legal advice and support in relation to all legal, commercial and regulatory matters at CNL;
- Managing and overseeing the performance of the Ethics and Business Conduct Office, Corporate Secretariat, Export & Import compliance, and the Internal Audit function at an organisational level;
- Leading the development and implementation of CNL Intellectual Property policy, plans, and procedures;
- Managing all legal claims that relate to the operations of CNL;
- Providing CNL with all necessary insurance and related risk management advice to enable CNL to meet its statutory and contractual obligations and to use insurance as a strategic risk management tool;
- Overseeing all engagements with outside legal counsel;
- Providing legal advice and support to support CNL intellectual property resources;
- Providing legal advice and support in relation to statutory and regulatory compliance, including operational elements of privacy requirements;
- Leading the organizational unit of Legal and Insurance Department with the following departments: Ethics and Business Conduct, and Legal Department;
- Establishing, maintaining, assessing, and continuously improving the company-wide processes and programs for the Legal Services Functional Support Area; and
- Providing a high level of assurance to CNL's Executive and Board of Directors that:
  - The business activities and operations are being carried out to meet or exceed CNL's regulatory and legal obligations and other applicable standards,
  - All employees know and understand their compliance roles and responsibilities; and
  - CNL's employees, officers and directors of the company are acting ethically and with integrity.

A.11 Vice-President, Corporate Affairs

The Vice-President, Corporate Affairs leads a team responsible for developing and conducting communications, information dissemination, public engagements, and maintaining an overall public affairs program including internal and external communications; community involvement and outreach; interactions with the media, businesses, and the scientific and technical community and is responsible for:

- Delivering and lead the Public Information Program, a CNSC licence condition;
- Managing relationships with key stakeholders including industry associations and Indigenous communities;
- Liaising and consulting with indigenous groups, local, provincial, and federal levels of government with an overall goal to enhance the benefits of CNL to its host communities and Canada;
- Establishing and maintaining effective working relationships with community stakeholders in order to build awareness, understanding, and support for company activities and operations;
- Developing initiatives to bring benefits to the host communities, including, participation in community initiatives, fundraisers, and community service announcements, local events, while continuing to champion and encourage local development;
- Building constructive community engagement and support;
- Managing brand awareness including speeches, website, and conferences and tradeshows;
- Managing sponsorships, fundraisers, public tours, school programs, and special events and occasions;
- Supporting marketing and advertising;
- Acting as official corporate media spokesperson including receiving, responding to, and managing all media requests and press releases;
- Ensuring timely, open and transparent communications in response to issues or emergencies;
- Providing support to the Office of the President & CEO, CNL and CNEA Board of Directors, the Executive Team, Special Advisors, and special projects through Corporate Affairs;
- Building employee engagement and understanding of corporate plans, priorities and strategies;
- Supporting morale and employee recognition programs (i.e. Voyageur luncheon series, Awards Gala);
- Managing myCNL, All Staff engagements, and the CONTACT and Voyageur newsletters;
- Leading the organizational unit of Corporate Affairs with the following departments: Corporate Communications, and HWP Communications and Stakeholder Relations; and
- Establishing, maintaining, assessing, and continuously improving the company-wide processes and programs for the Corporate Affairs Functional Support Area.

A.12 Vice-President, Business Development

The Vice-President, Business Development is responsible for the following commercial strategic and transactional activities:

- Leading the market analysis and commercial strategy development with respect to growing CNL's Energy, Health, Environment, and Safety/Security products and services business;
- Leading the marketing and market engagement/ongoing interaction with existing customers and leading market associations;
- Leading the interaction with primary client, AECL, to ensure endorsement of commercial strategies, and clear understanding and support for short, medium, and long term goals;
- Leading improvement initiatives required to achieve long term business development and organizational sustainability;
- Leading the development, review/analysis, and endorsement of business cases for potential public private partnerships and Make or Buy opportunities;
- Driving or assisting in the implementation of approved business cases;
- Structuring and managing the routine engagement with internal organizational areas to ensure strategy alignment, planning, and execution with respect to commercial work;
- Planning and coordinating all new sales, proposals, and account management activities that facilitate response to current and potential customers including scope development, risk assessment, cost estimating, pricing, terms and conditions, contractual structure, and legal/contracts review;
- Managing new and existing strategic customer relationships including external and internal interfaces (e.g. S&T Program Directors) as required in order to meet customer expectations and focus on improvements that increase customer satisfaction and potential revenue growth;
- Providing the interface between CNL's customer and line organizational units for the purpose of commercial sales planning and scheduling to ensure notifications, production, scheduling, and product delivery are coordinated;
- Ensuring Intellectual Property policy/protection/exploitation as applicable to performing federal work and negotiating commercial contracts;
- Leading the organizational unit of Business Development with the Business Development and Commercial department; and

- Establishing, maintaining, assessing, and continuously improving the company-wide processes and programs for the Business Development and Commercial Ventures Functional Support Area.

A.13 Vice-President, Isotope Business

The Vice-President, Isotope Business is responsible for the following commercial strategic and transactional activities:

- Providing the interface between CNL's customer and line organizational units for the purpose of Isotopes Sales planning and scheduling to ensure notifications, production, scheduling, and product delivery are coordinated; and
- Leading the organizational unit of Isotopes Business.

Corporate Functional Authority Roles

Additional corporate functional authority roles have been established in response to regulatory and other legislative requirements. These roles have an independent reporting relationship to the President & CEO:

- Chief of Staff
- Ombuds Officer
- Corporate Secretary
- Chief Information Officer
- Chief Financial Officer
- Chief Engineer
- Chief Safety & Licensing Officer
- Chief Regulatory Officer
- Chief Security Officer
- Management Representative for Quality
- Site Licence Holder

A.14 Chief of Staff

The Chief of Staff is accountable to the CEO/COO, representing them with internal and external stakeholders, while fulfilling the following responsibilities:

- Acting as the communication arm for the CEO/COO with other Executives, the Client, the Board, and other stakeholders as required. Facilitates communications with CEO/COO, ensuring wants, needs, concerns, and ideas are communicated effectively and efficiently in both directions;
- Acting as a strategic advisor and counsel for the CEO, COO and Executive Team;

- Improving current processes and coordinating organizational procedures for optimized efficiency and productivity, enabling the CEO/COO to focus on larger strategic organizational initiatives;
- Creating and maintaining strong cross-departmental relationships to enable collaborative leadership success;
- Preparing the CEO/COO for emerging issues and opportunities; and
- Delegating tasks/activities on behalf of the CEO/COO.

A.15 Ombuds Officer

The Ombuds Officer is accountable to the CEO/COO, representing them with internal and external stakeholders, while fulfilling the following responsibilities:

- Addressing concerns about transparency, fairness, and process consistency, as well as other issues of significance to the stakeholder community without sacrificing CNL's mission;
- Improving CNL's understanding of the workforce concerns and, more specifically, how the company can institute changes to address those concerns when appropriate;
- Being an accessible resource and actively participating in resolution processes, informal conversations, and neutral conflict coaching;
- Identifying areas for improvement, from a conflict resolution perspective, which might serve to benefit CNL processes;
- Evaluating and upgrading the efficiency of CNL's conciliation and mediation processes, as necessary;
- Providing a confidential, to the extent permitted by law, and trustworthy channel for conflict resolution for CNL stakeholder community;
- Creating a climate in which CNL workforce feels comfortable contacting the Ombuds Service while dispelling the notion that raising issues or concerns with CNL will adversely impact employees in the future;
- Equipping CNL staff and the stakeholder community with conflict resolution skills;
- Ensuring that stakeholders and CNL staff understand the benefits of respectful, transparent, and efficient communications; and
- Remaining accessible and visible to CNL and external stakeholders through speaking engagements.

A.16 Corporate Secretary

The Corporate Secretary to the Board of Directors, is accountable to the Board of Directors and is responsible for:

- Advising on the appropriateness of CNL'S governance strategies and that its governance obligations are being met including those relating to ethics and business conduct;
- Ensuring the integrity of the corporate governance system, and compliance with statutory and regulatory board governance requirements;
- Acting as a trusted adviser to the Board of Directors;
- Tracking implementation of decisions made by the Board of Directors;
- Administering interactions with the Board of Directors including Board and Board committee meetings, minutes of meetings, and corporate records;
- Liaising with Directors and Corporate Officers, as well as with shareholders, auditors, and external advisor on board governance issues; and
- Supporting the Board of Directors in engaging the Shareholder and AECL on relevant governance issues.

A.17 Chief Information Officer

The Chief Information Officer (CIO) provides strategic direction and leadership in the efficient and effective use of information and information technology across CNL.

The Chief Information Officer (CIO) responsibilities are further described in the Program Description Document for *Information Technology* [42].

A.18 Chief Financial Officer

The Chief Financial Officer is responsible for:

- Ensuring the financial integrity and strategy of the business;
- Advising senior management on overall long- and short-term strategic issues, including matters related to financial management, performance management strategies, revenue/market growth strategies, and organization structure;
- Developing structure for internal financial controls;
- Developing accounting policies;
- Ensuring the integrity of CNL's financial systems and controls, and safeguarding and controlling the associated records; and
- Working closely with the Executive Team on their planning activities to ensure the plans support the profitability and continued financial viability of the company.

A.19 Chief Engineer

The Chief Engineer assumes professional responsibility for all engineering services provided by CNL to the public under CNL's Professional Engineering Certificate(s) of Authorization, and has authority for establishing and maintaining the design of CNL facilities.

The Chief Engineer is responsible for:

- Executing the design authority function for CNL facilities, design and licensing basis and engineering activities;
- Maintaining appropriate Professional Engineering Certificate(s) of Authorization;
- Conducting technical review and oversight of engineering activities to ensure compliance with design requirements, codes, standards, regulatory requirements, quality standards and engineering practices;
- Acting as the Functional Authority for Engineering processes including Configuration Management, Design Authority and Design Engineering; and
- Executing the owner's duties for CNL sites as defined by Pressure Boundary codes and standards.

A.20 Chief Safety & Licensing Officer

The Chief Safety & Licensing Officer responsibilities are further described in the Program Description Document for *Safety Analysis* [43].

A.21 Chief Regulatory Officer

The Chief Regulatory Officer responsibilities are further described in the Program Description Document for *Compliance* [25].

A.22 Chief Security Officer

The Chief Security Officer provides oversight to confirm that CNL meets its obligations under the Treasury Board Policy on Government Security in ensuring that information, assets and services are protected against compromise and individuals are protected against workplace violence.

The Chief Security Officer responsibilities are described in the Program Description Document for *Compliance* [25].

A.23 Management Representative for Quality

The Management Representative for Quality has organizational independence, functional responsibility and authority for:

- Ensuring that quality assurance processes needed for the management system are established, implemented and maintained;
- Ensuring awareness of customer requirements are promoted throughout CNL;
- Identifying and recording quality problems or conditions adverse to quality and compliance;
- Initiating, recommending, or providing solutions;
- Verifying implementation of solutions; and
- Ensuring that further processing, delivery, installation, or use of an identified nonconformity is controlled until corrective actions have occurred.

The Management Representative for Quality responsibilities are further described in the Program Description Document for *Quality* [44].

A.24 Site Licence Holders

Site Licence Holders are designated Executives and Senior Management responsible for the management and control of CNSC-licenced activities at their respective CNL-managed sites. Site Licence Holders are appointed by the President & CEO with the concurrence of the Chief Nuclear Officer and have the necessary functional authority to discharge responsibility for assuring the safe conduct and compliant operation of all licenced activities at their respective sites, including the authority for operating or shutting down nuclear facilities and radioisotope laboratories.

Specifically, the Site Licence Holder is responsible for:

- Ensuring no activity requiring a licence under the *Nuclear Safety Control Act* [45] is carried out on the site, other than those activities listed in the licence, as stated in the application for licence renewal, and as approved by the CNSC;
- Ensuring the management system is effective and implemented at the site, and that the senior management is committed to and meets its responsibility for reviewing and ensuring the success of the management system and safety management, including the ongoing proactive oversight and surveillance of nuclear safety activities and compliance with regulatory requirements;
- Ensuring site and facility operations meet health, safety, security, environmental, quality, and regulatory requirements, and take appropriate action for non-compliances up to and including ceasing operations;
- Taking site safety, quality, licensing, and technical issues to the Executive level for resolution where these cannot be resolved at the site;
- Representing CNL at CNSC meetings on matters relating to their respective site;

- Ensuring that conditions and requirements of site licences granted by the CNSC are communicated to site and facility management;
- Ensuring that “Obligations of Licensee” in the *General Nuclear Safety and Control Regulations* [46], where applicable, are met;
- Ensuring Facility Authorities are appointed for all nuclear facilities;
- Authorizing, where required, changes to programs and processes that support the site licences where such changes affect safe or compliant operation of the site;
- Ensuring adequate preparedness for responses to anticipated operational occurrences and emergency conditions and that appropriate actions have been taken to provide for the protection of site personnel, the public, and the environment;
- Ensuring that arrangements are in place to manage the situations that fall outside normal operating procedures at the site; these arrangements shall ensure that appropriate controls are maintained and due consideration is given to the safety implications of the situation; and
- As required, recommending to the CEO the appointment of Emergency Operations Centre Commanders for managing CNL and site emergency responses.

Appendix B Management System Framework Overview

The CNL Management System is based on a framework developed through benchmarking of industry standards, review and application of lessons learned from previous experience and systems, and alignment with the strategic direction of the corporation.

Functional Authorities have responsibility for defining, interpreting, and maintaining functional requirements, and for supporting the Missions in their implementation. The Functional Authority structure consists of Responsible Executives, Functional Support Managers, and Functional Support Manager Designates, as identified in the *Functional Authorities* list [26], who work closely together to ensure that implementation of standards and requirements specific to their Functional Support Area(s) are consistent company-wide.

Table 2: Management System Framework Overview

Responsible Executive	Functional Support Area	Purpose
President & CEO and Chief Operating Officer	**Management System**	Enables effective corporate governance and interfacing between the Board of Directors, Executive, and Management. Formalizes and institutionalizes the controls and accountabilities by which CNL manages and executes work, in conformance with legislative, regulatory, shareholder, and commercial requirements. Drives key improvement initiatives to address common opportunities and challenges to meet corporate objectives. Facilitates organizational transformation and provides assurance that action plans effect sustainable improvement through the application of effective change management principles.
	Property (Asset) Management	Ensures stewardship of AECL resources in accordance with CNL objectives. Ensures decisions regarding the acquisition, accounting for, control, utilization, maintenance, service, protection, preservation, and disposition of resources is based on defined service levels, informed by asset conditions and risks, considers whole life costs and is aligned with CNL business needs and strategic requirements.
VP Business Management	**Supply Chain**	Effectively establishes and builds integrated capabilities from the supply chain to support delivery of CNL's work scope and obligations to AECL. CNL's supply profile includes contracted

Responsible Executive	Functional Support Area	Purpose
		work and material requirements for decommissioning and waste management, science and technology, capital works, as well as general support to programs and operational activities. Drives best value for CNL and AECL, and includes a framework that enables the development of small and medium-sized enterprises in addition to local and indigenous businesses where capabilities exist.
	Prime Contract	Involves the management and administration of the Site Operating Company Agreement, the Whiteshell Laboratories Target Cost Agreement, and Nuclear Power Demonstration Reactor Target Cost Agreement between AECL and CNL. Establishes communication processes to support monitoring of the contracts, reporting on performance, and controlling any changes, variations, or amendments to the contracts.
	Information Management	Governs the creation, classification, capture, use, dissemination, retention, preservation, and disposition processes of information throughout the company. Develops, implements, and monitors controls that apply to all structured, unstructured, or transitory Information Assets to ensure the authenticity, reliability, and integrity of the records, and minimize the risk associated with disclosure and loss while allowing for inspection of records to ensure their continued preservation. Provides on-site information resources, and access to worldwide resources through online subscriptions and inter-library loans.
	Project Management Office	Ensures that CNL uses a standardized framework of processes, procedures, tools and systems to plan, control and monitor the strategic plan of CNL. The Project Management Office function provides guidelines; oversight and monitoring to ensure that projects, and site facility operations, are performed using CNL rules, follow industry best practices, and add value to the business.

Responsible Executive	Functional Support Area	Purpose
	Information Technology	Establishes effective governance practices, tools, and processes required to ensure the safety and security of information and technology assets falling within the mandate of CNL. Ensures industry best practices for IT services management and delivery and ensures a relevant and secure infrastructure for its continuing business.
	Nuclear Cyber Security	Facilitates compliance with all applicable requirements for the protection of nuclear cyber assets and information. Delivers nuclear cyber security services and solutions to the business and ensures confidentiality, availability, and integrity of all systems, information, data, and intellectual property under the control of CNL.
	Finance	Establishes a framework for all financial activities to ensure: financial resources are consumed in accordance with approved plans, budgets and/or allocated funding; financial transactions are undertaken in compliance with governing legislation, policies, and procedures; and financial reporting is timely, complete, accurate, and delivered in accordance with prescribed accounting and reporting standards. Provides financial stewardship and controllership for CNL and, supports the full scope of departmental and functional financial accountabilities including: sound financial policies, strong internal controls, accurate, responsive and timely financial reporting, and timely decision support.
VP Human Resources	**Human Resources**	Fosters a positive union-company relationship through management of Collective Agreements including: compliance, interpretation and negotiation. Optimizes organizational design, alignment, health, and change to support strategic workforce and business requirements. Enables competitive, cost effective benefits and compensation programs to attract, retain, motivate, align and reward employee performance.

Responsible Executive	Functional Support Area	Purpose
		Enables management to clearly set expectations in line with corporate culture and business objectives, and to support, recognize, and manage employee performance. Ensures awareness of each individual's responsibilities to ensure CNL's culture is inclusive, respectful, and supportive; ensures individuals are empowered to speak out when concerned with how they are being treated by another; and, ensures everyone has access to tools and resources to resolve conflict. Builds and sustains excellence in: securing top talent; developing talent; optimizing the application of capabilities across CNL; retaining and engaging talent employees; and managing the employee lifecycle.
VP Legal	**Legal Services**	Ensures the business' of CNL are executed in a strategic, legally compliant, risk informed, and ethical manner and assists and supports all CNL departments in the execution of their related legal and ethical responsibilities.
VP Corporate Affairs	**Corporate Affairs**	Ensures effective communications for engaging our employees, our Shareholder, Natural Resources Canada, and our key stakeholders that foster alignment with corporate objectives and strategies.
VP Business Development	**Business Development & Commercial Ventures**	Facilitates customer acquisition and retention, including the evaluation of investment in new capabilities to expand commercial offerings for CNL.
VP Science & Technology	**Conduct of Research**	Maintains integrity in research, and ensures research activities do not adversely affect the health and safety of the worker, the environment or the quality of data obtained, waste resources, or damage CNL's reputation or credibility with customers. Ensures adherence to good research practices leading to more attention to the details of scientific research including qualitative analysis, quantitative and statistical techniques, more thoughtful collaboration among investigators, performing work safely and cost effectively and complying

Responsible Executive	Functional Support Area	Purpose
		with all requirements while meeting the needs of the customer(s).
VP Health, Safety, Security, and Environment	**Environmental Protection**	Ensures protection of our natural environment in and around CNL sites. It provides the framework to implement CNL's Environment Policy [6]. The Environmental Protection (EnvP) requirements apply to operations and activities that may affect the environment in and around CNL sites. A graded approach to requirements is applied based upon environmental risks/events that could occur at any given location and considering the amount of control or influence that CNL has on the activity. The EnvP Program considers life cycle perspective for activities, products and services on and around CNL sites where CNL has control or influence and on products or services off site which the company has influence.
	Radiation Protection	Prescribes limits and requirements for safe work practices in a radiological environment and the monitoring required. Limits employee exposure and maintains doses to workers As Low As Reasonably Achievable (ALARA), social and economic factors taken into account.
	Occupational Safety & Health	Prevents accidents and injury to health arising out of, linked with or occurring to employees in the course of employment, and to all persons on sites or workplaces controlled by CNL. Supports industrial safety, industrial hygiene, and respiratory safety and the alignment of various safety programs.
	Health Centre	Ensures a safe and healthy workplace for employees. Enables employees to maintain, improve, and regain their health when needed.
	Emergency Preparedness	Enables the prevention and mitigation of, preparedness for, response to, and recovery from abnormal or emergent events.
	Fire Protection	Ensures an immediate coordinated response to fire and other incidents/emergencies.

Responsible Executive	Functional Support Area	Purpose
		Establishes a risk graded approach in conjunction with the defence-in-depth principles to its operations and activities in so far as they may affect fire protection.
	Security	Ensures the physical protection of assets, safeguarding the public and personnel and resumption of business and ensuring the protection of CNL employees, assets, and operations.
VP Environmental Remediation Management and Stewardship and Renewal Group	**Transportation of Dangerous Goods**	Supports the protection of public and environment by ensuring dangerous goods are adequately packaged and controlled for company activities.
	Waste Management	Ensures (a) activities involving planning for, handling, processing, transporting, storage and disposal of wastes are performed in a manner that protects workers, public, and environment, and are in compliance with applicable regulatory and licence requirements; and (b) waste hierarchy is effectively implemented across CNL sites.
	Cleanup	Ensures a CNL wide approach to effective land use planning, decommissioning, demolition, and environmental remediation. The Function ensures there is adequate and appropriate Indigenous, public, and stakeholder engagement, which is conducted as part of the planning process and considered throughout the facility lifecycle. The facility lifecycle includes: a) Design b) Construction c) Commissioning d) Operation e) Decommissioning & Demolition f) Remediation. This will enable a consistent approach to CNL sites with clear processes and guidance on key requirements. The Cleanup Function provides guidance to new builds on incorporating end state planning and next land use considerations as part of their project plans.
VP Capital	**Construction**	Manages, controls, and monitors construction and installation activities in accordance with the contract and compliant with requirements.

Responsible Executive	Functional Support Area	Purpose
VP Central Technical Authority & CNO	**Conduct of Operations**	Provides a framework which ensures facility operations are managed, organized, and conducted in a manner that results in high levels of safety, performance, and reliability, while maintaining compliance with requirements. Ensures Class I and Class II Nuclear Facilities are operated within their limiting conditions for safe operation.
	Fitness for Service	Ensures maintenance is carried out adequately and effectively. Decreases the likelihood, or impact of system, equipment, or component failures on nuclear safety, the health and safety of workers, public, security, environment, equipment, and property. Ensures safety-related systems function reliably in accordance with the relevant design and performance criteria, including any safety goals of the Facility and Canadian Nuclear Safety Commission. Enables evaluation of equipment, development, and implementation of long-term equipment improvement plans, monitoring of equipment performance and condition, and adjustment of preventive maintenance tasks and frequencies based on equipment performance.
	Design Authority & Design Engineering	Manages the organizational responsibility to ensure the technical integrity of designs and design processes, establishing the requirements for CNL design work. (Chief Engineer) Ensures design is planned, executed, verified and documented according to applicable codes, standards, regulatory, and design customer requirements. Controls the design basis of CNL within approved safety margins and regulatory requirements. (Design Authority)
	Configuration Management	Facilitates orderly management of system/facility information and system/facility changes for such beneficial purposes as to revise capability, improve performance, reliability or maintainability, extend life, reduce cost, risk and liability, or

Responsible Executive	Functional Support Area	Purpose
		correct defects within approved safety margins and regulatory requirements. Ensures changes are assessed, approved, designed, implemented, commissioned, and placed into service within the safety envelope at all CNL sites, in accordance with the design requirements.
	Pressure Boundary	Assures that pressure-retaining systems and components are designed, constructed and operated in full compliance with statutory and legislative requirements, while promoting and supporting performance excellence with a strong safety culture. The ultimate objective is "no pressure boundary failures".
	Electrical Safety	Prevents electrical accidents and injury to health arising out of, linked with or occurring to employees in the course of employment, and to all persons on sites or workplaces controlled by CNL. Provides the framework to eliminate or reduce the risk of worker exposure to electrical hazards in the workplace. Ensures that electrical work executed at CNL is compliant to all applicable requirements.
	Safety Analysis	Conducts and maintains nuclear safety analysis to permit the successful completion of safe engineering design in support of new build, facility modification, facility operation, research and product development, decommissioning and disposal.
	Training & Development	Supports the Organization's operational capabilities by ensuring that workers are effectively and efficiently trained to safely and competently perform their position or role.
	Commissioning	Ensure the as-constructed structures, systems, and components satisfy the functional, performance, and safety design requirements and meet the needs of the users. Provide a systematic and objective method that enables commissioning to proceed in a controlled manner, safely and to a high quality, and ensuring the necessary assurances and evidence are provided.

Responsible Executive	Functional Support Area	Purpose
	Quality	Ensures the efficient delivery of high-value, and quality products and services, and oversees that all activities and tasks are accomplished to maintain a desired level of excellence with alignment to requirements. Utilizes a combination of internal, second and third party audits and evaluations to provide performance oversight and reporting.
	Performance Assurance	Supports CNL's ability to improve operational performance, enhance safety, and reduce the occurrence of unplanned events. Provides an improvement framework to assist in decision making while promoting organizational learning, innovation, and continual improvement.
	Compliance	Ensures compliance with the verification criteria for each of the 14 Safety and Control Areas (SCA) established by the CNSC, consistent with CNL's licence obligations. Provides the regulatory and licensing framework, and independent technical reviews, for a coordinated and consistent approach in managing relationships with regulators throughout CNL.
	Nuclear Criticality Safety	Establishes the framework for ensuring that accidental nuclear criticality is prevented, and that the consequences of accidental nuclear criticality are mitigated during operations with fissionable material outside nuclear reactors.
	Nuclear Materials & Safeguards Management	Enables the tracking of our fissionable materials and supports international non-proliferation agreements.

Application Attachment A

[A-11] Site Licences, Certificates, Permits, Building/Facility Contacts, & Licence Representatives, 900-514300-LST-001, 49255143

Canadian Nuclear Laboratories | Laboratoires Nucléaires Canadiens

Site Licences, Certificates, Permits, Building/Facility Contacts, & Licence Representatives REV 13

900-514300-LST-001

Approved by	Title	Date
Sarah Brewer	Senior Director, Compliance	2023/06/22

Effective Date: 2023/06/23
Expiry Date: 2026/06/23

Refer to ATOM for current version. Printed copies should not be considered current without first consulting ATOM.

This page is for Content Controls that apply to this document. If no Content Controls apply, none will be listed.

Revision History

Rev. No.	Date	Details of Rev.	Authored By	Reviewed By	Approved By
13	2023/06/16	Issued as "Approved for Use"	B. Scott	S. Brewer	S. Brewer
13D1	2023/04/14	Issued for "Review and Comment" Major revision The following Sections were updated: 1. Scope and Applicability 2. Purpose 3.1 Added Site Licence Holder to Roles & Responsibilities 3.3 Changed Compliance FSA to Chief Regulatory Officer 3.4 Removed 4.1 Updated DROL list as per DROL Reduction Briefing Note, 61137373 4.2 Moved Primary & Secondary Contacts List to Appendix A 5.1 Condensed sections 5.1.1 to 5.1.8 into 1 table 5.2 Condensed sections 5.2.1 to 5.2.5 into 1 table 5.4 Renamed to Port Hope Area Initiatives Updated template	B. Scott	R. Corby A. Dash R. Dufour S. Faught C. Gallagher W. Graydon K. Leroux K. Lundie S. Morris B. Phillips P. Pottelberg R. Rao D. Ryland K. Schruder G. Snell R. Swartz J. Therrien T. Wieclawek	
12	2022/06/29	Issued as "Approved for Use" Minor comments to update new DROL assignments. Updated template.	B. Scott	K. Leroux	C. Gallagher for S. Brewer
12D1	2022/06/13	Issued for "Review and Comment" Minor comments to update new DROL assignments. Updated template. DROLs/Contacts in the following sections in 4. LISTS were updated:	B. Scott	L. Adams K. Barks M. Boileau M. Crowe D. Delano M. Deloughery J. deRuiter R. Dufour C. Gallagher	

Rev. No.	Date	Details of Rev.	Authored By	Reviewed By	Approved By
		4.1, 4.2.1 (added CSO), 4.2.2, 4.2.3 (added Dir. Ind. Relations), 4.2.4, 4.2.6, 4.2.8, 4.2.13 to 4.2.16 (updated names and removed FM Designate column), 4.3.1, 4.5.3, 4.5.5. Dates and Revision numbers for Documents in the following sections in 5. FACILITY AND LABORATORY DOCUMENTATION were updated: 5.1.2 (GDIs removed) 5.5.3, 5.4 (date column removed)		D. Garrick M. Hammell K. Leroux D. Meldrum S. Morris B. Phillips R. Rao A. Rehman T. Scott J. Slade G. Snell P. Stirbys R. Swartz J. Therrien D. Woods	
11	2021/12/24	Issued as “Approved for Use”	B. Scott	S. Cotnam	S. Cotnam
11D1	2021/12/10	Issued for “Review and Comment” Updated template. Updated DROL names, document revisions, licences, and certificate. Added Director, Indigenous Engagement to 4.2.2.		B. Scott R. Swartz T. Scott S. Brewer K. Lundie S. Morris S. Cotnam K. Barks D. Delano A. Coulas M. Hammell W. Graydon R. Dufour P. Pottelberg J. Therrien K. Leroux D. Ryland D. Woods M. Crowe R. Corby C. Gallagher	
10	2021/03/01	Issued as “Approved for Use”	K. McGee	S. Karivelil	
10D1	2021/02/05	Issued for “Review and Comment” Updated template.	K. McGee	S. Karivelil R. Swartz S. Brewer	

Rev. No.	Date	Details of Rev.	Authored By	Reviewed By	Approved By
		Updated DROL names, document revisions, licences, and certificates. Removed first initials with name in brackets format from document. Moved NRX from 4.2.15 to 4.2.15 Moved NRU from 4.2.6 to 4.2.15 Revised CRL labs to match ACMR submission. Formatted table 4.7 to match table in 4.6.		T. Scott S. Morris K. Lundie S. Cotnam L. Nel D. Delano K. Barks M. Hammell A. Coulas R. Dufour W. Gaydon J. Therrien K. Leroux B. Phillips P. Pottelberg M. Crowe D. Woods A. Bilton	
9	2020/07/24	Issued as "Approved for Use"	K. McGee	S. Karivelil	S. Cotnam
9D1	2020/05/15	Issued for "Review and Comment" Updated DROL names, document revisions, licences, and certificates. Removed designated role column from facility tables and separated Facility Manager and Designates into separate columns.	K. McGee	S. Karivelil R. Swartz S. Brewer T. Scott S. Morris K. Lundie S. Cotnam G. Hamilton D. Delano K. Barks M. Hammell A. Coulas R. Dufour W. Graydon N. MacDonald M. Patterson B. Phillips P. Pottelberg	S. Cotnam
8	2019/06/13	Issued as "Approved for Use"	K. McGee	S. Karivelil	S. Cotnam
8D1	2019/05/11	Issued for "Review and Comment" Updated DROL names, document revisions, licences, and certificates	K. McGee	S. Karivelil D. Delano S. Brewer M. Hammell S. Morris R. Dufour A. Coulas	S. Cotnam

Rev. No.	Date	Details of Rev.	Authored By	Reviewed By	Approved By
				R. Swartz K. Leroux K. Barks D. Garrick N. Wang J. Turcotte T. Gorman M. Burke-Legge T. Scott W. Graydon S. Cotnam Y. Dube P. Pottelberg G. Hamilton	
7D1	2018/01/12	Issued for “Review and Comment” Updated DROL names, document revisions, licences, and certificates	K. McGee	S. Karivelil D. Pilgrim N. Mantifel I. Castillo P. Pottelberg J.D. Garrick J. Gibb S. Faught A. Drom R. Swartz K. Leroux J. Chilton K. Barks A. Coulas G. Hamilton S. Brewer	S. Cotnam
6	2018/10/31	Issued as “Approved for Use”	K. McGee	S. Karivelil	S. Cotnam
6D1	2018/10/26	Issued for “Review and Comment” Updated DROL names, document revisions, licences, and certificates	K. McGee	S. Karivelil N. Yazdani N. Mantifel I. Castillo P. Pottelberg S. Needham J. Gibb S. Faught A. Drom R. Swartz K. Leroux J. Chilton K. Barks A. Coulas G. Hamilton	S. Cotnam

Rev. No.	Date	Details of Rev.	Authored By	Reviewed By	Approved By
				S. Brewer	
5	2018/07/27	Issued as “Approved for Use”	K. McGee	S. Karivelil	S. Cotnam
5D1	2018/07/06	Issued for “Review and Comment” Updated documents, licences and certificates throughout section 5 and included staff changes throughout section 4. Added sections that were missed during the combination in Revision 4. Updated formatting. Changed the location of a few sections for better flow.	K. McGee	S. Karivelil N. Yazdani N. Mantifel I. Castillo P. Pottelberg S. Needham J. Gibb S. Faught A. Drom R. Swartz K. Leroux J. Chilton	S. Cotnam
4	2018/03/21	Issued as “Approved for Use”	K. McGee	S. Karivelil	S. Cotnam
4D1	2018/03/06	Issued for “Review and Comment” Combined 900-508200-LST-001 into this LST.	K. McGee	S. Karivelil R. Swartz S. Cotnam R. McNamara K. Leroux B. Sanderson A. Coulas M. Scheer A. Bakewell K. Daniels J. West S. Needham S. Faught D. Cox T. Gorman S. Suppiah N. Mantifel K. Lundie D. Murphy M. Hammell N. Yazdani J. D. Garrick S. Brewer N. Wang I. Bainbridge A. McIvor P. Heeney A. Drom M. Vickerd	

Rev. No.	Date	Details of Rev.	Authored By	Reviewed By	Approved By
3	2017/09/29	Issued as “Approved for Use” No R&C required. Quarterly update.	J. Hunt	S. Karivelil	S. Cotnam
2	2017/05/31	Issued as “Approved for Use” No R&C required. Quarterly update.	J. Hunt	S. Karivelil	S. Cotnam
1	2017/01/24	Issued as “Approved for Use” No R&C required Update DROL listing and licences	J. Hunt	S. Cotnam	S. Cotnam
0	2017/01/06	Issued as “Approved for Use”	J. Hunt	S. Cotnam	S. Cotnam
D1	2016/12/12	Prepare D1 for review	J. Hunt	S. Karivelil K. Leroux R. Swartz B. Sanderson J. West A. Coulas	

Table of Contents

1. Scope and Applicability

Information contained in this list is applicable to all licensed activities, and those who perform them, managed by Canadian Nuclear Laboratories (CNL) Ltd.

This document captures the current listing of Site Licence Holders, appointments to Designated Representatives of the Licensee (DROL) as defined in the *General Nuclear Safety and Control Regulations* (GNSCR) [1] (Clauses 15 (a) and (b)), and the current status of appointments to Facility Authorities. These lists identify CNL staff who are designated and authorized to communicate with and make commitments to CNSC staff on behalf of CNL

This document also provides a listing of documentation, including licences, certifications, and permits held by various branches of CNL, and issued by other regulators. These licences, certifications, and permits apply to the various facilities and laboratories for the activities conducted therein.

2. Purpose

The purpose is to capture, in one document, the list of CNL staff who are designated and authorized to communicate with and make commitment to CNSC staff on behalf of CNL, and all licences, certifications, and permits issued to CNL by all regulators

This document is not used to assign an individual to a role. Appointments are covered by other Management System processes.

3. Roles and Responsibilities

3.1 Site Licence Holder

The Site Licence Holder is the designated Executives and Senior Management responsible for their respective site, with overall responsibility for the management and control of licensed activities at that site. The Site Licence Holder has the necessary functional authority to discharge responsibility for assuring the safe conduct of all licensed activities at their respective site, including authority for operating or shutting down nuclear facilities and radioisotope laboratories on the site. Further responsibilities are defined in the *CNL Management System Manual* [2].

3.2 Designated Representatives of the Licensee (DROL)

A DROL is a CNL staff member who is designated and authorized to communicate with, and make commitments to, CNSC staff on behalf of CNL for their Functional Support Area (and associated Safety and Control Area (SCA)) organizational unit, facility, project, or program within their financial authority to do so. The DROL is also designated and authorized to make and submit unplanned situation or event reports to CNSC staff. DROLs may only delegate their authority to other DROLs listed in this document.

3.3 Chief Regulatory Officer

The Chief Regulatory Officer (CRO) is responsible for maintaining the controlled list of DROLs and Facility Authorities for CNL-Managed Facilities & Sites.

Further responsibilities are defined in Management System manual [2].

4. List

4.1 Designated Representative of the Licensee (DROL)

The following table identifies CNL staff who are designated and authorized to communicate with and make commitments to CNSC staff on behalf of CNL, as defined in 3.1

4.1.1 Executive/Senior Team

Name	Designated Role	Area of Representation
[redacted]	President and Chief Executive Officer	Canadian Nuclear Laboratories
[redacted]	Chief Operating Officer	Chief Operating Officer
[redacted]	Vice President, Central Technical Authority and Chief Nuclear Officer	Central Technical Authority
[redacted]	Deputy Vice President, Central Technical Authority	Central Technical Authority
[redacted]	Vice-President, Science and Technology	Science & Technology (S&T)
[redacted]	Vice-President, Environmental Remediation Management and Stewardship and Renewal Group	Environmental Remediation Management (ERM) & Stewardship and Renewal Group (SRG)
[redacted]	Vice-President, Health, Safety, Security and Environment	Health, Safety, Security and Environment (HSSE)
[redacted]	Vice-President, Legal and Insurance	Legal and Insurance
[redacted]	Vice-President, Corporate Affairs	Corporate Affairs

4.1.2 Licence Holders

Name	Designated Role	Site and Licence
[redacted]	Vice President, Central Technical Authority and Chief Nuclear Officer	Chalk River Laboratories Licence NRTEOL-01.00/2028
[redacted]	General Manager, Historic Waste Program	Port Hope Area Initiative Licence WNSL-W1-2310.00/2032 Low Level Radioactive Waste Management Office (Historic Waste) WNSL-W2-2202.0/2026 Low Level Waste Programs Licence 15193-5-23.0
[redacted]	General Manager & Deputy VP, ERM	Whiteshell Laboratories Licence NRTEDL-W5-8.00/2024 Gentilly-1 Waste Facility Licence WFDL-W4-331.00/2034 Douglas Point Waste Facility Licence WFDL-W4-332.03/2030 Nuclear Power Demonstration (NPD) Waste Facility Licence WFDL-W4-342.00/2034
[redacted]	Director, S&T Facilities Operations	La Prade Site Licence 15193-4-26.1
[redacted]	Manager, CRL Dosimetry Services	Dosimetry Services Licence 15193-1-26.3
[redacted]	General Counsel	Export & Import Compliance (see section 4.3.1 for Licences)

4.1.3 Licensing & Regulatory Programs

Name	Designated Role	Area of Representation
[redacted]	Chief Regulatory Officer	Canadian Nuclear Laboratories
[redacted]	Chief Security Officer	Canadian Nuclear Laboratories
[redacted]	Manager, Regulatory Affairs	Chalk River Laboratories
[redacted]	Manager, ERM Licensing Support	Environmental Remediation Management
[redacted]	Manager, WL Licensing and End State	Whiteshell Laboratories
[redacted]	Manager, Programs and Compliance	Port Hope Area Initiative (PHAI)

4.1.4 Safety and Control Areas

Name	Designated Role	Area of Representation
[redacted]	Director, Operational Excellence	1.1 Management System 2.1 Human Performance Management 2.2 Training Program 2.3 Staffing and Certification 13.1 Safeguards and non-Proliferation
[redacted]	Deputy Vice President, Central Technical Authority	3.1 Operating Performance
[redacted]	General Manager, Engineering	4.1 Safety Analysis 4.2 Nuclear Criticality Safety 5.1 Physical Design 5.2 Pressure Boundary and Authorized Inspection Agency 6.1 Fitness for Service
[redacted]	Director, Corporate Radiation Protection	7.1 Radiation Protection
[redacted]	Director, Corporate Occupational Health & Safety	8.1 Conventional Health and Safety
[redacted]	Director, Corporate Environmental Services	9.1 Environmental Protection
[redacted]	Director, Corporate Fire & Emergency Preparedness	10.1 Emergency Management 10.2 Fire Protection
[redacted]	Director, Corporate Security	12. 1 Security
[redacted]	Acting, Chief Information Officer	12.1 Cyber Security
[redacted]	Acting Director, ERM Integrated Functional Support Service	11.1 Waste Management 11.2 Decommissioning 14.1 Packaging and Transport
[redacted]	Director, Corporate Communications	G.6: Public Information and Disclosure Program (Including Indigenous Engagement)
[redacted]	Manager, Export Import Compliance	Import/ Export Compliance

4.1.5 Projects

Name	Designated Role	Area of Representation
[redacted]	Deputy Vice President, Integrated Waste Services	Near Surface Disposal Facility (NSDF)
[redacted]	Director, Fuel Programme & Projects Development	Fuel Programme & Projects
[redacted]	Director, NPD & WR-1 Reactor Decommissioning	NPD & WR-1 Reactor Decommissioning

4.1.6 CRL Nuclear Facilities

Name	Designated Role	Area of Representation
[redacted]	EOC Commanders[1]	Emergency Operations Centre (EOC) – Chalk River Laboratories
Class I Facilities		
[redacted]	Facility Authority	Recycle Fuel Fabrication Laboratories (RFFL) Tritium Laboratory (B215) Combined Electrolysis Catalytic and Exchange Upgrade and Detritiation Test Facility (CECEUD)
[redacted]	Facility Authority	ZED-2 Reactor Nuclear Fuel Fabrication Facility (NFFF), Building 405
[redacted]	Facility Authority	Universal Cells Fuels and Materials Cells Molybdenum-99 Production Facility
[redacted]	Facility Authority	Waste Treatment Centre and Associated Facilities
[redacted]	Facility Authority	Waste Management Areas
Class II Facilities		
[redacted]	Facility Authority	Gamma Beam 150C Irradiation Facility Gamma Beam Irradiators Model GC60 Health Physics Neutron Generator

[1] Employees listed are only considered DROLs when they are acting in the position of EOC Commander

Name	Designated Role	Area of Representation
[redacted]	Facility Authority	Van de Graaff Accelerator
CRL Nuclear Facilities in Extended Shutdown State		
[redacted]	Facility Authority	MAPLE 1 and 2 Reactors New Processing Facility
CRL Nuclear Facilities Undergoing Decommissioning Activities		
[redacted]	Facility Authority	NRX Reactor (B100, B100A) NRX Reactor Ancillary Building (B100x) NRX Reactor Ancillary Buildings (B103, B104) NRX Reactor Ancillary Buildings (B101, B101x, B122) NRX Reactor Ancillary Building (B126) Former Reactor Bay Deionization System (B200A) NRX Fuel Storage and Handling Bays (B204) Plutonium Recovery Laboratory (B220) Plutonium Tower (B223) Waste Water Evaporator (B228) Active Waste Disposal (B240, B241)
[redacted]	Facility Authority	Building 250 including former Tritium Laboratory and Radio Isotope labs Nuclear Fuel Fabrication Facility (NFFF) (B429A/B)
CRL Permanently Shut Down Facilities		
[redacted]	Facility Authority	NRU

4.1.7 Whiteshell Nuclear Facilities

Name	Designated Role	Area of Representation
[redacted]	EOC Commanders[1]	Emergency Operations Centre (EOC) – Whiteshell Laboratories
Nuclear Facilities		
[redacted]	Facility Authority	Concrete Canister Storage Facility Waste Management Area

Name	Designated Role	Area of Representation
[redacted]	Facility Authority	Health and Safety (Building 402) Research and Development (Building 300) Shielded Facilities
WL Permanently Shut Down Facilities		
[redacted]	Facility Authority	WR-1 Reactor

4.1.8 Prototype Reactors

Name	Designated Role	Area of Representation
[redacted]	Facility Authority	Gentilly-1 Waste Facility Douglas Point Waste Facility
[redacted]	Facility Authority	NPD Waste Facility

4.1.9 Port Hope Area Initiative

Name	Designated Role	Area of Representation
[redacted]	Manager, Programs & Compliance	Long-Term Low-Level Radioactive Waste Management Facility – Port Hope Port Hope Radioactive Waste Management Facility (Strachan Street Consolidation Site, Pine Street North Extension Consolidation Site and Waste Treatment Plan Temporary Storage Site) Historic Waste Program Environmental Laboratory Historic Waste Program Pine Street Extension Temporary Storage Site (PSE TSS) Historic Waste Program Management Office Long-Term Low-Level Radioactive Waste Management Facility – Port Granby

4.1.10 La Prade

Name	Designated Role	Area of Representation
[redacted]	Director, S&T Facilities Operations	La Prade Site

4.2 Building, Facility and Other Contacts

For a list of Primary and Secondary Contacts for various facility and laboratories, see Appendix A. The list of Primary and Secondary Contacts are not considered DROLs and is provided for informational purposes only.

4.3 Licences & Certificates

4.3.1 CNSC Licences and Certificates

Number	Title	Expiry	Comment
Chalk River Laboratories			
NRTEOL-01.00/2028	Nuclear Research and Test Establishment Operating Licence, Chalk River Laboratories	2028 Mar 31	
NRTEOL-LCH-01.00/2028	Licence Conditions Handbook for Chalk River Laboratories	N/A	Revision 3 Effective 2023 Feb 14
15193-1-26.4	Dosimetry Service Licence	2026 May 31	
EL-01.00/2031	Export Licence	2031 Jul 31	
EL-A1-29053.1/2023	Export Licence	2023 Jun 30	
EL-A1-29724.0/2024	Export Licence	2024 May 31	
EL A1 A4 28008.1/2023	Export Licence	2023 Jul 31	
EL-A1-A4-29196.0/2023	Export Licence	2023 Dec 31	
EL A1 B1 28732.0/2023	Export Licence	2023 Dec 31	
EL A1 B1 29032.0/2023	Export Licence	2023 Jul 31	
EL-A3-29675.0/2023	Export Licence	2023 Aug 31	
EL A4 26880.1/2024	Export Licence	2024 Sep 30	
EL A4 28928.0/2027	Export Licence	2027 Apr 30	
EL-A4-29235.0/2023	Export Licence	2023 Sep 30	
EL-A4-29536.0/2024	Export Licence	2024 Mar 31	
EL B1 27857.0/2025	Export Licence	2025 Dec 31	
EL B1 27875.0/2025	Export Licence	2025 Dec 31	
EL B1 28924.0/2024	Export Licence	2024 Dec 31	
EL-B2-29230.0/2023	Export Licence	2023 Aug 31	

Number	Title	Expiry	Comment
EL B3 27924.0/2025	Export Licence	2025 Dec 31	
EL B3 27925.0/2025	Export Licence	2025 Dec 31	
EL B3 28075.0/2023	Export Licence	2023 Dec 31	
EL B3 28731.0/2023	Export Licence	2025 Aug 1	
IL-01.00/2031	Import Licence	2031 Jul 31	
IL A1 27152.0/2025	Import Licence	2025 Dec 31	
IL-A1-29092.0/2023	Import Licence	2023 Dec 31	
IL-A1-29405.0/2024	Import Licence	2024 Mar 31	
IL A1 B1 28350.0/2023	Import Licence	2023 June 30	
IL A1 B1 28739.0/2023	Import Licence	2023 Dec 31	
IL A4 27449.0/2025	Import Licence	2025 Mar 31	
IL A4 28929.0/2027	Import Licence	2027 Apr 30	
IL-A4-29487.0/2024	Import Licence	2024 Feb 29	
IL-A4-29535.0/2024	Import Licence	2024 Mar 31	
IL B1 29273.0/2023	Import Licence	2023 Dec 31	
C2-234-0002-4-2047	Class II Prescribed Equipment Certificate - Hopewell Designs GC60 Series Gamma Beam Irradiator	2047 Jan 31	
C2-041-0001-1-2036	Class II Prescribed Equipment Certificate - Texas Nuclear Neutron Generator 150-1H	2036 Jan 31	
C2-513-0001-0-2036	Class II Prescribed Equipment Certificate - Adelphi Technology DD-109 Neutron Generator	2036 Nov 30	
C2-513-0005-0-2045	Class II Prescribed Equipment Certificate - Adelphi Technology DT108API Neutron Generator	2045 May 31	
C2-005-0027-1-2036	Class II Prescribed Equipment Certificate - MDS Nordion Gammabeam 150C	2036 Nov 30	
C2-234-0006-0-2037	Class II Prescribed Equipment Certificate - Hopewell Designs GC60-1000	2037 Sep 30	

Number	Title	Expiry	Comment
Van de Graaff Electron Accelerator	Class II Prescribed Equipment	N/A	As per 153-NOAC-12-0001-L no certification is required.
R-005-0016-3-2032	Radiation Device Certificate - MDS Nordion Gammacell 220/220 Excel	2032 May 31	
R-005-0031-2-2032	Radiation Device Certificate - MDS Nordion Gammacell 200	2032 May 31	
R-061-2032-5-2026	Radiation Device Certificate - QSA Global Models 680B and 680E	2026 May 31	
Whiteshell Laboratories			
NRTEDL-W5-8.00/2024	Nuclear Research and Test Establishment Decommissioning Licence, Whiteshell Laboratories	2024 Dec 31	
NRTEDL-LCH-08.00/2024	Licence Conditions Handbook for Whiteshell Laboratories	N/A	Revision 1 Effective 2023 Apr 03
Prototype Reactors			
WFDL-W4-342.00/2034	Waste Facility Decommissioning Licence, Nuclear Power Demonstration (NPD)	2034 Dec 31	
WFDL-LCH-W4-342.00/2034	Licence Conditions Handbook for Nuclear Power Demonstration (NPD)	N/A	Revision 1 Effective 2019 Apr 12
WFDL-W4-332.03/2030	Waste Facility Decommissioning Licence, Douglas Point	2030 Dec 31	
WFDL-LCH-W4-332.03/2030	Licence Conditions Handbook for Douglas Point	N/A	Revision 1 Effective 2021 Jun 11
WFDL-W4-331.00/2034	Waste Facility Decommissioning Licence, Gentilly-1	2034 Dec 31	
WFDL-LCH-W4-331.00/2034	Licence Conditions Handbook for Gentilly-1	N/A	Revision 1 Effective 2019 Jul 15
Port Hope Area Initiative			
WNSL-W1-2310.00/2032	Waste Nuclear Substance Licence, Port Hope Area Initiative Waste Management Project	2032 Dec 31	
WNSL-W1-2310.00/2032	Licence Conditions Handbook for Port Hope Area Initiative	N/A	Revision 0 Effective 2023 Jan 01

Number	Title	Expiry	Comment
WNSL-W2-2202.0/2026	Waste Nuclear Substance Licence, Low Level Radioactive Waste Management Office (Historic Waste)	2026 Nov 30	
15193-5-23.0	Nuclear Substance and Radiation Devices Licence, Historic Waste Program Management Office, Port Hope	2023 Sep 30	
La Prade			
15193-4-26.0	Nuclear Substance and Radiation Devices Licence, La Prade	2026 Sep 30	
Transport Packages and Licences			
Shipping Certificates	Various CNSC certificates for transport packages used by CNL for shipping off-site.	N/A	List is separately maintained by the Transportation of Dangerous Goods Functional Support Area.
TL-S-15193-44.00/2023	CRL Onsite Licence to Transport	2023 Dec 31	

4.3.2 Other Licences, Certificates and Permits

Number	Title	Expiry	Comment
ISO Certifications and Accreditations			
SAI Global CERT-0139267 (file no. 000255 and 026248)	ISO 9001:2015 Quality Management System Certification for Canadian Nuclear Laboratories	2024 Apr 20	Scope of activities and CNL sites is defined on certificate.
SAI Global CERT-0121355 (file no. 026360 and 1611199)	ISO 14001:2015 Environmental Management System Certification for Canadian Nuclear Laboratories	2024 Jul 18	Scope of activities and CNL sites is defined on certificate.
SAI Global CERT-0138137 (file no. 000255)	Conformance to Drinking Water Quality Management Standard Version 2 -2017		Issued 2021 Mar 11 CRL
Canadian Association for Laboratory Accreditation Inc. (CALA) Cert: 1002677	ISO/IEC 17025:2017 for CNL, CRL Analytical Chemistry Branch	2025 May 02	Accreditation is limited to those tests in the laboratory's scope of testing.

Number	Title	Expiry	Comment
Standards Council of Canada File no. 151230	Good Laboratory Practice (GLP) Facility-Only recognition	2023 Dec 31	
TSSA Pressure Boundary Certifications			
QA 84	Manufacture of pressure vessels at CRL only in accordance with ASME Boiler and Pressure Vessel Code, Section VIII, Division 1 and CSA Standard B51, Boiler, Pressure Vessel and Pressure Piping Code	2024 Sep 23	CRL
QA 230	Repair of ASME Section VIII, Div.1, pressure relief valves using original equipment manufactured parts at CRL only in accordance with CSA Standard B51, Boiler, Pressure Vessel and Pressure Piping Code. Special Processes are limited to Machining. Test Media shall include Air/Gas and Liquid.	2024 Sep 23	CRL
QA 379	Construction and Shop Assembly of Class 1, 1C, 2, 2-C, 3, and 3-C Piping Systems at CRL only in accordance with CSA Standard N285.0, General Requirements for Pressure Retaining Systems and Components in CANDU Nuclear Power Plants.	2024 Sep 23	CRL
QA 00547	Repair and alteration of boilers, pressure vessels, piping and Category A, B, D, E and H type fittings at CRL only in accordance with CSA Standard B51, Boiler, Pressure Vessel and Pressure Piping Code.	2024 Sep 23	CRL
QA 00548	Fabrication, assembly and erection of power piping at CRL only in accordance with CSA Standard B51, Boiler, Pressure Vessel and Pressure Piping Code and ASME B31.1 Power Piping	2024 Sep 23	CRL
QA 00549	Fabrication, assembly and erection of process piping at CRL only in accordance with CSA Standards B51, Boiler, Pressure Vessel and Pressure Piping Code and ASME B31.3 Process Piping.	2024 Sep 23	CRL

Number	Title	Expiry	Comment
QA 02107	Fabrication of Class 1, 2, 3, and 4 Welded and Non-welded Supports; with and without Design Responsibility; At CRL only in accordance with CSA Standard N285.0, General Requirements for Pressure Retaining Systems and Components in CANDU Nuclear Power Plants.	2024 Sep 23	CRL
QA 05178	Fabrication of Class 1, 1C, 2, 2C, 3, 3C and 4 Welded and Non-welded Category A, B, D, E, and H type Fittings, with and without Design Responsibility at CRL only in accordance with CSA Standard N285.0, Requirements for Pressure Retaining Systems and Components in CANDU Nuclear Power Plants.	2024 Sep 23	CRL
QA 02716	Fabrication of welded and non-welded Category A, B, D, E & H type Fittings at CRL only in accordance with CSA Standard B51, Boiler, Pressure Vessel and Pressure Piping Code.	2024 Sep 23	CRL
QA 03880	Fabrication, assembly and erection of refrigeration piping at CRL only in accordance with CSA Standard B52, Mechanical Refrigeration Code and ASME B31.5 Refrigeration Piping.	2024 Sep 23	CRL
QA 02180	Repairs, Modifications or Replacements of Class 1, 1C, 2, 2C, 3, 3C and 4 Nuclear Items; At CRL only in accordance with CSA Standard N285.0, General Requirements for Pressure Retaining Systems and Components in CANDU Nuclear Power Plants.	2024 Sep 23	CRL
TSSA	Various certificates of inspection (C of I) for pressure vessels issued by TSSA		
TSSA R-1415	Certificate of Registration of a Plant (CRL, Building 420 (Powerhouse))		
TSSA	Various Licences for Elevators and Lifting Devices – Issued by TSSA, posted on the applicable equipment (at CRL)		

Number	Title	Expiry	Comment
MB-21-014	Certificate of Authorization Issued in Accordance with Manitoba Steam and Pressure Plants Act S210 and CSA B51	2024 Aug 10	WL
Environment			
Permit No. 1093102	Licence to Collect Fish for Scientific Purposes; issued by Ontario Ministry of Natural Resources	2024 Oct 30	CRL
Permit SARA-OR-2018-0434	Permit allowing for Long Term Blanding's Turtle Monitoring; issued by Canada Wildlife Service	2023 Jan 30	CRL
ENVP-ECCN-18-001-L	Letter of Advice issued by ECCC to ensure that the four Barn Swallow condos are available to the species at least until 2027.	2027 Dec 31	A letter resulting from the Barn Swallow monitoring activities under prior permit application (EnvP-18-004).
FHR-PER-23001 through FHR-PER-23016	Federal Halocarbon Regulations Permits to Charge a Fire-Extinguishing System; issued by Environment and Climate Change Canada (ECCC)	2026 May 10	A total of 16 permits to charge fire-extinguishing systems at CRL's Recycled Fuel Fabrication Laboratories; a request by CNL is required annually.
A 413105	Ontario Ministry of the Environment, Provisional Certificate of Approval – Waste Disposal Site		CRL
3-0944-77-006	Certificate of Sewage Works. Issued by the Ministry of the Environment, Ontario Approval to construct a 0.16 MGD physical chemical sanitary wastewater treatment plant		
Permit No. WB14720	Wildlife Scientific Permit - Issued by Fisheries Branch of Manitoba Conservation and Water Stewardship		WL
Permit No. 09-13	Scientific Collection Permit - Issued by Fisheries Branch of Manitoba Conservation and Water Stewardship		WL

Number	Title	Expiry	Comment
Transportation			
181-307-638117	Ontario Ministry of Transportation - Commercial Vehicle Operator Registration (CVOR) Certificate		CRL
MVIS 41-55210	Ontario Ministry of Transportation - Motor Vehicle Inspection Station Licence		CRL
0076522978-C	Propane Conversion Licence		CRL
Engineering			
100216258	Professional Engineers of Ontario Certificate of Authorization		
5993	Engineers Geoscientists Manitoba Certificate of Authorization		
F1402	Association of Professional Engineers and Geoscientists of New Brunswick Certificate of Authorization		
Various Certificates	Stationary Engineer Certificates for the Power Plant Chief Operating Engineer, Shift Engineers and Operators		CRL
Canadian Border Services Agency			
12060	Canadian Border Services Agency (CBSA) Partners in Protection (PIP) Program		A Signed Memorandum of Understanding (MoU) 2013 Dec
47302992	U.S. Customs and Border Protection (CBP) Customs – Trade Partnership Against Terrorism (C-TPAT) Program		Accepted to program 2012 Mar
Royal Canadian Mounted Police			
128432225.0003	Royal Canadian Mounted Police Firearms Business Licence CRL	2023 Oct 20	
12843745.0005	Royal Canadian Mounted Police Firearms Business Licence WL	2023 Dec 31	
Radiobiology & Health			
Canadian Council on Animal Care	Good Animal Practices (GAP)		Issued 2023 Mar 27

Number	Title	Expiry	Comment
L-R2-55355-23-YL-00	Public Health Agency of Canada Risk Group 2 Pathogen and Toxin Licence Risk Group 2 Terrestrial Animal Pathogen Permit	2028 Feb 07	Containment Level 2
Various Other Licences			
EW-2022-0316	Electricity Wholesaler Licence issued by Ontario Energy Board for CRL	2027 Dec 14	
AECLR1	Canadian Welding Bureau CSA W47.1 Certification of Companies for Fusion Welding of Steel	2023 Feb 05	
CA-00296 CA-00750	Canadian Wood Packaging Certification Program Participation – issued by Canadian Food Inspection Agency		
Company Code 80002690	Site Radio Licences (various) issued by Industry Canada		CRL and WL
010041105-001	UHF Radio Licence		Gentilly-1
010321051-001	CB Radio Licence		La Prade
010469485-001	CB Radio Repeater Licence		La Prade

5. Facility & Laboratory Documentation

This section covers the index to documents for Facilities at CRL, WL, the Prototype Reactors as well as other off-site locations listed from Section 4.1.6 to Section 4.1.10, along with Radioisotope Laboratory Protocols for the laboratories listed in Appendix A.

The information includes the organization responsible for the safe operation or decommissioning of the facility or laboratory.

5.1 CRL Nuclear Facilities

Facility	Organization	Applicable Document(s)
Class I Nuclear Facilities		
Nuclear Fuel Fabrication Facility (NFFF), Building 405	Science & Technology	B405-00583-FA-001, *Facility Authorization for the Operation of the Nuclear Fuel Fabrication Facility Building 405 at the Chalk River Laboratories,* Revision 6, 2019 May
		NFFF-03500-SAR-001, *Safety Analysis Report for the Nuclear Fuel Fabrication Facilities Building 405 and 429*, Revision 2, 2014 September

Facility	Organization	Applicable Document(s)
		NFFF-123450-CSD-002, *Criticality Safety Document - Nuclear Fuel Fabrication Facility, Building 405, CRL (CSD-21),* Revision 10, 2021 October
Recycle Fuel Fabrication Laboratories (RFFL)	Science & Technology	RFFL-00583-FA-001, *Facility Authorization for the Operation of the Recycle Fuel Fabrication Laboratories at the Chalk River Laboratories,* Revision 6, 2011 October
		RFFL-03500-SAR-001, *The Recycle Fuel Fabrication Laboratories Safety Analysis Report,* Revision 5, 2011 September
		RFFL-123400-CSD-001, *Recycle Fuel Fabrication Laboratories (RFFL), Building 375, CRL (CSD-3*), Revision 4, 2017 October
ZED-2 Reactor	Science & Technology	ZED2-00583-FA-001, *Facility Authorization for the Operation of the ZED-2 Reactor at the Chalk River Laboratories,* Revision 8, 2018 June.
		ZED2-03500-FSAR-001*, Final Safety Analysis Report – Safety Analysis of the ZED-2 Reactor*, Revision 8, 2018 May
		ZED2-123450-CSD-001, *ZED-2 Reactor Nuclear Criticality Controlled Area, Building 145, Chalk River Laboratories (CSD-37),* Revision 1, 2015 December
Universal Cells	Science & Technology	9410-00583-FA-001, *Facility Authorization for Building 234 Universal Cells (formerly AECL-FA-06),* Revision 4, 2019 July
		9410-03500-FSAR-001, Final Safety Analysis Report for Building 234 Universal Cells, Revision 3, 2018 April
		B234-123450-CSD-001, *Universal Cells, Building 234, CRL (CSD-28),* Revision 3, 2016 October
Fuels and Materials Cells	Science & Technology	*9420-00583-FA-001, Facility Authorization for Fuels and Materials Cells (formerly AECL-FA-17),* Revision 5, 2019 July
		9420-03500-SAR-001, *Safety Analysis of the Fuels and Materials Cells at the Chalk River Laboratories*, Revision 5, 2012 July
		9420-123400-CSD-001, *Fuels and Materials Cells Facility, Building 375 (CSD-49),* Revision 3, 2017 June
Molybdenum-99 Production Facility	Science & Technology	MPF-00583-FA-001, *Facility Authorization for the Operation of the Molybdenum-99 Production Facility at the Chalk River Laboratories,* Revision 10, 2020 February

Facility	Organization	Applicable Document(s)
		CRNL-1537, *Molybdenum-99 Production Facility* Safety Analysis Report, Revision 2, 1993 July
		CRNL-1537, Addendum 2, *Final Safety Analysis Report for the Fissile Solution Storage Tank. Addendum 2 to the CRNL-1537 (Rev. 2, 1993 July)*, Revision 1, 1994 June
		MPF-123450-CSD-001, Criticality Safety for the Storage and Retrieval of TRM in FISST (CSD-1), Revision 4, 2017 November
		MPF-03340-CSD-002, *Molybdenum-99 Production Facility, Building 225, CRL (CSD-42*), Revision 1, 2011 June
Tritium Laboratory	Science & Technology	TF-00583-FA-002, *Facility Authorization for the Operation of the Tritium Facility (Building 215) at the Chalk River Laboratories,* Revision 2, 2019 May.
		TF-508770-SAR-001, *Safety Analysis Report for the Building 215 Tritium Facility*, Revision 1, 2018 December
Combined Electrolysis and Catalytic Exchange Upgrading and Detritiation Test Facility	Science & Technology	CECEUD-00583-FA-001, *Facility Authorization for the Operation of the Combined Electrolysis and Catalytic Exchange Upgrading and Detritiation (CECEUD) Test Facility at the Chalk River Laboratories,* Revision 5, 2016 February
		CECEUD-05410-004-NSN (NSN-SRSD-212*), The CCE Upgrading/Detritiation Test Facility Safety Analysis Report - Detritiation Demonstration*, Revision 2, 2000 Nov
		CECEUD-05410-004-NSN (NSN-SRSD-212*), The CCE Upgrading/Detritiation Test Facility Safety Analysis Report - Detritiation Demonstration*, Revision 1, 1997 March
		CECEUD-102320-SSSA-001, *CECE Upgrading and Detritiation Test Facility Safe Shutdown State Report*, Revision 1, 2014 December
Waste Treatment Centre and Associated Facilities	Environmental Remediation Management	WTC-00583-FA-001, *Facility Authorization for the Operation of the Waste Treatment Centre and Associated Facilities at the Chalk River Laboratories,* Revision 8, 2018 June
		WTC-03500-SAR-001, *Safety Analysis of the Waste Treatment Centre and the Associated Facilities*, Revision 2, 2018 June

Facility	Organization	Applicable Document(s)
		WTC-508770-SAR-001_AD3*, Addendum 3 to the Safety and Hazard Review of the Waste treatment Centre, AECL-MISC-304 (Revision 0) - Active Area Liquid Waste Facilities,* Revision 0, 2006 September
		WTC-123450-CSD-001, *Criticality Safety Document, Waste Treatment Centre B222 Tanks and B205X Guard Tank (CSD-52),* Revision 1, 2015 May
		B538-12345-CSD-001, *CSD-22 Waste Tank Farm*, Revision 0, 2017 October
Waste Management Areas	Environmental Remediation Management	WMA-00583-FA-001, *Facility Authorization for the Operation of the Waste Management Areas at the Chalk River Laboratories,* Revision 17, 2020 September
		Waste Management Areas Safety Analysis Report (Part A) Non -Operating Facilities, WMA-508770-SAR-001, Revision 1, 2018 January
		Waste Management Areas Safety Analysis Report (Part B) Operating Facilities, WMA-508770-SAR-002, Revision 1, 2019 April
		THRR-03610-FSAR-001, *Final Safety Analysis Report for the Fuel Packaging and Storage Facility*, Revision 4, 2017 October
		THRR-106660-CSD-002*, Fuel Packaging and Storage Facility, Building 584, CRL (CSD-65),* Revision 3, 2015 July
		WMA-123450-CSD-001, *Criticality Safety Document - Chemical Pit,* Revision 0, 2007 March
		WMA-123450-CSD-002, *Criticality Safety Document - Reactor Active Drain Liquid Disposal Area*, Revision 0, 2007 May
		WMA-123450-CSD-003, *Criticality Safety Document for the WMO Transfer Flask*, Revision 6, 2017 March
		WMA-123450-CSD-004, *Criticality Safety Document for the Storage of Fissionable Materials in Concrete Lined Cribs CLC-1 to CLC-3 and the GP-18 Galvanized Steel Standpipes in Waste Management Area "B",* Revision 2, 2008 July
		WMA-123450-CSD-005, *Storage of Fissionable Materials in CD Bunkers, and CF, CW, IRP and Rod Tile Holes in Waste Management Area B, CRL (CSD-32),* Revision 11, 2021 February

Facility	Organization	Applicable Document(s)
		WMA-123450-CSD-006, *Storage of Fissionable Materials in the IMD and IFE Series Tile Holes, Waste Management Area B, CRL (CSD-13A),* Revision 2, 2013 December
		WMA-123450-CSD-007, *Storage and Retrieval of Fissionable Materials in the IMD and IFE Series Tile Holes, Waste Management Area B, CRL (CSD-13B)*, Revision 1, 2017 March
		WMA-123450-CSD-008, *Cemented Molybdenum-99 Waste (CMW) Retrieval from Irradiated Rod Part (IRP) Tile Holes in Waste Management Area "B" (CSD-69),* Revision 1, 2014 June
		WMA-123450-CSD-009, *Dry Transfer System (DTS)-XL Flask (CSD-71)*, Revision 3, 2021 October
		WMA-123450-CSD-010, *Storage of Fissionable Materials in the Dry-Storage Facility Concrete Canisters in Waste Management Area G, CRL (CSD-30)*, Revision 2, 2022 May
		SMAGS-03340-CSD-001, *Criticality Safety Document CSD-61 for the Storage of Fissionable Materials in the SMAGS Buildings in Waste Management Area H*, Revision 3, 2007 November
Class II Nuclear Facilities		
Health Physics Neutron Generator	Science & Technology	HPNG-00583-FA-001, *Facility Authorization for the Operation of the Health Physics Neutron Generator at the Chalk River Laboratories,* Revision 13, 2022 April
		HPNG-03500-SAR-001, *Safety Analysis of the Health Physics Neutron Generator Facility*, Revision 7, 2022 April
Gamma Beam 150C Irradiation Facility	Science & Technology	GBF-00583-FA-001, *Facility Authorization for the Operation of the Gamma Beam Irradiation Facility at the Chalk River Laboratories,* Revision 7, 2015 September
		GBF-03500-SAR-001, *Safety Analysis of the Gamma Beam Irradiation Facility at Chalk River Laboratories*, Revision 4, 2015 September
Gamma Beam Irradiator Model GC60	Science & Technology	203-00583-FA-001, *Facility Authorization for the Operation of the GC60 Gamma Irradiator at the Chalk River Laboratories,* Revision 7, 2018 October

Facility	Organization	Applicable Document(s)
		203-03500-SAR-001, *Safety Analysis for the GC60 Gamma Irradiator at the Chalk River Laboratories*, Revision 3, 2018 October
Van de Graaff Accelerator	Science & Technology	B320-00583-FA-001, *Facility Authorization for the Operation of the Van de Graaff Accelerator at the Chalk River Laboratories,* Revision 4, 2014 September.
		B320-03500-SAR-001, *Safety Analysis of the Van De Graaff Accelerator at the Chalk River Laboratories*, Revision 4, 2014 September
Nuclear Facilities in Extended Shutdown		
MAPLE 1 and 2 Reactors	Environmental Remediation Management	6425-05410-OLC-001, *Maple Reactors Operations Limits and Conditions,* Revision 29, 2018 November
New Processing Facility		6424-05410-OLC-001, *NPF Operations Limits and Conditions,* Revision 8, 2009 April
Permanently Shutdown Facilities		
NRU Reactor	Environmental Remediation Management	NRU-00583-FA-001, *Facility Authorization for the Operation of the NRU Reactor at the Chalk River Laboratories,* Revision 17, 2018 July
		NRU-01320-SAR-001, *NRU Reactor Safety Analysis Report,* Revision 3, 2016 March
		NRU-508770-NSN-002, *Nuclear Safety Note for NRU Permanent Shutdown*, Revision 0, 2017 October
		RSB-123450-CSD-001, *Building 150 Rod Storage Bays Criticality Safety Document (CSD-4B),* Revision 2, 2022 January
Nuclear Facilities Undergoing Decommissioning Activities		
Plutonium Tower	Environmental Remediation Management	B223-508310-DDP-001, *Detailed Decommissioning Plan, Building 223 Decommissioning,* Revision 3, 2012 April
		B223-508330-SWS-001, *B223 Plutonium Tower Storage with Surveillance Plan, Building 223 Decommissioning,* Revision 3, 2015 December
NRX Reactor	Environmental Remediation Management	B100-508330-SWS-001, *Storage With Surveillance Plan: NRX Reactor Facility Storage With Surveillance Plan (Buildings 100, 100X, 101, 101X, 103, 104, 122, 126, and 204),* Revision 4, 2018 January
		B100-508310-DDP-001, *Detailed Decommissioning Plan for the Interior Demolition (Stage 1) of Buildings 100, 100A at CRL,* Revision 2, 2019 August.

Facility	Organization	Applicable Document(s)
NRX Ancillary Buildings	Environmental Remediation Management	NRXMF-508310-DDP-001, D*etailed Decommissioning Plan for: Heavy Water Salvage: Building 100X, Fan House: Building 101, Filter House: Building 101X, Valve House & Delay Tank No. 1: Building 103, Valve House & Delay Tank No. 2: Building 104, Exhaust Stack Base: Building 122, Effluent Monitoring: Building 126, and Above Ground Ventilation Stack Duct: Building 157,* Revision 3, 2012 July
		B100-508330-SWS-001, *Storage With Surveillance Plan: NRX Reactor Facility Storage With Surveillance Plan (Buildings 100, 100X, 101, 101X, 103, 104, 122, 126, and 204),* Revision 4, 2018 January
Waste Water Evaporator	Environmental Remediation Management	B228-508310-DDP-001, *Detailed Decommissioning Plan for Building 228 Decommissioning,* Revision 2, 2012 April
		B228-508330-SWS-001,*The Waste Water Evaporator (Building 228) Storage with Surveillance Plan for Building 228 Decommissioning,* Revision 2, 2012 April
Plutonium Recovery Laboratory	Environmental Remediation Management	B220-508330-SWS-001, *B220 Storage with Surveillance Plan,* Revision 4, 2023 June
		B220-508310-DDP-001, *B220 Detailed Decommissioning Plan,* Revision 2, 2014 September
NRX Fuel Storage and Handling Bays	Environmental Remediation Management	B204-508310-DDP-001, *Detailed Decommissioning Plan (DDP) for Building 204A/B Fuel Rod Storage and Handling Bays at Chalk River Laboratories (CRL),* Revision 3, 2014 September
		B100-508330-SWS-001, *Storage With Surveillance Plan: NRX Reactor Facility Storage With Surveillance Plan (Buildings 100, 100X, 101, 101X, 103, 104, 122, 126, and 204),* Revision 4, 2018 January
Nuclear Fuel Fabrication Facility (NFFF), Buildings 429 A/B	Environmental Remediation Management	B429-508310-DDP-001, *Detailed Decommissioning Plan for Building 429*, Revision 3, 2019 March Note: Storage with Surveillance (SWS) Plan is included in this document.
Tritium Laboratory (B250)	Environmental Remediation Management	B250-508310-DDP-001, *Detailed Decommissioning Plan for Building 250*, Revision 2, 2019 June Note: Storage with Surveillance (SWS) Plan is included in this document.

Facility	Organization	Applicable Document(s)
Active Waste Disposal	Environmental Remediation Management	B240-508310-SWS-001, *Storage with Surveillance Plan B240/241 – Active Waste Disposal System,* Revision 0, 2015 April B240-508310-DDP-001, *Detailed Decommissioning Plan for Building 240 and Building 241 (CRL),* Revision 2, 2019 January.
Class A Radioisotope Laboratories		
Tritium Laboratory	Science & Technology	TF-508740-RLP-002, *Class A Radioisotope Laboratory Protocol for the Tritium Facility / Building 215, Room 153, 155, 156, 157, 158, 163, and 164*, Revision 0, 2018 March.
Class B Radioisotope Laboratories		
Active Wet Chemistry Laboratory	Science & Technology	B320-108360-RLP-005, *Class B for Active Wet Chemistry Laboratory, Building 320, Room 324,* Revision 2, 2019 March
Chalk River Advanced CANDU Fuel Development Laboratories	Science & Technology	B375-124200-RLP-002, *Class B Radioisotope Laboratory Protocol For Building 375, Room 43, Chalk River Advanced Fuel Technology Section Laboratory,* Revision 5, 2022 April
Chalk River Advanced Fuel Technology (CRAFT) - Ceramics Laboratories	Science & Technology	B375-124200-RLP-001, *Chalk River Advanced Fuel Technology Ceramics Section Laboratories, Bld. 375, Rooms 258-262,* Revision 2, 2017 September
Chromatography Laboratory	Science & Technology	B320-108360-RLP-002, *Class B Radioisotope Laboratory Protocol For Building 320, Rooms 317,318/319 And 320, The Chromatography Laboratory,* Revision 2, 2021 April
Containment Chemistry & Gammacell Laboratories	Science & Technology	B320-108344-RLP-001, *Class B Radioisotope Laboratory Protocol For The Containment Chemistry Laboratory B320 Room 333 And Iodine-131 Tracer Studies In The Gammacell Laboratory B320 Room 334,* Revision 3, 2023 March
Coulometric Titration Laboratory	Science & Technology	B375-108360-RLP-001, *Class B Radioisotope Laboratory Protocol For Coulometric Titration Laboratory, Building 375, Room 257,* Revision 1, 2017 October
Focused Ion Beam Facility	Science & Technology	B375-108720-RLP-001, *Radioisotope Laboratory Protocol for Building 375, Room 158, Focused Ion Beam Facility*, Revision 0, 2017 August.
Hydrogen and Deuterium (H&D) Analysis Laboratories	Science & Technology	B330-108360-RLP-006, *Class B The Hydrogen And Deuterium Analysis Laboratories; Building 330, Floor 3, Room 326a And 327,* Revision 3, 2023 January

Facility	Organization	Applicable Document(s)
ICP-MS Laboratory	Science & Technology	B330-108360-RLP-005, *Radioisotope Laboratory Protocol for ICP Laboratories (Building 330, Room 316/318/319 and B320, Rooms 309/309A/312/312B)* Revision 3, 2019 March
Imaging-XPS Laboratory	Science & Technology	B375-108730-RLP-001, *Radioisotope Laboratory Protocol for Building 375, Rooms 160 and 160A: the Imaging XPS Laboratory,* Revision 2, 2018 May
Material Sciences Radioactive Specimen Preparation Laboratories	Science & Technology	B375-128740-RLP-001, *Class B Radioisotope Laboratory Protocol for Building 375, Rooms 153 and 157B, Material Sciences Radioactive Specimen Preparation Laboratories,* Revision 1, 2022 February
Molten Fuel Moderator Interaction Laboratory	Science & Technology	B137-108460-RLP-001, *Class B Radioisotope Laboratory Protocol For Building 137, Molten-Fuel-Moderator-Interaction Laboratory*, Revision 3, 2017 September
Neutron Activation Analysis and Radiochemistry Laboratory	Science & Technology	B330-108360-RLP-004, *Radioisotope Laboratory Protocol for Building 330, Room 321, Class B NAA & Radiochemistry Laboratory,* Revision 1, 2017 September
B150 ACB Satellite Laboratories	Science & Technology	NRU-157901-RLP-001, *Radioisotope Laboratory Protocol for Class B ACB Satellite Laboratories, Bldg 150 Rooms 322 and 326*, Revision 3, 2022 November
Radiochemical Analysis Laboratory	Science & Technology	B330-108360-RLP-002, *Class B Radiochemical Analysis Laboratory; Building 330, Floor 3, Room 325 And 328,* Revision 3, 2021 April
Radiochemical Analysis Laboratory	Science & Technology	B330-108360-RLP-001, *Radiochemical Analysis Laboratory, Building 330,Floor 3, Room 326,* Revision 4, 2022 December
Radiochemistry Applications Laboratory	Science & Technology	B350-121100-RLP-001, *Radioisotope Laboratory Protocol for Class B Laboratories, Building 350, Room LD-103 and LD-105 Radiochemistry Applications Laboratory,* Revision 3, 2020 September
Research Reactor Fuel Development Laboratories	Science & Technology	B375-124200-RLP-003, *Class B - Radioisotope Laboratories Protocol For Research Reactor Fuel Development Laboratories (B375, Rooms 38,40,50,162),* Revision 2, 2017 October
SIMS, SEM and Radioactive Specimen Preparation Laboratories	Science & Technology	B375-108730-RLP-002, *Radioisotope Laboratory Protocol for Building 375, Rooms 161, 161A, 161B, 159, 157A, 157B: The SIMS, SEM and Radioactive Specimen Storage Laboratories,* Revision 2, 2017 October

Facility	**Organization**	**Applicable Document(s)**
TIMS Sample Preparation Laboratory	Science & Technology	B320-108360-RLP-003, *Radioisotope Laboratory Protocol for Building 320, Room 212, TIMS Sample Preparation Laboratory,* Revision 2, 2022 September
Waste Processing Technology Development Laboratory	Science & Technology	B467-108360-RLP-001, *Class B Radioisotope Laboratory Protocol For Building 467, Rooms 101, 102, 106 And 106a,* Revision 2, 2022 April
Class C Radioisotope Laboratories		
Bioassay Laboratories	HSSE	B513-508790-RLP-001, *Class C Radioisotope Laboratory Protocol For Building 513, Rooms 115, 263, 265 And 266, Bioassay Laboratories*, Revision 5, 2022 April
Biological Research Facility Laboratory	Science & Technology	B524-121111-RLP-001, *Class C Radioisotope Laboratory Protocol For Building 524 Biological Research Facility,* Revision 5, 2017 February
Decontamination Test Loops	Science & Technology	B350-108330-RLP-001, *Radioisotope Laboratory Protocol for Class C Laboratories, Building 350, Room LD 101, LD 103, and LD 104, Decontamination Test Loops, Analytical Support and Chemical Cleaning Laboratories*, Revision 1, 2020 September
Class C Radioisotope Laboratory Protocol for Building 513, Lab LC105, Chalk River Laboratory	Science & Technology	B350-121111-RLP-001, *Class C Radioisotope Laboratory Protocol for Building 513, Lab LC105, Chalk River Laboratory,* Revision 0, 2022 October
Environmental Analysis Laboratory	Science & Technology	B320-108360-RLP-008, *Class C Radioisotope Laboratory Protocol for Building 320, Room 321,* Revision 1, 2023 March
Environmental Radiochemistry Laboratory	HSSE	B513-121110-RLP-002, *Class C Radioisotope Laboratory Protocol For Building 513, Room 143, Environmental Radiochemistry,* Revision 1, 2017 September
Fission Gas Laboratory	Science & Technology	B320-108360-RLP-007, *Class C Radioisotope Laboratory Protocol For Building 320, Room 205, Fission Gas Laboratory,* Revision 1, 2021 February
Fission Product Release Group Laboratory	Science & Technology	B469-03512-RLP-001, *Class C Radioisotope Laboratory Protocol for Building 469, Rooms 105, 124, 125 and 126B,* Revision 2, 2022 April
Fuel Assembly Science and Technologies Laboratory	Science & Technology	B405-124200-RLP-001, *Fuel Assembly Science and Technologies Laboratory (CRL,B405 FAST Lab),* Revision 1, 2021 November

Facility	Organization	Applicable Document(s)
Health Physics Neutron Generator	Science & Technology	HPNG-121130-RLP-001, *B513 Room 177, 178 And 179 Health Physics Neutron Generator*, Revision 0, 2010 November
Metallographic Services Laboratory	Science & Technology	B375-03210-RLP-001, *Radiological Laboratory Protocol- Metallographic Services Laboratory - Rm.125/127, Bldg 375,* Revision 1, 2019 March
Radiochemistry Applications Laboratory	Science & Technology	B513-121100-RLP-001, *Class C Radioisotope Laboratory Protocol For Building 513, Room 25 And 27, Radiochemistry Applications Laboratory,* Revision 2, 2017 April
Radiochemistry Research Laboratory	Science & Technology	B513-121120-RLP-001, *B513, R107 Radiochemistry Research Laboratory,* Revision 1, 2017 September
Radiochemistry Research Laboratory	Science & Technology	B330-108360-RLP-007, Class C Radioisotope Laboratory Protocol for Building 330, Room 218, Radiochemistry Research Laboratory, Revision 0, 2018 December
Small Scale Mechanical Testing Laboratory	Science & Technology	153-128720-RLP-001, *Radioisotope Laboratory Protocol for Building 380, Room 224 & 225, Small Scale Mechanical Testing Laboratory*, Revision 0, 2018 June
Medium Activity Material Testing Laboratory	Science & Technology	153-127660-RLP-001, *Laboratory Protocol for Medium Activity Material Testing Facility, Building 145,* Revision 1, 2021 September
Surface Science Laboratory	Science & Technology	B380-108730-RLP-001, *Radioisotope Laboratory Protocol for Building 380, Rooms 114, 116, 117 And 120, Surface Science Laboratory,* Revision 2, 2018 January
Tritium Instrument Calibration Laboratory	HSSE	B513-508740-RLP-001, *Class C Radioisotope Laboratory Protocol for Building 513, Room 259, Tritium Instrument Calibration Laboratory*, Revision 0, 2022 November
Wet Chemistry Laboratory	Science & Technology	B320-108360-RLP-006, *Class C Radioisotope Laboratory Protocol, Building 320, Floor 3, Room 326,* Revision 2, 2019 March

5.2 Whiteshell Nuclear Facilities

Facility	Organization	Applicable Document(s)
Nuclear Facilities		
Concrete Canister Storage Facility (CCSF)	Environmental Remediation Management	AECL-FA-22, *Facility Authorization for the Operation of the Concrete Canister Storage Facility at the Whiteshell Laboratories,* Revision 3, 1998 July
Shielded Facilities (SF, IFTF, HCF)	Environmental Remediation Management	WLSF-00583-FA-001, *Facility Authorization for the Operation of the Shielded Facilities at the Whiteshell Laboratories,* Revision 5, 2015 September
Waste Management Area	Environmental Remediation Management	WLWMA-00583-FA-001, *Facility Authorization for the Operation of the Waste Management Area at Whiteshell Laboratories,* Revision 3, 2015 December
Building 300 (Research and Development)	Environmental Remediation Management	Building 300 contains the Shielded Facilities (SF), Hot Cell Facility (HCF), the Immobilized Fuel Test Facility (IFTF), and the Environmental Management Laboratories
Permanently Shutdown Facilities		
WR-1 Reactor	Environmental Remediation Management	WLD-01600-SWS-001 (RC-1291-R1), *The Monitoring and Surveillance Plan for the WR-1 Deferment Period,* Revision 0, 1996 March
Class B Radioisotope Laboratories		
Radioisotope Laboratory Room (B300 Rm. 1-172)	Environmental Remediation Management	WL-108360-RLP-001, *Radioisotope Laboratory Protocol: WL Environmental Management Laboratory Complex B300*, Revision 1, 2021 March
Class C Radioisotope Laboratories		
Radioisotope Laboratory Room (B300 Rm. 1-173)	Environmental Remediation Management	WL-108360-RLP-001, *Radioisotope Laboratory Protocol: WL Environmental Management Laboratory Complex B300*, Revision 1, 2021 March
Other Facilities and Laboratories		
Radiation and Industrial Safety Instrumentation Shop	Environmental Remediation Management	191-508237-OP-009, *Radiation and Industrial Safety (RIS) Instrument Shop Overview,* Revision 1, 2016 May
WL Laundry and Decontamination `	Environmental Remediation Management	191-508740-OP-011, *Non-Radiological Laundry and Respirator Area – Respirator Laboratory,* Revision 0, 2015 February
Waste Transshipment Area	Environmental Remediation Management	WL-508470-041-000, *Authorization for Radiological Controlled Area 1 Designation for WL Waste Transhipment Area,* Revision 0, 2019 August 19.

Facility	Organization	Applicable Document(s)
Environmental Management - Radiochemical Counting Lab B300 Room 1-15	Environmental Remediation Management	WL-108360-RLP-003, *Radioisotope Handling Protocol: WL Radiochemical Counting Lab (B300 Room 1-15) and SMO Sample Receiving Office (B300 Room 1-16*), Revision 1, 2020 November
Sample Management Office Sample Receiving Office B300 Room 1-16	Environmental Remediation Management	WL-108360-RLP-003, *Radioisotope Handling Protocol: WL Radiochemical Counting Lab (B300 Room 1-15) and SMO Sample Receiving Office (B300 Room 1-16*), Revision 1, 2020 November

5.3 Prototype Reactors

Facility	Organization	Applicable Document(s)
Nuclear Power Demonstrator (NPD)		
Nuclear Power Demonstrator (NPD) Waste Facility Located: Rolphton Ontario	Environmental Remediation Management	WFDL-W4-342.00/2034, *Waste Facilities Decommissioning Licence, Nuclear Power Demonstration* (*NPD),* Expires 2034 December 31
		WFDL-LCH-W4-342.00/2034/ 64-508760-HBK-001, *Licence Conditions Handbook Prototype Waste Facilities –Waste Facility Decommissioning Licence Nuclear Power Demonstration Waste Facility,* Revision 0, 2019 April
		64-508330-SWS-001, *Nuclear Power Demonstration Waste Facility Storage With Surveillance Plan,* Revision 2, 2016 August
Douglas Point Waste Facility		
Douglas Point Waste Facility Located: Bruce Nuclear Power Development, Tiverton Ontario	Environmental Remediation Management	WFDL-W4-332.03/2030, *Waste Facilities Decommissioning Licence*, Douglas Point, Expires 2030 December 31
		WFDL-LCH-W4-332.03/2030/ 22-508760-HBK-002 *Licence Conditions Handbook Prototype Waste Facilities – Waste Facility Decommissioning Licence Douglas Point Waste Facility,* Revision 1, 2021 June
		22-009600-SWS-002, *Douglas Point Waste Facility Storage with Surveillance Activities and Schedules*, Revision 1, 2022 December
Gentilly-1 Waste Facility		
Gentilly-1 Waste Facility	Environmental Remediation Management	WFDL-W4-331.00/2034, *Waste Facilities Decommissioning Licence, Gentilly-1*, Expires 2034 December 31

Facility	Organization	Applicable Document(s)
Located: Ville de Bécancour, Québec		WFDL-LCH-W4-331.00/2034/ 61-00580-HBK-001, *Licence Conditions Handbook Prototype Waste Facilities Waste Facility Decommissioning License, Gentilly-1 Waste Facility,* Revision 0, 2019 July
		61-508330-SWS-001, *Gentilly-1 Waste Facility Decommissioning Storage With Surveillance Plan,* Revision 2, 2020 June

5.4 Port Hope Area Initiative

Facility	Organization	Applicable Document(s)
Port Hope Area Initiative		
Port Hope Area Initiative Waste Management Project Located: Port Hope, Ontario	Environmental Remediation Management	WNSL-W1-2310.00/2032, *Waste Nuclear Substance Licence Port Hope Area Initiative Waste Management Project,* Expires 2032 Dec 31
		WNSL-W1-2310.00/2032, *Port Hope Area Initiative Waste Management Project Licence Conditions Handbook,* Revision 0, 2023 January 1
Historic Waste Program Management Office		
Historic Waste Program Management Office Located: Port Hope, Ontario	Environmental Remediation Management	WNSL-W2-2202.0/2026, *Waste Nuclear Substance Licence Low-Level Radioactive Waste Management Office (Historic Waste)*, Expires 2026 Nov 30
		236-514200-GDI-001*, Historic Waste Program Management Office Governing Documentation Index,* Revision 2, 2022 December
Historic Waste Program Environmental Laboratory		
Historic Waste Program Environmental Laboratory Located: Port Hope, Ontario	Environmental Remediation Management	15193-5-23.0, *Nuclear Substance and Radiation Devices Licence – Environmental Laboratory*, Expires 2023 Sep 30
		LLRWMO-508760-OP-05002, *Environmental Laboratory Operating Procedure,* Revision 5, 2017 November

5.5 La Prade

Facility	Organization	Applicable Document(s)
La Prade Site Located: Ville de Bécancour, Québec	Science & Technology	1593-4-26.0, *Nuclear Substance and Radiation Devices Licence,* Expires 2026 Sep 30

6. References

[1] *General Nuclear Safety and Control Regulations*, SOR/2000-202

[2] *CNL Management System Manual*, 900-514100-MAN-001, 12489834.

Appendix A Building, Facility and Other Contacts

The following Primary and Secondary Contacts are for CNL internal use only, they are not considered DROLs for the areas listed.

For a list of all DROLs, see section 4.1.

A-1 Support Facilities Primary and Secondary Contacts

Facility/Building	Primary Contact	Secondary Contact
CRL Support Facilities		
Central Alarm Station (pursuant to section 15 of the *Nuclear Security Regulations*) Building 701	[redacted]	[redacted]
Emergency Power Generator Building 135	[redacted]	
Administration, Security Department, and Fire Department Services Building 700	[redacted]	[redacted]

A-2 Other Facilities/Buildings that Handle or have Handled Nuclear Materials and/or Nuclear Substances Primary and Secondary Contacts

Facility/Building	Primary Contact	Secondary Contact
Chalk River Laboratories		
Decontamination Centre Buildings 468 and 507	[redacted]	[redacted]
Nuclear Materials Storage Facility Building 539, Rooms 4, 5, 6, 7 and 8	[redacted]	[redacted]
Nuclear Materials Storage Facility Building 575	[redacted]	[redacted]
Nuclear Safety Experiments Building 469, Rooms 105, 124, 124A, 125 and 126A, Hallway, 126B, 127, 128, 129, 130 (shielded room)	[redacted]	[redacted]
Metallurgy Area C Building 375	[redacted]	[redacted]
Metallurgy Building 375	[redacted]	[redacted]
Site Maintenance Building 466B	[redacted]	[redacted]
Shipping/Receiving Facility Building 1565	[redacted]	[redacted]
Low Background Counting Facility Building 560, Room 115	[redacted]	[redacted]

Facility/Building	Primary Contact	Secondary Contact
Instrumentation and Control Laboratories Building 600, Rooms 3A, 3B, 19, 21, 208	[redacted]	[redacted]
Flasks/Radioactive-Contamination Equipment Building 557	[redacted]	[redacted]
Hydrogen Engineering Laboratory Building 137	[redacted]	[redacted]
Waste Analysis Facility Building 582	[redacted]	[redacted]
Effluent Monitoring/Filter Testing Building 226	[redacted]	[redacted]
Chemistry and Materials Building 320	[redacted]	[redacted]
Chemistry and Materials Building 330	[redacted]	[redacted]
Decontamination Building 507	[redacted]	[redacted]
Spring B Facility Building 594	[redacted]	[redacted]
Chemical Pit Facility Building 595	[redacted]	[redacted]
Spring B Pump and Treat Facility Building 598	[redacted]	[redacted]
Building 541 NRU/NRC Storage Equipment/Surplus Materials	[redacted]	[redacted]
Whiteshell Laboratories		
B412 Radiography Room	[redacted]	[redacted]
The Environmental Management - Radiochemical Counting Lab B300 Room 1-15	[redacted]	[redacted]
Sample Management Office Sample Receiving Office B300 Room 1-16	[redacted]	[redacted]
B300 Room 1-171 RP Sample Monitoring & Handling	[redacted]	[redacted]
B100 Beta Irradiator Room	[redacted]	[redacted]
B300 Room 1-67 RP Workshop/Laboratory Instrument Storage	[redacted]	[redacted]
B100 Radioactive Material Shipping & Receiving Cage	[redacted]	[redacted]
Waste Transhipment Area	[redacted]	[redacted]
Note: Buildings with floor area less than 50 m^2 are not included		

A-3 Radioisotope Laboratories Primary/Secondary Contacts

Laboratory	Primary/Secondary Contact	Building Information
CRL Class A Radioisotope Laboratories		
Tritium Facility	[redacted]	B215, Room 153, 155, 156, 157, 158, 163, and 164
CRL Class B Radioisotope Laboratories		
Active Wet Chemistry Laboratory	[redacted]	B320, Rooms 324
Chalk River Advanced CANDU Fuel Development Laboratories	[redacted]	B375, Room 43
Chalk River Advanced Fuel Technology (CRAFT) – Ceramics Laboratories	[redacted]	B375, Rooms 258, 259, 260, 261, 262
Chromatography Laboratory	[redacted]	B320, Rooms 317, 318, 319, 320
Containment Chemistry & Gammacell Laboratories	[redacted]	B320, Rooms 333, 334
Coulometric Titration Laboratory	[redacted]	B375, Room 257
Focused Ion Beam Facility	[redacted]	B375, Room 158
Hydrogen and Deuterium (H&D) Analysis Laboratories	[redacted]	B330, Rooms 326A, 327
ICP-MS Laboratory	[redacted]	B330, Rooms 316, 318, 319
Imaging-XPS Laboratory	[redacted]	B375, Room 160, 160a
Material Sciences Radioactive Specimen Preparation Laboratories	[redacted]	B375, Rooms 153 and 157B
Molten Fuel Moderator Interaction Laboratory	[redacted]	B137, Rooms 116, 117, 118, 119, 120
Neutron Activation Analysis and Radiochemistry Laboratory	[redacted]	B330, Room 321
ACB Satellite Laboratories in B150 (formerly NRU Control/Loop Laboratories)	[redacted]	B150, Rooms 322, 326, ,
Radiochemical Analysis Laboratory	[redacted]	B330, Rooms 325, 328
Radiochemical Analysis Laboratory	[redacted]	B330, Rooms 326

Laboratory	Primary/Secondary Contact	Building Information
Radiochemistry Applications Laboratory (Target Alpha Therapy)	[redacted]	B350, Rooms LD-103, LD-105
Research Reactor Fuel Development Laboratories	[redacted]	B375, Rooms 38, 40, 50, 162
SIMS, SEM and Radioactive Specimen Preparation Laboratories	[redacted]	B375, Rooms 161, 161A, 161B, 159, 157A, 157B
TIMS Sample Preparation Laboratory	[redacted]	B320, Room 212
Waste Processing Technology Development Laboratory	[redacted]	B467, Rooms 101, 102, 106, 106a
CRL Class C Radioisotope Laboratories		
Bioassay Laboratories	[redacted]	B513, Rooms 115, 263, 265, 266
Biological Research Facility Laboratory	[redacted]	B524, Rooms 173-175, 177-179, G168 Note: Rooms 130,150, 152 temporarily reclassified as Class C
Decontamination Test Loops	[redacted]	B350, Rooms LD-101, LD-103, and LD-104
Environmental Analysis Laboratory	[redacted]	B320, Room 321
Environmental Radiochemistry Laboratory (Environmental Monitoring Branch)	[redacted]	B513, Room 143
Fission Gas Analysis Laboratory	[redacted]	B320, Room 205
Fission Product Release Group Laboratory	[redacted]	B469, Rooms 105, 124, 125, 126B
Fuel Assembly Science and Technologies Laboratory (CRL,B405 FAST Lab)	[redacted]	B405 Rooms 207, 207A, 209, 210,211, 212
H3-Loop	[redacted]	B350, Rooms LC-103, LC-111, LC-112, LC-113, and LC-114
Health Physics Neutron Generator	[redacted]	B513, Rooms 177, 178, 179
Metallographic Services Laboratory	[redacted]	B375, Rooms 125, 127
Radiochemistry Applications Laboratory	[redacted]	B513, Rooms 25, 27
Radiochemistry Research Laboratory	[redacted]	B513, Room 107

Laboratory	Primary/Secondary Contact	Building Information
Radiochemistry Research Laboratory	[redacted]	B330 Room 218
Small Scale Mechanical Testing Laboratory	[redacted]	B380, Rooms 224, 225
Surface Science Laboratory	[redacted]	B380, Rooms 114, 116, 117, 120
Tritium Monitor/Technique Development Laboratory	[redacted]	B513, Room 259
Wet Chemistry Laboratory	[redacted]	B320, Room 326
WL Class B Laboratories		
Radioisotope Laboratory	[redacted]	B300, Room 1-172
WL Class C Laboratories		
Radioisotope Laboratory	[redacted]	B300, Room 1-173

[A-12] Amrouni, J.-C. (AECL), Letter to Howden, B.D. (Atomic Energy Control Board), WL Deed, JCA-00-034, 2000 May 02

ECD # 19742

AECL EACL

J.-C. AMROUNI, Manager
Licensing SPOC

Chalk River Laboratories
Chalk River, Ontario
Canada K0J 1J0
Tel (613) 584-8020
Fax (613) 584-8023

Laboratoires de Chalk River
Chalk River (Ontario)
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FACILITIES & NUCLEAR OPERATIONS UNIT
Office of the Single Point of Contact – Licensing

2000 May 2

JCA-00-034

B.D. Howden, P.Eng.
Head, Operational Facilities Licensing Section
Research & Production Facilities Division
Atomic Energy Control Board
280 Slater Street
P.O. Box 1046, Stn.B
OTTAWA, Ontario K1P 5S9

Dear Barclay:

WL DEED

Please find enclosed a document titled, *Title Report for Atomic Energy of Canada Ltd. Plant Site Lands, Sections 12 & 13 Township 14 Range 10 EPM and Sections 8, 9, 10, 11, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 26, 27, 28 & 29 Township 14 Range 11 EPM, LDG of Pinawa - Manitoba,* prepared by Pollock & Wright, June 25, 1999.

This information is provided in support of the application process for the Whiteshell licence renewal, and will be referred to in other related correspondence.

Yours sincerely,

J.-C. Amrouni, Manager
Single Point of Contact – Licensing

JCA/jjy

c. A.M.M. Aly J. Chilton W.G. Martin J.C. Wood

TITLE REPORT
for
Atomic Energy of Canada Ltd.
Plant Site Lands

Sections 12 & 13 Township 14 Range 10 EPM
and
Sections 8, 9, 10, 11, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 26, 27, 28 & 29 Township 14 Range 11 EPM

LGD of Pinawa - Manitoba

TO: J.C. AMROUNI

FROM: C W ZARECKI

SUMMARY OF AECL SITE LAND TITLES AS REQUESTED

Regards.
Cliff.

Prepared by:

Pollock & Wright
Land Surveyors
204-379 Broadway
Winnipeg, Manitoba
R3C 0T9

Phone: 1-204-947-1557
Fax: 1-204-943-8024

Title Report for Atomic Energy of Canada Ltd. (AECL) -- Plant Site Lands

Scope of Work

The scope of work is to provide a plan showing the locations of various lands held by AECL around the existing plant site (Title Plot), to provide a report as to the status of those lands and to determine the immediate past owners (historic search)

The area is generally contained within Sections 8, 9, 10, 11, 14, 15, 16, 17, 20, 21, 22, 23, 26, 27, 28 and 29 Township 14 Range 11 EPM and the E ½'s of Sections 18 & 19 Township 14 Range 10 EPM

Ownership Report

CT # 971327 - This CT covers parts of Section 8, 9, 16 & 17-14-11 EPM. The title excepts Power Transmission Line Plan No. 3400 in Sections 9 & 16-14-11 EPM and mines and minerals. The title is subject to a caveat registered as Instrument No. 192664, (copy attached). The land contained in this title was formerly Crown Land (Manitoba). Part of the Plant is contained on this property.

CT # 971328 - This CT covers land in Section 17-14-11 EPM on the West side of the Winnipeg River. The title excepts mines and minerals and is subject to a caveat registered as Instrument No. 192664, (copy attached). The land contained in the title was formerly Crown Land (Manitoba). Based on the aerial photograph, part of the land is being used for agricultural purposes.

CT # 971329 - This CT covers all the land within Section 11-14-17 EPM The title excepts mines and minerals and is subject to a caveat registered as Instrument No 192664, (copy attached). The land contained in the title was formerly Crown Land (Manitoba). Based on the aerial photographs, none of the land is being used for commercial, residential or agricultural purposes.

CT # 971330 - The CT covers land in part of Section 26-14-11 EPM. The title excepts mines and minerals and is subject to a caveat registered as Instrument No. 192664, (copy attached). The land contained in the title was formerly Crown Land (Manitoba). Based on the aerial photograph none on the land is being used for commercial, residential or agricultural purposes.

CT # 971331 - The CT covers land in part of Sections 20 & 29-14-11 EPM. The title except mines and minerals and is subject to a caveat registered as Instrument No. 192664, (copy attached). The land contained in the title was formerly Crown

Land (Manitoba). Based on the aerial photograph none on the land is being used for commercial, residential or agricultural purposes.

CT # 971332 – The CT covers land in part of Section 20-14-11 EPM lying to the West of the Winnipeg River. The title except mines and minerals and is subject to a caveat registered as Instrument No. 192664, (copy attached). The land contained in the title was formerly Crown Land (Manitoba). Based on the aerial photograph the land is being used for agricultural purposes.

CT # 971333 – The CT covers most of the Government Road Allowances in the area East of the Winnipeg River with the exception of the East-West road allowances under the Power Line Plan 3400. The title excepts mines and minerals and is subject to a caveat registered as Instrument No. 192664, (copy attached) The land contained in the title was formerly Crown Land (Manitoba).

CT # 978791 – The CT covers all the land in Section 10, 14 & 15-14-11 EPM. The title excepts mines and minerals and is subject to a caveat registered as Instrument No. 192664, (copy attached). Prior to acquisition by AECL, this land was held in CT # 97103, 97106 and 97107 in the name of His Majesty The King in Right of Manitoba. Based on the aerial photographs, none of the land is being used for commercial, residential or agricultural purposes.

CT # 978792 – The CT covers lands in Section 9, 16, 17, 20 and 21. The title excepts mines and minerals and is subject to a caveat registered as Instrument No. 192664, (copy attached). Prior to acquisition by AECL, the land was held in CT # 97102, 97108, 97109, 97112 and 97113 in the name of His Majesty The King in Right of Manitoba. This land is generally adjacent to the plant site and based on the aerial photographs is generally not being used for any purposes other than the access roadway to the plant.

CT # 978793 – The CT covers land in Sections 22, 23 & 26-14-11 EPM. The title excepts mines and minerals and is subject to a caveat registered as Instrument No. 192664, (copy attached). Prior to acquisition by AECL, the land was held in CT # 97114, 97115 and 97118 in the name of His Majesty The King in Right of Manitoba. Based on the aerial photography, the land is not being used for any commercial, residential or agricultural purposes with the exception of what appears to be a test site in Section 22.

CT # 978794 – The CT covers land in Sections 27 & 28-14-11 EPM. The title excepts mines and minerals and is subject to a caveat registered as Instrument No. 192664, (copy attached). Prior to acquisition by AECL, the land was held in CT # 97119 and 97120 in the name of His Majesty The King in Right of Manitoba. Based on the aerial photography, the land is being used by AECL.

CT # A 2124 – The CT covers land within Plan No. 6014 and road allowances in and adjacent to Sections 17, 20 and 29-14-11 EPM. The title excepts mines and minerals and is subject to a caveat registered as Instrument No. 192664, (copy attached). The land contained in this title was formerly Crown Land (Manitoba). Some of the land West of the river, based on the aerial photography, is being used for agricultural purposes.

CT # B 4983 – The CT covers land in the NE ¼ Section 13-14-10 EPM. The title is subject to the Crown Lands Act. Prior to acquisition by AECL, the land was held in CT # 948969 in the name of Her Majesty The Queen in Right of Canada. Based on the aerial photography, the land is not being used for any commercial, residential or agricultural purposes.

CT # B 4984 – The CT covers land in the NE ¼ of Section 12 14-10 EPM. The title is subject to the Crown Lands Act. Prior to acquisition by AECL, the land was held in CT # 948970 in the name of Her Majesty The Queen in Right of Canada. Based on the aerial photography, part of the land might be in agricultural use.

CT # 4985 – The CT covers land in the S ½ of Section 20-14-11 EPM. The title is subject to the reservations and provisoes contained in the Grant from the Crown and a caveat registered as Instrument No. 209724 (copy attached). Prior to acquisition by AECL, the land was held in CT # 949423 in the name of Her Majesty The Queen in Right of Canada. Part of the plant is currently situated on this title according to the aerial photography.

CT # B 4986 – The CT covers land in the SE ¼ of Section 13-14-11 EPM. The title is subject to the Crown Lands Act. Prior to acquisition by AECL, the land was held in CT # 950132 in the name of Her Majesty The Queen in Right of Canada. Based on the aerial photography, part of the land might be used for agricultural purposes.

CT # B 4987 – The CT covers land in the SE ¼ of Section 12-14-10 EPM. The title is subject to the reservations and provisoes contained in the Grant for the Crown. Prior to acquisition by AECL, the land was held in CT # 950198 in the name of Her Majesty The Queen in Right of Canada. Based on the aerial photography, part of the land is being used for agricultural purposes.

CT # B 4988 – The CT covers land in the SW ¼ Section 19-14-11 EPM. The title is subject to the Crown Lands Act and is also subject to two caveats registered as Instrument Nos. 226725 and 1799838, respectively. Prior to acquisition by AECL, the land was held under CT # 952417 in the name of Her Majesty The Queen in Right of Canada. Based on the aerial photography, the land is being used for agricultural purposes.

<u>CT # B 4989</u> – The CT covers land in the NE ¼ Section 19-14-11 EPM. The title is subject to the reservations and provisoes contained in the Grant from the Crown. Prior to acquisition by AECL, the land was held under CT # 953818 in the name of Her Majesty The Queen in Right of Canada. Based on the aerial photography, part of the land might be used for agricultural purposes.

<u>CT # B 4990</u> – The CT covers land in the S ½ of Section 28-14-11 EPM. The title is subject to the Crown Lands Act. Prior to acquisition by AECL the land was held in CT # 954778 in the name of Her Majesty The Queen in Right of Canada. The land is currently being used by AECL according to the aerial photography.

<u>CT # B 4991</u> – The CT covers land in the SE ¼ Section 19-14-11 EPM. The title is not subject to any encumbrances. Prior to acquisition by AECL, the land was held in CT # 954779 in the name of Her Majesty The Queen in Right of Canada. Based on the aerial photography, the land is being used for agricultural purposes.

<u>CT # B 4992</u> – The CT covers land in the S ½ of Section 18-14-11 EPM and is bisected by No. 11 Highway. The title is subject to the reservations and provisoes in the Grant from the Crown and is further subject to two caveats registered as Instrument Nos. 1799838 and 226725, respectively. Prior to acquisition by AECL the land was held in CT # 955395 in the name of Her Majesty The Queen in Right of Canada. Based on the aerial photography, the land is being used for agricultural purposes.

<u>CT # B 4993</u> – The CT covers land in the SW ¼ Section 20-14-11 EPM. The title is subject to the reservations and provisoes in the Grant from the Crown. Prior to acquisition by AECL, the land was held in CT # 956082 in the name of Her Majesty The Queen in Right of Canada. The land is currently being used by AECL as part of the plant site.

<u>CT # B 4994</u> – The CT covers land in the NW ¼ of Section 19-14-11 EPM adjacent to PTH No. 11. The title is subject to the Crown Lands Act and is also subject to two caveats registered as Instrument Nos. 1799838 and 226725, respectively. Prior to acquisition by AECL, the land was held in CT # 956083 in the name of Her Majesty The Queen in Right of Canada. Based on the aerial photography, the land seems to support some limited agricultural use.

<u>CT # B 4995</u> – The CT covers land in Section 18-14-11 EPM. The title is subject to the reservations and provisoes in the Grant from the Crown and is also subject to two caveats registered as Instrument Nos. 1799838 and 226725, respectively. Prior to acquisition by AECL, the land was held in CT # 956279 in the name of Her Majesty The Queen in Right of Canada. Based on the aerial photography, the land is being used for agricultural purposes.

CT # B 4996 – The CT covers land in the N ½ of Section 18-14-11 EPM. The title is subject to reservations and provisoes in the Grant from the Crown and is also subject to two caveats registered as Instrument Nos. 1799838 and 226725, respectively. Prior to acquisition by AECL, the land was held under CT # 957995 in the name of Her Majesty The Queen in Right of Canada. Based on the aerial photography, the land is being used for agricultural purposes.

CT # B 4997 - The CT covers lands in the N ½ of Section 19-14-11 EPM. The title is subject to the reservations and provisoes in the Grant from the Crown. Prior to acquisition by AECL, the land was held in CT # 959189 in the name of Her Majesty The Queen in Right of Canada. Based on the aerial photography, the land is being used for agricultural purposes.

CT # B 4998 – The CT covers land in the NW ¼ of Section 29-14-11 EPM. The title is subject to the reservations and provisoes in the Grant from the Crown. Prior to acquisition by AECL, the land was held in CT # 960330 in the name of Her Majesty The Queen in Right of Canada. Based on the aerial photography, the land is not being used for any commercial, residential or agricultural purposes.

CT # B 4999 – The CT covers land in the NW ¼ of Section 28-14-11 EPM. The title is subject to the Crown Lands Act. Prior to acquisition by AECL, the land was held in CT # 975955 in the name of Her Majesty The Queen in Right of Canada. Based on the aerial photography, the land is not being used for any commercial, residential or agricultural purposes.

CT # A 12172 – The CT covers parts of Sections 18, 19, 20 & 29-14-11 EPM. The title excepts mines and minerals for the land contained with Public Road Plan No. 5986 (closed) in Sections 18 & 19 and is subject to reservations and provisoes in the Grant from the Crown. The title is subject to a caveat registered as Instrument No. 192664, (copy attached). Prior to acquisition by AECL, the land was held under CT #'s 848253, 849091 and 991821 in the name of Her Majesty The Queen in Right of Manitoba. Based on the aerial photography, the land located to the West of the River is being used agriculturally.

CT # B 12922 – Parcel A, Plan No. 9216 WLTO. This CT is owned by Manitoba Hydro Electric Board and appears to be a substation on the plant site. The title is free and clear of all encumbrances and comes from CT # B 4985 – AECL.

CT # C 49602 – The CT covers land around the plant site as well as Parcel B, Plan No. 9216 WLTO. Parcel B is subject to a caveat registered as Instrument No. 209724. This area contains part of the plant site. This land was acquired from CT # B 66216, previous owner Peter Manisto, farmer.

Title Summary

Based on the foregoing, AECL has free and clear title to the lands as shown on the attached drawing subject to certain terms and conditions as outlined either on the title description or by way of registered instrument.

Encumbrances

Instrument # 209724 – This is a utility caveat in favour of the Manitoba Hydro Electric Board granting an easement over Parcel B, Plan No. 9216. Among other things, this grants access to Parcel A, Plan No. 9216 along the length of Parcel B and allows Parcel B to be used for Hydro purposes as outlined in the caveat.

Instrument # 1799838 – This is a utility caveat in favour of the Manitoba Telephone System granting an easement over CT #'s B 4988, B 4992, B 4995, B 4996 and B 4994 along PTH # 11, specifically within the boundaries of Plan No. 31094 as shown on the attached plan. The lands included in the caveat can be used for telephone purposes as outlined in the caveat.

Instrument # 226725 – This is a utility caveat in favour of the Manitoba Telephone System granting an easement in the same general area as Instrument No. 1799838. This caveat could probably be withdrawn.

Instrument # 192664 – This is an agreement between the Province of Manitoba (Crown) and AECL dealing with the development of the plant, townsite, various roads, a bridge, the establishment of a Local Government District among other things. This is a wide ranging agreement committing AECL to many things, among them:

> Item 11: "to construct a private road" which I take to mean the access road to the plant across AECL's lands.
> Item 7: "before offering the land to third parties, offer to re-sell the land to the Province"

This caveat affects Title Nos. 971330, 971327, 978792, 978791, 971329, 971332, 978793, 971330, 978794, 971331, 971328, A 2124 and A 12172.

Historic Search

Part of the requirements of this report is to determine who AECL acquired title from, ultimately and by what method. Private owners only. Namely:

CT # 991821 – Crown (Manitoba) – Public Road Plan No. 5986 (closed) – Acquired by consent – Now CT # A 12172.

CT # 947732 – Roy Biedler – Farmer – Part NW ¼ Section 28-14-11 EPM – Acquired by expropriation by Crown (Canada) CT # 975955 now CT # B 4999.

CT # 957942 – Olavi Valfrid Hanvisto – Farmer – All that portion of NW ¼ Section 29-14-11 EPM lying to the East of the right bank of the Winnipeg River except Plan No. 6014 WLTO – Acquired by expropriation by the Crown (Canada) CT # 960330 now CT # B 4998 – AECL

CT # 953859 ½ - Michael Bruchanski – Farmer – S ½ of Section 28-14-11 EPM except Plan No. 3400 WLTO – Acquired by expropriation by the Crown (Canada) CT # 954778 now CT # B 4990 – AECL

CT # 854823 – Ingrid Gustafson – administratrix – Part LS 1, 2, 3, 6, 7 & 8 Fractional Section 18-14-11 EPM – Acquired by expropriation by the Crown (Canada) CT # 955395 now CT # B 4992 – AECL

CT # 834775 – Sanford Petersen – SE ¼ Section 12-14-10 EPM – Acquired by expropriation by the Crown (Canada) CT # 950198 now CT # B 4987 - AECL

CT # 773563 – RM of Lac du Bonnet – Part of LS 4 Section 20-14-11 EPM lying East of Winnipeg River except Plan No. 6014 WLTO – Acquired by expropriation by the Crown (Canada) CT # 956082 now CT # B 4993 – AECL

CT # 754354 – Chistoffer Chistiansen Balness – Farmer – NE ¼ Section 13-14-10 EPM – Acquired by expropriation by the Crown (Canada) CT # 948969 now CT # B 4983 – AECL

CT # 723686 – RM of Lac du Bonnet – Fractional LS 11 & 14 Section 19-14-11 EPM except Plan No. 6073 WLTO – Acquired by expropriation by the Crown (Canada) CT # 956083 now CT # B 4994 – AECL

CT # 669515 – Adolf Sixten Holmberg – Farmer – NE ¼ Section 12-14-10 EPM – Acquired by the Crown (Canada) – CT # 948970 apparently by expropriation. There is no notice of intended expropriation on CT # 669515 but it does appear on CT # 948970. Now CT # B 4984 – AECL

CT # 660042 – Henry Sikora – Farmer – LS 10 & 15 Section 19-14-11 EPM – Acquired by expropriation by the Crown (Canada) CT # 953818 now CT # B 4989 – AECL

CT # 630180 – Henry Sikora – Farmer – LS 2, 3, 6 & 7 Section 19-14-11 EPM except Plan Nos. 5986 and 6973 WLTO – Acquired by expropriation by the Crown (Canada) CT # 952417 now CT # B 4988 – AECL

CT # 602665 - Carl and Beret Gustafson – life estate acquired by expropriation by Crown (Canada) CT # 957995 now CT # B 4996 – AECL

CT # 602663 – Eric Gustafson – Farmer – Part Section 18-14-11 EPM except Plan Nos. 6014 and 6073 – Acquired by expropriation by the Crown (Canada) CT # 956279 now CT # B 4995 – AECL

CT # 602662 – Eric Gustafson – Farmer – relates to life lease CT # 602665 – Acquired by expropriation by Crown (Canada) CT # 957641 now B 4996 – AECL

CT # 587281 – Rolf Larson – Farmer – LS 2, 3, 6 & 7 Section 20-14-11 EPM except Plan No. 6014 – Acquired by expropriation by the Crown (Canada) CT # 949423 now CT # B 4985 – AECL

CT # 566770 – Michael Brushanski – Farmer – Fractional LS 1 & 8 Section 19-14-11 EPM except Plan No. 6014 WLTO – Acquired by expropriation by the Crown (Canada) CT # 954779 now CT # B 4991 – AECL

CT # 556792 – Ottar Hegland – Farmer – SE ¼ Section 13-14-10 EPM - Acquired by expropriation by the Crown (Canada) CT # 950132 now CT # B 4986 – AECL

CT # 506715 – Michael Brushanske – Merchant – LS 9 & 16 Section 19-14-11 EPM – Acquired by expropriation by the Crown (Canada) CT # 959189 now CT # B 4997 – AECL

Summary

The scope of the project is to determine:

a) Extent of Atomic Energy Corporation Ltd. (AECL) holdings in the area of the existing plant site.
b) To report on any encumbrances
c) To determine how the land was acquired; expropriation or agreement
d) To determine from who the land was acquired; Historic Search
e) To provide a drawing showing the relative location of each title.

Extent of Title

AECL has valid title to various lands as shown on the attached drawing.

Ownership is held under 32 real property titles. See Appendix A.

Manitoba Hydro has two holdings within the plant site area; a powerline and what appears to be a substation. These areas are both shown on the referenced drawing.

AECL ownership extends to the Ordinary High Water Mark of the Winnipeg River but does not include the Winnipeg River.

Encumbrances

Certain encumbrances exist on most of the titles either through certain terms and conditions as outlined within the title description or by way of registered instrument.

Most of the encumbrances within the title itself deal with reservations and provisoes dealing with mines and minerals and the like. In these circumstances, AECL has the surface rights while the Crown holds the mineral rights and associated rights. While we could search each original transfer to determine the Crown's rights, I doubt it would serve any beneficial purpose at this point.

There are several utility caveats filed on some of the titles. These are generally used to allow access for maintenance, repair and re-construction of the utility if and when required.

Instrument No. 192664 is registered against the lands originally acquired from the Crown (Manitoba) and is essentially an agreement to do any number of things, some on an ongoing basis. It may be wise to review this agreement with the benefit of legal counsel.

Land Acquisition & Historic Searches

A total of 17 properties were acquired from private owners including the RM of Lac du Bonnet. These all appear to have been acquired by means of expropriation by the Crown (Canada) and then transferred to AECL. See Appendix B. All other lands were acquired from the Crown (Manitoba). See Appendix C.

Other Matters

Manitoba Hydro holds title to Parcel A, Plan No. 9216 WLTO which, according to the aerial photographs, appears to be a sub-station located South of the lagoon in the NE corner of the plant site.

The Roadway system, including the access road to the plant site, with the exception of the access road South of the South limit of Section 8 & 9-14-11 EPM, is owned by AECL.

AECL appears to be a Riparian owner for its lands adjacent to the Winnipeg River.

An aerial photograph of the plant site is appended hereto as Appendix D.

signed,

A. G. Degner, M.L.S., C.L.S.
June 25th, 1999

Application Attachment A

[A-14] Whiteshell Laboratories Detailed Decommissioning Plan – Volume 1 – Program Overview, WLDP-02000-DDP-001, Revision 2, 2021 (Revision 3, 2023 October, has been submitted to CNSC staff for acceptance)

Canadian Nuclear Laboratories | Laboratoires Nucléaires Canadiens

DETAILED DECOMMISSIONING PLAN

THE WHITESHELL LABORATORIES DETAILED DECOMMISSIONING PLAN VOLUME 1 – PROGRAM OVERVIEW

WHITESHELL LABORATORIES DECOMMISSIONING PROJECT

WLDP-02000-DDP-001

Revision 2

Prepared by:	H. Athauda-Arachchige Safety & Licensing Analyst	2021-07-07 Date
Reviewed by:	R. Swartz Manager, WL Licensing & Quality Management	2021-07-07 Date
Approved by:	D. LeBoeuf Senior Project Manager, Decommissioning & Demolition	2021-07-13 Date
Approved by:	D. Gilson Senior Manager, WMA D&D	2021-07-13 Date
Approved by:	(FOR D. FILLION) D. Fillion Facility Authority, WL Closure Project	2021 AUG 16 Date

UNRESTRICTED

This page is for Content Controls that apply to this document. If no Content Controls apply, none will be listed.

REVISION HISTORY

Rev. No.	Date	Details of Rev.	Prepared By	Reviewed By	Approved By
2	*2021/07/05*	*Issued as "Approved for Use (pending CNSC acceptance)".*	*H. Athauda-Arachchige*	*R. Swartz*	*D. Fillion* *D. Gilson* *D. LeBoeuf*
2D1	*2021/01/18*	*Addressed CNSC staff comments.* *Issued for "Review and Comment".*	*H. Athauda-Arachchige*	*R. Bilinsky* *D. Fillion* *D. Howlett* *D. LeBoeuf* *A. Luke* *J. Martino* *J. Reynolds* *R. Swartz* *A. Wilcox* *B. Wilcox* *L. Wojciechowski*	
1	*2019/09/12*	*Addressed SRC comments.* *No formal R&C is required.* *Issued as "Approved for Use (pending CNSC acceptance)".*	*H. Athauda-Arachchige* *S. Bukhari*	*R. Swartz*	*M. Smith* *B. Wilcox* *D. Onagi*
0	*2019/08/12*	*Issued as "Approved for Use (pending CNSC acceptance)".*	*H. Athauda-Arachchige* *S. Bukhari*	*R. Swartz*	*M. Smith* *B. Wilcox* *D. Onagi*
D1	*2019/07/11*	*Issued for "Review and Comment".* *This document will cancel and supersede WLDP-02000-DDP-001 (RC-2143-1, Rev. 4P0).*	*H. Athauda-Arachchige* *S. Bukhari*	*J. Betteridge* *R. Bilinsky* *P. Henschell* *D. Howlett* *A. Luke* *J. Martino* *J. Melillo* *L. Rasmussen* *T. Reimer* *M. Smith* *R. Swartz* *A. Wilcox* *B. Wilcox* *L. Wojciechowski*	

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1. INTRODUCTION AND SCOPE

1.1 Introduction

The Whiteshell Laboratories Site (WL) site at Pinawa, Manitoba was established in the early 1960s by Atomic Energy of Canada Limited (AECL) to carry out research and development activities for higher temperature versions of the CANada Deuterium-Uranium (CANDU) reactor. The initial focus of the research program was the Whiteshell Reactor-1 (WR-1) Organic Cooled Reactor (OCR) [1-1] [1-2]. The reactor design also provided a facility for engineering tests and scientific studies on alternative fuels, fuel channels, and reactor coolants. WR-1 operated from 1965 to 1985, accumulating 120,000 operating hours during its lifetime. The reactor was permanently shut down in 1985.

Other significant programs carried out at WL included the Nuclear Fuel Waste Management Program (NFWMP), the SLOWPOKE Demonstration Reactor Project and various accelerator activities. As a result, the WL site had a range of nuclear facilities which provided support for these programs.

On 2006 June 03, the Minister of Natural Resources announced federal government funding for decommissioning and remediation of a number of facilities managed by AECL on behalf of the federal government, including the decommissioning of WL in Pinawa.

In 2013, the Minister of Natural Resources announced plans to restructure AECL, and move to a Government Owned, Contractor Operated (GoCo) management model for AECL. In 2014, AECL created Canadian Nuclear Laboratories (CNL), a wholly owned subsidiary of AECL, as the Site Operating Company and holder of all Canadian Nuclear Safety Commission (CNSC) site licences, managing all work performed at AECL sites on behalf of AECL. In 2015 September, a contract was awarded to Canadian National Energy Alliance (CNEA), and ownership of CNL was transferred to CNEA. CNL retained ownership of all CNSC licences and is the operator of all AECL sites.

The funding structure for the decommissioning of the WL site was modified from an annual government funding program, to a single target cost agreement between AECL and CNL. The responsibility for funding remains with the federal government through AECL.

WL is regulated under a CNSC Decommissioning Licence [1-3]. WR-1 is a permanently shut down facility.

Canadian Nuclear Laboratories has a requirement, as described in the WL Detailed Decommissioning Plan (DDP), Volume 1 - Program Overview [1-4], to shut down and decommission the WL site. Activities are underway to complete the orderly decommissioning of the WL site, following the general plan laid out in the Comprehensive Study Report (CSR) [1-1], which supported the approval of the Environmental Assessment (EA) of the WL Decommissioning Project. The exception to this is the change in strategy for WR-1[1] . Accordingly, the nuclear facilities and buildings on the WL site are being systematically placed in a safe shutdown state and safely decommissioned, with the view of leaving the site in a safe and secure state of Monitoring and Surveillance (M&S).

This Decommissioning Program Overview document describes the strategy planned to place the WL site in the

[1] In situ decommissioning/disposal (ISD) and grouting of WR-1 is being considered as opposed to complete removal as outlined in the CSR [1-1]. Both options are discussed in this DDP, and an environmental assessment is underway for the proposed ISD of WR-1.

M&S state and indicates the approach considered for the final decommissioning end state.

1.2 Decommissioning Plan Structure

The planning requirement for decommissioning WL is unique for Canada since it addresses all of the site nuclear and non-nuclear facilities. The plan strives to document a clear picture of the overall site end state condition (interim and final), and the inter-relationships between various facilities and support programs as the site is decommissioned.

The structure for the overall plan is to describe the site and facilities in general in an overview document (Volume 1) [1-4], which summarizes the decommissioning strategy and describes briefly the individual facilities, the operational status, the proposed M&S end states and the proposed final end state for the site. Other key topics such as hazards, regulatory and EA considerations, waste management plans, program management, and Quality Assurance (QA) are also covered in general terms in the overview document.

In total, twelve separate volumes of decommissioning plans address all of the facilities, buildings and areas at the WL site. Each decommissioning plan has or will be submitted to CNSC staff, with new DDPs or revisions to existing DDPs requiring CNSC acceptance prior to executing the planned decommissioning work. The facility specific decommissioning plans include:

- Volume 2: Shielded Facilities (SF)
- Volume 3: Van de Graaff Accelerator
- Volume 4: Neutron Generator (NG)
- Volume 5: Active Liquid Waste Treatment Centre (ALWTC)
- Volume 6: Whiteshell Reactor-1 (WR-1)
- Volume 7: Concrete Canister Storage Facility (CCSF)
- Volume 8: Waste Management Area (WMA)
- Volume 9: Building 300 (B300)
- Volume 10: Decontamination Centre (B411)
- Volume 11: Health and Safety Facilities (B402 and B305)
- Volume 12: WL Licensed Site Supporting and General Infrastructure

Table 1-1 provides information about the WL facilities, DDP volumes, End-State Reports completed by 2020 November, and the DDP or facility current status.

The decommissioning work associated with the DDP Volumes 3, 4, and 10 has already been completed and these three facilities, the Van de Graaff Accelerator, Neutron Generator, and Decontamination Centre (B411), have been decommissioned.

The DDP Volume 6 is reserved for the WR-1 reactor and B100. Revision 3 of DDP Volume 6 describes the approved decommissioning approach of complete dismantlement and removal while a newer revision (e.g., Revision 4) provides details about the ISD approach of the WR-1 reactor which is currently undergoing an EA process.

The DDP Volume 8 is for the WMA and has three parts. Part 1 of DDP Volume 8 covers the standpipes area decommissioning. The decommissioning of Intermediate Level Waste Bunkers, B417 and Amine Tanks is described in part 2, and the Low Level Waste Liabilities are discussed in part 3.

For the site facilities not specifically identified as listed nuclear facilities under the WL site licence, DDP

Volume 12 was developed which addresses the Site General Buildings and Infrastructure. The DDP Volume 12 has five parts, which cover north-side buildings, south-side buildings, outer area buildings and facilities, site services, and site affected lands and contaminated structures.

Table 1-1 List of Facilities, Detailed Decommissioning Plans, End-State Reports and the Detailed Decommissioning Plan or Facility Status

WL Facility	DDP Document Title/Document #	End-State Reports (as of 2021 June)	DDP or Facility Status
	The Whiteshell Laboratories Detailed Decommissioning Plan: Volume 1 - Program Overview, WLDP-02000-DDP-001, (RC-2143-1, Rev. 4P0), January 2002		To be Cancelled and Superseded by WLDP-02000-DDP-001, Rev. 2.
	The Whiteshell Laboratories Detailed Decommissioning Plan: Volume 1 - Program Overview, WLDP-02000-DDP-001, Revision 1, 2019		Current version of DDP Volume 1 submitted to CNSC for acceptance.
Shielded Facilities	Whiteshell Laboratories Detailed Decommissioning Plan: Volume 2 - Shielded Facilities, WLDP-21400-DDP-001, Revision 1, 2016	Hot Cells Facility Storage Blocks, WLDP-21412-IES-001, Revision 1, 2009 (note this is an Interim End-State Report)	- Facility is operational and decommissioning activities ongoing. - DDP Volume is available for use.
		Decommissioning of Hot Cells 6-12 and Scanning Electron Microscope, WLDP-21414-IES-001, Revision 1, 2009 (note this is an Interim End State Report)	
		Shielded Facilities Work Plan 6 - Cells 14-18, WLDP-21417-ESDR-001, Revision 1, 2012	
		Decommissioning of the Immobilized Fuel Test Facility Canisters, WLDP-21418-ESDR-001, Revision 0, 2008	
		Shielded Facilities Work Plan 10 - Immobilized Fuel Test Facility Main Floor Operating Areas, WLDP-21421-ESDR-001, Revision 1, 2012	
		Shielded Facilities Work Plan 11 - Thorium Fuel Reprocessing Experiment (TFRE) Tanks and Piping, WLDP-21422-ESDR-001, Revision 1, 2013	
Van de Graaff Accelerator	Whiteshell Laboratories Detailed Decommissioning Plan: Volume 3 - Van de Graaff Accelerator, RC-2143-3, Revision 1, 2000	Van de Graaff Accelerator, WLDP-28500-ESDR-002, Revision 0, 2004	- Facility has been decommissioned.
Neutron Generator	Whiteshell Laboratories Detailed Decommissioning Plan: Volume 4 -— The 14-MeV Neutron Generator Facility, RC-2143-4, Revision 1, 2000	14-MeV Neutron Generator Facility, WLDP-28500-ESDR-001, Revision 1, 2004	- Facility has been decommissioned.
Active Liquid Waste Treatment Centre	Whiteshell Laboratories Detailed Decommissioning Plan: Volume 5 - Active Liquid Waste Treatment Centre Building 200, WLDP-25400-DDP-001, Revision 0, 2011		- Facility is being decommissioned. - DDP Volume is available for use.
Whiteshell Reactor-1	Whiteshell Laboratories Detailed Decommissioning Plan: Volume 6 - Whiteshell Reactor -#1: Building 100, WLDP-26400-DDP-001, Revision 3, 2015 (Complete Dismantlement and Removal Approach)		- Facility has been shut down and currently under M&S. - Complete Dismantlement and Removal approach has been approved by the CNSC. - EA process for ISD is in progress, DDP Volume (Revision 4) is to be revised with final EA and licensing submission. - DDP Volume (Revision 3) is available for use.
	Whiteshell Laboratories Detailed Decommissioning Plan: Volume 6 – Whiteshell Reactor #1: Building 100, WLDP-26400-DDP-001, Revision 4, 2017 (In Situ Decommissioning Approach)		

WL Facility	DDP Document Title/Document #	End-State Reports (as of 2021 June)	DDP or Facility Status
Concrete Canister Storage Facility	Whiteshell Laboratories Detailed Decommissioning Plan: Volume 7 - Concrete Canister Storage Facility, WLDP-22500-DDP-001, Revision 1, 2017		- Facility is operational. - DDP was sent to the CNSC for information and comments received (to be dispositioned).
Waste Management Area	Whiteshell Laboratories Detailed Decommissioning Plan: Volume 8 - WMA Part 1: Standpipes Area, WLDP-36500-DDP-001, Revision 0, 2016		- Facility is operational - DDP Volume not yet submitted to CNSC.
	Whiteshell Laboratories Detailed Decommissioning Plan: Volume 8 - WMA Part 2: Intermediate Level Waste Bunkers, Building 417 and Amine Tanks, WLDP-24900-DDP-001, Revision 1, 2017		- Facility is operational. - DDP Volume not yet submitted to CNSC.
	Whiteshell Laboratories Detailed Decommissioning Plan: Volume 8 - WMA Part 3: Low Level Waste Liabilities, WLDP-24400-DDP-001, Revision 3, 2018	Decommissioning and Demolition of Organic Coolant Incinerator Complex (B514), WLDP-24400-ESDR-001, Revision 1, 2021	- Facility is operational. - DDP Volume is available for use.
Research and Development Facilities Complex	Whiteshell Laboratories Detailed Decommissioning Plan: Volume 9 - Building 300, WLDP-23500-DDP-001 (RC-2143-9), Revision 0, 2007 Whiteshell Laboratories Detailed Decommissioning Plan: Volume 9 - Building 300_Addendum, WLDP-23500-DDP-001_AD, Revision 2, 2018	Building 300 Core and South High Bay Area Active Drain Line Removal, WLDP-23511-ESDR-001, Revision 0, 2009	- Facility is operational. - DDP Volume is available for use.
		Building 300 Core Area Shutdown & Decontamination, WLDP-23512-ESDR-001, Revision 1, 2015	
		Decommissioning of Building 300 Computer Centre, Machine Shop / Stores Area, & South High Bay Shutdown & Decontamination, WLDP-23513-ESDR-001, Revision 0, 2012	
		Building 300 Work Plan 4 - North Extension Active Drain Lines, Pneumatic Transfer Lines and Thorium-Nitric Acid Solution Storage Tank Removal, WLDP-23514-ESDR-001, Revision 0, 2013	
		WL Bldg 300 Work Plan #5 - Active Ventilation Shutdown, Removal and Penthouse Cleanup of Highbay and Stages 1, 4 and 7, WLDP-23515-ESDR-001, Revision 0, 2015	
		WL B300 WP6 Stage 4 and 7 Crawlspace Fill and Soil Remediation, Pneumatic Transfer Line Removal and MLLW Line Removal, WLDP-23516-ESDR-001, Revision 0, 2015	
		Whiteshell Laboratories Building 300 Work Plan 7: North Extension Shutdown and Decontamination, WLDP-23517-ESDR-001, Revision 1, 2014	
		WL Bldg. 300 Work Package #9 - Segregation and Demolition of B300 Stages 4 and 7, WLDP-23519-ESDR-001, Revision 1, 2017	
Decontamination Centre	Whiteshell Laboratories Detailed Decommissioning Plan: Volume 10 - Decontamination Centre Building 411, WLDP-27400-DDP-001, Revision 0, 2011	Decommissioning and Demolition of the Decontamination Centre (Building 411), WLDP-27400-ESDR-001, Revision 1, 2019	- Facility has been decommissioned.
Health and Safety Facilities	Whiteshell Laboratories Detailed Decommissioning Plan: Volume 11 - Building 402 and 305, WLDP-37000-DDP-001, Revision 2, 2020		- Facility is being decommissioned. - DDP Volume is available for use.

WL Facility	DDP Document Title/Document #	End-State Reports (as of 2021 June)	DDP or Facility Status
DDP Volume 12	Whiteshell Laboratories Detailed Decommissioning Plan: Volume 12 - WL Licensed Site Supporting and General Infrastructure: North-Side Buildings, WLDP-32000-DDP-001, Revision 0, 2009	Building 525, WLDP-32010-ESDR-001, Revision 0, 2011 Building 532 Environmental Monitoring Storage Equipment Shed, WLDP-32020-ESDR-001, Revision 0, 2016 Fuel Oil Storage Tanks for Building 911, WLDP-32030-ESDR-001, Revision 1, 2016 Buildings 307 and 312, WLDP-32040-ESDR-001, Revision 1, 2012 Building 511 Storage Sheds and Building 527, WLDP-32060-ESDR-001, Revision 1, 2016	- Operational and decommissioning activities ongoing. - DDP Volume is available for use.
	Whiteshell Laboratories Detailed Decommissioning Plan: Volume 12 - WL Licensed Site Supporting and General Infrastructure-Part 1: South-Side Buildings, RC-2143-12, Revision 1, 2006	Decommissioning of Whiteshell Laboratories (WL) Internal Friction Laboratory Building 500 and Building 530, WLDP-31020-ESDR-001, Revision 0, 2007 Buildings 504, 509 and 526, WLDP-31030-ESDR-001, Revision 0, 2011 Building 505 and Concrete Pads of Buildings 504 and 509, WLDP-31030-ESDR-002, Revision 0, 2017 Buildings 400, 406, 410 and 921-S, WLDP-31040-ESDR-001, Revision 1, 2010 B404 MET Tower Facility, WLDP-31070-ESDR-001, Revision 0, 2016 End-State Decommissioning Report for Building 403, WLDP-31070-ESDR-002, Revision 0, 2016	- Operational and decommissioning activities ongoing. - DDP Volume is available for use.
	Whiteshell Laboratories Detailed Decommissioning Plan: Volume 12 - WL Licensed Site Supporting and General Infrastructure-Part 3: Outer Area Buildings and Facilities, WLDP-33000-DDP-001, Revision 1, 2008	Decommissioning of Deep Bedrock and Selected Overburden Boreholes at WL, WLDP-03704-ESDR-002, Revision 0, 2007 Building 515, WLDP-33010-ESDR-001, Revision 1, 2012 Removal of Field Irradiator Gamma, Zoological Environment Under Stress and Surrounding Area Redundant Infrastructures in the Outer-Area, WLDP-33020-ESDR-001, Revision 0, 2011 Decommissioning of Deep Bedrock and Shallow Overburden Boreholes Used for Historical Tracer Experiments at Whiteshell Laboratories, WLDP-33040-ESDR-002, Revision 0, 2011 Building 503, WLDP-33050-ESDR-001, Revision 1, 2014	- Operational and decommissioning activities ongoing. - DDP Volume is available for use.
	Whiteshell Laboratories Detailed Decommissioning Plan: Volume 12 - WL Licensed Site Supporting and General Infrastructure-Part 4: Site Services, WLDP-34000-DDP-001, Revision 1, 2013	Removal of Abandoned Power Lines in the Outer Area, WLDP-34010-ESDR-001, Revision 0, 2013	- Operational and decommissioning activities ongoing. - DDP Volume is available for use.
	Whiteshell Laboratories Detailed Decommissioning Plan: Volume 12 - WL Licensed Site Supporting and General Infrastructure-Part 5: Site Affected Lands and Contaminated Structures, WLDP-35000-DDP-001, Revision 1, 2012		- Decommissioning activities ongoing. - DDP Volume is available for use.

1.3 Graded Approach for Decommissioning

Based on the complexity and the needs during decommissioning, a graded approach will be used through the WL decommissioning project [1-5].

1.4 Acronyms

ACMs	Asbestos Containing Materials
ACMR	Annual Compliance Monitoring Report
AECL	Atomic Energy of Canada Limited
ALs	Action Levels
ALARA	As Low As Reasonably Achievable
ALWTC	Active Liquid Waste Treatment Centre
CA	Controlled Area
CANDU	**CAN**ada **D**euterium-**U**ranium
CCSF	Concrete Canister Storage Facility
CEAA	Canadian Environmental Assessment Act
CED	Committed Effective Dose
CNEA	Canadian National Energy Alliance
CNL	Canadian Nuclear Laboratories
CNSC	Canadian Nuclear Safety Commission
CSA	Canadian Standards Association
CSR	Comprehensive Study Report
DDP	Detailed Decommissioning Plan
D&WM	Decommissioning and Waste Management
DRL	Derived Release Limit
EA	Environmental Assessment
EDRMS	Electronic Document Records Management System
EIS	Environmental Impact Statement
EmP	Emergency Preparedness

EOC	Emergency Operations Centre
FIG	Field Irradiator Gamma
FMBS	Fissionable Materials Bearing Standpipes
GoCo	Government Owned, Contractor Operated
HCF	Hot Cell Facility
HDPE	High Density Polyethylene
HEPA	High Efficiency Particulate Air
HLW	High Level Waste
HLLW	High Level Liquid Waste
HSSE&Q	Health, Safety, Security, Environment and Quality
IAEA	International Atomic Energy Agency
ICRP	International Commission on Radiation Protection
IFTF	Immobilized Fuel Test Facility
ILLW	Intermediate Level Liquid Waste
ILW	Intermediate Level Waste
ISD	In Situ Decommissioning/Disposal
LCH	Licence Condition Handbook
LLLW	Low Level Liquid Waste
LLW	Low Level Waste
LSVCTF	Large Scale Vented Combustion Test Facility
M&S	Monitoring and Surveillance
MLW	Medium Level Waste
MLLW	Medium Level Liquid Waste
MMF	Manitoba Metis Federation
NFMBS	Non Fissionable Materials Bearing Standpipe
NFWMP	Nuclear Fuel Waste Management Program
NG	Neutron Generator

NM&SM	Nuclear Materials and Safeguards Management
NSDF	Near Surface Disposal Facility
OCR	Organic Cooled Reactor
ODS	Ozone Depleting Substance
OSH	Occupational Safety and Health
PCBs	Polychlorinated Biphenyls
PHT	Primary Heat Transport
PLC	Public Liaison Committee
PPE&C	Personal Protective Equipment and Clothing
QA	Quality Assurance
QAP	Quality Assurance Plan
SARS	Severe Acute Respiratory System
SF	Shielded Facilities
SMAGS	Shielded Modular Above-Ground Storage
TFRE	Thorium Fuel Reprocessing Experiments
TLD	Thermoluminescent Dosimeter
URL	Underground Research Laboratory
WM	Waste Management
WMA	Waste Management Area
WL	Whiteshell Laboratories
WLDP	Whiteshell Laboratories Decommissioning Project
WR-1	Whiteshell Reactor-1
ZEUS	Zoological Environment Under Stress

1.5 References

The following references were current at the time of development of this DDP. Where a reference is to be complied with, ensure the latest revision is used.

[1-1] WLDP-03702-041-000-0008, *Whiteshell Laboratories Decommissioning Project Comprehensive Study Report Volume 1: Main Report*, Revision 2, 2001 March.

[1-2] WLDP-26000-ENA-001, *Environmental Impact Statement: In Situ Decommissioning of Whiteshell Reactor #1*.

[1-3] NRTEDL-W5-8.00/2024, *Nuclear Research and Test Establishment Decommissioning Licence Whiteshell Laboratories*.

[1-4] RC-2143-1, *Whiteshell Laboratories Detailed Decommissioning Plan - Volume 1 – Program Overview*, Revision 4, 2002 January.[2]

[1-5] WLD-508300-QAP-001, *Quality Assurance Plan Whiteshell Laboratories Decommissioning*.

2. WHITESHELL LABORATORY SITE DESCRIPTION

2.1 General Site Layout

Whiteshell Laboratories is located approximately 100 km northeast of Winnipeg and covers an area of approximately 4,375 hectares near the towns of Lac du Bonnet, Seven Sisters Falls and Pinawa, Manitoba (Figure 2-1). The WL site is accessed via Provincial Highway 11 and Provincial Road 211 (Figure 2-2). The WL Decommissioning Project CSR [2-1] [2-2] [2-3], and the Whiteshell Reactor, WR-1 In Situ Decommissioning Environmental Impact Statement (EIS) [2-4] describe the area in greater detail.

Whiteshell Laboratories infrastructure consists of seven major facilities and a number of smaller support facilities. The seven major facilities include:

- Shielded Facilities (SF)
- Active Liquid Waste Treatment Center (ALWTC)
- Whiteshell Reactor-1 (WR-1)
- Concrete Canister Storage Facility (CCSF)
- Waste Management Area (WMA)
- Research and Development Facilities Complex (B300)
- Health and Safety Facilities (B402 and B305)

The current WL main laboratory site layout is shown in Figure 2-3 and the entire licensed property is shown in Figure 2-4. The WMA, CCSF, recently decommissioned Large Scale Vented Combustion Test Facility (LSVCTF), and other supporting infrastructure locations are shown in Figure 2-4. The licensed site has been subdivided into areas affected by nuclear development and areas unaffected by nuclear development and operations (Figure 2-5). The unaffected area is excluded from the site decommissioning work scope.

[2] This document (WLDP-02000-DDP-001) will supersede RC-2143-1 once accepted by the CNSC.

Figure 2-1 Area Map of the Region

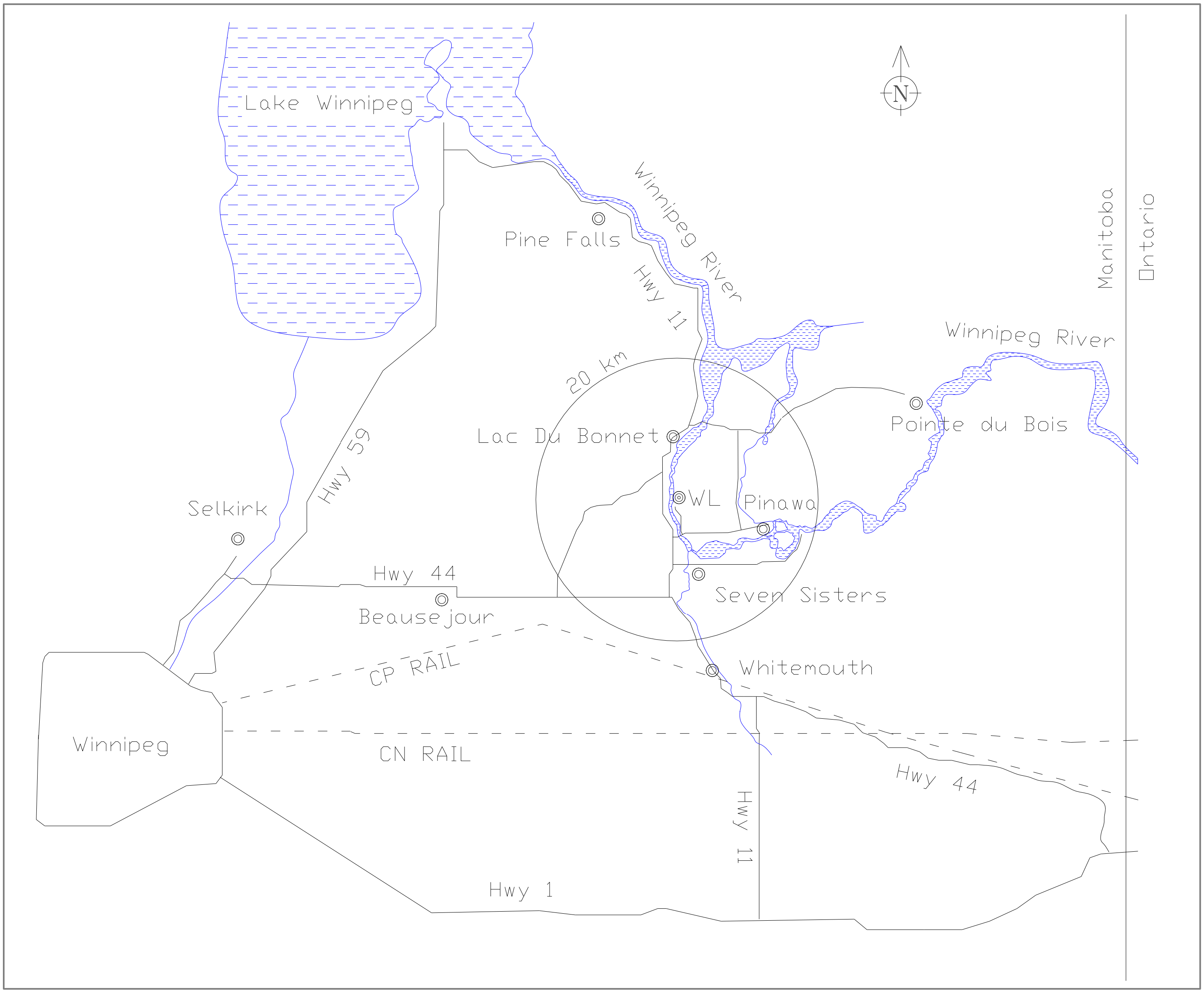

Figure 2-2 Location of Whiteshell Laboratories

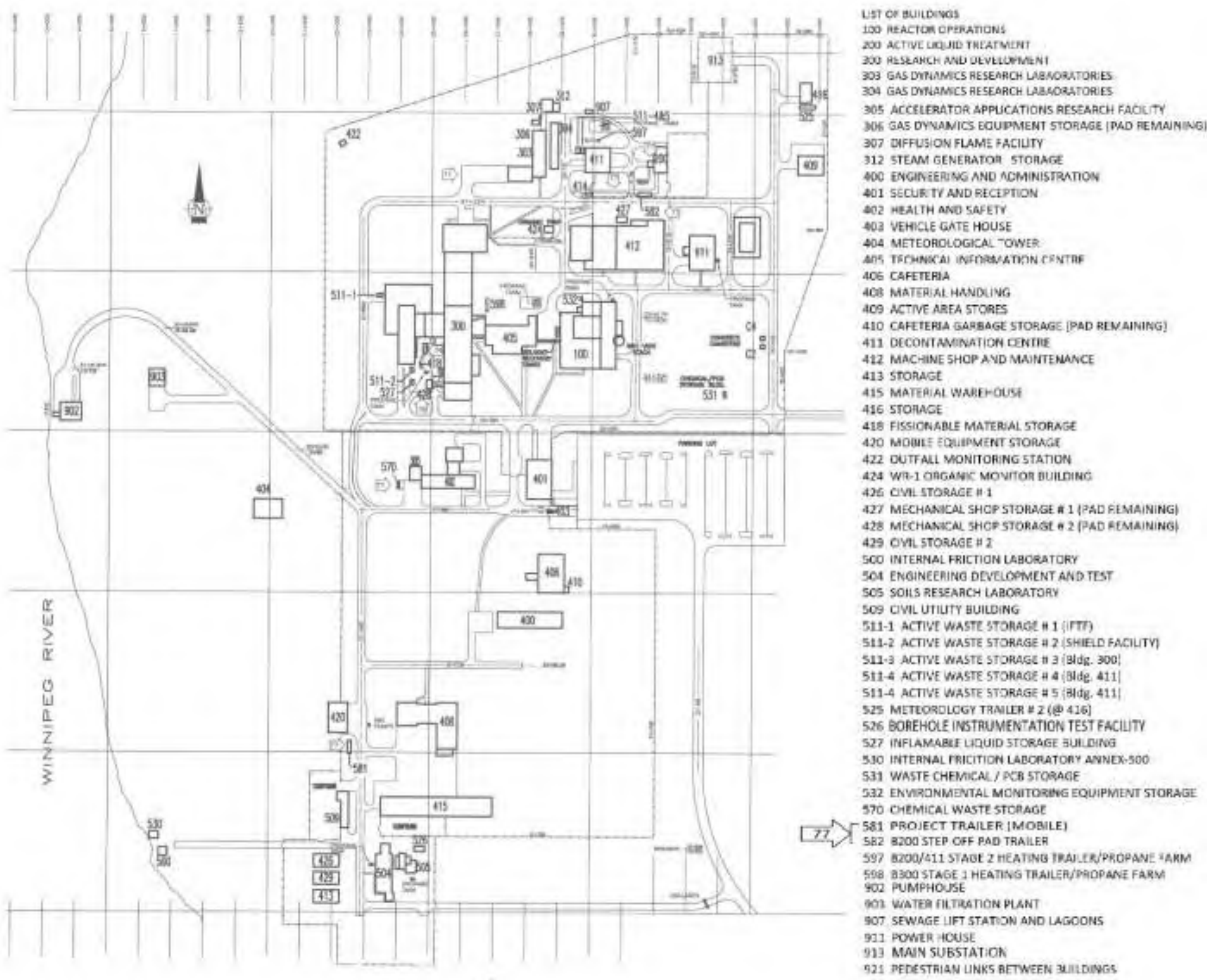

Figure 2-3 Whiteshell Laboratories Site Layout

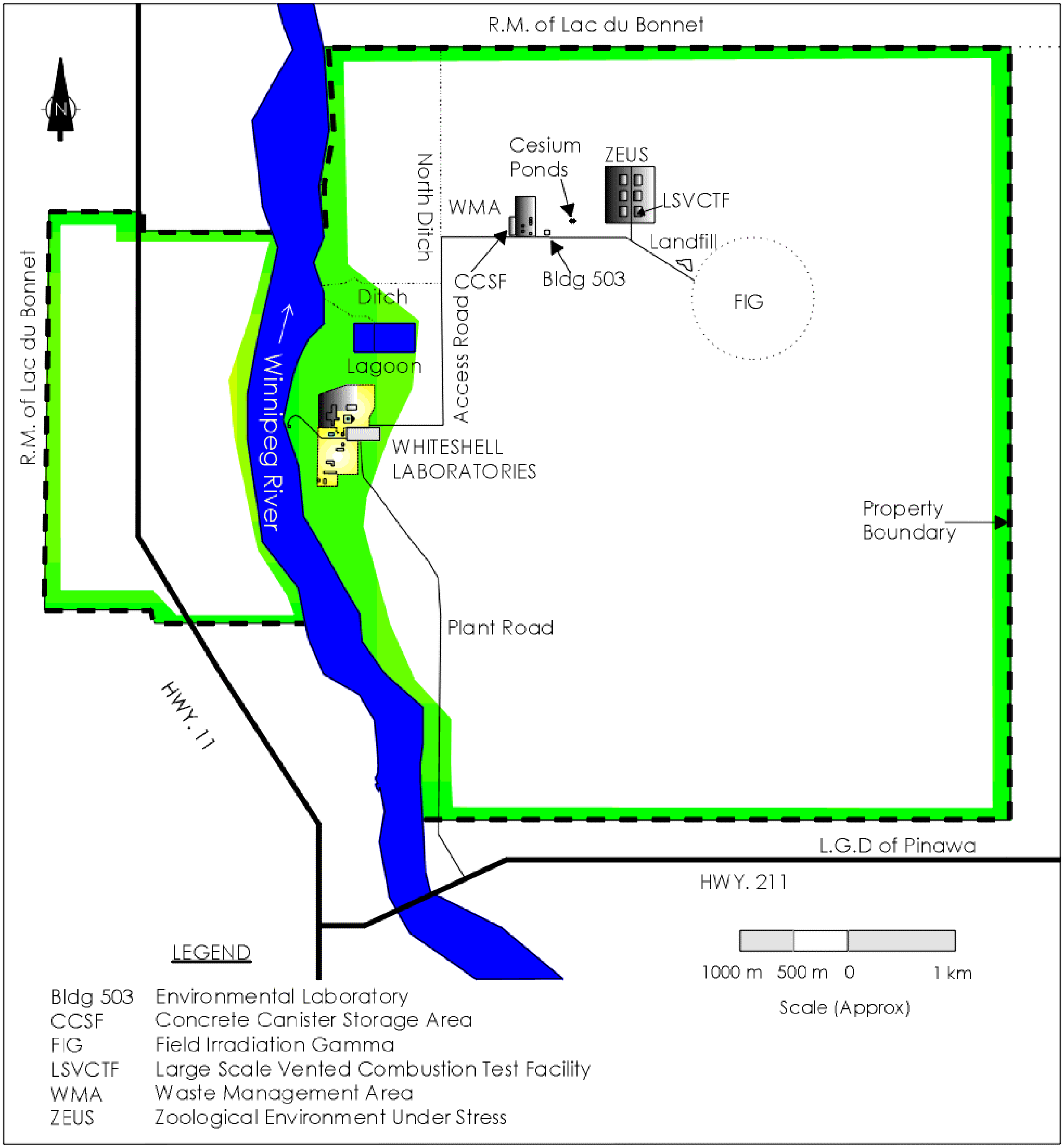

Figure 2-4 Licensed Property

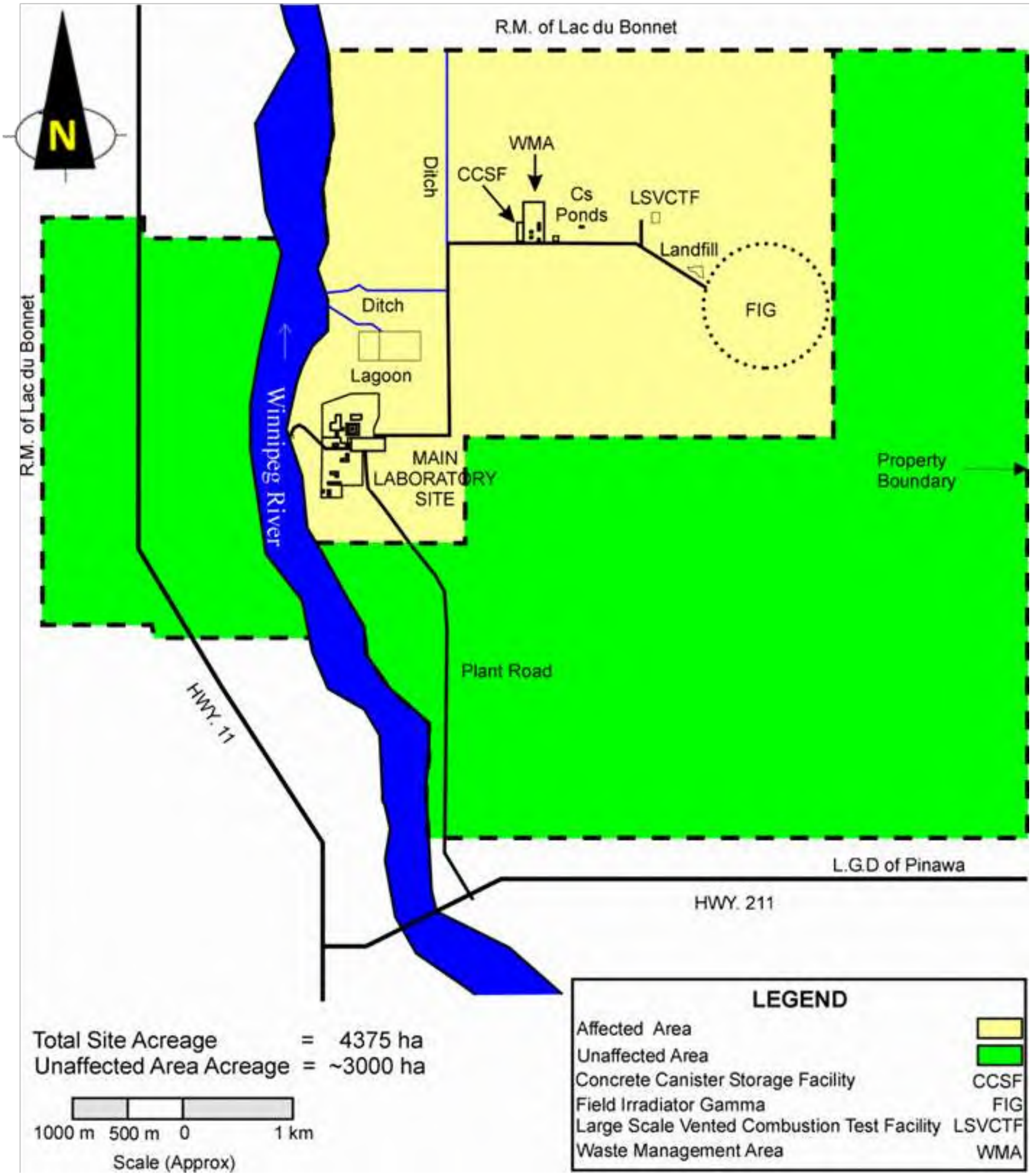

Figure 2-5 Affected vs Unaffected Area Designation

2.2 Site Facilities and Infrastructure Overview

The WL Site operates under Decommissioning Licence NRTEDL-W5-8.00/2024, issued by the CNSC [2-5].

The original focus of the WL research program was the 60 MWt WR-1 OCR. The OCR program was terminated in the early 1970s, however, the reactor continued to operate as a research tool until 1985. The broader range of nuclear research work conducted at WL included the NFWMP, the SLOWPOKE Reactor Project and various accelerator programs. Additional facilities were established to support the site nuclear research programs. These facilities include: 1) Shielded Facilities, 2) the Active Liquid Waste Treatment Centre, 3) Concrete Canister Storage Facility, and 4) the Waste Management Area. Two other facilities were established and have been decommissioned: 1) the Van de Graff Accelerator and 2) the Neutron Generator.

General site buildings and infrastructure, also administered under the site licence are addressed under the headings of Auxiliary Operating Facilities and WL Licensed Site Supporting and General Site Infrastructure. The buildings addressed under Auxiliary Operating Facilities are the Research and Development Facilities Complex (B300), and the Health and Safety Facilities (B402). Brief descriptions for each facility including current status are presented below. Non-nuclear buildings, the inactive landfill, the sewage lagoon, affected site lands and off site contamination are addressed under the heading of WL Licensed Site Supporting and General Site Infrastructure.

The WL main campus buildings housing the nuclear facilities at WL are primarily of steel reinforced concrete construction. Some building components are pre-engineered steel clad construction. Roofs are generally flat, constructed over metal decking covered with insulation, a sealing membrane, tar and gravel.

Table 1-1 presents information about the WL facilities, DDP volumes, End State Reports completed by 2020 November, and the DDP or facility current status.

A summary of the key hazards, which require attention in each facility building or infrastructure area is provided in Section 4.

2.2.1 Nuclear Facilities

Nuclear facilities at WL include the following and these are described in detail in the following sub sections. This list does not include those facilities that are decommissioned.

- Shielded Facilities
- Active Liquid Waste Treatment Centre
- Whiteshell Reactor-1
- Concrete Canister Storage Facility
- Waste Management Area

2.2.1.1 Shielded Facilities

The SF consist of the Hot Cell Facility (HCF) and the Immobilized Fuel Test Facility (IFTF), which are located in the R&D Complex (B300).

The HCF began operation in 1965, to provide shielded, remote handling facilities in support of CANDU reactor safety research programs including post irradiation examination of fuels and reactor core components, post experimental examination of radioactive materials used in Waste Management (WM) studies and services for other AECL programs or industrial work involving radioactive materials.

The HCF is a single storey structure with a main floor area of approximately 1200 m^2 and a ceiling height of 9.5 m. A 1 to 2 m deep crawlspace is located beneath the main floor Operating Area and a full basement is located beneath the balance of the HCF.

The main floor of the HCF consists of the Cells, the Decontamination Area, the Horizontal and Vertical Storage Blocks, the Manipulator Decontamination and Repair Facility, the Operating Area, a Scanning Electron Microscope facility (decommissioned), office areas, hallway, a change room and a shipping room. The cells consist of 11 steel lined, ilmenite concrete shielded cells (Cells 1-11) and one steel lined lead shielded cell (Cell 12) (decommissioned). All cells are equipped with remote manipulators and lead glass shielding windows.

The HCF Cells 1 to 5 and IFTF Cell 13 remain operational while HCF Cells 6 to 11 have been shut down and partially dismantled.

The IFTF is a building extension located at the northwest corner of the HCF. The IFTF is also a single storey structure and has a main floor area of about 1300 m^2, with a high ceiling area of 9.5 m high and a low ceiling area of 3.5 m high. A 3 m deep crawlspace is located beneath the high ceiling area and a full basement is located beneath the low ceiling area.

The IFTF began operation in 1984 and provided space and facilities for a wide range of experiments using radioactive materials in support of the Canadian Nuclear Fuel Waste Management and CANDU Reactor Safety research programs. The main floor of the IFTF consisted of six warm cells (decommissioned), the Decontamination Vestibule (Cell 13), the Operating Area (decommissioned), the Canister Storage Area (decommissioned), laboratories, change rooms and several offices, with new facilities including the Waste Handling Area (operated for compaction and assaying of radioactive waste) and decontamination work area.

All safety systems remain in operation to support the shutdown operation and the decommissioning work.

2.2.1.2 Active Liquid Waste Treatment Centre

The ALWTC began operation in 1963, receiving low level liquid waste effluent from operating nuclear facilities (WR-1, SF, B300 Research Laboratories, Laundry/Decontamination, etc.). The ALWTC is no longer operational and has begun to be decommissioned.

The liquid effluents were transferred via underground piping connecting operational facilities to the ALWTC.

The ALWTC included a MLLW processing system, which concentrated a waste stream originating from the SF. The resulting concentrate was solidified and stored at the WMA. The processed liquid was pumped out of WMA Medium Level Waste (MLW) bunkers.

The ALWTC is a two storey building, with external dimensions of 24.7 m by 12.8 m and a height of 7.6 m. Exterior walls from grade to 3.0 m above grade are constructed of 0.30 m thick reinforced concrete on the inside, followed by 25 mm of rigid insulation and 0.10 m thick brick facing. A thicker wall (0.46 m reinforced concrete) is used in Room 1-07. The upper part of the building is similar except that 0.20 m thick hollow concrete blocks are used rather than reinforced concrete. Two storey shielded process cells run along both sides of the ground floor pump gallery and second-floor operating gallery. The process cells contain hold tanks, which were provided to store liquid wastes as follows:

- Room 1-04 Laundry Tanks Cell
- Room 1-05 Decontamination Tanks Cell

- Room 1-07 Evaporator Cell
- Room 1-08 B300 Tanks Cell
- Room 1-09 B100 Tanks Cell

The evaporator cell (Room 1-07) and the adjacent areas of the building house the MLW concentration and solidification system.

2.2.1.3 Whiteshell Reactor-1

Whiteshell Reactor-1 (B100) was placed in service in 1965 to demonstrate the OCR concept using heavy water as the moderator. The system also provided a facility for engineering tests on alternative fuels, fuel channels and reactor coolants.

Whiteshell Reactor-1 operated from 1965 to 1985, accumulating 120,000 operating hours during its lifetime. The reactor was permanently shut down in 1985 and it was placed in a secure shutdown state in preparation for decommissioning. The shutdown activities included defueling the reactor, placing the irradiated fuel in the storage bays and removing bulk heavy water to storage. Bulk organic coolant was removed from the reactor cooling circuits and transferred to the WL WMA for incineration. Reactor control systems were isolated. All building services and systems required for M&S were, and still are, maintained in an operating mode.

The first phase of decommissioning commenced in 1989 and was completed in 1995. Phase I work addressed the removal of easily mobilized radioactivity (fuel, fluids, etc.) from the facility and cleaning up of the main floor (600 level) and first sub level (500 level) space with potential for reuse by WL. This work substantially decreased potential hazards from the facility and reduced the M&S requirements for the deferment period. The Phase 1 end-state prepared WR-1 for a deferment period during which significant radioactivity decay will reduce the postulated dose commitment associated with future decommissioning work.

The building contains equipment for the processing of Low Level Liquid Waste (LLLW) generated in B100. The building is heated and important safety systems such as ventilation, fire detection and drain line system remain operational.

2.2.1.4 Concrete Canister Storage Facility

The Concrete Canister Fuel Storage Program was developed at WL to demonstrate that dry storage is a feasible alternative to water pool storage for irradiated reactor fuel. Because of the success of the demonstration program, concrete canisters have been used to store all remaining WR-1 spent fuel. The CCSF is comprised of two storage areas; 1) the canister site adjacent to the WMA and 2) the demonstration canister site within the main site north-side area.

The production canisters are located on a prepared site approximately 2.7 km to the north east of the main site (Figure 2-4). The site was excavated to a depth 0.6 m and then backfilled with gravel to the original elevation. The centre to centre canister spacing is 7.5 m within a row and the canister rows are 9 m centre to centre apart. Each canister is located on a pad of reinforced concrete 3.66 m square and 0.2 m thick. A second pad was poured over the top of each pad to prevent water accumulation around the bases of the canisters after years of service. Various weatherproofing coatings have been applied to the bases and canisters.

The production canister site adjacent to the WMA is surrounded by a dual heavy duty galvanized chain link fence 2.5 m high, with 3 strands of barbed wire on top. Locked gates restrict access to the canisters. The production canister site adjacent to the WMA also contained an experimental canister and control building B425 that housed the instrumentation, electrical, monitoring, sampling, and alarm equipment for the experimental program. The experimental program was discontinued in 1999 and the associated canister has been used for routine fuel storage.

The concrete canister demonstration site is located within the present WL north-side area approximately 140 m east of B100 and 85 m southeast of the central powerhouse. There are two canisters remaining at this location. They are located in a north south row immediately adjacent to an existing access road running along the east boundary of the main campus. The demonstration site is surrounded by a 2.4 m fence topped with 3 strands of barbed wire. The canisters are placed on 3.048 m square reinforced concrete pads, and 0.2 m thick. Irradiated fuel has been removed from the demonstration canister site and was transferred to the production canister site.

2.2.1.5 Waste Management Area

The WMA is located approximately 2.7 km north east of the WL site (Figure 2-1). The area is approximately 148 m by 312 m. The WMA has been in operation since 1963, providing storage for low level and intermediate level radioactive wastes, and small volumes of active liquid waste and historic small volumes of hazardous industrial chemicals. This waste is comprised of waste generated since the earliest days of WL operation, waste accepted from external sources, and waste generated during the current decommissioning activities and ongoing operations. The WMA is designated as a Controlled Area as per CNL's Radiation Protection Requirements [2-6].

The WMA is surrounded by a 2.5 m high wire mesh fence. Personnel access is through B423, and road access is through a normally locked north or east gate. Access to the Protected Area portion of the WMA is through B533 for personnel and a normally locked gate on the west side of the Protected Area.

Facilities at the WMA are designed to provide safe storage for the various waste types received at the site.

The following facilities are/were located within the WMA and are described in the sub-sections below:

- WMA main access building (B423)
- Low Level Waste (LLW) processing Quonset (B421)
- LLW storage bunkers (LLW #1 to 6)
- Intermediate Level Liquid Waste (ILLW) Processing Centre (B202 former LLW #6 in the process of being converted to its new purpose)
- Storage Quonset (B430) –ILLW storage
- LLW Storage Quonsets (B431, B432, B433)
- LLW trenches (#1 to 23)
- Incinerator Complex (B514) – (has been decommissioned)
- Intermediate Level Waste (ILW), previously termed MLW, in ground concrete bunkers (ILW #1 to 5)
- ILW storage bunkers (ILW #6, 7)
- Above Ground Storage Bunker (ILW #8)
- ILW in-ground concrete standpipes (171 in total)
- High level active liquid waste (Amine) storage tanks (B417)

- Shielded Modular Above Ground Storage (SMAGS) Building (B923) in the process of being converted to a Cask Loading Facility
- Soil Storage Compound
- B533, an Operations and Office Trailer Complex adjacent to the WMA
- B550, a water supply system in a metal seacan to support B533
- B551, a septic system in a metal seacan to support B533
- B535, an electrical building immediately adjacent to the WMA perimeter fence

2.2.1.5.1 Building 423 (WMA Main Access Building)

Building 423 was constructed in 1977 at the entrance of the WMA and was used to control personnel entering and exiting the active area (the location of B423 is shown in Figure 2-6). B423 is wood framed, has exterior siding, insulated drywall interior walls, a shingled gable roof and a concrete floor, and has a footprint of approximately 61 m^2.

Domestic water is supplied by using a holding tank system consisting of two 2000 L insulated water tanks interconnected to insulated and heat-traced waterlines to B423.

Domestic sewage is gravity-fed to a two-compartment concrete septic tank and septic field.

B423 has been modified to serve as an entry-exit portal building now that the WMA Operations Centre (Building 533) (see Section 2.2.1.5.16) is installed to replace most of the functions of the building. Two-step whole-body contamination monitors are used to monitor personnel for contamination upon exiting the WMA and prior to reaching the change rooms that are provided in Building 533.

2.2.1.5.2 LLW Processing Quonset/Building (B421)

Building 421 was originally constructed in 1975 to temporarily store solid waste in the WMA. B421 (shown in Figure 2-6) is a quonset-type building, originally constructed on a concrete perimeter foundation with gravel floor, and has a footprint of approximately 216 m^2.

In 1985, the building was upgraded to incorporate a LLW contaminated waste baling and compaction centre by adding an insulated and heated room with a concrete floor, a sump pit, and a ventilation system and stack inside the perimeter of B421. Outside the room, the remainder of B421 was unheated.

In 2015, B421 was converted into a repackaging centre for contaminated materials. The baler, baler room, and drum compactor were all removed and were later processed through B421 as waste material. A checker plate floor was added after fixing known contamination spots on the existing concrete floor. Engineered fabric hoop structures were added on the east and west ends of the quonset to provide unheated and covered staging areas for waste handling. A ventilated enclosure was constructed of fire resistant wood and plastic sheeting. The ventilated enclosure consists of two chambers; on the east side of the building, waste material was brought in the east chamber of the ventilated enclosure and was handled by workers in protective clothing and respirators. A dedicated portable HEPA unit provided negative pressure to keep air flowing towards this space. The west chamber of the ventilated enclosure is where processed waste in bins is checked by Radiation Protection staff prior to moving the bins to the west vestibule. An office room is provided adjacent to the ventilated enclosure on the south side. B421 is heated and air conditioned by use of a HVAC unit.

Figure 2-6 Plan View of the WL Waste Management Area

2.2.1.5.3 LLW Storage Bunkers (LLW #1 to 6)

The LLW bunkers are constructed of concrete and built above grade to avoid storage in or near the water table. The LLW bunkers contain sumps with external pump-out access. Bunkers LLW-B1 to LLW-B5 are filled and concrete end walls have been installed as a final seal. Bunker LLW-B6 waste is largely removed and will be reconfigured into an ILLW processing system to facilitate decommissioning efforts. LLW #6 will be re-numbered as B202 (see Section 2.2.1.5.8). Figure 2-6 shows the location of LLW bunkers in the WMA.

The overall dimensions of a LLW bunker are 26.4 m long by 6.6 m wide by 5.2 m high with a wall thickness of 0.3 m. Bunkers were built in two 13.2 m long sections. A gasket seals the joint between the two sections. The foundations are 30 cm reinforced concrete slabs with 90 cm wide by 60 cm thickened edges cast on a minimum 60 cm of compacted granular fill.

The walls of the LLW bunkers are 30 cm thick and have two layers of reinforcing steel each with 25 mm of cover.

The roof slab varies in thickness from 35 cm at the outside edges to 37.5 cm to allow for drainage. The roof slab is reinforced concrete with two layers of reinforcing steel.

2.2.1.5.4 Storage Quonset/Building (B430)

Building 430 was constructed in 1985 to store WR-1 organic coolant drums. The location of B430 is shown in Figure 2-6. B430 is a quonset-type building with a concrete floor, two sump pits, and has a footprint of approximately 216 m^2.

B430 has been insulated and heated, and an engineered fabric hoop vestibule attached to the east end of the quonset. The area will be converted to storage of liquid waste awaiting processing in B202.

2.2.1.5.5 LLW Storage Quonsets (B431, B432, B433)

The LLW storage quonsets B431, B432, B433 are constructed with a ribbed, metal exterior on a concrete foundation. Building B431 has a sloped concrete floor and a collection sump. Buildings B432 and B433 have flat concrete floors without sumps. The quonset buildings were used for placements of waste that may have required retrieval or subsequent transfer to another storage facility at the WMA and were chronologically constructed as they were needed.

B431, B432, and B433 have footprints of approximately 216 m^2, like B421 and B430. The locations of B431, B432 and B433 are shown in Figure 2-6.

2.2.1.5.6 LLW Trenches (#1-23)

From 1963 to 1985, LLW was buried in unlined trenches excavated into the clay. Trenches were excavated with a backhoe and wastes were transferred into the trench with a front-end loader. The trenches were then backfilled and covered with approximately 1.5 m of material. There are 25 filled trenches, numbered #1 to #12, #13A, #13B, #14 to #18, #18A, #19 to #23, as shown in Figure 2-6. The trenching concept was discontinued completely in the fall of 1985 when above-ground low level bunker storage facilities were introduced.

Trenches were sometimes flooded with water when open and are below the water table level much of the year. The trenches are on average 4 m deep with 1 m of clay-based cover material. Some trenches were covered with contaminated soil removed from other facilities on the Whiteshell site. The degree of degradation of waste is unknown.

Exceptions to the general waste storage include Trenches 6 and 10. Trench 6 is used to store 31 stainless steel fuel channels from WR-1.

Trench 10 was specially constructed for filtration of WR-1 wastewater containing small amounts of organic materials at low specific activity. The excavation was backfilled with gravel.

2.2.1.5.7 Incinerator Complex (B514)

The organic incinerator was used to burn organic coolant from WR-1. The incinerator is an industrial type, manufactured by Trecan Limited, with a burning capacity of about 75 L of organic liquids per hour and was used for the combustion of oil, laboratory solvents, laboratory draining, and paint thinner.

B514 was constructed in 1967 along the east fence of the WMA to mix fuel oil and waste organic coolant for incineration. The building originally housed a 1600 L storage tank, an 1100 L fuel oil tank, pumps, process piping and miscellaneous fixtures. B514 was wood framed, had interior plywood walls and metal-cladded 1.2 m high, was insulated and had exterior plywood siding interior walls, metal gable roof, a concrete floor, was electrically heated, and had a footprint of approximately 24 m^2.

The incinerator and B514 have been decommissioned and all material removed from its former location.

2.2.1.5.8 ILLW Processing Centre (B202)

The ILLW processing system consists of two storage and two mixing tanks, a pump gallery, an evaporation-mixer system to volume reduce and then solidify liquid waste for off-site transport and associated piping systems.

2.2.1.5.9 ILW In-Ground Concrete Bunkers (ILW #1 to 5)

ILW Bunkers 1 to 5 are located adjacent to the WMA standpipes area (Figure 2-6), which is within a security controlled Protected Area fence.

These oldest ILW bunkers 1 to 3 were constructed between 1966 and 1977. The overall bunker dimensions are 13.6 m long by 5.6 m wide by 3 m high from its base with a 0.2 m projection above grade. The foundation of 0.076 m of granular fill was placed directly over the native soil overlain by a 0.254 m thick reinforced concrete slab. The reinforced exterior walls are 0.305 m thick. The interior is divided into four cells separated by two 0.254 m reinforced concrete walls.

ILW bunkers 1 to 3 were not designed with sump or pump out systems.

The waste was placed into these bunkers through the top. After a bunker's cell had been filled, it was topped with gravel and sealed with a concrete slab, a minimum of 0.25 m thick to provide shielding.

ILW bunkers 4 and 5 were constructed in 1979 and 1982, respectively. Both bunkers are based on the same design as the ILW Bunkers 1, 2, and 3 with some modifications. ILW Bunkers 4 and 5 are grade supported, reinforced concrete structures with a footprint of 13.6 m by 6.3 m and a height of 3.3 m and are both situated nearly entirely below grade. In the design, ILW Bunker 5 was set to extend approximately 0.6 m above grade, however the profile of the soil was later raised around the bunker, so the ground surface slopes up to the base of the roof slab. The foundation of ILW Bunker 4 is 0.075 m of granular fill placed directly over native soil. The fill is overlain by a layer of 6 mil polyethylene. The foundation of ILW Bunker 5 is 0.375 m of two thirds of gravel and sand mixture and one third of bentonite. Both measures were to reduce potential moisture intrusion into the concrete floor slabs. The floor slabs of the structures are 0.255 m thick reinforced concrete. The slabs have a one percent slope towards a concrete sump pit at the northwest corner of each of the bunkers.

The perimeter foundation walls are reinforced concrete and are 0.255 m thick. These bunkers are divided into four quadrants (cells) by 0.255 m thick interior concrete walls.

Currently, ILW Bunker 4 is operational. ILW Bunker 4 is pumped out as required as part of its operational status. ILW Bunkers 1 to 3, and 5 are used for continuing storage only, and these bunkers are sealed with a concrete roof and no visual inspection is possible. ILW Bunker 4 has roof hatches that permit visual inspection.

2.2.1.5.10 ILW Storage Bunkers (ILW #6 and 7)

ILW Bunkers 6 and 7 are located adjacent to the WMA standpipes area (Figure 2-6), which is within a security controlled Protected Area fence. ILW Bunker 6 and 7 were constructed in 1986 and 1989, respectively.

ILW Bunker 6 is a grade supported concrete structure with a footprint of approximately 11.1 m by 6.6 m. The bunker is 5.2 m in height from its base. This bunker is approximately one half below grade with 2.6 m above grade in the original drawings.

The foundation is based on 0.3 m of compacted granular fill placed directly upon native soil. Moisture protection in the form of Volclay RX® panels (bentonite clay pellets in biodegradable cardboard) was installed on top of the fill. The north and south foundation walls consist of 0.4 m thick reinforced concrete. The east and west foundation walls are 0.4 m thick at both ends and 0.65 m thick along the centre portion of each wall. The bunker is divided into three compartments by 0.255 mm thick concrete walls. The slab incorporates drainage trenches across the compartments to direct water to the sump pit.

ILW Bunker 7 is a grade supported, reinforced concrete structure with a 12.0 m by 6.0 m footprint. The bunker is 3.3 m in height from the top of the foundation slab, of which 1.85 m was designed to be above grade.

The foundation consists of a 0.3 m thick layer of compacted granular fill placed directly over native soil. Volclay RX® panels were used as a layer of moisture protection and a 0.4 m thick reinforced concrete slab was cast directly over the panels. The walls are 0.3 m thick reinforced concrete and are divided into three roughly equally sized compartments by 0.3 m thick interior walls.

ILW Bunker 7 is currently operational. ILW Bunker 6 is not receiving waste due to water ingress. ILW Bunker 6 and 7 are both pumped out as required as part of their operational status. The ILW Bunker 6 roof consists of tapered shielding plugs, which can be removed for visual inspection using a crane. ILW Bunker 7 has large roof slabs that can be removed for visual inspection.

2.2.1.5.11 Above Ground Storage Bunker (ILW #8)

Above Ground Storage Bunker (ILW Bunker 8) is located between LLW B5 and LLW B6, and marked as AGSB in Figure 2-6. ILW Bunker 8 was built in 2006 and has a 3.0 m by 4.4 m footprint with the slab extending 2.6 m beyond the edge of the structure walls on the west side and 0.5 m on the three other sides. The bunker was built entirely above grade with 0.6 m of compacted A-base granular fill.

The bunker was cast with six sites to receive drums of cemented liquid waste from historical fuel reprocessing experiments. Each of the sites has a carbon steel sleeve installed to accept cementation drums. The steel sleeve is fabricated from 0.5 m (22 inch) Schedule 10 steel pipe. Each site can hold two stainless steel drums, one on top of the other. At the top of each sleeve is a concrete plug with a steel edge, which seals the sleeve and provides shielding. To accommodate potential hydrogen gas generated by radiolysis of the cemented Thorium Fuel Reprocessing Experiment (TFRE) and Amine waste, the storage bunker was designed with vent lines to allow the hydrogen to vent continuously to the atmosphere. In 2020, the waste was removed to be stored in the Hot Cells Facility. The bunker is being maintained until the waste is removed from the site.

The drain line at the bottom of each storage site includes a trap to catch any water collecting in the liner. Provisions are made for sampling on an annual basis for evidence of moisture.

2.2.1.5.12 ILW In-Ground Concrete Standpipes

The ILW standpipes are located in the southwest corner of the WMA (Figure 2-6), and has dimensions of approximately 50 m (north-south) by 62.5 m (east-west). The standpipes have four internal diameters 0.46 m (16 in total), 0.61 m (118 in total), 0.76 m (17 in total), and 0.91 m (20 in total). Storage volumes are approximately 0.48 m^3, 0.89 m^3, 1.31 m^3, and 1.89 m^3, respectively.

Early standpipes were prefabricated using 2-3 unlined sections of concrete pipe and a concrete base joined via offset connections. The sections and base were held together by two steel strands that run at 90° to each other through the concrete base and through tubes inside the walls of each section of concrete pipe. The strands were tensioned in grooves at the top of the standpipe, after which the grooves were filled with grout. Apparent wall thicknesses were 0.15 m for the 0.46 m and 0.61 m-ID standpipes, 0.18 m for the 0.76 m-ID standpipes and 0.19 m for the 0.91 m-ID standpipes.

Early standpipes were externally coated with bitumen[3], and installed on freshly-poured concrete pads in augered holes. After the last waste emplacement, they were topped up with gravel, sealed with bitumen[4], and capped with poured in place concrete.

New standpipes were of a different design. These were constructed by suspending a galvanized carbon steel liner and rebar in an augered hole, and filling the annulus between the liner and the walls and bottom of the augered hole with poured concrete (nominal side wall thickness, 0.2 m; bottom wall thickness, 0.3 m; unsealed height, 3.97 m). The 76 exposed standpipes are of this design. These standpipes are not believed to have been topped with gravel or sealed with bitumen as records show that the plugs were removed on some standpipes in the 1990s to either inspect for water, or to transfer material to another location. Recent inspections by boroscope of approximately 20 non-FM bearing new style standpipes found that no gravel or bitumen was present.

Some New standpipes are also buried. After the last waste emplacement these were topped up with gravel, sealed with bitumen, and capped with concrete like the early standpipes.

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[3] Early documentation referred to the coating as asphalt, but it is believed to be bitumen.

[4] Early documentation referred to this as asphalt, but it is believed to be bitumen.

The standpipes are arranged in 7 rows (called rows “A” to “G”) with 95 of the 171 standpipes buried under up to 0.5 m of soil[5]. The remaining 76 standpipes have their tops exposed up to 0.5 m above ground (east half of row D, rows E and F, and partial row G).

The standpipes provide storage for historic ILW (previously called medium level waste, MLW or medium active waste, MAW) packages with permitted radiation fields up to 4.0 Gy/h (400 rad/h) at 0.3 m from the package. These packages contain typical waste that originated from the WL HCF or WR-1, equipment and scrap metal materials from experiments, sealed sources, and filters. Some standpipes also contain irradiated fuel from experiments and post irradiation examination (PIE) work conducted in the HCF, and some unirradiated fuel materials used in experiments. Almost all emplacements of these fissionable materials (FM) and special fissionable materials (SFM)[6] were made from 1967 to 1977.

Sixty-nine (69) of the 171 standpipes contain FM. The FM- and SFM-bearing standpipes (FMBS) are interspersed among the 102 standpipes not bearing these fissionable materials (NFMBS). Fifty-three (53) FMBS are buried, and 16 are in the exposed region. Many of these also contain typical non-FM waste[7] from the WL HCF or WR-1.

Three (3) of the 102 NFMBS are empty, though at least one of these has some radioactive contamination from materials formerly stored in it.

2.2.1.5.13 High Level Active Liquid Waste (Amine) Storage Tanks (B417)

The WMA contains two buried storage tanks, TK-1 and TK-2, constructed in the early 1970s to store High Level Liquid Waste (HLLW) derived from amine-extraction experiments conducted at WL with reactor fuel. The grade level terminal ends of the access tubes used for filling, draining and monitoring the tanks are located inside B417. HLLW was placed in tank TK-2 in 1974, most of which was removed in 2004 for cementation in the WL Hot Cells. There is no record of tank TK-1 ever being used.

B417 is an off-the-shelf metal garden shed with external dimensions of 2.6 m by 2.2 m. No services are provided to the building. Available Engineering drawings show the building is resting on a 0.61 m (2 ft) deep concrete plinth with the top surface of the plinth near grade level. However, field observations indicate the base of the building is resting on a stub wall constructed of wood studs and (assumed) plywood walls extending down about 0.9 m.

HLLW tanks TK-1 and TK-2 are located in separate concrete vaults believed to lie on a north south axis beneath B417. The bases of the vaults are approximately 5.33 m below grade level. A part of each vault is thought to lie beneath B417.

A drawing indicates the vaults are 1.88 m square and 2.13 m tall. The side walls are approximately 0.19 m thick, the concrete floor approximately 0.15 m thick and the fitted lid approximately 0.23 m thick. There is no confirmation that the vault lids contain lifting hooks, but it is presumed they exist. The vault exteriors were coated with a bitumen substance. The access pipe penetration in the vault tops was sealed using a combination of grout, epoxy and bitumen.

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[5] Note that a few are at ground level.

[6] FM and SFM refer to reactor fuel that includes thorium and all enrichment levels of uranium, both irradiated and non-irradiated.

[7] It is important to note that NFMBS standpipes may contain non-accountable amounts of FM.

Each vault contains a drip tray with a volume capacity approximately 20% greater than the maximum capacity of the HLLW tank located within it.

2.2.1.5.14 SMAGS Building (B923), Cask Loading Facility (CLF)

Building 923 (B923), SMAGS, was constructed for storage of contaminated wastes generated during the WL decommissioning project. The design is based on the Low Level Storage Buildings developed by Ontario Power Generation (OPG) for use at their Western Waste Management Facility, and at CNL's Chalk River Laboratories (CRL). B923 was constructed in 2010 to the north of LLW-B6, as shown in Figure 2-6. The SMAGS facility is being reconfigured to a CLF. The new CLF will stage packaged ILW wastes and load the waste packages into specially designed Type B casks for transportation off site to a licensed waste repository.

B923 is 47.2 m long by 30.5 m wide by 7.9 m high and provides an effective storage capacity of approximately 4,000 m^3. The building is constructed using pre-fabricated concrete technology for walls, columns, beams and roof panels. The floor is constructed such that it maintains a constant slope to a single drain point connected to an outside tank for the collection of any liquids that may accumulate within the building. In addition, a secondary collection system is in place to monitor liquids that may penetrate the concrete floor.

The concrete wall panels are 0.36 m thick, which provides adequate radiation shielding as well as a 2-hour firewall. The building is unheated but includes internal and external lighting, fire detection, and a ventilation system.

Upon conversion to the CLF, the building will host an overhead crane, bays for storage of FM canisters and ILW drums, a control room and a waste transfer-assay station. Casks on tractor trailers will be backed into the building adjacent and the overhead crane will be used to lift the cask lid, place the waste and return the lid to the cask.

2.2.1.5.15 Soil Storage Compound (SSC)

The Soil Storage Compound (SSC) is a containment area similar to the Port Hope LLW long term management mound, though much smaller in scope. The construction of the compound consisted of a perimeter berm designed to contain an estimated 2,000 m^3 volume of contaminated soil, protected with a plastic cover during filling stages. The cover system was used to minimize any spread of contaminated soil. Monitoring for potential leaks in the cover was provided by monitoring water collected by a High Density Polyethylene liner underneath the soil mound. The SSC was constructed above ground level, to prevent saturation of the mound base. The risk to groundwater and surface water from this design was negligible and is further mitigated by the integral leak detection and leachate removal system. The SSC was constructed over the location of the removed tritium inject wells.

The SSC construction footprint is 29.5 m (north-south) by 41.5 m (east-west) by 5.0 m (high). Figure 2-6 shows the location of the SSC in the WMA. A cap and cover system was used to minimize any spread of contaminated soil. All waste has been removed from the SSC.

2.2.1.5.16 WMA Operations Centre (B533)

The operations centre consists of 10, 60-foot long portable trailer units connected side-by-side on their long axis. The building hosts a security office for the personnel assigned to area, change rooms with domestic showers, meeting spaces, offices and lunchroom for area workers.

2.2.1.5.17 Water Seacan (B550)

A commercially available seacan was converted to host five interconnected High Density Polyethylene (HDPE) water tanks to supply domestic water for B533. The water tanks provide 5000 gallons of water. The seacan is insulated and heated with electric baseboard heat.

2.2.1.5.18 Septic Seacan (B551)

A commercially available seacan was converted to host five interconnected HDPE septic tanks to receive domestic waste for B533. The septic tanks provide 5000 gallons of storage. The seacan is insulated and heated with electric baseboard heat.

2.2.2 Auxiliary Facilities/Radioisotopes Facilities

Auxiliary operating facilities at WL are listed in Table 2-1 and described in the following sub-sections (decommissioned buildings are not listed).

Table 2-1 Auxiliary Operating Facilities at Whiteshell Laboratories

Building Number	Building Description
300	Research and Development (R&D) Facilities Complex
402	Health and Safety Facilities

2.2.2.1 Research and Development Facilities Complex (B300)

Building 300 was the primary research laboratory for the site, housing a wide range of nuclear Research and Development (R&D) programs. The building comprises an area of approximately 17,000 m^2 and was built in seven stages from 1964 to 1982 (stages 2 and 5 are the Shielded Facilities (see Section 2.2.1.1). The building contained 68 laboratories as well as numerous offices. The south end high bay area contained experimental activities that required large areas and significant headroom; RD-14M and RD-17 experimental loops were located in the South High Bay.

Most of the building has been operationally shut down, decontaminated and decommissioned. The demolition of Stages 4 and 7 was completed in 2016.

Routine activities carried out in B300 include:

- Non rad laundry activities;
- Respirator fit test/maintenance activities;
- Processing of low level liquid waste generated in B300 and the SF;
- Radiation protection instruments and counting labs; and
- Decontamination Centre/Boot Washer.

2.2.2.2 Health and Safety Facilities (B402)

Building 402 formerly housed a private accelerator company, Acsion Industries Inc. The building has three floors comprising an area of approximately 2,162 m^2, housing WL dosimetry services and Environmental

Management laboratories. The CNL facilities in B402 include a whole body counting facility, Thermoluminescent Dosimeter (TLD) readers, bioassay counting facilities and a Cs-137 Gamma Calibrator.

2.2.3 Whiteshell Licensed Site Supporting and General Site Infrastructure

The licensed site supporting and general site infrastructure at WL are administered under the general terms of the site licence and include a number of buildings or structures and common services that were used for a variety of purposes. These are described in the following sub sections.

2.2.3.1 Non-Nuclear Facilities/Buildings

Non-nuclear facilities/buildings at WL are listed in Table 2-2 with the exception of the buildings that were decommissioned.

Table 2-2 Non-Nuclear Facilities/Buildings at Whiteshell Laboratories

Building Number	Building Description
401	Security, Reception, Fire Hall and Security Monitoring Room
405	Lunch Room/Offices (formerly the Library)
412	Offices/Machine Shop
413	Quonset: Cold Storage
420	Cold Garage
422	Outfall Monitoring Station
426	Quonset: Cold Storage
429	Quonset: Cold Storage
531	Asbestos/PCB Storage
570	Hazardous Chemical Storage
597	Portable Boiler Building 1
598	Portable Boiler Building 2
902	Pump House
903	Water Filtration Plant
904	Fire Protection Water System
905	Process Water System
906	Storm Drainage System
907	Sewage Lift Station and Lagoons
911	Powerhouse
913	Main Substation (Owned by MB Hydro)
914	Main Power Distribution
916	Communications System
917	Supervisory Control and Alarm
918	Clarified Water System
921	Access Tunnel

2.2.3.2 Inactive Landfill

The inactive (i.e., non-radioactive) landfill was placed in operation when the WL site was established to contain non-radioactive and non-hazardous wastes, excluding food waste. The landfill is located at a high point in the local terrain east of WMA at the end of a service road and next to the entrance to the former Field Irradiator Gamma (FIG) facility. The surficial geology in this area is mainly sand and gravel.

The landfill is less than 10 m in height and less than 0.01 km^2 (1 ha) in area. Typical materials placed in the landfill include plastic, paper, wood, cardboard, glass, and building materials. Typical activities include dumping, ditching, and capping with sand and gravel from surrounding borrow pits. Two derelict concrete canisters (used for non-radioactive testing only) originating from the early Concrete Canister Fuel Storage Program are located just north of the landfill.

2.2.3.3 Sewage Lagoon

The lagoon system, placed in operation when the WL site was established, is located north of the main site. The lagoon system comprises a primary settling pond, a secondary pond, an outlet and the sewage lift station (B907). The lagoon receives liquid wastes from washrooms, showers and non-active drains.

The lagoon was constructed of low permeability clay embankments placed on a prepared clay surface, with no additional lining. The primary and secondary ponds are connected to each other via a culvert.

There are levees around each lagoon, with a roadbed at the top. At various times of the year, the water level in the lagoons is higher than the surrounding land surface. Emergent macrophytes (primarily cattail) vegetate the water’s edge. Water may be released from the pond every spring and fall, and flows from the lagoon to the Winnipeg River through a drainage way that is about 400 to 500 m in length.

2.2.3.4 Buried Services

Buried services run through the entire site, and include:

- Drainage systems.
- District heating.
- Electrical.
- Fire (250 mm diameter pipe) and process water (600 mm diameter pipe).
- Domestic water (200 mm diameter pipe).

The most significant buried services from a decommissioning perspective are the three types of drainage systems:

<u>Sanitary drains (250 mm diameter[8] pipe)</u>: collect waste water from toilets, showers, sinks, etc., and discharge it to the site sewage lagoon. The lagoon water is retained for approximately six months to allow for settling and biodegradation. The lagoon water is analyzed for fecal coliform and biochemical oxygen demand and, if within limits, may be released in May and October each year to the Winnipeg River.

<u>Aqueous radioactive waste collection drains (38 mm diameter pipe enclosed in 200 to 300 mm diameter pipe)</u>: collect wastewater containing radioactive (and chemical) contaminants. The waste was pumped to tanks in the ALWTC. Any leaks in the active lines would be contained within the outer wall of the transfer pipes, and

[8] This dimension only represents 30% of the length of sanitary line.

flow to leak collection points (man holes or sumps) located at low points along the route. No leaks have been detected since the system was placed in operation.

Storm drains (process drains, 1200 mm diameter[9] pipe): collect cooling water from experimental facilities, site runoff water, low level radioactive liquid waste from the ALWTC following sampling and monitoring, inactive effluent from non-active building sump floor drains and laboratory sinks, and process water that is used to maintain a minimum flow (50 L/s) at the outfall for a flow measurement. The storm drain water is discharged via the outfall to the Winnipeg River.

Between 1967 and 1971, drain line breaks just outside of B300 east side had occurred. The aqueous radioactive waste collection system was replaced by the existing double pipe system in the mid-1980s. The old system had failed and leakage from some lines adjacent to the ALWTC had occurred. The area was partially remediated through removal of excavated soil; however, in subsequent years, the vegetation in the spill area was found to have elevated levels of beta and gamma emitting radioactivity, in particular Cs-137 and Sr-90. Routine monitoring of the area is maintained to provide an indication of mobility, which will require remediation.

2.2.3.5 Affected Site Lands

The affected lands[10] (Figure 2-5) are those lands within the WL site (i.e., the Licensed Property Study Area) that are contaminated, potentially contaminated or affected by nuclear operation and are more than approximately 1 m away from buildings. Decommissioning of land within approximately 1 m of the buildings is considered part of the decommissioning of the building. The affected lands also include land that is retained as a buffer zone between the unaffected lands and areas impacted by nuclear operations. The affected lands may contain contamination because of proximity to facilities and unusual occurrences.

2.2.3.5.1 Active Area Soil Contamination

The following is a description of various events at WL having radiological and non-radiological hazardous material impacts of the main site grounds.

2.2.3.5.1.1 Radiological Events

1971, 1984 and 2016: Low Level Liquid Waste (LLLW) drain line breaks occurred outside of B300, east side, between 1967 and 1971. The lines were replaced and approximately 765 m^3 of contaminated soil remediated. In 1984, approximately 100 m of lines transporting ILLW from the HCF were removed along the east side of B300 to the north roadway. Approximately 35 m of the drain line pipe remains where the lines penetrated through the B300 Stage 1 crawlspace east wall. There are also approximately 265 m of the drain line pipe that remains north of the main access road that runs from B303/304 to B200. The 2016 decommissioning activities in the Stage 4 crawlspace identified Sr-90 soil and wall contamination at the east basement foundation wall penetrations for the LLLW and service lines conduits. The contamination is believed to originate from a 1997 LLLW line leak and/or is the result of residual contamination following the removal of the abandoned ILLW lines. The degree of contamination outside of the B300 east foundation wall is unknown. There is a potential

9 This dimension only represents 10% of the length of storm line.

10 Much of the affected lands located on the WL south side and outer area are likely non-impacted.

for radiological impact of underground electrical conduits, power and control concrete bus ducts, and associated electrical junction pits, that transverses these areas.

1971: An airborne radioactive emission occurred from the SF active exhaust system. As the prevailing wind was from the north, radioactive particulates were transported from the Shielded Facilities stack for up to 120 m southward, causing contamination to the lawns and topsoil on the north side of B402 and the south side of B300. The contamination plume included Cs-137 and the short half-life radionuclides (<365 days) I-131, Ce-141, Ru-103, and Zr-95/Nb-95. The release was at a low level, and no contamination above acceptable limits is expected, though residual Cs-137 contamination likely remains. There is a potential for radiological impact of exterior lighting fixtures, overhead power lines and power poles that transverse these areas and still exist.

1972: During a filter change in the SF exhaust filtration system, a gasket failed and an exhaust filter was shredded. The filter remnants were released from the exhaust stack and deposited on the grass north of B300. The contaminated area extended north past the active area fence. Some radioactive contamination was also found in the area northwest of the SF in 1972 mid-June. Remediation involved removal of the contaminated sod, soil, and vegetation over an area of approximately 6000 m^2 of lawn. The releases during remediation were at very low levels, and there was no detectable contamination remaining in the affected area after removal actions. There is a potential for radiological impact of exterior lighting fixtures, overhead power lines and power poles that transverse these areas and still exist.

1980: Three active drain lines near the ALWTC (B200) failed, causing the release of approximately 65 GBq of mixed fission products (in liquid form) to the topsoil. This same incident affected the storm drain system as well. The release resulted in contamination of a 370 m^2 area, including lawns and a roadway area to the east and south of the building. Remediation involved removing the affected topsoil to 30 cm depth, together with some surface material from a cement curb, and approximately 860 m^3 of roadway surface. Approximately 9 GBq of Cs-137 and Sr-90 are estimated to remain in the contaminated area around B200. There is a potential for radiological impact of underground electrical conduits, power and control concrete bus ducts and associated electrical junction pits that transverse these areas.

1983: An incident occurred at the Organic Monitoring Building (B424) when a polyethylene foam filter, which had been used in a test filtering of process water from B100, was mistakenly left on the ground near B424. The filter was allowed to drip during removal from B424, causing contamination of the floor and of a 2.3 m^2 area of ground outside B424. The topsoil from this area was removed, and subsequent monitoring confirmed that there was no detectible contamination. There is a potential for radiological impact of underground electrical conduits, power and control concrete bus, and associated electrical junction pits that transverse these areas.

1984: A spill occurred at the north side of B200. Active liquid (20,000 Bq/ml; primarily Cs-137) was pumped from Bunker #3 at the WMA into a tank mounted onto a trailer. The liquid was transferred from the trailer tank to a holding tank in B200. Soil was contaminated near the transfer point, probably from tank leakage at the time of transfer. The area near the transfer point was surveyed, and soil samples were collected. Contaminated soil was removed and sent to the WMA. No residual contamination or impact to the Storm Drain system is expected from this incident. There is a potential for radiological impact of underground electrical conduits, power and control concrete bus ducts, and associated electrical junction pits that transverse these areas.

2005: Radioactive soil contamination was discovered at numerous locations on the grass outside the IFTF (B511-1) north wall, and also in the HCF (part of B300), IFTF and the B300 Machine Shop roof areas. The source of the radioactivity was identified to be remnants of a paintbrush that somehow got into the ventilation system and was chopped up through the exhaust fans and released through the effluent stack. It is likely that the samples also contained mixed fission products (Cs-137, Sr-90) and actinides (Am-241, Pu). The contamination was widespread on the roof areas and on the ground along the IFTF north wall. The area was remediated. There is a potential for radiological impact of underground electrical conduits, power and control concrete bus ducts, and associated electrical junction pits that transverse these areas.

2006: The WMA tanker was used to transport 556 litres of liquid waste from ILW Bunker #6 sump in the WMA to the ALWTC (B200). During transfer into the Medium Level Liquid Waste (MLLW) system at B200, a small spill occurred from the tanker vent. The spill was remediated, and contaminated soil was moved to the WMA. No residual contamination or impact to the underground is expected from this incident.

2006: During the excavation of a failed water pipe adjacent to the two MLLW lines outside B303, one of the MLLW lines broke as a result of collapse of the nearby waterlogged soil. The open ends of the broken lines were capped, and the site was remediated. There is a potential for radiological impact of underground electrical conduits, power and control concrete bus ducts, and associated electrical junction pits that transverse this area.

2.2.3.5.1.2 Non-Radiological Hazardous Materials Events

1988: A stainless steel soaking tank containing 25% nitric acid was left overnight in the B411 parking lot. The tank was to be used the next morning for soaking SLOWPOKE Demonstration Reactor components. The acid corroded the body of the brass drain valve, allowing approximately 500 litres of acid solution to drain onto the cement and into the storm sewer system. The cement pad was damaged but was remediated afterwards.

Multiple hydrocarbon leaks/spills have been documented (e.g., hydraulic line break on heavy machinery), and the records show that all sites were remediated.

There are also multiple operational fuel tanks at WL, including one diesel tank, one propane tank near B911 (north side), and one gasoline/diesel tank near B420 (south side). Though specific contamination events are not necessarily associated with these tanks, it is possible that undocumented spills impacted the local soil or nearby manholes.

2.2.3.5.2 Cesium Ponds

This area was located directly east of the WMA. The ponds were developed to study the distribution of dose received by organisms living at the water mud interface. The contaminated soil, which had been excavated and moved to the WMA in 2014, was then packaged into certified transportation packages and safely transported to CRL.

2.2.3.5.3 Field Irradiator Gamma (FIG)

This project was conducted in the late 1970s to early 1980s to study the ecological effects on a mixed boreal forest ecosystem from continuous exposure to gamma radiation. Only sealed sources were used and these were later placed in a standpipe in the WMA. These have been removed and there is no radioactive contamination in the FIG area. The FIG area has been decommissioned.

2.2.3.5.4 Zoological Environment Under Stress (ZEUS)

The ZEUS project studied the effects of ionizing radiation on small mammals. Only sealed sources were used and these were later sent to the WMA. These have been removed and there is no radioactive contamination in the area. The ZEUS area has been decommissioned.

2.2.3.5.5 Deep Borehole Site

The borehole site was located north of the CCSF. Small amounts of short half-life tracers were injected into three wells to study radionuclide transport in bedrock. The radioactivity has decayed to background by 2002. The site has been decommissioned.

2.2.3.5.6 Tritium Injection Sites #2 and #3

Tritium was injected in both sites (located west of the north/south road near the east borehole site road) as part of groundwater flow experiments in 1969. Tritium activity measured at the associated sampling points is below drinking water limits. The site has been decommissioned.

2.2.3.6 Off-Site Contaminated Areas

Off-site contamination resulting from the operation of the WL has occurred in two areas. Routine releases (well within regulatory limits) and some spill incidents have resulted in contamination of river sediments. A second area is the north property ditch and a natural drainage creek northwest of the site boundary, which was contaminated as the result of a spill in the WMA. These off-site contamination areas are described below.

2.2.3.6.1 River Sediments

Whiteshell Laboratories is situated on the east bank of the Winnipeg River. The river in this area is wide and flows rapidly several metres below the level of the surrounding land. The average flow is approximately 950 m^3/s, although this is controlled by Manitoba Hydro control stations, and may vary from time to time according to Manitoba Hydro policies.

Liquid effluent from the ALWTC and now the LLLW systems in B100 and B300 are discharged to the Winnipeg River via the process discharge at the process outfall located about 8 m offshore in 5 m of water. The Cs-137 (the dominant radionuclide) concentration in downstream river water is well within the 10 Bq/L Canadian Drinking Water Quality Guidelines.

A reduction in the effluent particulate load was accomplished in 1998-99 by the installation of filter stations to collect the larger particulate for the most critical waste streams. The effluent from the WMA sumps was routinely filtered through 5 micron filters before being transferred by tanker to the ALWTC. The effluent is now collected and stored in totes until a disposition path is determined. In 1995, a decision was made to reduce the concentration control point for ALWTC waste by reducing the Administrative Level from 1 GBq/m^3 to 0.1 GBq/m^3. This means the overall level of releases was reduced and a significant fraction of the larger particulate (settleable solids) was collected, and therefore, prevented from being released to the river.

Elevated sediment contamination has been measured in the local outfall area (an area 20 m wide by 80 m downstream). The total inventory was estimated to be approximately 1.3 GBq. However, this is substantially less than the annual releases of Cs-137 prior to 1985 when the reactor was operating. A detailed evaluation of the sediment contamination is presented in Appendix B.1 of [2-1]. The assessment concludes that using the most conservative dose estimation methods; doses to non-human biota and humans are below accepted guidelines.

2.2.3.6.2 North Ditch/Creek

A spill incident at the WMA in 1979 led to fission product contamination of a 2 km ditch system, (including the west ditch, the north ditch, and a small creek). The creek is located in the public domain north of WL, and discharges into the Winnipeg River. A follow-up ditch sampling program indicated radioactivity was deposited throughout the 5 to 10 cm of clay silt soil in the ditch system near the WMA. Surface water was present in the ditches at the time, and contamination of the water flowing down the drainage system exceeded the maximum permissible concentration in drinking water for continuous consumption. No significant increase in the level of radioactivity in the river water was attributed to this event.

The ditch flowing west from the WMA was excavated to remove contaminated soil. The entire ditch/creek system was surveyed to determine the immediate remediation required. Routine monitoring continues to be carried out in this ditch/creek system.

2.3 Operational History

To date, no significant incidents or accidents have occurred while executing decommissioning work at WL. This section summarizes the operational events/incidents that have occurred at WL since 2002.

The Intermediate Level Waste (ILW) Bunkers have a history of water ingress. Water ingress is believed to result from a combination of groundwater ingress and surface run off. Previous investigations have found that ILW Bunkers 1, 2, 3 and 5 contain water [2-7]. In 2011, surface soil contamination was discovered near ILW Bunkers 1 and 2 [2-8]. Further investigations were conducted along with the remediation of the contaminated soil. Point holes were drilled through the concrete roof slab of each of ILW Bunkers 1 to 3 and a well screen and well cap installed in the south west corner. Water was found at the base of the roof slab. The roof slabs are approximately 15 cm thick at the edges, but are thicker away from the walls due to compaction of the backfill during the concrete pour. Concrete cores were up to 0.4 m thick and water was found at the base of the cored holes indicating the bunkers were fully flooded. In 2014, the ground was landscaped to reduce the potential for surface water entering ILW Bunkers 1 to 3; grading of the surface is to the east, towards a water collection swale.

Intermediate Level Waste Bunkers 4, 6 and 7 all experience varying degrees of water inflow [2-7]. Bunker 4 had water inflow, reportedly from precipitation (5774 L in 1997) until the wooden roof was installed. The wooden roof later had aluminium installed over the wood for fire protection. Bunker 4 experienced an average water ingress of 558 L per year from 2009 to 2015. Grading was done for ILW Bunker 4 in 2001 along with the installation of an impermeable geotextile membrane just below grade.

In 1997, the ground was graded away from the roof of ILW Bunker 5. In 2002, ILW Bunker 5 had water pumped from the sump (205 L). After that time, the pump out lines were damaged and were not used. Repairs done in 2014 found that water was present to the top of the repaired sample lines. It is assumed from this observation that ILW Bunker 5 is also flooded. It was not pumped out to avoid disturbing the state of the material in the bunker and the groundwater.

Large amounts of pumping will disturb the groundwater movement and could mobilize contamination from other waste structures. For these reasons, it was decided not to pump out ILW Bunkers 1, 2, 3, and 5 until it was time to decommission them.

Significant water amounts have been pumped from ILW Bunker 6 (the records for 1997-2004 show a range from 880 L to 6969 L per year). In 1997, the soil was graded to direct surface water runoff away from the structure. Repairs and modifications in 2001 saw the addition of foil tape across the gaps between the bunker shielding plugs, caulking in the joints between the access shielding plug and the curbs. Additional caulking and installation of a geotextile just below grade were done to enhance water shedding. Rain gutters were also installed at that time. While this reduced inflow, subsequent years saw increased inflow, suggesting that an alternate pathway for inflow exists.

In 2015, in order to support the decision to defer water removal from the flooded bunkers and demonstrate that the ILW Bunkers were fit for service by effectively containing contamination, shallow wells were installed adjacent to ILW Bunkers 1 to 7 [2-9]. These wells were drilled to a depth just below the base of each bunker. The water chemistry from inside each bunker was compared to the adjacent wells.

Water stains were noticed on the outside of the ILW Bunker 8 below the lower air vent inlet line [2-10]. These were observed following a heavy rain. Investigation indicated water had infiltrated the temporary weather shield tarping covering the top of the bunker at that time and penetrated into some of the six inner storage sites in the bunker. Radiation surveys found up to 3000 cpm beta/gamma on swipe on the exterior of the bunker and up to 25,000 cpm beta/gamma fixed on the exterior of the bunker and small amounts of contamination in the soil directly below some of the bunker vent lines. Further surveys after decontamination of the bunker exterior found no detectable loose activity.

In addition to the above, and the events listed in Section 2.2.3.5.1 (Active Area Soil Contamination), Table 2-3 lists any other unusual occurrences that occurred at WL since 2002.

Table 2-3 Unusual Occurrences Since 2002

Date	Event	Description	Remediation/Impact
2006 Sept 21	WMA tanker pump-out spill at Addition Station on north side of B200	Approximately 4 L of ILLW spilled from the drip tray of the WMA tanker during transfer to receiver tank, TK807	Soil was excavated from the spill area and analyzed; corrective landscaping of loading area was done and guiding markers added. An air vent was installed on the tanker and the pump-priming procedure was updated. No subsurface migration of radionuclides is expected.
2009 Dec 15	Release of friable asbestos	Asbestos was released and spread when workers were moving, rigging and lowering pipe in B100, Room 601	Access to Room 601 was limited and a thorough clean-up of the room was completed, as confirmed with air monitoring.

2.4 References

The following references were current at the time of development of this DDP. Where a reference is to be complied with, ensure the latest revision is used.

[2-1] WLDP-03702-041-000-0008, *Whiteshell Laboratories Decommissioning Project Comprehensive Study Report, Volume 1: Main Report*.

[2-2] WLDP-03702-041-000-0009, *Whiteshell Laboratories Decommissioning Project Comprehensive Study Report, Volume 2: Appendices*.

[2-3] WLDP-03702-041-000-0010, *Whiteshell Laboratories Decommissioning Project Comprehensive Study Report, Volume 3: Addendum*.

[2-4] WLDP-26000-ENA-001, *Environmental Impact Statement – In Situ Decommissioning of WR-1 at the Whiteshell Laboratories Site, Pinawa, Manitoba*.

[2-5] NRTEDL-W5-8.00/2024, *Nuclear Research and Test Establishment Decommissioning Licence for Whiteshell Laboratories*.

[2-6] 900-508740-PRD-001, *Radiation Protection*.

[2-7] WLDP-03705-REPT-001, *Fitness-For-Service Report for Whiteshell Laboratories Waste Management Area Bunkers*.

[2-8] WL-00583-ASR-2011, *WL Annual Safety Review for 2011*.

[2-9] WL-00583-ASR-2015, *WL Annual Safety Review for 2015*.

[2-10] WL-00583-ASR-2009, *WL Annual Safety Review for 2009*.

3. APPLICABLE PROGRAMS, CODES AND STANDARDS

Compliance programs, codes and standards applicable to the WL Decommissioning Project are described in this section.

3.1 CNL Management System and Health, Safety, Security, Environment and Quality

The CNL Management System [3-1] is the platform to enable the continuance of safe operational practices. The Management System ensures safe, effective and efficient conduct of work, delivering against commitments within appropriate accountabilities and controls.

The Management System is comprised of an integrated set of documented policies, expectations, standards, procedures, and responsibilities through which CNL is governed and managed, from the high level setting of direction through to day to day operations, all within a coherent control and accountability framework. The system applies to all CNL locations including WL.

Canadian Nuclear Laboratories corporate policies continue to provide direction and expectations to management and employees for all business activities performed at WL, and all other site locations. As itemized below, CNL operates under eleven corporate policies. All policies have been authorized by the CNL Board of Directors and approved by the CNL President and Chief Executive Officer.

- Nuclear Safety
- Safety and Health
- Environment
- Code of Conduct
- Quality
- People
- Security
- Property (Asset) Management
- Supply Chain
- Intellectual Property
- Ethics & Business Conduct

A core prerequisite for CNL’s success in consistently bringing high value to its customers and stakeholders is the effective and efficient governance and management of the company. Canadian Nuclear Laboratories is committed to excellence in management, thereby providing the foundation on which the company and our employees can thrive.

The Management System applies to all CNL management and execution activities. Management activities include setting expectations, enabling, planning and budgeting, and assessing all aspects of business, thereby ensuring delivery against commitments within appropriate accountabilities and controls. Execution activities include the safe, effective and efficient conduct of work across all CNL lines of business, performed by CNL employees, as well as third parties engaged through external partnerships, collaboration and CNL’s Supply Chain.

The CNL Management System [3-1] aligns with Canadian Standards Association (CSA) N286-12 [3-2]. The QA program for decommissioning at WL is based on CSA N286.6 [3-3].

3.1.1 Occupational Safety and Health

The CNL Occupational Safety and Health (OSH) program [3-4] [3-5] applies to all work performed at WL by CNL employees and other personnel (attached staff, visitors, contractors and students, etc.). The program ensures compliance with all applicable policies and regulations. The program also ensures that conventional hazards from routine activities and decommissioning projects are identified, assessed and managed adequately to protect the environment and the health and safety of workers and the public.

3.1.2 Radiation Protection

The CNL Radiation Protection program [3-6] [3-7] is designed to protect workers and members of the public from harmful effects of radiation exposure arising from CNL activities and to ensure that CNL complies with, or exceeds, the level of radiation safety that is required by the Nuclear Safety and Control Act [3-8] and the CNSC Regulations [3-9] [3-10] [3-11] [3-12].

The Program [3-6] [3-7] applies to the monitoring, surveillance, maintenance, and decommissioning activities that affect the safety of staff and equipment in terms of ionizing radiation at all CNL sites, and applies to all employees and other personnel (attached staff, contractors, visitors, students, etc.) conducting work at all CNL sites including the WL site. The Program provides the overall framework including the requirements and responsibilities, processes and procedures, and other related activities as it relates to radiation protection for CNL's activities.

Dosimetry is a necessary component of the program, providing a quantitative measure of the effectiveness of the radiation protection program as it applies to both the individual worker and the collective workforce. Dosimetry is a fundamental requirement for the demonstration of compliance with regulatory obligations mandated by the site licence.

3.1.2.1 As Low As Reasonably Achievable Approach

The As Low As Reasonably Achievable (ALARA) approach is intended "to keep the amount of exposure to radon progeny and the effective dose and equivalent dose received by and committed to persons as low as reasonably achievable, social and economic factors being taken into account" [3-13]. The ALARA work control process provides a systematic, practical and duplicable approach to the planning and control of radiological work that will provide optimized radiation protection and assurance that:

- Doses are kept below applicable regulatory limits [3-7] and WL's Action Levels (ALs) [3-14].
- Exposures and doses are kept ALARA, social and economic factors taken into account.
- The occurrence of unplanned events exceeding a radiation deterministic effective dose threshold are prevented.
- The probability of the occurrence of unplanned events exceeding a regulatory dose limit or an action level is kept ALARA, social and economic factors being taken into account.

At WL and other CNL sites, it is achieved through the implementation of:

- Management control over work practices.
- Personnel qualification and training.
- Control of occupational and public exposure to radiation.
- Planning for unusual situations/emergencies.

Applying the above measures, while complying with the CNL Radiation Protection program requirements and federal Radiation Protection regulations, will keep doses received by workers and members of the public from exposure to sources of radiation ALARA.

3.1.2.2 Dose Estimates and Monitoring

Dose to workers shall be justified, maintained below regulatory dose limits [3-6] and kept ALARA, social and economic factors taken into account. At WL, this is accomplished by the control of radiation work and the application of individual and source related dose constraints, including Dose Control Points and radiological Control Hold Points. The dose limitations apply to all doses received as a consequence of the worker's occupation from all sources of ionizing radiation. They do not apply to doses received from non-occupational radiation sources, such as medical diagnostics or therapy, natural background, doses from air travel and other regulatory exempt sources of exposure.

3.1.3 Environmental Protection and Monitoring

Canadian Nuclear Laboratories Environmental Protection program [3-15] [3-16] is designed to ensure protection of the environment and the public with respect to its activities, products, or services. The Environmental Protection program requirements apply to all CNL employees for the CNL operated sites including the WL site. Whiteshell Laboratories is ISO 14001:2015 compliant and is governed by Federal regulations and legislation and, where applicable, Provincial and municipal regulations and legislation. The program [3-15] [3-16] describes the organization, responsibilities, processes, controls and requirements that are applicable to the projects and other activities of CNL including:

- Identification and assessment of significant environmental aspects related to CNL operations.
- Management and monitoring of emissions.
- Environmental monitoring.
- Management of land and habitat.
- Environmental incident reporting and investigation.

Canadian Nuclear Laboratories is legally obligated under the Canadian Environmental Assessment Act 2012 (CEAA, 2012) [3-17] to ensure that projects are considered in a careful and precautionary manner to avoid significant adverse environmental effects.

3.1.4 Emergency Preparedness

Canadian Nuclear Laboratories Emergency Preparedness (EmP) program [3-18] [3-19] focuses on the prevention and mitigation of, preparedness for, and recovery from abnormal or emergent events. The Program applies to design, operations and other activities including decommissioning work that may affect EmP at CNL sites, including the WL site. A graded approach to EmP requirements [3-19] is applied based upon an assessment of the most credible events that could occur at any given location such as the one at the WL site.

Emergency Preparedness provides the oversight to ensure personnel, equipment, and response facilities are maintained in a state of readiness to assure both response and site licensing requirements are met. To this end, the Program interfaces with internal and external stakeholders to ensure effective plans, training, equipment, and resources are in place to prevent emergencies and to respond in an integrated and timely manner in the unlikely event that an emergency occurs.

Employees are responsible to be familiar with their work area and building emergency procedures, and promptly respond to emergencies as trained or as requested. They shall conduct their work and use equipment, devices, and facilities in accordance with Program requirements [3-19] and related procedures and practices specific to their facility or activity.

3.1.5 Fire Protection

Canadian Nuclear Laboratories has a comprehensive Fire Protection program, which identifies the requirements, processes and responsibilities to fulfill health and safety, security, environmental and regulatory obligations pertaining to fire protection at CNL, including the WL site. The Program Description Document [3-20] supplements the Program Requirements Document [3-21], both of which apply to all CNL employees and to other personnel (contractors, consultants, etc.) conducting work at all CNL sites, including routine monitoring and maintenance work and non-routine decommissioning activities. The Fire Protection program applies a risk graded approach in conjunction with the defence in depth principles to its operations and activities insofar as they may affect fire protection.

Whiteshell Laboratories decommissioning work is subject to a fire protection screening process by Fire Protection staff to ensure fire protection is maintained throughout the decommissioning process.

3.1.6 Security

Canadian Nuclear Laboratories Security program [3-22] [3-23] applies to the operation and activities that may affect security, and to all employees and other personnel (visitors, contract staff, etc.) conducting work at CNL sites. Adhering to the Security program requirements [3-23] ensures protection of CNL employees, facilities, and nuclear materials, and meets the objectives of the CNL Security Policy [3-24]. By implementing a strong Security program, CNL also supports Canada’s interest in ensuring the protection of assets, information, safeguarding of the public and personnel, and resumption of business.

Routine work and non-routine decommissioning activities at WL are subject to CNL’s Security program, where applicable. All Contractors must be security cleared through CNL Security before working at WL and must comply with the Facility’s access control requirements. Canadian Nuclear Laboratories periodically performs site security and threat risk assessments for WL, and acts on the findings as required. The routine inspections, testing and maintenance of Security systems at WL are performed by WL personnel.

3.1.7 Nuclear Materials and Safeguards Management

Canadian Nuclear Laboratories Nuclear Materials and Safeguards Management (NM&SM) program [3-25] [3-26] applies to all nuclear material and safeguards management activities performed at CNL facilities, including WL. It covers procurement, receipt, disposition, transfer, accounting, safeguards management, storage, and inventory management of nuclear material. The primary focus of the NM&SM program is on facilities that contain fissionable material, and are therefore subject to regulatory safeguards measures and reporting requirements.

All routine and non-routine work, including decommissioning activities at WL, meet the program requirements. The Facility is also subject to periodic Compliance and Safeguards inspections and verifications by the regulatory bodies.

3.1.8 Transportation of Dangerous Goods

Canadian Nuclear Laboratories Transportation of Dangerous Goods Program [3-27] [3-28] provides an operational framework for the safe transport of dangerous goods by conforming to all applicable laws and regulations [3-12] [3-29] [3-30], and company policies and procedures. It enables an effective, consistent and comprehensive application of International standards. The Program applies to off-site shipping of dangerous goods by all modes of transport, and to anyone who performs an activity associated with the transport of such materials. Transport activities include all operations associated with the movement of dangerous goods such as classification, documentation, packaging, safety marks, security, emergency response, training, and regulatory permits and licences.

All off-site transport of dangerous goods, including radioactive materials/waste at the WL site, follows the Program requirements [3-28], which provide compliance with the decommissioning licence conditions [3-14] [3-31].

3.1.9 Waste Management

Canadian Nuclear Laboratories Waste Management Program [3-32] [3-33] applies to all operations and activities that result in the generation, transportation, treatment, storage and/or disposal of wastes (i.e., the lifecycle of waste) generated by CNL or received by CNL from an external organization. The Program applies to all CNL employees, including other personnel (contractors, attached staff, consultants, etc.) for waste management activities conducted on behalf of CNL.

The Program addresses Federal and Provincial regulatory obligations applicable to CNL sites and the CNSC requirements for waste management at all CNL operated sites, including WL. The Program provides advice to CNL waste generators to ensure that activities involving the waste management lifecycle are performed in a manner that protects the workers, the public, and the environment. The Program is driven by a series of requirements and supported through a series of procedures for the application of work processes, practices and activities.

All waste generated during the decommissioning and demolition phase at WL will be monitored, segregated, packaged or contained, shipped for processing/storage or disposal in accordance with the project specific Waste Management Plans, which will be prepared as part of the DDP. The Waste Management Plans will ensure that:

- All waste material will be adequately characterized, in order to meet CNL Waste Management program requirements [3-33], including waste acceptance criteria for clean waste and solid radioactive waste [3-34].
- Waste materials are properly packaged for transportation and storage, or disposal [3-32].

All waste generated from the operational phase of WL or from the decommissioning of the WL site will be packaged and readied for transportation to approved off-site facilities (primarily CRL for radioactive wastes).

3.1.10 Quality Assurance

Quality Assurance activities are integrated into work procedures to provide confidence that products and services will meet specifications and perform as expected. At CNL, this is mostly achieved by aligning its Management System Manual [3-1] with applicable standards such as CSA N286-12 [3-2], CSA N285.0 [3-35], CAN/CSA ISO 14001:2015 [3-36], and CSA N286.6-98 [3-37]. The result is the QA program description and requirements documents [3-38] and [3-39], which describe CNL's quality program and processes, and applicable QA requirements. The program description document [3-38], together with the Management System Manual, provides the framework that all employees shall use in their work to support the delivery of high value, quality products and services. Implementation of the QA Program helps to assure adequate protection of workers, the public, and the environment from adverse consequences as a result of CNL's operations, including decommissioning. Where appropriate, the degree and level of rigor applied to program elements, items, or activities are based on a graded approach that takes into account the complexity of work to be performed and the magnitude of the hazards to maintain an acceptable level of risk. Decommissioning activities at WL are further governed by the WL Quality Assurance Plan (QAP) [3-40], which is based on CSA N286.6 [3-3] and aligned to CSA N286-12 [3-2].

Effectiveness of the decommissioning activities for the facility in complying with various programs and documented procedures is evaluated through internal audits, assessments and reviews.

3.1.11 Human Performance Management and Operating Experience

Canadian Nuclear Laboratories Performance Assurance program [3-41] [3-42] provides the Organization with necessary tools, methods, training, and expertise to ensure safety of its employees and the public and protect the environment from any potential hazards associated with operating its sites and facilities. The Program also focuses on achieving continual improvement in efficiency and effectiveness without compromising safety or quality. Elements of the Performance Assurance program include Human Performance, Operating Experience and Corrective Action Program, Assessment, Continual Improvement, and Performance Measures and Analyses.

The Program elements are implemented across the Organization, and are applicable to all CNL sites including the WL site, with the objectives to (1) identify and address program and performance deficiencies and opportunities for improvement, (2) provide the means and requirements to consistently assess and report deficiencies, (3) establish and effectively implement corrective and preventive actions, and (4) share lessons to be learned across all aspects of operations.

3.1.12 Staffing, Personnel Qualifications and Testing

Staff hiring at CNL is effected through a well-defined hiring process, which is consistent with applicable Federal laws, regulations, CNL policies, and collective agreements. The hiring procedure [3-43] is designed to support a fair and transparent application of processes in order to attract and hire the best qualified candidates. The recruitment process ensures the selection of an applicant(s) who has the most desired qualifications, knowledge, skills, and experience to fill job vacancies against defined position descriptions and specifications.

Canadian Nuclear Laboratories Training and Development program [3-44] [3-45] provides employees with the knowledge, skills and competencies required to safely and successfully perform the work for which they are responsible. The Program scope also includes building and sustaining employees' skill sets in order to maintain and achieve CNL's corporate objectives, and creating and maintaining an efficient and effective investment in training on a company wide basis that is planned and budgeted. The Program supports career and individual development through experience, mentoring, and training.

In the event that the decommissioning work is undertaken by Contractors, the Contractors shall provide adequately trained and licensed resources capable of performing the work in accordance with best industry practices and in compliance with codes and standards noted in Section 3.2. The Contractor's Supervisor shall provide basic instructions and training to their staff who are on site regarding work procedures, rules and requirements, and ensure contract personnel have all required training, including training on safe and proper use of vehicles and equipment required for their work. Where required, Contractor employees selected to work at the WL site will attend a general safety orientation training session. This training is site specific and will be held at the WL site. If Contractors will be performing radiological work, there will be additional radiation protection training that will be provided to the Contractor. The Project Supervisor will ensure that contract staff members receive the site specific training, plus any other additional project specific training as determined by the Project.

3.1.13 Human Factors

The human factors approach for the WL project focuses on protection of environment, health and safety associated with the critical safety tasks in the final phases of decommissioning. Canadian Nuclear Laboratories has used the Energy Institute document, Guidance on Managing Human and Organizational Factors in Decommissioning [3-46] to identify the elements that will be important to the project during execution of decommissioning. In addition, human factors elements that apply to all phases of decommissioning are assessed for the WL decommissioning project.

Human factors are embedded in many of CNL's existing processes and procedures, such as OPEX review, organizational management, task analysis (work instruction process), qualification of staff and contractors, physical work environment, and human performance:

- Staffing assessments, which include analyzing the work to be performed and assessing the time required to perform are completed for the project.
- Training needs and competency are identified and reviewed annually for individuals involved in all work positions. Records of qualifications are maintained. The OSH Program applies this requirement to Contractor staff through a systematic check of special skills for the work and retention of worker records as proof of training.
- Safety culture for all CNL staff and Contractors is well inculcated in the organization. Focus on "*Safety First*" and "*Safety Begins With Me*" maintains a culture of safety before production. In addition, programs for monitoring safety statistics, near miss reporting and continued dialogue on safety are practiced throughout the organization and with Contractors. The OSH Program includes minimum training requirements for all employees and standards to be met by Contractors.
- Task hazard analysis is performed during the writing of work instruction packages, and CNL provides rigorous oversight of Contractors including the review of their hazard analysis and work instructions.
- Organizational change is managed through a documented change management process. Canadian Nuclear Laboratories has a well-developed project organization as site closure has been in progress for over 10 years.

Those human factors identified that are not part of existing management programs will be assessed using the Energy Institute guidelines [3-46].

All work plans and job steps in work instruction packages will incorporate a Human Factors assessment to identify any issues requiring particular attention. An example would be the use of communication protocols such as hand signals and radios, particularly when CNL staff will integrate with Contractors.

3.1.14 Nuclear Criticality Safety

Nuclear criticality safety is aimed at preventing criticality accidents. The CNL Nuclear Criticality Safety program [3-47] [3-48] complies with the CNSC Regulatory document, REGDOC-2.4.3 [3-49], which provides the requirements for the prevention of criticality accidents in the handling, storage, processing, and transportation of fissionable materials, and the long-term management of nuclear waste.

3.1.15 Pressure Boundary

The purpose of the Pressure Boundary program [3-50] [3-51] is to ensure that pressure retaining systems and components are designed, constructed and operated in full compliance with statutory and legislative requirements, while promoting and supporting performance excellence with a strong safety culture. The ultimate objective of the Pressure Boundary program is to have “no pressure boundary failures” [3-35] [3-52].

3.2 Acts, Laws and Regulations and Codes, Guides and Standards

Decommissioning work shall comply with the requirements of several Codes, Guides and Standards including Provincial and Federal Acts, Laws, and Regulations, as applicable. All applicable Federal requirements (which are incorporated in the Management System documents noted in Section 3.1 and its sub-sections), shall be adhered to, and if Contractors are involved, they shall additionally work to all applicable Manitoba codes and standards. The Licence Conditions Handbook (LCH) [3-14], associated with the decommissioning licence [3-31], specifies relevant Acts, Laws and Regulations, Codes, Guides, and Standards with their use being either mandatory and complied with or recommended and used as guidance in the conduct of licensed activities at WL.

3.2.1 Acts, Laws and Regulations

- Nuclear Safety and Control Act.
- Canadian Environmental Protection Act.
- Transportation of Dangerous Goods Act.
- Access to Information Act.
- Canadian Environmental Assessment Act.
- Nuclear Liability Act.
- Radiation Emitting Devices Act.
- Canada/IAEA Safeguards Agreements.
- General Nuclear Safety and Control Regulations.
- Class I Nuclear Facilities Regulations.
- Radiation Protection Regulations.
- Nuclear Security Regulations.
- Nuclear Non Proliferation Import and Export Control Regulations.

- Packaging and Transport of Nuclear Substances Regulations.
- Transportation of Dangerous Goods Regulations.

3.2.2 Codes, Guides and Standards

The Codes, Guides, and Standards are specified in the WL LCH [3-14]. This list is not an exhaustive list of all applicable codes and standards; there could be other standards with which compliance might be required as per the CNL Management System Manual [3-1] and its sub tier documents.

3.3 References

The following references were current at the time of development of this DDP. Where a reference is to be complied with, ensure the latest revision is used.

[3-1] 900-514100-MAN-001, *CNL's Management System (Manual)*.

[3-2] CSA Standard, N286-12, *Management System Requirements for Nuclear Facilities*.

[3-3] CSA Standard, N286.6, *Decommissioning Quality Assurance for Nuclear Power Plants*.

[3-4] 900-510400-PDD-001, *Occupational Safety and Health*.

[3-5] 900-510400-PRD-001, *Occupational Safety and Health*.

[3-6] 900-508740-PRD-001, *Radiation Protection*.

[3-7] 900-508740-PDD-001, *Radiation Protection*.

[3-8] *Nuclear Safety & Control Act*, Government of Canada, S.C. 1997.

[3-9] SOR/2000-202, *General Nuclear Safety and Control Regulations*, Government of Canada.

[3-10] SOR/2000-203, *Radiation Protection Regulations*, Government of Canada.

[3-11] SOR/2000-207, *Nuclear Substances and Radiation Devices Regulations*, Government of Canada.

[3-12] SOR/2015-145, *Packaging and Transport of Nuclear Substances Regulations*, Government of Canada.

[3-13] CNSC Regulatory Guide, G-129, *Keeping Radiation Exposures and Doses "As Low as Reasonably Achievable (ALARA)"*.

[3-14] WLD-508760-HBK-002, *Licence Conditions Handbook for Whiteshell Laboratories*.

[3-15] 900-509200-PDD-001, *Environmental Protection*.

[3-16] 900-509200-PRD-001*, Environmental Protection*.

[3-17] CEAA 2012, *Canadian Environmental Assessment Act 2012*.

[3-18] 900-508730-PDD-001, *Emergency Preparedness*.

[3-19] 900-508730-PRD-001, *Emergency Preparedness*.

[3-20] 900-508720-PDD-001, *Fire Protection*.

[3-21] 900-508720-PRD-001, *Fire Protection*.

[3-22] 900-508710-PDD-001, *Security*.

[3-23] 900-508710-PRD-001, *Security*.

[3-24] 900-508710-POL-001, *Security*.

[3-25] 900-508510-PDD-001, *Nuclear Materials and Safeguards Management*.

[3-26] 900-508510-PRD-001, *Nuclear Materials and Safeguards Management*.

[3-27] 900-508520-PDD-001, *Transportation of Dangerous Goods*.

[3-28] 900-508520-PRD-001, *Transportation of Dangerous Goods*.

[3-29] SOR/2001-286, *Transportation of Dangerous Goods Regulations*, and SOR/2017-253*, Amendment*.

[3-30] IAEA Safety Standards SSR-6, *Regulations for the Safe Transport of Radioactive Material*, 2012 Edition.

[3-31] NRTEDL-W5-8.00/2024, *Nuclear Research and Test Establishment Decommissioning Licence for Whiteshell Laboratories*.

[3-32] 900-508600-PDD-001, *Waste Management*.

[3-33] 900-508600-PRD-001, *Waste Management*.

[3-34] 900-508600-MCP-004, *Management of Waste*.

[3-35] CSA Standard, N285.0, *General Requirements for Pressure-Retaining Systems and Components in CANDU Nuclear Power Plants*.

[3-36] CAN/CSA ISO 14001:2015, *Environmental Management System – Requirements with Guidance for Use*.

[3-37] CSA Standard, N286.6-98, *Decommissioning Quality Assurance for Nuclear Power Plants: General Instruction No 1*.

[3-38] 900-514200-PDD-001, *Quality*.

[3-39] 900-514200-PRD-001, *Quality Assurance*.

[3-40] WLD-508300-QAP-001, Revision 2, *Whiteshell Decommissioning Quality Assurance Plan*.

[3-41] 900-514000-PDD-001, *Performance Assurance*.

[3-42] 900-514000-PRD-001, *Performance Assurance*.

[3-43] 900-510000-MCP-012, *CNL Staff Hiring*.

[3-44] 900-510200-PDD-001, *Training*.

[3-45] 900-510200-PRD-001, *Training and Development*.

[3-46] Energy Institute, *Guidance on Managing Human and Organizational Factors in Decommissioning*, 2010 March.

[3-47] 900-508550-PDD-001, *Nuclear Criticality Safety*.

[3-48] 900-508550-PRD-001, *Nuclear Criticality Safety*.

[3-49] CNSC Regulatory Document, REGDOC-2.4.3, *Nuclear Criticality Safety*.

[3-50] 900-508140-PDD-001, *Pressure Boundary*.

[3-51] 900-508140-PRD-001, *Pressure Boundary*.

[3-52] CSA Standard, B51, *Boiler, Pressure Vessel and Pressure Piping Code*.

4. HAZARDS ASSESSMENT

4.1 Facility Current Hazards

Currently, the WL site is comprised of nuclear and non-nuclear facilities either operating, undergoing decommissioning and/or under M&S. The hazards that may invariably exist at WL site under its current state include:

- Radiological Hazards
- Chemical Hazards
- Industrial Hazards
- Biological Hazards
- Environmental Hazards

A brief description of the above listed hazards is outlined in the following subsections.

The Annual Compliance Monitoring Report (ACMR) for WL (e.g., [4-1]), has demonstrated that risks from normal anticipated operations, unplanned events, or accidents that may occur during its current operational phase are low, controlled and ALARA.

4.1.1 Radiological Hazards

The radiological safety of the workers and visitors at the WL site is ensured through the implementation of CNL's Radiation Protection Program (see Section 3.1.2).

4.1.1.1 Radiological Area and Zoning

The WL site has been segregated into radiological areas and those areas further divided in radiological safety zones to organize nuclear facilities and decommissioning activities in an effective way and to optimize the provision of radiation protection measures and controls.

The radiological area designation indicates whether activities, operations, or facilities posing a radiological hazard are permitted and details the required radiation protection practices and procedures. The system for classifying site areas is based on the International Commission on Radiation Protection (ICRP) and International Atomic Energy Agency (IAEA) recommended work place designations of Controlled, Supervised, or Uncontrolled Areas. The radiological area designation reflects the potential for allowed work activities to result in exposure to radiation and contamination hazards and the need to follow well-established radiation protection procedures and practices. The following radiological areas designations are used to segregate the WL site:

- Controlled Area 2 (CA-2): Activities and facilities that pose a radiation and/or contamination exposure hazard are permitted.
- Controlled Area 1 (CA-1): Activities and facilities that pose predominantly an external radiation hazard are permitted and activities posing a low potential for contamination may be allowed on a case-by-case basis.

- Supervised Area: Storage, possession and handling of radioactive material within a Supervised Area is not permitted, except for the transfer of packaged radioactive material or waste being transferred between Controlled Areas or moved off-site. Exceptions require approval by the WL Radiation Protection Program Manager.
- Uncontrolled Area: Treated as a public access areas with no radiation protection oversight or controls. The only permitted radioactive material in Uncontrolled Areas is that packaged and being transported in accordance with the applicable transport regulations at WL.

Radiological safety zoning is used to communicate the type and level of radiological hazards in rooms and work areas within a radiological area and the degree of radiation protection measures required to control contamination and radiation exposure. The CNL zoning system categorizes work areas into 1 (none) to 5 (very high) radiological safety zones that reflect the external radiation and contamination exposure hazards in a work area. The greater the level of the zone, greater the potential hazard and greater the operational measures needed to control radiation exposures and contaminations. Appendix A provides a general description of each of the zone levels.

The radiological areas and zoning at the WL site are ever evolving as decommissioning work progresses. Table 4-1 summarizes the site radiological area designations, main facilities within the area and the radiological safety zone classifications.

Table 4-1 WL Site Radiological Areas and Facility Radiological Safety Zone Summary

Radiological Area	Facility	Contamination Zone	Radiation Zone
Controlled Area 2	Shielded Facilities – Hot Cells Facilities	2-5	2-5
	Shielded Facilities – Immobilized Fuel Test Facility (repurposed areas and labs)	2-3	2-3
	Low Level Liquid Waste Treatment Systems (B100, B300)	2	2
	Shutdown Radioisotope Laboratories with M&S (B100)	2	1
	Whiteshell Reactor-1 (B100)	2-4	2-3
	Active Liquid Waste Treatment Centre (B200)*	2-4	2-3
	Concrete Canister Storage Facility**	1	2
	Waste Management Area**	1-3	1-3
Controlled Area 1	Shielded Facilities – Radioactive Waste Trailers and Contaminated Tooling Storage Area	1	1-2
	Research and Development Facilities Complex (B300) – Inactive laundry facility, shutdown and decommissioned areas with M&S	1	1
	Containment Test Facility (B303)	1	1
	Waste Clearance Facility (B304)	1	1
	Health and Safety Facilities (B402) – Environmental Monitoring Laboratory Complex	1-2	1-2
	Radiation Device Storage Room (B412)	1	2-3
	Crawlspace (B412)	1-2	1
	Former B411 site and surrounding area	1	1-2
	WR-1 Organic Trap Building and Pit (B424)	1-2	1
Supervised Areas	WL Site North and South Side Remaining Buildings	1	1
	B100 Remaining Areas		
	WL Outer Area – Buildings and Grounds		
Uncontrolled Areas	Plant Road	n/a	n/a
	Employee Parking Lot		
	Non-Affected Lands		

* Shutdown and undergoing decommissioning.

** Zoning classifications relate to the levels accessible to personnel. In some areas, higher levels exist in systems or areas sealed from access such as the standpipes in the WMA.

4.1.1.2 Radiation Dose Rates

External radiation doses to all CNL staff (WL staff and CNL staff from other sites working at WL), non-CNL employees (contractors) and visitors, received in either Controlled or Supervised Areas at WL, are individually monitored using TLDs. Additional dosimeters for neutron exposures are issued to individuals who may be exposed to neutrons in excess of 1 mSv in a year or where accidental neutron exposures are possible. Extremity dosimeters are worn for a defined job by a person who is likely to receive an extremity dose exceeding 1 mSv and significantly greater than a surface dose as monitored by their TLD, or if there is a reasonable probability that an extremity will be exposed to a beta and/or photon dose rate greater than 10 mSv/h.

WL employees and contractors who have a reasonable potential of internal radiation doses exceeding 1 mSv participate in an internal dose monitoring program. WL employs an internal dose monitoring program consisting of internal dosimetry field monitoring, routine bioassay monitoring of individuals and follow-up bioassay monitoring. The purpose of the monitoring program is to confirm workers are not receiving intakes of radioactivity resulting in a committed effective dose exceeding 1 mSv. When intakes, or potential intakes, have been identified, follow-up bioassay monitoring is perform to determine the level of intake and the evaluation and assignment of Committed Effective Dose (CED).

Annual Compliance Monitoring Reports present the data of radiation doses received by employees and contractors working at the WL site, including doses for CNL employees from other sites working at WL. According to WL ACMR 2018, during 2013 to 2018 [4-1] the doses received by workers remained consistently well below the regulatory allowable dose limits. This dose measure data during the period 2013 to 2018 is considered representative of the dose rates that will be received by employees at WL during future decommissioning work. Canadian Nuclear Laboratories will continue to implement the RP programs to ensure doses from future decommissioning activities are low, controlled and ALARA. Below is a brief summary of the doses measured during 2013 to 2018:

- There were no tritium exposures.
- There were no neutron exposures.
- There were no skin doses resulting from skin contamination.
- There were no internal exposures resulting in a CED exceeding 1 mSv.
- External whole body photon dose collective dose decreased from 80 to 40 person-mSv during the period 2013 to 2018.
- Average external whole body gamma dose per person ranged from 0.02-0.07 mSv with a maximum dose of 1.65 mSv (3.3% of the allowable regulatory limit).
- Average external surface photon plus beta ($\gamma + \beta$) doses ranged from 0.02-0.12 mSv with a maximum dose of 3.72 mSv (0.74% of the allowable regulatory limit).
- Average extremity dose per person ranged from 0.05-5.02 mSv with a maximum dose of 36.71 mSv (7.3% of the allowable regulatory limit).
- There was only one occasion where there was an identified internal intake to a worker which required follow-up dosimetry monitoring and evaluation of a CED. The evaluated internal dose was less than a CED of 1 mSv.

Dose estimates will be prepared and documented in facility-specific DDPs.

4.1.2 Facility Radiological Hazards

A large range of radiological activities were conducted at WL in support of the research and development programs. The most significant activities that contributed to the current residual hazards were the operation of WR-1, and the testing and post-irradiation examination of a wide variety of experimental fuels. These activities impacted the source term of all of the listed facilities. They also contributed to the source term of B300/SF, the former Decontamination Centre (now decommissioned), the ALWTC, the buried active drainage piping, and to the residual contamination in the Affected Area from unplanned events.

The WR-1 reactor was shut down in 1985, terminating post-irradiation examination work for WR-1 fuel. The SF continued to examine irradiated fuel from offsite facilities until 1997. The last irradiation date from this fuel was in 1996. Therefore, short-lived radionuclides from the fuel cycle have decreased significantly or decayed completely. In addition, the easily mobilized hazards in B300 were addressed during the operational shutdown activities and the WR-1 mobile hazards were addressed during the first phase of decommissioning (completed in 1995).

The sources of radiological hazards associated with the routine operations and M&S activities at the WL site are:

- Solid low level, intermediate and high level radioactive waste.
- Low level and intermediate level liquid waste.
- Contaminated facility rooms, system components, and materials and equipment.
- Contaminated crawlspaces, lands and buried piping.
- Radioactive and contaminated samples.

The radiological hazards remaining in each WL facility and area are assessed in detail in the individual facility DDPs. A general description of the type and extent of hazards is provided below.

4.1.2.1 Shielded Facilities

The SF is one of the most significant radiological areas on the WL site and is operated in accordance with SF Facility Authorization [4-2] and Safety Analysis Report [4-3]. The radiological hazards associated with the current operation of the SF are summarized in the SF Safety Analysis Report [4-3] and WL ACMR 2018 [4-1]. Based on the radiological safety zone classification, the SF is CA-2 with Contamination Zone 2-5 and Radiation Zone 2-5 [4-4].

The most significant historical activities that contributed to the current radiological hazards in the SF included:

- Post-irradiation examinations of a wide variety of experimental fuels.
- Fuel channel sectioning and testing.
- Inspection and storage of fuel elements.
- Fuel reprocessing experiments and treatment and storage of the resulting liquid waste.
- Cementation of active liquid waste that resulted from the fuel reprocessing experiments.

These activities impacted the hot cells, warm cells (decommissioned), storage blocks (decommissioned), HCF decontamination vestibule and room, manipulator decontamination and repair facility, sampling stations, LLLW and ILLW drainage and collection systems, high level liquid waste drainage and collection systems (decommissioned), active ventilation system, and some areas of the crawlspaces.

Recent activities that also contributed to the current radiological hazards in the SF include:

- Handling and compaction of decommissioning waste.
- Decontamination of items, tools, boots/shoe covers, and respirators.
- Operation of WL Environmental Management laboratories.

The radiological hazards in the SF include potential exposure to alpha, beta and gamma emitting radionuclides typically associated with irradiated fuels and activated reactor components.

Sources of potential exposure include external gamma radiation from facility systems and storage areas, and both loose and fixed radioactive contamination during decontamination and dismantling activities. Contaminated soils also exist in the crawlspaces as a result of leakages from the active drainage systems.

4.1.2.2 Active Liquid Waste Treatment Centre

The ALWTC is a shutdown nuclear facility currently being decommissioned. The radiological hazards associated with the current operation of ALWTC are summarized in the WL ACMR 2018 [4-1]. Based on the radiation and contamination zone classification, the ALWTC is CA-2 with Contamination Zone 2-4 and Radiation Zone 2-3 [4-5].

The most significant radiological hazards associated with the ALWTC are the result of processing ILLW. Processing included collection, storage, concentration, and solidification of liquid effluent from the SF hot cells, warm cells, and manipulator wash-down facility, and water pumped out from ILW Bunkers 4, 6 and 7 in the WMA. Other residual hazards are contained in the active ventilation and drainage systems for the LLLW and ILLW systems, their associated glove sampling boxes, and the LLLW system tanks. The building crawlspace also includes soil contaminated by leakage from the LLLW and ILLW process piping and systems.

The radiological hazards in the ALWTC include potential exposure to alpha, beta, and gamma emitting radionuclides typically associated with irradiated CANDU nuclear reactor fuels and activated reactor components. Any evaporated liquid waste residues that may be within, or on the surface of contaminated structures in the ILLW solidification room, are concentrated sources of radioactive material that originated from the WL HCF and pumped out water ingress from the WMA ILW bunkers.

Currently, the predominant contaminants are Cs-137 and Sr-90, which represent between 85% and 95% of the total activity of most WL waste streams. The Cs-137 is the primary external gamma radiation hazard. The predominant alpha emitter is Am-241 and, when present, the typical activity concentration is approximately 5% (LLLW) to 15% (ILLW) of the Cs-137 concentration.

4.1.2.3 Whiteshell Reactor-1

Whiteshell Reactor-1 is an organic-cooled, heavy water moderated (99.78% isotropic purity), vertical pressure tube, thermal neutron research reactor with an output rating of 60 MW (thermal). It was in operation from 1965 November until 1985 May when it was permanently shut down and defueled. Fuel used in WR-1 was enriched to 1-5% U-235 by weight. First phase of decommissioning started in 1989 and was completed in 1995 placing the reactor in a storage with surveillance operational state.

Following the completion of Phase 1 decommissioning, WR-1 was divided into two general access areas:

- WR-1 unrestricted access
- WR-1 restricted access

The WR-1 unrestricted access area consists of rooms that underwent decommissioning and decontamination under the Phase 1 decommissioning activities and had radiological hazards reduced to background or minimal levels (i.e., CA-2 with Contamination Zone 2-4 and Radiation Zone 2-3). This includes the majority of rooms on the 600 and 500 levels.

The WR-1 restricted access area is comprised of rooms that have not undergone any decommissioning activities or had remaining elevated radiological hazards following the completion of Phase 1 decommissioning. This includes rooms and areas on the 100 to 400 levels, and some rooms on the 500 to 600 levels. The restricted access areas of B100 are classified as Supervised Area with Contamination Zone 1 and Radiation Zone 1.

The main sources and mechanisms of radiological contamination and hazards expected to be present following the shut down and defueling of WR-1 are:

- Fuel failures resulting in the release of fission products and actinides to the Primary Heat Transport (PHT) system and/or experimental loops.
- Contaminated components due to contact with radioactivity transported through the PHT and heavy water moderator systems.
- Reactor rooms and materials that became contaminated as a result of spills or system leaks.
- Fuel handling and storage systems that became contaminated.

Activation products make up the vast majority of radioactivity remaining in WR-1, which are located within the reactor core, fuel channels, calandria and biological shield. Activation products of concern include C-14, Cl-36, Fe-55, Ni-63, Ni-59, Co-60, and Nb-94.

Mixed fission products (Cs-137 and Sr-90) and actinides (Am-241 and Pu) are the primary radionuclides of concern in the PHT system piping, tanks and rooms.

Tritium and C-14 are the primary radionuclides of concern in the heavy water moderator system.

4.1.2.4 Concrete Canister Storage Facility

The CCSF is a nuclear facility and operated in accordance with the requirements of the CCSF Facility Authorization [4-6] and Safety Analysis Report [4-7]. The radiological hazards associated with the current operation of CCSF are summarized in the CCSF Safety Analysis Report [4-7] and WL ACMR 2018 [4-1]. The CCSF is designated as a Radiological CA-2 for radiation protection.

The main radiological hazard present in the CCSF is external radiation levels due to the irradiated fuel bundles stored in concrete canisters. The fuel was sealed in baskets prior to emplacement in the canisters. The fuel baskets were sealed in the WL hot cells and then loaded remotely using a transfer flask. During fuel transfers some loose contamination remained on the exterior of the fuel baskets. These baskets are stored within the inner liner of the concrete canisters and the canisters are sealed from the environment.

4.1.2.5 Waste Management Area

The WMA is designed to provide safe storage for radioactive, hazardous, and mixed wastes originating from the operation of nuclear facilities and laboratories, and from decommissioning activities at the WL site.

The WMA is operated in accordance with requirements of the WMA Facility Authorization [4-8] and the WMA Safety Analysis Report [4-9]. The radiological hazards associated with the current operation of WMA are summarized in the WMA Safety Analysis Report [4-9] and WL ACMR 2018 [4-1]. The WL WMA is CA-2 with Contamination Zone 1-3 and Radiation Zone 1-3.

The hazards present in the WMA cover the entire range of radiation hazards from the nuclear fuel cycle, since all wastes produced from site research and support activities are stored in the facility. Key hazards are:

- Irradiated fuel stored in standpipes.
- Active liquid waste stored in underground storage tanks.
- LLW/ILW stored throughout the area.

4.1.2.5.1 Standpipes Area

The Standpipes Area is designated as a Radiological Safety Zone 2 (Radiation Zone 2 and Contamination Zone 2) [4-10]. The Standpipes Area "Protected Area" was expanded and now encompasses both the standpipes and the ILW bunkers. Average accessible whole-body dose rates within the area are in the range of <0.1 to 0.2 mrem/h with elevated radiation fields existing at two standpipe locations. Accessible areas are generally free of removable surface contamination, but there is some potential for encountering contaminated soil within the Standpipes Area.

Based on the presence or absence of fissionable materials, the standpipes are of two types, Fissionable Materials Bearing Standpipes (FMBS) and Non Fissionable Materials Bearing Standpipes (NFMBS). The primary radionuclides of concern in the FMBS are mixed fission products (Cs-137, Sr-90 as beta-gamma contamination) and actinides (Am-241, Pu as alpha contamination hazards). In the case of NFMBS, Cs-137 is the single most dominant radionuclide contributor to the external dose.

4.1.2.5.2 Intermediate Level Waste Bunkers, B417 and Amine Tanks

The most significant radiological hazards associated with the ILW bunkers are the emplaced wastes, which primarily originated from the SF hot cells, WR-1, ALWTC, B300 high hazard laboratories, and some external sources [4-11]. The ILW Bunkers 1 to 7 are unlined and were not designed to be sealed water tight so the internal surfaces will also contain significant contamination from the emplaced wastes. Four of these bunkers are known to be fully saturated with water. These wastes contain radionuclide inventories consisting primarily of mixed fission products (Cs-137, Sr-90) and actinides (Am-241, Pu). Cs-137 is the primary source of external gamma radiation hazard. Intermediate Level Waste Bunker 8 currently contains cemented Thorium Fuel Reprocessing Experiments (TFRE) and Amine waste in specially designed 110 L drums.

For B417, Amine tanks, and vaults, only tank TK-2 presents a significant hazard as it is expected to contain a relatively small volume of diluted High Level Liquid Waste (HLLW), and, possibly, precipitate.

4.1.2.5.3 Low Level Waste Liabilities

Table 4-2 lists the sources of LLW along with a brief description of radiological hazards present within the WL WMA [4-12].

Table 4-2 Low Level Waste Liabilities

Building/Structure	Radiological Hazard Description
Main Entrance (B423)	Minimal amounts of radiological contaminants in the structure and grounds.
LLW Processing Building (B421)	Above-ground metal structure has minimal amounts of radiological contamination. It also contains mixed fission products and actinides surface contamination.
LLW Storage Bunkers (LLW-B1 to LLW-B6)	The bunkers contain radioactive bagged waste, radioactive bulk materials, radioactive scrap metal waste, contaminated ground materials, and radioactive concrete waste.
LLW Storage Quonsets (B431, B432, B433)	These buildings contain various waste materials for short to longer term interim storage. This may include sources slated for disposal, ILLW totes, contaminated ground materials, radioactive scrap metal, radioactive bulk materials and surplus sealed radiation sources.
Storage Building (B430)	The building housed a baling machine that was used to reduce the volume of LLW bags into compacted bales that were then placed in the LLW storage bunkers. Therefore, it may have become contaminated.
LLW Trenches (#1-23)	These contain LLW and are located to a depth of 4 m below ground-surface and 1 to 2 m below the water table. The dominant radionuclides of concern include mixed fission products (Sr-90, Cs-137) and actinides (Am-241, Pu), activated WR-1 fuel channels (Co-60, Nb-94 gamma emitters) and Tc-99 waste.
SMAGS (B923)/Cask Loading Facility	This was a storage building for prepackaged and sealed waste. It is in the process of being emptied of waste and will be converted to a Cask Loading Facility needed for decommissioning.

4.1.2.6 Research and Development Facilities Complex (B300)

The facilities and laboratories within B300 provided space for a wide range of radiological and non-radiological work including experiments, post-irradiation examinations, radiotracer studies, chemical analysis, and storage of radioactive sources and materials [4-13]. This work was done in support of the NFWMP, Reactor Development Programs, Decommissioning and Waste Management (D&WM), and WL site engineering/environmental monitoring programs and activities.

The most significant radiological hazards associated with B300 were the result of work performed in the radioisotope laboratories. This included experiments using short and long lived radionuclides.

Building 300 includes current and historical Radiological Safety Zone Classifications 1 through 4. Most of the radiological hazards in B300 have been decommissioned/remediated.

4.1.2.7 Health and Safety Facilities (B402 and B305)

Building 402 houses the Environmental Monitoring Laboratory Complex, dosimetry lab and whole-body counter, gamma calibrator room and offices for WL staff. The Environmental Monitoring Laboratory Complex is designated a CA-1 and is comprised of environmental and low level radioactivity analytical labs, with Contamination Zone 1-2 and Radiation Zone 1-2.

Room B-01 is a CA-1 which houses a Cs-137 gamma source calibrator used for the calibration of radiation protection survey meters and dosimeters. The calibrator is a J.L. Shepherd & Associates Model 81 20 Ci (740 GBq) Cs-137 source gamma calibrator (activity as of 1991 March). This room was originally built as a safety storage vault. Its inner dimensions are 3 m x 3 m x 2.7 m high. The concrete walls are 30 cm thick. The calibrator is operated remotely at a control panel located outside the room near the entrance door. It is equipped with an interlock system, which will not allow the calibrator to be operated when the door is open and will cause the source to drop down into its shielding if the door is opened during operation.

The remainder of B402 is a Supervised Area where historical rooms and labs were re-purposed and are now being used as office space.

Building 305 housed an electron accelerator and a Co-60 gamma cell operated by Acsion Industries under a separate licence issued to Acsion by the CNSC. The accelerator was dismantled and removed in 2017 and the space turned back to CNL.

4.1.2.8 Underground Active Drain System

The expected radionuclides in the active drain lines include mixed fission products (Sr-90, Cs-137) and actinides (Am-241, Pu).

4.1.2.9 Storm Drain System

The section of the storm drain south of B200 that was contaminated as a result of the spill in 1980 contains low levels of mixed fission products (Sr-90, Cs-137) and actinides (Am-241, Pu). There is some sludge residue in this section of the drain that may have higher levels of contamination.

4.1.2.10 Sewage System

The sewage lagoon does have low levels of contamination in the sludge, primarily Cs-137 (<1 Bq/g), suggesting that some sludge residue in the sewage line may also have some residual radioactivity. Flushing the lines should minimize or eliminate this potential for residual radioactivity.

4.1.2.11 Affected Lands

The spill area near B200 and the areas around the WMA fence contain radionuclides (Cs-137 and Sr-90) at levels above the unconditional clearance levels. The area near the SF (IFTF), and other grounds areas/roadways are considered as having potential for contamination.

4.1.2.12 Sewage Lagoon

Sewage lagoon sediment has very low levels of contamination, less than 1 Bq/g for Cs-137 and trace quantities of Co-60. Samples collected from both the primary and secondary cells of the sewage lagoon showed the presence of progeny of naturally occurring Th-232 (Ac-228, Bi-212, Pb-212 and Tl-208) and U-238 (Bi-214 and Pb-214).

4.1.2.13 Landfill

The landfill does not have radiological conditions above Radiation Zone 1 criteria. The radiological levels near the landfill are below the CNSC unconditional clearance limit of 0.1 Bq/g [4-14]. The water in adjacent ponds is also below the Canadian drinking water limits for Cs-137, Sr-90 and naturally occurring uranium and its progeny (0.05 Bq/L) [4-15].

4.1.2.14 Cesium Ponds

These ponds were developed to study the distribution of dose received by organisms living at the water-mud interface. 18.5 GBq of Cs-137 were injected into the pond in the 1960s. As much as 6.7 GBq of Cs-137 was distributed in the pond sediment and around the pond. This area was decommissioned as per [4-16].

4.1.3 Chemical Hazards

The chemical hazards that exist at the WL site are due to previous operations, current operations, and ongoing decommissioning activities. These chemical hazards include lead based paint surfaces, lead blocks used for shielding, friable and non-friable Asbestos Containing Materials (ACMs) (includes pipe lagging and floor tiles), mercury contained in instrumental panel switches and fluorescent tubes, and Polychlorinated Biphenyls (PCBs) in fluorescent light fixture ballasts. Due to the age of the facilities/buildings/structures, small amounts of PCBs could also be present in other building materials such as oil-based paints and joint-compounds (sealants, caulking, etc.). Some buildings/facilities also contain ozone depleting materials, pyrophoric materials, resins, organic materials such as solvents, hydrocarbons, organic coolants, Amines, etc., inorganic materials such as boron, beryllium, salts, bases, acids, sulphur compounds, cyanides, etc., and research chemical carcinogens. Table 4-3 provides a brief summary of chemical hazards along with their locations which are currently or were present in the WL site.

Table 4-3 Chemical Hazards at the Whiteshell Laboratories Site

Facility/Building/Structure	Chemical Hazards
Shielded Facilities	• ACMs • PCBs in paint and fluorescent light ballasts • Metals: mercury, lead (paint and solid form)
Active Liquid Waste Treatment Centre: B200	• ACMs, • Metals: mercury • Compressed gases • Research chemical carcinogens • Organic materials such oils, glycols, solvents • Fluorescent tubes

Facility/Building/Structure	Chemical Hazards
Whiteshell Reactor-1: B100	• ACMs • PCBs in paint and fluorescent light ballasts • Metals: mercury, lead (paint and solid form), palladium, platinum • Organic materials such as hydrogenated terphenyl, xylene • Inorganic materials: MgO, KOH, boron, gadolinium nitrate • Ozone depleting substances
Concrete Canister Storage Facility	• None
Waste Management Area: Standpipes Area	• Inorganic materials: nitric acid, sulfur compounds, cyanide, cesium-chloride compounds • Organic Materials: 2-ethyl-1-hexanol
Waste Management Area: ILW Bunkers, B417 and Amine Tanks	• PCBs in paint and fluorescent light ballasts • Inorganic materials: beryllium, cyanide, arsenic chemicals, acidic and neutralized solutions • Metals: mercury, lead • Organic materials: amine solutions, solvents • Pyrophoric material
Waste Management Area: LLW Liabilities	• ACMs • Metals: mercury, lead • Organic materials: reactor coolant, (HB-40), solvents and other hydrocarbons • Inorganic materials: DDT, arsenic, beryllium
B300	• ACMs • PCBs • Metals: mercury, lead (paint and solid) • Inorganic materials: beryllium • Research chemical carcinogens
B402 and B305	• ACMs • PCBs • Metals: mercury, lead (paint)

Facility/Building/Structure	Chemical Hazards
WL Licensed Site Supporting and General Infrastructure: North-Side Buildings	• ACMs • PCBs • Metals: mercury, lead • Organic materials: hydrocarbons • Ozone Depleting Substances (ODSs)
WL Licensed Site Supporting and General Infrastructure: South-Side Buildings	• ACMs • PCBs • Metals: mercury, lead (paint)
WL Licensed Site Supporting and General Infrastructure : Outer Area Buildings and Facilities	• ACMs • PCBs in ballasts • Metals: mercury, lead (paint and solid form), copper (wiring and piping), galvanized steel, zinc coated fencing
WL Licensed Site Supporting and General Infrastructure : Site Services	• ACMs • PCBs • Metals: mercury, lead • Organic materials: glycol and other fluid additives
WL Licensed Site Supporting and General Infrastructure : Site Affected Lands and Contaminated Structures	• ACMs • PCBs • Metals: mercury, lead

4.1.4 Industrial Hazards

The WL site has both operational and non-operational facilities. The non-operational facilities are under a M&S phase. Furthermore, the WL site has ongoing decommissioning activities. Industrial hazards are associated with operations, M&S and decommissioning activities. To ensure the safety of the workers during all these activities, all relevant industrial hazards are identified, evaluated, and mitigation measures proposed and implemented through work plans and lower level planning documents. Section 4.2.3 lists the industrial safety hazards that are associated with routine and non-routine operations as well as decommissioning activities.

4.1.5 Biological Hazards

Currently, there are no biological hazards present at the WL site, however, sewage in the sewage system could potentially contain biological hazards. Therefore, whenever work is performed on the sewage system, precautionary and safety measures will be implemented to prevent release of these sewage based biological hazards to the environment and exposure of workers. As a part of routine operations and M&S, CNL will continue to perform proper housekeeping, planning, and preparation so that the growth of biological hazards should be prevented. On discovery of any biological hazard, CNL will act promptly and safely to remove it.

4.1.6 Environmental Hazards

A complete list of the environmental hazards is provided in Table 5-5 (Radiological Hazards) and Table 5-6 (Non-radiological Hazards) of the WL Environmental Monitoring Plan [4-17]. Some of them are:

- Tritium
- Carbon-14
- Gross Alpha (Am-241, Pu-238, Pu-239, and Pu-240)
- Gross Beta (Sr-90 and Cs-137)
- Halocarbon
- Greenhouse Gas Emissions

4.1.6.1 Environmental Emissions

The WL monitoring program will meet the standards set out in CSA N288.4-10 (by 2020 January) [4-18]. The WL ACMR 2018 provides the details of the current environmental emissions at the WL site [4-1].

The primary source of liquid radioactive effluents is the process water outflow (Outfall), which discharges continuously to the Winnipeg River. The discharge from the Outfall is composed of storm water runoff from paved roadways or around buildings, cooling water used in process facilities, and holding tank discharges including those from the new active liquid waste treatment system tanks based in B100 and B300. The average emissions for the past six years (2013-2018) for the WL site continue to be very small, below 0.0003% of the Derived Release Limit (DRL) for air emissions and 1.0% of the DRL for liquids.

The non-radiological effluent monitoring program established by CNL continues to supply valuable information about the potential impacts of operations on the Winnipeg River, and thus the local environment. The results of the monitoring program demonstrate that controls for the release of potentially hazardous substances currently in place at WL continue to provide substantial protection of the environment.

4.1.6.2 Wastewater

The WL monitoring program also meets the regulations set out in the Federal Wastewater Systems Effluent Regulations [4-19].

According to WL ACMR 2018 [4-1], the results of federally regulated parameters for the wastewater discharge were below the regulatory limits. The results are given below:

- Carbonaceous Biochemical Oxygen Demand - annual volume weighted average was 17.7 mg/L (Regulatory limit = 25 mg/L limit).
- Total Suspended Solids - annual volume weighted average was 3.8 mg/L (Regulatory limit = 25 mg/L limit).
- Un-ionized Ammonia - the maximum concentration was 0.0097 mg/L (Regulatory limit = 1.25 mg/L limit).
- Total Residual Chlorine - annual volume weighted average was 0.018 mg/L (Regulatory limit = 0.020 mg/L limit. This limit is not in force until 2021).

The site's chlorination practices have been adjusted over the last few years, with the result that the 2018 effluent from the lagoon (0.018 mg/L) was below the proposed limit (0.020 mg/L).

The Lagoon collects sanitary and wastewater from most buildings on the site, as well as from the laundry facility. Lagoon water residence time is more than three months, to allow for biodegradation and settling. Prior to each planned discharge, the secondary cell is isolated, and tested for a series of non-radiological parameters which include Carbonaceous Biochemical Oxygen Demand, fecal and total coliform bacteria, and acute lethality (a biological assessment on the survivability of trout in the proposed effluent). If these are acceptable, the accumulated contents of the secondary cell only are released to the Winnipeg River via a small drainage ditch leaving the Lagoon's north side.

4.2 Facility Future Hazards due to Decommissioning

The future hazards are those that are anticipated during decommissioning activities and include:

- Radiological hazards
- Non-radiological hazards (chemical, industrial, biological and environmental hazards)

In order to prevent, control and/or mitigate the potential risks anticipated from both radiological and non-radiological hazards, CNL will take appropriate actions during the execution of the decommissioning activities, which include decontamination, dismantlement, demolition, and remediation. These actions will be documented in the DDPs and associated work plans.

To reduce the future hazards, prior to the commencement of demolition activities:

- All stored radiological and hazardous wastes will be removed from each facility where practicable.
- Buildings, structures, systems, and components will be decontaminated to the extent feasible to remove both loose and fixed radiological and/or hazardous contaminations.
- All service supplies such as air, water and electricity will be disconnected.

Comprehensive and systematic survey results of radiological and other potentially hazardous conditions, including identification and description of the remaining significant gaps or uncertainties in the measurement or prediction of such conditions, will be provided in the individual facility DDPs. During the development of individual facility DDPs, using a graded approach, safety assessments will also be performed to identify potential hazards to workers and the public from both routine decommissioning activities and credible accidents during decommissioning. The assessments will identify the methods for mitigating the risks associated with the potential hazards. The assessments will also address the residual risks to the public, if any, after decommissioning is completed.

4.2.1 Radiological Hazards

Currently, the radiological hazards at the WL site are located in the nuclear buildings (SF, ALWTC, WR-1, CCSF and WMA), auxiliary operating facilities (B300, B402, and B305), and some of the areas of the Whiteshell Licensed Site Supporting and General Infrastructure (drain systems, sewage lagoon, landfill, and affected lands). The details are provided in Section 4.1.2 of this document.

As a part of the decommissioning planning and execution for nuclear buildings, all stored waste will be removed, active systems and components removed, and building surfaces decontaminated to allow full or partial radiological release of the building for demolition or to safe levels for open air building demolition. The following internal and external radiological hazards may be present during decommissioning activities.

- Gamma and beta radiation dose rates from:
  - Radioactive and contaminated systems, components and surfaces in building rooms;
  - Radiation sources and devices; and
  - LLW and ILW waste packages and containers.
- Loose surface contamination on:
  - Room floors, walls and material and equipment;
  - Internal contamination within closed systems; and
  - Tools and equipment used for system removal, dismantling and decontamination during the decommissioning work.
- Airborne and loose contamination generated during the:
  - Removal, volume reduction, and waste packaging of active systems and components (e.g., piping, tanks, fume hoods, ventilation ducting);
  - Decontamination of building surfaces;
  - Demolition of buildings and waste packaging; and
  - Remediation of contaminated lands, underground piping, structures and waste trenches.

Radiological hazard mitigating measures are listed in Table 4-4.

Table 4-4 Radiological Hazards and Mitigation Measures

Hazard	Mitigation Measures
Radiation	• Radiation source term reduction • Radiation surveys and monitoring • Time, distance and shielding • Dose and dose rate constraints – alert and back-out points • Dose tracking using personal alarming dosimeters and finger dosimeters
Contamination	• Decontamination – High Efficiency Particulate Air (HEPA) vacuum, mopping, decontamination gel, concrete scabbling and shaving equipment • Fixatives or immobilization agents • Water misting • Portable HEPA filtered ventilation units • Ventilated enclosures and containment • Glove bags • Personal Protective Equipment and Clothing (PPE&C): full body suits, gloves, shoe covers and respirators • Airborne contamination monitoring • Contamination monitoring of workplaces, tools and equipment, and workers • Internal dosimetry bioassay monitoring of workers

4.2.2 Chemical Hazards

Currently, the chemical hazards present at the WL site include asbestos, PCBs, metals such mercury and lead, organic and inorganic materials, resins, and ozone depleting substances (see Section 4.1.3 for details). Although most of these chemical hazards will be removed as a part of the hazard reduction campaign and decontamination activities, some hazardous waste will remain and become part of the decommissioning waste. Therefore, based on the level of hazards, decommissioning workers will handle the hazardous waste in accordance with the relevant Provincial codes and standards.

Most likely the following chemical hazards are expected during decommissioning activities:

- Cleaning agents used for decontamination work.
- Concrete dust generated due to dismantling work.
- Silica dust from vehicle traffic on gravel roads.
- Airborne asbestos due to dismantling work.
- Airborne lead due to grinding of material covered with lead based paints.

The mitigation measures for these chemical hazards will be put in place to ensure that the workers, the public and the environment are fully protected during decommissioning activities.

4.2.3 Industrial Hazards

Industrial hazards at WL will be typical of a decommissioning and demolition project. Examples of such hazards that may occur while decommissioning and demolition of the buildings, structures, systems, and components at the WL site are listed along with their mitigation measures in Table 4-5. Mitigation measures are outlined in OSH program documentation [4-20] [4-21]. Many of these industrial hazards are also relevant to routine and non-routine operations and M&S phase of the WL site.

Table 4-5 Industrial Hazards and Mitigation Measures

Hazard	Mitigation Measures
Sharp Objects Cuts, Puncture and Abrasions Cutting: Dust	• Specify the Cut/Puncture Protection Level of glove or sleeve required based on the anticipated degree of cut/puncture hazard. • Plan and control work using work plans and other lower level planning document. • Workers to wear protective clothing, including appropriate gloves during material handling as per requirements identified. • Wetting or misting techniques.
Fire	• Comply with CNL Fire Protection Screening and Fire Safety Clearance requirements, if applicable.
Slip, Trip and Fall	• Maintain proper housekeeping throughout work phases to minimize slip/trip and fall hazards. • Route any temporary electrical or pneumatic cords to minimize slip/trip and fall hazards. • Follow working at heights procedures. • Follow designated walking routes. • Plan and control work using work plans and other lower level planning document.
Ergonomics (Sprains, Strains and Pinch Points)	• Walk down task to consider ergonomics prior to start of work. • Use mechanical means to move material whenever feasible. • Wear appropriate gloves during material handling. • Keep hands clear of potential pinch points. • Use proper lifting techniques. • Beware of uneven walking surfaces. • The maximum recommended weight limit to be lifted per person is 22 kg.

Hazard	Mitigation Measures
Excavation (Cave-ins, Underground Services and Overhead Power Lines, etc.)	• Maintain Limits of Approach. • Follow excavation procedures. • Plan and control work using work plans and other lower level planning document.
Confined Space Entry	• Assess, plan, and control of work in accordance with confined space procedures. • Identify and address any unique aspects of confined space in the applicable characterization work plans.
Heavy Equipment (Backhoe or Excavator)	• Assign/use trained spotters to guide heavy equipment and vehicles reversing. • Establish a traffic control plan to allow a drive through vehicle flow wherever possible. • Establish safe work areas to limit and control access. • Plan and control work using work plans and other lower level planning documents. • Move heavy items using pallet trucks, forklifts, hoist and cranes. • Assign only qualified personnel to complete all hoisting and rigging activities.
Hazardous Energy (Electrical, Pneumatic, Steam, etc.)	• Isolate equipment, if required. • Plan and conduct work in accordance with Digging, Drilling, Cutting and Coring procedures. • Control electrical work according to hazardous energy procedures.
Environmental Conditions (e.g., Wind, Rain, Snow, Extreme Temperatures, Poor Lighting, etc.)	• Schedule/reschedule work to avoid periods of extreme weather conditions.
Power Tool Injuries	• Use power tools in accordance with procedures.
Motor Vehicle Accidents	• Establish/use a traffic control plan to allow a safe drive through vehicle flow wherever possible and to delineate a construction zone. • Establish safe work areas to control access.

4.2.4 Biological Hazards

Biological hazards during decommissioning that can be present at WL include:

- Mould.
- Sewage based biological hazards include funguses, parasites, and viruses.
- Stings and bites from insects, rodents, birds, or other animals that might live or nest inside accessible buildings.
- Toxins and antigens produced by moulds and other fungi that might grow on surfaces (particularly those made of wood or other biological materials).
- Infections or adverse reactions resulting from exposure to organisms living in decaying biological material (such as carcasses, droppings and animal feces), or their by-products.
- Poisonous plants/weeds.

The mitigation measures of these biological hazards are given in Table 4-6.

These biological hazards will not have any significant effect on the type and quantity of the waste that will be generated during decommissioning and demolition activities.

Table 4-6 Biological Hazards and Mitigation Measures

Potential Biological Hazards	Mitigation Measures
Mould	• Use PPE&C • Pack and dispose according to the hazardous cleaning agent used during mould remediation
Sewage based	• Use PPE&C
Stings and bites	• Use PPE&C • Use insect repellent, if required
Organisms living in decaying biological material or their by-products	• Use PPE&C • Ensure Housekeeping
Poisonous plants/weeds	• Use PPE&C • Ensure Housekeeping

4.2.5 Environmental Hazards

The potential environmental hazards during decommissioning and demolition activities will be similar to those that are currently present at the WL site (see Section 4.1.6). Additional environmental hazards that may result from the decommissioning activities are dust, airborne contamination (radiological and chemical), and noise. Note that continuous air monitoring for dust during demolition is a requirement.

To minimize the release of both radiological and chemical hazards to the environment, all stored waste will be removed and each facility, building, structure, and equipment will be decontaminated or contamination fixed in place before the onset of the demolition activities, where practicable. Furthermore, surveys will be conducted to make sure that the residual contamination levels are not higher than the maximum values for unrestricted use, where practicable. The dust management will include use of dust suppression agents such as water, wind fences/screens, HEPA filtration and temporary ventilated enclosures. If required, best practices will be used for noise management, such as limiting hours of operation of noisy work, using best available technology to limit noise by the use of quiet equipment, setting noise levels for work and/or using noise barriers.

Residual contamination may be released to the external environment because of the decommissioning activities, and abnormal weather conditions such as high wind and heavy rains. Administrative control measures will be put in place to mitigate the risks associated with the dust, airborne contamination and noise. Furthermore, the implementation of the effluent monitoring will make sure that the air and water quality remain acceptable and meet the regulatory requirements.

4.3 Nuclear Criticality Control

Following the permanent shutdown of WR-1 in 1985, all irradiated fuel bundles were removed from the reactor and stored in Fuel Bays. In 1993, the spent fuel bundles were removed from the Fuel Bays and transferred to dry storage at the CCSF (see Section 4.1.2.4). The restrictions about the spent fuel bundles are documented in the Criticality Safety Document of CCSF. These restrictions will remain applicable until the spent fuel is removed and CCSF is fully decommissioned.

The standpipes are non-operational (Passive Storage) structures located within a criticality controlled area at the WMA. Irradiated and un-irradiated fissionable materials, after handling and/or destructive testing, were originally placed in the concrete standpipes and for criticality control the following restrictions were implemented:

a. For enrichments of 5 wt% or greater, no more than 350 g U 235 shall be placed in one standpipe.
b. For enrichments less than 5 wt%, no more than 800 g U-235 shall be placed in one standpipe.
c. No more than a combined total of 200 g of separated Pu and U-233 shall be placed in one standpipe. For criticality purposes, the Pu buildup in unprocessed, irradiated U fuel will not be included in this total.
d. No mass limit shall be applied to Th alone. Limits shall be applied to the U content of unirradiated U+Th mixtures. These limits will be:
   - For enrichments less than or equal to 5 wt% (U-235 in total U+Th), no more than 800 g U-235 shall be placed in one standpipe.
   - For enrichments greater than 5 wt% (U-235 in total U+Th), no more than 350 g U-235 shall be placed in one standpipe.
   - Irradiated U+Th mixtures shall be treated as described in Section 5 of reference [4-22].
e. If mixtures of the materials stated in a, b, c and d above are present in one standpipe, the lowest limit for those materials present will apply.
f. No mass limit shall be applied to natural U.
g. Moderators such as heavy water, beryllium, beryllium oxides or graphite (beyond strictly trace amounts) are not permitted in the standpipes. Hydrogen-bearing materials such as water, plastics, etc. are permitted.

As part of the WL decommissioning standpipe remediation planning process, detailed studies of all available records have determined that under the conservative approach of not crediting fuel burnup, eight standpipes were historically loaded with amounts of fissionable materials in excess of the above limits. Safety arguments were presented in Section 4.4.1 of [4-23] to demonstrate that these standpipes are safely subcritical as loaded.

The above mentioned restrictions will remain applicable until the standpipes are fully decommissioned.

4.4 External Hazards

Severe external hazards include earthquake, tornado, flooding, forest fires, lightening, high winds, blizzards and ice storms.

The WL Emergency Preparedness Program considers radiological, non-radiological and public health emergencies, such as Severe Acute Respiratory Syndrome (SARS) and pandemics. The Program includes provisions for emergency call-out of key personnel, for an off-site Emergency Operations Centre (EOC) if the on-site EOC becomes untenable, and for the provision of longer term staff relief and provisions (food, fuel, etc.).

4.5 Unplanned Events

Unplanned events that may occur during decommissioning activities, radiological or otherwise, will be reported to line management, who will assess the events; categorize them according to their consequences; notify internal and external authorities (such as the CNSC), as required; investigate the cause; devise corrective actions; and ensure their implementation, in order to prevent recurrence.

4.6 References

The following references were current at the time of development of this DDP. Where a reference is to be complied with, ensure the latest revision is used.

[4-1] WL-00583-ACMR-2018, *Whiteshell Laboratories Annual Compliance Monitoring Report for 2018*, Revision 0, 2019 April.

[4-2] WLSF-00583-FA-001, *Facility Authorization for the Operation of the Shielded Facilities at Whiteshell Laboratories*, Revision 5, 2015 September.

[4-3] WLSF-03500-SAR-001, *Safety Analysis Report Whiteshell Laboratories Shielded Facilities*, Revision 4, 2015 September.

[4-4] WLDP-21400-DDP-001, *Whiteshell Laboratories Detailed Decommissioning Plan: Volume 2-Shielded Facilities*.

[4-5] WLDP-25400-DDP-001, *Whiteshell Laboratories Detailed Decommissioning Plan: Volume 5 – Active Liquid Waste Treatment Centre Building 200*.

[4-6] AECL-FA-22, *Facility Authorization for the Operation of the Concrete Canister Storage Facility at the Whiteshell Laboratories*, Revision 3, 1998 July.

[4-7] RC-983, *Whiteshell Laboratories Concrete Canister Storage Safety Analysis Report*, Revision 1, 2000 January.

[4-8] WLWMA-00583-FA-001, *Facility Authorization for the Operation of the Waste Management Area at the Whiteshell Laboratories*, Revision 3, 2015 December.

[4-9] WLWMA-508640-SAR-001, *Safety Analysis Report for the Whiteshell Laboratories Waste Management Area*, Revision 2, 2015 December.

[4-10] WLDP-36500-DDP-001, *Detailed Decommissioning Plan Volume 8-WMA Part 1: Standpipes Area*, Revision 2, 2015 December.

[4-11] WLDP-24900-DDP-001, *Detailed Decommissioning Plan Volume 8-WMA Part 2: Intermediate Level Waste Bunkers, Building 417, and Amine Tanks*, Revision 1, 2017 March.

[4-12] WLDP-24400-DDP-001, *Detailed Decommissioning Plan: Volume 8-WMA Part 3: Low Level Waste Liabilities*, Revision 3, 2018 March.

[4-13] WLDP-23500-DDP-001 (RC-2143-9), *Detailed Decommissioning Plan, Volume 9-Building 300*.

[4-14] NSRDR SOR/2000-207, *Nuclear Substances and Radiation Devices Regulations*.

[4-15] Health Canada, *Guidelines for Canadian Drinking Water Quality*.

[4-16] WLDP-35000-DDP-001, *Detailed Decommissioning Plan, Volume 12 – Whiteshell Laboratories Licensed Site Supporting and General Infrastructure – Part 5: Site Affected Lands and Contaminated Structures*.

[4-17] WL-509200-PLA-002, *WL Environmental Monitoring Plan*.

[4-18] CSA N288.4-10, *Environmental Monitoring Programs at Class I Nuclear Facilities and Uranium Mines and Mills*, Edition: 2, 2010 May 01.

[4-19] The Canada Gazette, Part I, Volume 144, No. 12, *Federal Wastewater System Effluent Regulations*, 2010 March 20.

[4-20] 900-510400-PDD-001, *Occupational Safety and Health*.

[4-21] 900-510400-PRD-001, *Occupational Safety and Health*.

[4-22] WNRE-9, *Guide for WNRE Criticality, Approvals*.

[4-23] WLWMA-123400-CSD-001, *Whiteshell Laboratories Waste Management Area (CSD-27)*, Revision 6, 2019 May.

5. DECOMMISSIONING APPROACH

The decommissioning approach and alternatives in this section are the ones that were presented in the original Overview DDP document [5-1], with notable changes below. The strategy and timeline for WL decommissioning changed with the restructuring of AECL, and the contract awarded to CNEA, which included the prompt decommissioning of the WL site (initially to complete decommissioning by 2024, subsequently revised to complete by 2027). This strategy and timeline (see Alternative 4 in Section 5.1.1.4 and the schedule in Section 9.2) includes the proposed ISD of the WR-1 reactor, which is currently going through the EA process, as well as shipping waste for licensed off-site storage/disposal (i.e., not waiting for a national repository for used fuel or other waste disposal). As mentioned, this section comes from [5-1], with the addition of Section 5.1.1.4 for Alternative 4, as well as Section 5.3.3.2 for the proposed ISD of WR-1.

5.1 Rationale for the WL Decommissioning Strategy

In 1997, AECL made a business decision to discontinue research programs and operations at WL. In 1998, the federal government concurred with AECL's decision to decommission WL. The shutdown and decommissioning of WL was planned to take into account a number of business objectives and operational and decommissioning constraints.

The business objectives for WL shutdown and decommissioning were to:

- ensure an orderly consolidation of all remaining CANDU programs so as not to jeopardize the CANDU business,
- continue to fulfill management responsibilities for the NFWMP until privatization or termination of the program occurs,
- minimize the operational costs for WL by aligning the WL site operational activities with the level of activity in the remaining programs, and
- fulfill the management responsibilities for the decommissioning program and provide operational support to the decommissioning program.

Following were the operational constraints:

- AECL's Reactor Safety Research program will continue to operate at WL until December 2003 which will require continued operations in three active area buildings,
- the NFWMP will continue to operate out of WL and/or the Underground Research Laboratory (URL) (subject to continued funding from Ontario Power Generation or other non-AECL sponsors) until an as yet undefined date and will require continued operations in one active area building (B300),
- the WL WMA will need to continue as an operational facility for the initial decommissioning work to support the continuing AECL programs and to support the decommissioning of those buildings that are no longer required by AECL,
- AECL assets (including surplus buildings in the non-active area) not required for the continuing CANDU programs will be made available for commercialization purposes, and
- the public - particularly in Manitoba - will be given the opportunity to provide input to the Decommissioning Program. The mechanism for such input will be through the CEAA process.

Following were the decommissioning constraints:

- unavailability of waste disposal in Canada limits the decommissioning activity, when viewed from a risk/benefit perspective, to achieving and maintaining a secure M&S state for the nuclear facilities. Large scale removal of radioactive materials to an interim storage facility will result in increased operational dose due to the double handling of the waste, first to interim storage and then to final disposal; and
- the impact of interim waste management decisions on an initiative to establish a national radioactive waste management organization, with a current focus on used fuel, must also be considered in the WL decommissioning strategy. This development is in keeping with the federal radioactive waste policy framework.

While developing decommissioning strategy for WL site, it was ensured that a plan is in place for transition of the site from a nuclear operating state to a decommissioning state, and portion of the nuclear facilities and support facilities remain operational to support the decommissioning work.

The financial impacts of end state options were also factored to optimize WL Decommissioning Program. The implementation plan for the decommissioning program considered following key factors:

- identification, characterization and safety assessments for site hazards,
- development of detailed plans and procedures,

- waste management policy and structure which allows definition of a suitable end state, specifically, availability of waste disposal or suitable storage alternatives,
- satisfactory completion of the regulatory approvals process, including the environmental assessment process, and
- implementation and control of the decommissioning process.

These factors dictated the time frame required to achieve a final end state within which the WL Decommissioning Program.

According to CSA N294-09, a decommissioning strategy should be based on one or a combination of the following [5-2]:

- **Prompt decommissioning**, where the facility would be decontaminated and dismantled immediately after shut down.
- **Deferred decommissioning**, where the facility would be safely placed in a period of SWS to allow radiation levels to decay prior to decontamination and dismantlement.
- **In situ confinement**, where the facility would be placed in a safe and secure condition with the intention to abandon in-place.

Based on the Health, Safety, Security, Environment and Quality (HSSE&Q) considerations, AECL selected a combination of prompt decommissioning and deferred decommissioning. The CEAA process was followed and the Environment Minister made decision that the proposed Whiteshell Laboratories Decommissioning project is not likely to cause significant adverse effects, and that no further environment assessment by a review panel or mediation is warranted [5-3].

The WL Decommissioning Project encompasses five nuclear facilities, two auxiliary operating facilities and Whiteshell Licensed Site Supporting and General Infrastructure. Table 1-1 provides the information about the WL facilities, DDP volumes, End-State Reports completed by 2020 November, and the DDP or facility current status.

5.1.1 Decommissioning Alternatives

5.1.1.1 Alternative 1: Decommission the Site to a Final End State in a 20 Year Period (2020)

The intent of this alternative would be to decommission the site to a final end state in a period of 20 years. There would be sufficient time to meet the characterization, safety assessment and planning/approval requirements needed to implement the project work. It would allow for a complete assessment of the WL wastes, to differentiate the wastes which can be managed in situ at the site from those which will require removal to disposal or alternate storage.

However, to secure final end points, actions toward implementation of the waste policy and siting of waste disposal or alternate storage facilities would have to commence immediately. It is expected that to establish a national waste disposal policy, and to site and construct a facility fulfilling all the regulatory review requirements would take at least 10 years under the most optimistic approach. That would leave only 10 years to move wastes requiring relocation and establishing controls for those which can be safely managed in situ. If alternate storage were a component of the project implementation, transport and relocation of various waste volumes would need to be reassessed on a safety and environmental impacts basis. Although in theory, this option could be accomplished it presents substantial risks in terms of waste management requirements which are outside the control of the WL program management. The actual timing and availability of disposal will be factored into future updates of the Decommissioning Plan, particularly in terms of any impacts on the planned schedules for decommissioning activities.

5.1.1.2 Alternative 2: Deferred Decommissioning With Completion in 100 Years (2100)

This alternative proposes decommissioning of Whiteshell Laboratories over as long a period as necessary to implement national waste disposal policies. The assumption is that the longest this process would take is 100 years. As in Alternative 1, the initial work would proceed by placing site facilities in a secure M&S state. It is likely that all waste disposal requirements can be optimized as part of the national program. Implementation would occur in three phases:

Phase 1 activities directed toward nuclear and radioisotope buildings and facilities to place them in a safe, secure, interim end state. The Van de Graaff Accelerator and the Neutron Generator will be completely decommissioned. Phase 1 would be completed in approximately 6 years.

Phase 2 regular M&S of all buildings and facilities; most project activity would be focused on WMA. Most waste management facilities will be placed in a passive operational state and interim processing, handling and storage facilities, required during M&S and decommissioning project activities, will be established. Phase 2 would be followed by a deferment period of approximately 45 years during which site M&S would be maintained.

Phase 3 activities directed to bringing the site to a final end state that will fulfill all pertinent regulatory and national policy requirements. Phase 3 would involve decommissioning to a final end-state within 100 years. The site would be decommissioned to an unrestricted release state except for some parts of the WMA which may be disposed of in situ. Infrastructure refurbishment and rebuilding would likely be required to maintain the facilities under M&S state for the 45 year deferment period and beyond, resulting in increased rubble during the final decommissioning.

The three phases of decommissioning activities will be followed by a period of institutional control where the performance of the remaining in situ disposal components are monitored and controlled. The institutional control activities are designed to demonstrate that the in situ components perform in the manner predicted in the related safety assessments and to ensure that there is no development or intrusion into affected areas until the hazards have been reduced to acceptable levels. For Whiteshell Laboratories, this period is expected to extend for approximately 200 years beyond the physical project work.

5.1.1.3 Alternative 3: Decommission the Site to a Final End State in a Phased Approach Over a Period 60 Years (2060)

This alternative has the advantage of presenting a feasible approach which is planned in accordance with project assumptions that disposal space for WL waste will be available in a disposal facility by 2025 for LLW and by 2050 for High Level Waste (HLW). This plan would meet all of the key factors required to secure a final decommissioning end state. It also achieves maximum cost efficiency since it capitalizes on existing engineered structures and building envelopes to control nuclear liabilities under M&S in the interim, and schedules final decommissioning for individual facilities based on the expected lifetime of the structures.

This is likely the optimal approach and is AECL's reference option for the WL site decommissioning program.

If off-site waste disposal becomes available earlier, all site facilities except those which provide radioactivity decay benefits (e.g., WR-1 and some WMA wastes) could be decommissioned earlier. On the other hand, should off-site waste disposal availability take longer than assumed, the contingency would be to revert to Alternative 2.

The work and scheduling planned for each phase under this option is described briefly below.

Phase 1 Decommissioning, will address the site Active Area research facilities and the support laboratories/facilities not required for the remaining AECL programs. The primary focus of the initial decommissioning work will be on a limited set of facilities, including Shielded Facilities (includes the Neutron Generator), Laboratories (includes the Van de Graaff Accelerator), Active Liquid Waste Treatment Center, Decontamination Center, and Active Area General - (e.g., underground services, operational impacts to the site).

The Van de Graaff accelerator and the Neutron Generator will be completely decommissioned. The other facilities will be decommissioned to a safe, secure M&S interim end state. Shutdown of the research programs will require operational processing of research materials. Examples include irradiated component samples, irradiated fuel samples and small volumes of active liquid waste currently stored within the nuclear facilities. The impacts of these shutdown operations and decommissioning activities on WM facilities will be assessed as part of Phase 1 activity. However, WM facilities will need to remain operational under the existing facility authorization structure. Completion of this phase will require about 6 years.

Phase 2 Decommissioning, will address the WM facilities with the objective of achieving a passive operational state. The Phase 2 work will also address the longer term planning for the management of the collected waste inventory including future options for consolidating wastes such as irradiated fuel at an alternate location. The research facilities will be maintained in a safe, secure M&S state throughout this phase which is expected to last about 10 years.

The incinerator facility will be decommissioned.

The retrieval, processing and relocation of HLW from standpipes would commence in approximately 2010, and bunkers and buildings will be placed in M&S.

Phase 3 The final phase will see a staged decommissioning of the site to a final end state that will fulfill all pertinent regulatory and national policy requirements. The timing and sequence of decommissioning actions on the remaining facilities will be determined largely by the actual availability of disposal facilities and by the age and condition of engineered structures and buildings.

Phase 3 targets for decommissioning of the significant remaining facilities/buildings are:

Active Area Infrastructure	Decommissioned to End state	2015
WMA	Bunkers and Buildings Waste Removal	2024
	Bunkers and Buildings Decommissioning	2030
	Trench Decommissioning	2025
	Implementation of Waste Trench In situ Disposal, Capping, Stabilization, Institutional Controls (waste removal/trench remediation where required)	2050
CCSF	Fuel Transferred to Disposal Facility	2050
	Decommissioning to End state	2055
ALWTC	Decommissioning to End state	2055
Decontamination Centre	Decommissioning to End state	2025
B300	Decommissioning to End state	2030
Active Drainage System	Decommissioned to End state	2035
Shielded Facilities	Decommissioned to End state	2040
WR-1	Decommissioned to End state	2050

The three phases of decommissioning activities will be followed by a period of institutional control where the performance of the remaining in situ disposal components are monitored and controlled. The institutional control activities are designed to demonstrate that the in situ components perform in the manner predicted in the related safety assessments and to ensure that there is no development or intrusion into affected areas until the hazards have been reduced to acceptable levels. For WL, this period is expected to extend for approximately 200 years beyond the physical project work.

5.1.1.4 Alternative 4: Decommission the Site to a Final End-State in a Phased Approach Over a Period of ~27 Years (~2027)

This alternative is similar to Alternative 3 in Section 5.1.1.3, but without a waiting period for disposal facilities. This alternative presents a feasible approach which is planned in accordance with project assumptions that most of the waste generated by WL decommissioning project will be transferred to either the proposed Near Surface Disposal Facility (NSDF) or interim storage at CRL until disposal facilities become available.

Alternative 4 assumes that intermediate and high-level waste disposal facilities will not become available within the Alternative 3 decommissioning time frame. This creates a long term uncertainty and risk for the decommissioning project. A decision was made to commence full decommissioning of the site, including the WMA, with no deferment period. Low level, intermediate-level and high level radioactive waste will be packaged and characterized to allow for safe transport, receipt, and interim storage at CRL (or another suitable licensed storage/disposal facility), and subsequent retrieval and placement into a final disposal facility.

An assessment on the potential impact of Alternative 4 compared with Alternative 3 (previously selected alternative) has been prepared to estimate the occupational dose consequences to workers [5-4]. The accelerated decommissioning dose is twice the deferred decommissioning dose as a result of not having radioactive decay from a 30 year decommissioning deferment period. The annual individual doses range from 1 to 2 mSv and up to a maximum of 3 to 5 mSv, and a total collective dose up to 400 person-mSv. Decommissioning the site under Alternative 4 will result in additional occupational dose at the CRL site from additional waste handling and storage with annual individual doses ranging from less than 0.5 mSv and not more than 3 mSv, and the total collective doses not exceeding 110 person-mSv. These doses are relatively low and are acceptable from an ALARA perspective. Annual individual doses are a low percentage (≤6% at CRL and ≤10% at WL) of the regulatory limit of 50 mSv for Nuclear Energy Workers. The estimated total collective doses (400 person-mSv) are below the CNSC ALARA assessment trigger guideline of 1,000 person-mSv [5-5].

The current detailed project schedule for the WL decommissioning activities for Alternative 4 is shown in Figure 9-1.

Safety assessments for all nuclear facilities/buildings will be performed to identify potential hazards to workers, the public and the environment from routine decommissioning activities and credible accidents during execution of their decommissioning activities and due to release of contaminants during the institutional control period, if disposed in situ. This information will also be summarized in the facility or building specific DDPs.

For the proposed in situ disposal of WR-1, an environmental assessment under CEAA 2012 shall demonstrate that the proposed decommissioning project will not likely cause significant adverse environmental effects. For the proposed in situ disposal of the LLW trenches in WMA, a safety case will be developed and submitted to the CNSC as per the Comprehensive Study Report [5-6].

Decommissioning activities will be followed by a period of institutional control where the performance of the remaining in situ disposal components (LLW trenches in WMA, proposed WR-1 Disposal Facility, and the Inactive Landfill/Asbestos Burial Pit Site) are monitored and controlled. The institutional control activities are designed to demonstrate that the in situ components perform in the manner predicted in the related safety assessments, and to ensure that there is no development or intrusion into affected areas until the hazards have been reduced to acceptable levels. The rationale for and duration of the institutional control periods will be provided in safety case or other documentation leading towards an institutional control licence, or through the Environmental Assessment for WR-1 ISD.

5.1.1.5 Preferred Decommissioning Approach

The main difference between the four alternative means of decommissioning the Whiteshell Laboratories is the time involved. The steps to completing decommissioning of the site and the proposed end-state are virtually the same for the four alternatives considered. It is understood that the public preference is for an early and complete decommissioning, that is, Alternative 1. That approach appears to have two limitations. One relates to the short period for deriving benefits from natural radioactive decay; the other to the unavailability of a site or facilities for disposal of radioactive wastes. Alternatives 2 and 3 offer longer time frames to complete the project, allowing optimization of radioactivity decay (Figure 5-1 and Figure 5-2) and the avoidance of double handling by moving wastes directly to disposal facilities.

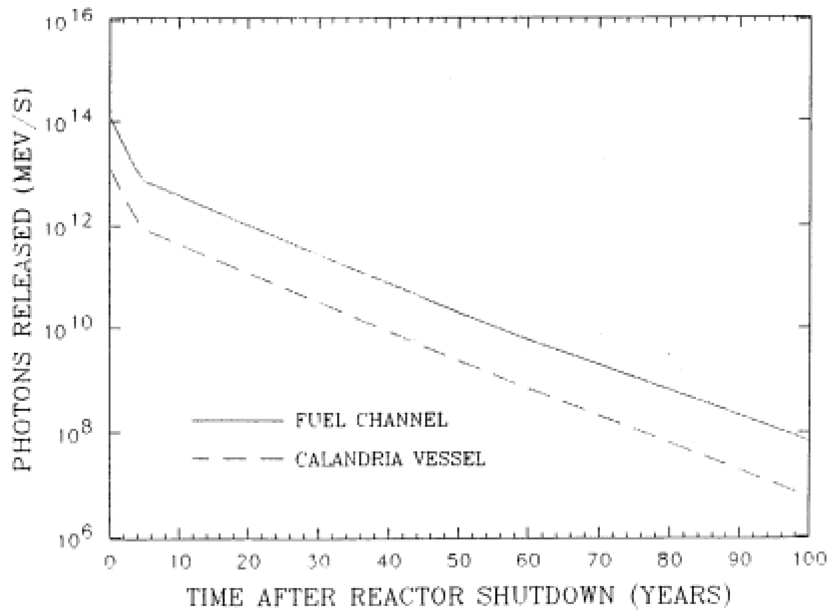

Figure 5-1 Decay Curves for the Steel Fuel Channels and the Steel Calandria Vessel (per kilogram)
(Reactor shutdown in 1985)

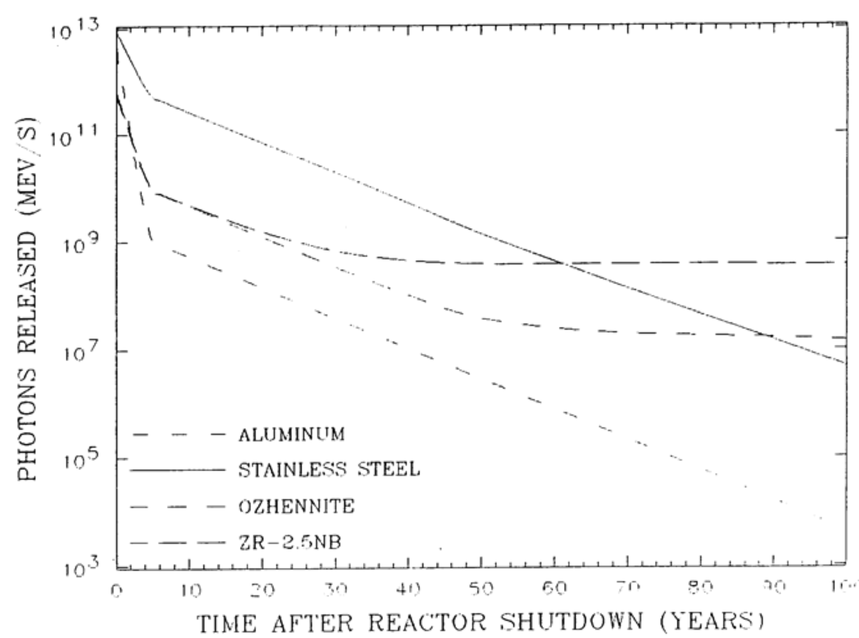

Figure 5-2 Decay Curves for the Fuel Channel and Calandria Tubes (per centimeter height)
(Reactor shutdown in 1985)

Handling of the highly radioactive materials places economic and safety limitations on the implementation of the decommissioning program. Although doable, removal of highly radioactive material prior to optimizing radioactive decay, dramatically increases the cost to maintain worker safety. The additional shielding and remote handling required is estimated to add between $40M and $80M to the reference project cost.

Similarly, the unavailability of disposal facilities impacts cost and worker safety. To provide interim storage space requires the construction of high integrity shielded facilities estimated to add between $20M and $40M to the reference cost of the decommissioning project. The double handling to move materials to disposal adds an additional $10M to $20M to the reference cost of the project and contributes to significant additional dose to workers.

The management of the irradiated fuel inventory currently stored in concrete canisters at Whiteshell Laboratories until disposal facilities become available also provides an economic benefit. The canister life safely extends to at least 2050. Although, handling equipment does exist to allow transfer to another location, the construction of replacement interim storage and the associated double handling would add approximately $20M to $30M to the reference project cost.

Alternative 3, (60 years) is the reference option and represents the baseline project cost.

Alternative 1 (20 years) would incur the highest overall additional cost to complete the project. Although the M&S cost (approximately $2M/a) would be lower by approximately $40M, the remote handling and interim storage costs would increase the reference project cost in the range of $90M to $170M for an overall increase of between $50M and $130M.

Alternative 2 (100 years), would incur no additional cost for interim storage or remote handling beyond those already estimated in the reference option because there is limited benefit from additional radioactivity decay. However, the M&S costs (approximately $2M/a) would be higher by approximately $80M because of the increased project time frame. As well, most buildings housing nuclear facilities on the site would have exceeded their economic and structural life span and would require extensive replacement. This would add approximately $28M to overall project cost (estimated at about $2000/m^2 for the basic building footprint space of 14,000 m^2 occupied by nuclear facilities). The rebuilding would also increase the amount of waste which ultimately requires disposal. The cost of Alternative 2 is higher than the reference alternative by at least $108M. A cost comparison for the first three alternatives is presented in Table 5-1.

The first three alternatives involve virtually identical decommissioning steps. As a result, the main differences relate to overall project cost and the greater risk to worker health and safety associated with the dismantling of WR-1 before radioactivity levels have been lowered naturally over time.

Table 5-1 Comparison of Cost for Decommissioning Alternatives 1 to 3 [5-1]

Alternative	Time Frame (Years)	Base Cost ($M)	$M Reductions Provided by Option	$M Additional Costs of Option	$M Total Incremental Cost of Option
1	20	Reference project cost	-40	90 - 170	50 to 130
2	100	Reference project cost	0	108	108
3	60	Reference project cost	0	0	0

The foregoing discussion indicates that Alternative 3 provides the best worker dose optimization and is the lowest cost approach. This approach is summarized as follows:

1. The achievement of a M&S state for the site nuclear facilities within 6 years of project implementation.
2. Monitoring and surveillance of the nuclear facilities with decommissioning activities scheduled to coincide with the end of building structural life and the expected availability of national disposal facilities.
3. Movement of wastes only when off-site disposal is available or when safety in existing structures is compromised.
4. In situ management for selected LLW trenches in the WMA.

The decommissioning Alternatives 1 to 3 were evaluated in the previous overview DDP [5-1] and the Comprehensive Study Report [5-6]. These alternatives include a decommissioning deferment period with shut down, monitoring and surveillance until suitable radioactive waste disposal facilities becoming available in Canada and then site decommissioning being performed. Alternative 4 was proposed when AECL transitioned to a GoCo model with CNL established and a contractor hired to operate the WL site. Alternative 4 (Decommission the Site to a Final End State in a Phased Approach Over a Period 27 Years (2027)), was evaluated in a dose impact assessment [5-4]. This assessment provides the potential impact that Alternative 4 may have on occupational dose due to reduced radioactive decay, multiple decommissioning activities being performed concurrently, and additional waste handling and storage. The dose consequences associated with Alternative 4 are described in Section 5.1.1.4. In summary, the accelerated decommissioning dose is twice the deferred decommissioning as the result of not having radioactive decay from a 30 year decommissioning deferment period. Accelerated decommissioning will also result in additional occupational dose at the CRL site from additional waste handling and storage with individual doses ranging from less than 0.3 mSv to a maximum of 3 mSv and total collective doses not exceeding 110 person-mSv. These doses for accelerated decommissioning are relatively low and acceptable from an ALARA perspective.

5.1.2 Decommissioning Strategy

CNL's decommissioning strategy is based upon two fundamental characteristics of decommissioning work. First, that the decommissioning process does not begin until there is a clear intent to permanently retire a facility, or a defined area, from service. Second, that decommissioning work can be phased and may be defined by stages with discrete end state where each end state may be followed by a period of surveillance where no decommissioning activities would be conducted. Therefore, once all ongoing operations cease then following strategy will be followed:

1. The facility will be placed in a safe and sustainable shut-down state, e.g., inventories are reduced, short-term risks and hazards are removed, M&S systems may be augmented. These actions will be taken under the provisions of the Facility Authorization by the Facility Authority responsible for operations.
2. The end state condition of the facility, the facility boundaries and monitoring/surveillance requirements will be documented in a facility turnover document which is submitted by the Facility Authority to the Facility Decommissioning Manager. Following acceptance of the turnover document by the Decommissioning Manager, the facility ownership will be transferred from the Facility Authority (Operator) to the Decommissioning Manager.
3. The facility will be maintained and monitored in its shutdown state either under the provisions of an approved M&S Plan or under the licence conditions for the decommissioning facility as listed in either. The licence conditions specify the responsibilities and requirements for the storage with surveillance stage. This stage will be maintained until such time as a decision is made to proceed to the next stage of decommissioning.
4. Completion of the decommissioning process to an agreed, defined end state will proceed through a series of staged actions, appropriate to each specific facility, that are designed to achieve a decreasing level of worker and public risk. Each stage will be approved by CNL through a detailed decommissioning plan. Each stage may be followed by a surveillance period and where a surveillance period is applied, appropriate end state documentation is prepared. Decisions on the scope and timing of each stage will be based upon an analysis of the relevant costs, benefits, risks and priorities.
5. The sequence of decommissioning actions or stages is defined in the conceptual decommissioning plan which is updated, as required, to keep it current throughout the life cycle of the decommissioning process.

The application of this strategy will be determined for each specific facility and documented in the facility's detailed decommissioning plan.

5.1.3 Implementation of the Preferred Decommissioning Approach

The proposed Whiteshell Laboratories Decommissioning Project (WLDP) was to be implemented through a phased approach preceded by operational shut down work, as per the original Overview DDP [5-1] (schedule is provided in Table 5-2). The activities planned in each phase were:

Phase 1 (approximately 5 years) – activities directed toward nuclear and radioisotope buildings and facilities to place them in a safe, secure, interim end state. The Van de Graaff Accelerator and the Neutron Generator will be completely decommissioned.

Phase 2 (approximately 10 years) – regular M&S of all buildings and facilities. Most project activity will be focussed on the WMA. Most waste management facilities will be placed in a passive operational state and interim processing, handling and storage facilities, required during M&S and decommissioning project activities, will be established.

Phase 3 (approximately 45 years) – activities directed to bringing the site to a final end state that will fulfil all pertinent regulatory and national policy requirements. The timing and sequence of decommissioning activities will be determined largely by the availability of disposal facilities and by the age and condition of engineered structures and buildings.

Following the completion of Phase 3, part of the site, namely, the WMA, will remain under institutional control for an additional 200 year period.

Preparatory work for the initial phase of decommissioning will be completed in parallel with the shutdown operations work as follows:

- preparation and submission of DDPs and Shutdown and Decontamination Plans for approval,
- preparation and submission of EA documentation including documentation of the results of the public consultation process,
- acceptance of the findings of the EA,
- on approval of DDP's transfer the listed facilities addressed in Phase 1 to the decommissioning section of the Site Decommissioning Licence structure,
- establish the licensing structures for the WM facilities (CCSF, WMA) which will remain in operation, and
- establish the licensing process for turning over general site buildings for commercialization.

At the time the implementation of Alternative 4 began in 2015 (at the time of transition to the GoCo model), the decommissioning project was part-way through these three phases, and proceeding through these distinct phases was abandoned, in essence moving straight in to Phase 3, on a different timescale.

Table 5-2 Whiteshell Laboratories Decommissioning Schedule (as per original Overview DDP [5-1])

Facility	Decommissioning Activity/State	Phase
Shielded Facilities	Operational - processing of high level liquid waste	Phase 1
	Decontamination	Phase 1
	Monitoring and surveillance	Phases 2 and 3
	Final Decommissioning	Phase 3
Active Liquid Waste Treatment Center	Part of facility remains operational through to Phase 3	Phase 1, 2 and 3
	Decommissioning of unused portion	Phase 1
	Monitoring and Surveillance	Phase 2
	Final Decommissioning	Phase 3
Concrete Canister Storage Facility	Operational	Phase 1
	Placed in a Passive Operational State	Phase 2
	Monitoring and Surveillance	Phase 2 and 3
	Final Decommissioning	Phase 3
Waste Management Area	Operational	Phase 1
	Define and operate remaining facility	Phase 2 and 3
	Storage of Monitoring and Surveillance wastes	Phase 2 and 3

Facility	Decommissioning Activity/State	Phase
	Recover and process stored waste from facilities requiring upgrading	Phase 2
	Placing retrieved waste into new upgraded facilities	Phase 2
	Transfer WMA storage facilities not required for Phase 2 activities to a passive operational state	Phase 2
	Monitoring and Surveillance in the Passive Operational State until wastes are removed to disposal facilities	Phase 3
	Maintain institutional controls until in situ waste is acceptable for unconditional release	Institutional control period
	Preparation and transfer of waste to disposal facilities	Phase 3
B300	Decontamination and/or Fixation of Contamination	Phase 1
	Monitoring and Surveillance	Phase 2 and 3
	Final Decommissioning to an unrestricted release state	Phase 3
B402	Operational throughout Phase 1 Decommissioning. Approach is dependent on the extent of continued commercial use of B402 beyond Phase 1	Phase 1
	Final decommissioning as early as the first part of Phase 2 (if commercialization is discontinued)	Phase 2
Non-Nuclear Buildings	An assessment will be made of the decommissioning of the general site service facilities by the end of Phase 1	Phase 1
	Final decommissioning	Phase 2 and 3
Inactive Landfill	Operational throughout Phases 1 and 2	Phase 1 and 2
	Development of a remediation plan	Phase 2
	Final Decommissioning	Towards the end of Phase 3
Sewage Lagoon	Operational throughout Phase 1 and 2	Phase 1 and 2
	Development of a remediation plan	Phase 2
	Final Decommissioning	Phase 3
Buried Services	Operational	First part of Phase 1
	Drains will be assessed, remediated and capped	Phase 1

Facility	Decommissioning Activity/State	Phase
	Monitoring and Surveillance	Phase 2
	Most systems, other than parts of the active drainage, will remain functional during Phase 2 Remediation of buried services and soil contamination associated with the active drainage system	Phase 2 and 3
Affected Lands	Surveying, assessing and developing remediation plans	Phase 1
	Monitoring and surveillance	Phase 2 and 3
	Remediation to levels acceptable for unrestricted release	Phase 3
River Sediments	Monitoring and surveillance	Phase 1, 2 and 3
	Re-evaluation to confirm final in situ end state	Phase 3
North Ditch	Identification of contamination above levels acceptable for unconditional release	Phase 1
	Preparation of a remediation plan	Phase 1
	Remediation if necessary	Early in Phase 2

5.1.4 Monitoring and Surveillance Approach

The primary objective of the Phase 1 work was to place the site in a M&S state. Radioactive contamination and sources were planned for removal or fixation to deliver a building/facility interim end state where any changes in condition would take place over an extended period and allow for detection through remote monitoring coupled with routine inspections. A central monitoring station was proposed for B100 to serve as the base of M&S and project operations. Key parameters such as building temperature, ventilation, leak detection, sump levels were identified as part of Phase 1 work to establish the monitoring functions. Periodic walk-throughs were scheduled for buildings/facilities in accordance with level of hazard remaining. The minimum inspection schedule for any building is semi-annually.

5.1.5 Building/Facility End-State Approach

Clearance levels for materials and equipment are established based on either surface contamination (e.g., Bq/cm^2) or volumetric contamination (e.g., Bq/g or Bq/kg). The clearance levels to be applied for materials and equipment that will be removed during the WL decommissioning activities are listed in Contamination Clearance Levels Used for WL Decommissioning [5-7]. The maximum allowable surface contamination levels for unrestricted use of materials, equipment and clothing are listed in Table A-3.

The decommissioning plan includes demolition of building structure to achieve a final end state. The rationale for the end state is based on survey and removal of radiological and non-radiological hazards to meet release criteria after which the building will be rubblized and removed. The foundation and building footprint will be characterized to ensure that radiological and non-radiological hazards have been removed and subsequently the building footprint will be backfilled, leveled and seeded leaving the underground footings etc. in situ.

5.2 Whiteshell's Decommissioning Planning Process

The planning process used at WL for decommissioning projects is a rolling wave process whereby the detail of the work and tasks is refined from stage to stage. The work planning methodology describes the requirements and processes for assessment and planning of decommissioning work at WL. It provides a process to effectively manage health, safety, and security of persons and protect the environment risks and to ensure the work planning requirements of the WL Decommissioning QAP [5-8] are met prior to executing decommissioning work. It is to be used by WL staff and others who may be charged with planning and execution of decommissioning activities. As well, requirements are set out in the WL Site Licence [5-9] and the Licence Conditions Handbook (LCH) for WL [5-10] reference documents pertaining to decommissioning at WL, including compliance programs and QA requirements.

Each DDP Volume is a bounding scope document that describes the work to be done for a specific facility, lays out the high level work breakdown structure and provides a high-level hazard assessment.

The next stage in the planning process is the development of more detailed Work Plans. The Work Plans have the detailed work breakdown structure, schedule and resource requirements. The Work Plans are supported by rigorous hazard and risk assessments and work execution planning. Figure 5-3 summarizes the relationship between DDPs and Work Plans. To support the execution of the Work Plans, work tasks are planned with supporting work planning tools (e.g., Job Scope Analysis, Hazard and Risk Screening Assessments, Work Instruction Packages, Radiological Work Assessments, Safe Job Instructions, and Temporary Operating Instructions).

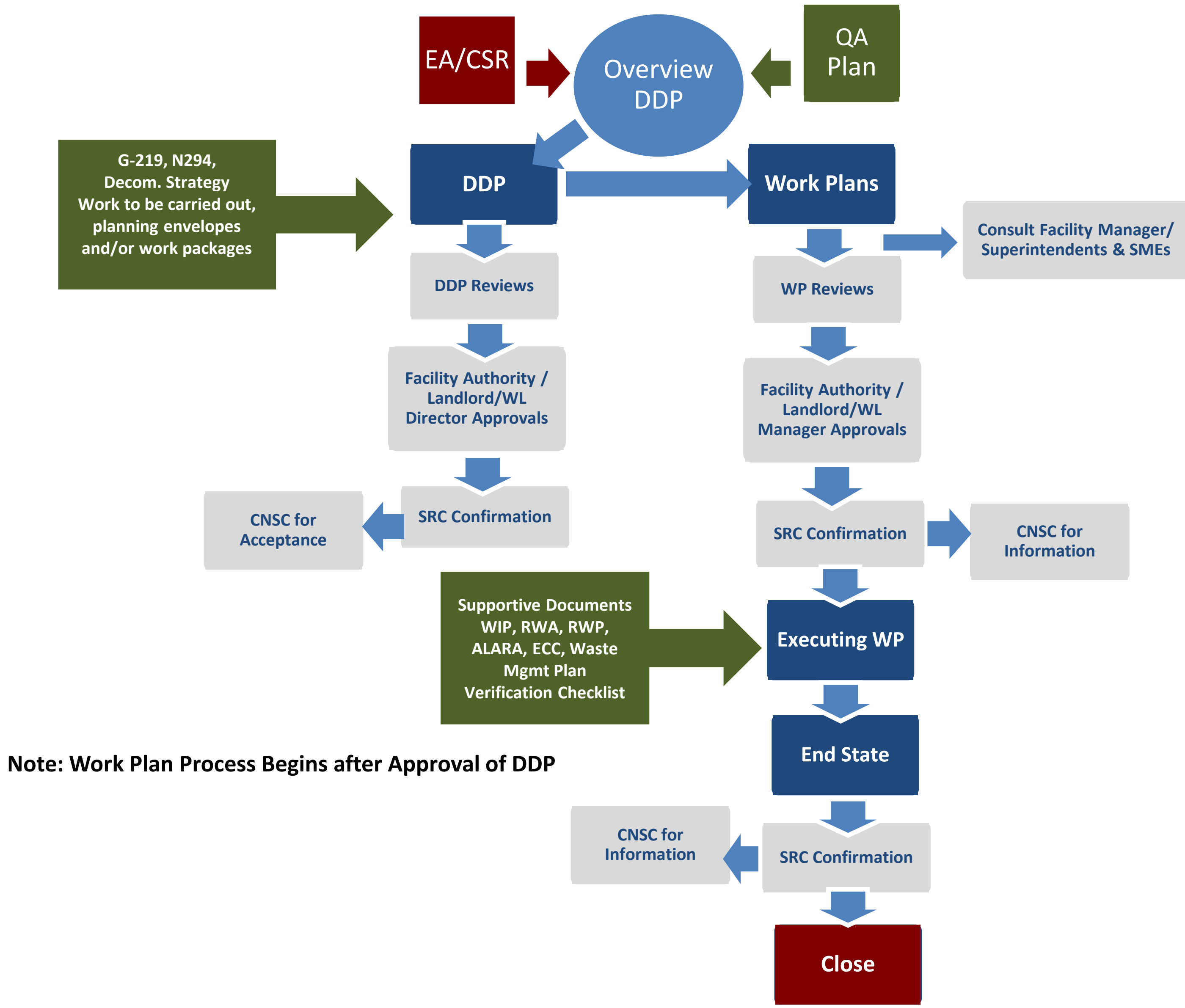

Figure 5-3 Whiteshell's Decommissioning Process

5.3 Decommissioning of Nuclear Facilities

5.3.1 Shielded Facilities

Operational cleanup of cells and work areas to remove research program equipment, materials and wastes is in progress as part of operational shut down. Processing of two active liquid waste volumes stored at the site, 270 L of Thorium Reprocessing Experiment (TFRE) waste, stored in a tank in the HCF, and 180 L of Amine Experiment waste (Amine), stored at the WMA will be processed to a solid waste form for interim storage at Whiteshell Laboratories under the SF operational licence. This work will emphasize identification, design, construction and operation of a processing facility in the HCF to solidify these wastes in an acceptable form for interim storage. The work includes the transfer of the amine wastes to the HCF. All facility safety systems will remain in operation until Amine/TFRE waste processing and decontamination operations are complete.

A summary of the decommissioning phases of SF and activities that were to be performed in each decommissioning phase as per the original Overview DDP [5-1] are given in Table 5-3.

Table 5-3 Shielded Facilities Decommissioning Phases and Activities

Phase	Activities
Operational Shutdown Period	• Disposition research samples and equipment. • Repackage Douglas Point fuel from Canister C-4 and transfer to the production canister site. • Process SF and WMA stored active liquid waste to a solid form. • Prepare the facility DDP. • Confirm facility operational shutdown complete and document turnover condition.
Phase 1	• Decontaminate all HCF/IFTF shielded cells to remove major mobile contamination and/or fix loose contamination in situ. Survey and document cell end state. • Isolate cells from ventilation systems and seal all cell openings, ports, etc. • Decontaminate and/or fix loose contamination in situ for IFTF canisters and seal with the existing plugs. Survey and document. • Decontaminate operating halls and service areas to remove major loose contamination or fix contamination in situ. Survey and document. • Specify and implement minimum building ventilation, heating, and maintenance plan to protect integrity of the building envelope. • Lock/secure building access. • Complete and document facility hazards characterization. • Document interim end state. • Document and implement the M&S Plan. The Phase 1 end state achieves a secure M&S state for the Shielded Facilities.
Phase 2	• Maintain the M&S Plan. • Maintain integrity of the building envelope. • Address any problems identified by periodic inspection. • Maintain the facility DDP current. • Maintain annual reporting. The Phase 2 end state is a continued M&S state.
Phase 3	• Final decommissioning phase targeted for 2040. • Decontaminate and/or remove radioactively contaminated material to meet release criteria. Transfer to alternate storage or disposal facilities. • Final survey. • Secure regulatory approval for uncontrolled site release. The Phase 3 end state is complete decommissioning of the facility for release from regulatory control.

The schedule of completing decommissioning activities under the new Alternative 4 is provided in Figure 9-1.

5.3.2 Active Liquid Waste Treatment Centre

As per the original Overview DDP [5-1], for the first part of Phase 1, the ALWTC will remain fully operational. By about 2004, most of the facility will be decommissioned to an interim end state. The process systems required for managing the reduced amount of aqueous LLW from building sumps and small amounts of aqueous MLW generated from M&S and site decommissioning operations will be retained in an operational state beyond Phase 1 as follows:

- seven existing waste collection tanks will be consolidated to collect building sump wastes for M&S into two tanks; and
- a replacement waste concentration system will be designed and constructed to process Medium Level aqueous waste arising from WMA waste processing operations (e.g., standpipe waste retrieval). The existing method of treatment using an evaporator is worker radiation dose intensive and was eliminated as an option.

The active drainage lines are out of service and capped. These active drainage lines were used to transfer surface drainage sump-water from nuclear facilities buildings (B100/B300/B411) to the ALWTC.

Phase 1 decommissioning of the unused portion of the ALWTC will include sealing active systems and active drainage. For example, drainage and ventilation systems will be removed or modified. Any systems remaining in place, which are not being used, will be capped off. Rooms will be decontaminated, hazards assessed and remediation applied where needed. In some areas contamination may be sealed/fixed in place until the final decommissioning in Phase 3. Radiological surveying will be carried out to document the facility condition for the interim end state.

In Phase 2, the unused portion of the ALWTC will remain in a M&S state. Liquid waste processing operations will be continued in a portion of the building. The design and operation of the remaining facility will be controlled to ensure the impact of operation is well within regulatory requirements.

The ALWTC will be decommissioned to an unrestricted use level in Phase 3 (2021).

A summary of the decommissioning phases of ALWTC and activities that were to be performed in each decommissioning phase as per the original Overview DDP [5-1] are given in Table 5-4.

Table 5-4 Active Liquid Waste Treatment Center Decommissioning Phases and Activities

Phase	Activities
Operational Shutdown Period	• Process waste arising from shutdown operations. • Identify any continuing WL site requirements for central collection of sump drainage, etc. • Prepare the facility PDP. • Identify the formal shutdown date. • Drain collection tanks and process all waste. • Document safe shutdown state/turnover condition.

Phase	Activities
Phase 1	• Develop the PDP to a DDP in year 3. • Process waste arising from SF/B300 decommissioning. • Confirm waste transfer from site facilities is complete. • Identify and establish the process for continued aqueous sump waste collection. • Flush all waste transfer system lines to the ALWTC collection tanks. • Flush all collection tanks to remove gross contamination and process flushing waste as appropriate. • Isolate collection lines from tanks and cap. • Cap all redundant collection lines at the source location (WR-1, B300, and Decontamination Centre). • Decontaminate and survey tanks, characterize tank condition. • Isolate tanks from ventilation, exit piping and seal openings. • Decontaminate tank rooms/operating halls to remove loose contamination, fix minor contamination in situ, survey and document. • Specify and implement minimum building ventilation, heating and maintenance plan to protect integrity of the building envelope. • Lock/secure building access. • Complete and document facility hazards characterization. • Document the interim end state. • Document and implement the M&S Plan. The Phase 1 end state will place most of the facility in a secure M&S state with the remaining operational component identified.
Phase 2	• Maintain the M&S Plan. • Maintain integrity of the building envelope. • Address any problems identified by periodic inspection. • Maintain the facility DDP current. • Maintain annual reporting. The Phase 2 end state is a continued M&S state.
Phase 3	• Final decommissioning phase targeted for 2040. • Decontaminate and/or remove radioactively contaminated material to meet release criteria. Transfer to alternate storage or disposal facilities. • Final survey. • Secure regulatory approval for uncontrolled site release. The Phase 3 end state is complete decommissioning of the facility for release from regulatory control.

The schedule of completing decommissioning activities under the new Alternative 4 is provided in Figure 9-1.

5.3.3 Whiteshell Reactor-1

5.3.3.1 Complete Removal Approach (as per the original Overview DDP [5-1])

The Complete Removal Approach for WR-1 Reactor has gone through the EA process as a part of the WL Decommissioning project and a decision has been made that Whiteshell Laboratories Decommissioning project is not likely to cause significant adverse effects, and that no further environment assessment by a review panel or mediation is warranted [5-3].

The Phase 1 decommissioning commenced in 1989 and was completed in 1995. This work addressed the removal of easily mobilized radioactivity (fuel, fluids, etc.) from the facility and decontamination of the main floor (600 level) and first sub-level (500 level) space with potential for reuse by Whiteshell Laboratories. Phase 1 work substantially decreased potential hazards from the facility and reduced the M&S requirements for the deferment period. The Phase 1 end state prepared WR-1 for a deferment period during which significant radioactivity decay will reduce the postulated dose commitment associated with future decommissioning work.

The WR-1 will remain under M&S throughout Phases 1 and 2.

RC-1290-R1 [5-11] and RC-1291-R1 [5-12] document the facility description and the M&S Plan at the end of the first phase of decommissioning for the facility which is already complete. These documents represent the Decommissioning Plan for the facility and will be included as DDP Volume 6 of the WL Decommissioning Plan [5-13].

The approach for WR-1 is to fully remove and package all activated and contaminated components for disposal in offsite facilities, to decontaminate the facility structure and then to demolish the building to achieve unrestricted release criteria.

Table 5-5 describes briefly the activities that will be performed in each decommissioning phase of WR-1 Reactor involving complete removal.

Table 5-5 WR-1 Reactor Decommissioning Phases and Activities for Complete Removal

Phase	Activities
Operational Shutdown Period	• Maintain M&S Plan.
Phase 1	• Maintain M&S Plan as documented in RC-1291-R1 [5-12].
Phase 2	• Maintain M&S Plan as documented in RC-1291-R1 [5-12].
Phase 3	The dismantling and remediation activities include: • Removal of reactor vault components, • Removal of process piping and equipment, • Transfer of radioactive waste to off-site facilities, • Decontamination of building structure, • Demolition of the building structure, • Remediation of the site to a “natural” state, and • Secure regulatory approval for final end state. The Phase 3 end state is complete decommissioning of the facility and release from regulatory control.

5.3.3.2 In Situ Decommissioning Approach (as per Alternative 4)

In keeping with the evolution of international best practices, CNL's decommissioning strategy has been moving towards reduced deferment periods. The resulting plan, to decommission WR-1 'in situ', incorporates these international standards and current best practices of decommissioning, reflecting a strong commitment to protect workers, the public and the environment in accordance with CNL's Health and Safety Policy [5-14], and Environmental Policy [5-15] and to recognize the government's liability for legacy nuclear wastes at all CNL sites.

The selected ISD option for WR-1 and B100 is also based on an evaluation of the short and long term risks associated with ISD of WR-1 [5-16] in accordance with CNSC G-320 [5-17]. Currently, this proposed ISD of WR-1 is going through the EA review process.

In situ decommissioning is a combination of permanent, passive disposal of the WR-1 below grade reactor area, and demolition and complete removal of the other building areas, including removal of above-grade building and infrastructure. It reduces the short term risk to workers, both of exposure to radiation, and other industrial hazards, and reduces the risk of releases to the public and the environment during decommissioning by minimizing the handling, and transporting of radioactive materials. The source term, including both non-radiological and radiological hazards, will be grouted in place to isolate the hazards from people and the environment. The nuclear source term will decay through time. Institutional controls will be incorporated for a duration of 300 years, or any other period that the CNSC prescribes[11]. A defined portion of land will remain under Government of Canada control and monitoring.

The building is divided into two parts; the ISD envelope and the balance of the building. The ISD envelope defines the boundaries of WR-1 systems and equipment that are to be disposed of in situ, and the balance of B100 (including the remaining Slowpoke Demonstration Reactor components) is decontaminated, demolished, and disposed of or recycled at an approved off-site facility.

The ISD envelope will contain the overwhelming majority of radioactive/contaminated equipment and materials. The ISD envelope is to be filled with a grout that will encase the contaminated equipment and materials, and provide containment and a barrier to the local environment. The grout material will be selected to ensure that an adequate level of protection is provided to ensure the safety of workers, the public and the environment.

The ISD envelope includes the core areas of the WR-1 below grade structure. These core areas house all of the most contaminated WR-1 systems and equipment, including the reactor vessel, the heavy water moderator system, portions of the primary heat transport system, and various support systems. Non-radiological hazardous materials that are in the ISD envelope will be removed where it is practical to do so, considering the hazard to the workers, and the long term safety as assessed in the EIS [5-16] and Decommissioning Safety Assessment (DSA) [5-18].

In some cases, there will be areas outside of the ISD envelope, such as the Primary Heat Transport Pump Room (Rm 602) that contain equipment that will be relocated below grade into the ISD envelope for in situ disposal.

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[11] The proposal for WR-1 institutional control is 100 years of active institutional control followed by 200 years of passive institutional control.

The balance of B100 is expected to contain little to no radiological contamination. All equipment will be removed, segregated and disposed of. The below grade structure of the balance of B100 will be left in place and backfilled with grout to minimize groundwater movement that could potentially facilitate transport of contamination. The composition of grout will be selected to provide the appropriate low permeability conditions. The above grade building will be decontaminated to the extent practical, and receive radiological clearance surveys, to allow the bulk of the construction material to be reused, recycled, or rubblized and transferred to an inactive landfill. Demolition may produce contaminated concrete rubble and other building components, which will be safely managed according to the CNL Waste Management Program [5-19].

The final End-State for WR-1 will be a multilayered ISD system that applies a Defense in Depth strategy. The primary pathway for release of contamination from the system is by groundwater that has infiltrated into the sub-surface structure, picked up contamination, and then carried it out of the sub-surface structure to the groundwater. Each layer of the ISD provides an additional measure to prevent and mitigate the release of contaminants to protect the Public and the Environment. The layers of defence against contaminant release include reactor system components, grout, internal walls, outer foundation walls, the local geosphere, an engineered cover, and active environmental monitoring. Combined, they form a rigorous system of barriers to provide long term safety to the Public and the Environment.

Table 5-6 describes briefly the activities that will be performed in each decommissioning phase of WR-1 Reactor involving ISD.

Table 5-6 WR-1 Reactor Decommissioning Phases and Activities for In Situ Decommissioning

Phase	Activities
Operational Shutdown Period	• Maintain M&S Plan.
Phase 1	• Maintain M&S Plan as documented in RC-1291-R1 [5-12].
Phase 2	• Maintain M&S Plan as documented in RC-1291-R1 [5-12].
Phase 3	The ISD activities include: • Isolation of building from site infrastructure, • Remove above ground structures, • Preparation of reactor systems and materials to permit encapsulation with grout, • Encapsulation of reactor systems and below grade structure with grout, • Demolition of non-reactor systems and structures, installation of an engineered cap, and site restoration, and • Institution of ongoing environmental monitoring program and return to AECL control. The Phase 3 end state is a multilayered ISD system that applies a Defense in Depth strategy.

The schedule of completing decommissioning activities under the new Alternative 4 is provided in Figure 9-1.

5.3.4 Concrete Canister Storage Facility

The CCSF remained in operation throughout Phase 1 under the current facility authorization. In Phase 2 the continuing operational requirements was to be assessed and the CCSF will be placed in a passive operational state.

Monitoring and surveillance was to be carried out during most of Phase 3. The fuel was to be transferred to CRL WMA G for interim storage (planned for 2050). All canisters then would be decontaminated and demolished. The canister rubble would be disposed of or recycled and the CCSF sites will be rehabilitated to unrestricted release.

A summary of the decommissioning phases of CCSF and activities that were to be performed in each decommissioning phase as per the original Overview DDP [5-1] are given in Table 5-7.

Table 5-7 Concrete Canister Storage Facility Decommissioning Phases and Activities

Phase	Activities
Operational Shutdown Period	• Store obsolete research fuel in canisters. • Consolidate site storage canisters (C-2, C-4) into main CCSF. • Prepare the facility PDP/DDP.
Phase 1	• CCSF remains in operation. • Identify and store other site wastes requiring canister storage. • Develop the PDP into a DDP. The facility remains in operation at the end of Phase 1.
Phase 2	• Prepare and document the facility hazards assessment, • Place the facility in a passive operational state, • Prepare, implement and maintain an M&S plan for the facility in the passive operational state. The facility will be placed in a passive operational state at the end of Phase 2.
Phase 3	• Transfer irradiated fuel inventory to disposal facilities, 2050. • Assess radiological condition of canister liner. • Demolish canisters, confirm and remove concrete as clean waste, decontaminate liners based on economics or store as radioactive waste targeted for 2055. • Survey site for final release. • Remove fencing and security systems. • Document final end state and secure regulatory approval for end state as controlled release within the WL site. The Phase 3 end state is a completely decommissioned facility released from regulatory control.

The schedule of completing decommissioning activities under the new Alternative 4 is provided in Figure 9-1.

5.3.5 Waste Management Area

The WMA remained fully operational during Phase 1.

The buildings, structures and grounds within the WMA will be deactivated, demolished, and remediated to end-state release criteria, with the exception of 21 of the 25 LLW trenches, which are proposed for in situ disposal without any remediation work, and are out-of-scope for this DDP. The case for in situ disposal is presented in [5-6].

Phase 1 work included the design and implementation of an enhanced hydrogeological and environmental monitoring program to collect additional site data to support a final decision on in situ disposal. The wastes have continued to be managed under CNSC licensing conditions which provide an audit and review mechanism to ensure that any additional monitoring or EA required to support a final decision is conducted.

A summary of the decommissioning phases of WMA and activities that were to be performed in each decommissioning phase as per the original Overview DDP [5-1] are given in Table 5-8.

Table 5-8 Waste Management Area Decommissioning Phases and Activities

Phase	Activities
Operational Shutdown Period	Not Applicable
Phase 1	• Acceptance of low-, medium- and high-level radioactive waste generated from decontamination of the site research facilities (e.g., Shielded facility, B300). Waste includes: - Solidified TFRE/Amine active liquid waste, - Decontamination waste, - Contaminated laboratory equipment, and - Contaminated building service system components. • Construction of additional bunker storage space to meet capacity requirements for Phase 1 decommissioning waste. • Maintenance of the WMA facilities and grounds. • Design and implementation of an enhanced monitoring system for the LLW trenches to collect data in support of the final in situ disposal decision.
Phase 2	In Phase 2, waste-processing operations will be implemented to address wastes which cannot remain in existing storage structures until waste disposal becomes available. This work will specifically address irradiated fuel waste in standpipes, waste in trenches 6 and 16 and some industrial/chemical waste in trenches 1 and 10. The key activities to be carried out are: • Establishing the remaining operating area required to process, package and provide interim storage throughout Phases 2 and 3. New facilities will be constructed to meet regulatory requirements and will include retrieval, processing, segregation and interim storage for waste which cannot be managed in existing facilities until waste disposal facilities become available.

Phase	Activities
	• Placing the WMA facilities, no longer receiving or processing waste, into a passive operational state. This may include modification to facilities and some relocation of waste within facilities. • Recovering and processing the fuel waste from the standpipes and the irradiated reactor components from Trenches 6 and 16[12]. • Recover industrial chemical wastes from Trenches 1 and 10. • Constructing facilities in the remaining operating area to meet Whiteshell Laboratories' requirements for managing waste from decommissioning activities. • Carrying out enhanced monitoring in support of trench in situ disposal. Several new facilities will be designed and constructed in the newly defined operating area located within the existing WMA boundary. New facilities comprise: • Interim storage bunker for solidified TFRE/Amine active liquid waste. • Interim bunker storage for routine M&S waste. • Interim storage for processed waste arising from WMA retrieval operations and from any site decommissioning work required prior to the availability of off-site disposal. • A de minimis segregated facility to process waste into appropriate handling categories for off-site disposal. • Transport equipment (shielded tanker) to accommodate transfer of aqueous waste to the ALWTC. WMA storage facilities which are not required for Phase 2 activities will be transitioned to a passive operational state.
Phase 3	• Preparation and packaging of waste for immediate transfer to disposal facilities, since the major site decommissioning activities are planned in accordance with assumptions on waste disposal facility availability. • Monitoring and surveillance in the passive operational area until the wastes are removed to disposal facilities or in situ management controls are in place. • Preparation of final safety case for in situ disposal of LLW Trenches to support the final decision on in situ disposal. Optimization of the disposal plan will consider: - Removal/remediation of trench waste unsuitable for in situ disposal,

[12] Trench 16 was deemed marginally high due to the levels of Tc-99. With an updated understanding of Tc-99 contents of Trench 16 (completed in 2019), it is likely that inaccurate and overly conservative conclusions in the evaluations and assessments resulted in a conclusion that Trench 16 required partial remediation, when in fact the trench likely does not require any remediation to remove the Tc-99 for safe in situ disposal. The errors in the original assessments likely placed an unnecessary commitment on CNL.

Phase	Activities
	- Engineered barriers, - Surface drainage patterns, - Additional monitoring locations, and - Additional controls following Phase 3 • Processing final decommissioning project wastes as required to accommodate transport to disposal facilities (e.g., segregation of contaminated waste from clean waste, packaging, loading shipping containers). • Retrieving and transfer all WMA waste that cannot be managed in situ at the site to final disposal, • Stabilizing/capping/securing the low level trench area to manage waste in situ and establish institutional controls, and • Remediating the balance of the WMA to a more “natural” condition. The Phase 3 end state is full of removal of all wastes except for 21 LLW trenches which will remain under institutional control for a period of approximately 200 years.

The schedule of completing decommissioning activities under the new Alternative 4 is provided in Figure 9-1.

5.4 Decommissioning of Radioisotopes Facilities/Auxiliary Facilities

5.4.1 Research and Development Facilities Complex (B300)

The Phase 1 work for B300 included decontamination and/or fixation of contamination throughout the facility. Fume hoods were isolated from the exhaust ventilation system and active drainage lines were drained and capped. Active drainage system connections to the ALWTC were maintained to manage building sump wastewater. Minimum heating and ventilation was established.

A summary of the decommissioning phases of Research and Development Facilities Complex and activities that were to be performed in each decommissioning phase as per the original Overview DDP [5-1] are given in Table 5-9.

Table 5-9 Research and Development Facilities Complex Decommissioning Phases and Activities

Phase	Activities
Operational Shutdown Period	• Disposition research materials/equipment.
Phase 1	• Confirm operational shutdown activity is complete for the building envelope (Reactor Safety Research Program Operation until 2003 December. North Extension operations are dependent on program decisions and may result in continued operation separate from balance of facility).

Phase	Activities
	• Assess radioactive service systems, laboratories ventilation and active drains. Seal in place or package as waste for storage at the WMA. • Decontaminate building interior to remove loose contamination or fix in situ. • Specify and implement minimum ventilation, heating and the maintenance plan to ensure integrity of the building envelope, • Lock/secure building access. • Complete and document facility hazards characterization. • Document end state. • Document and implement the M&S Plan. The Phase 1 end state achieves a secure M&S state for B300.
Phase 2	• Maintain the M&S Plan. • Address any problems identified by periodic inspection. • Maintain annual reporting. The Phase 2 end state is a continued M&S state.
Phase 3	• Final decommissioning, completion target 2030. • Decontaminate and/or remove radioactively contaminated material to meet release criteria. • Transfer radioactively contaminated material to alternate storage or disposal facilities. • Demolish the building. • Final survey. • Secure regulatory approval for uncontrolled site release. The Phase 3 end state is complete decommissioning of the facility and release from regulatory control.

The schedule of completing decommissioning activities under the new Alternative 4 is provided in Figure 9-1.

5.4.2 Health and Safety Facilities (B402 and B305)

B402 was operated throughout Phase 1 to provide dosimetry services to AECL and to accommodate commercialization activities such as ACSION.

The decommissioning approach for the building includes:

- Characterization and decontamination activity similar to the Decontamination Center to prepare the building for decommissioning to an unrestricted release level.

The schedule of completing decommissioning activities under the new Alternative 4 is provided in Figure 9-1.

5.5 Decommissioning of Whiteshell Licensed Site Supporting and General Site Infrastructure

5.5.1 Non-Nuclear Buildings

During the operational shut down period, non-nuclear buildings were prepared for demolition or for transfer to other (commercial) owners.

The general site buildings were maintained in an operational state to support continuing research programs (e.g., B303, B304), the decommissioning program, commercialization opportunities (e.g., B401,) or to support the site operation generally (e.g., Powerhouse B911, Pump house B902).

A summary of the decommissioning phases of Non-Nuclear Buildings and activities that were to be performed in each decommissioning phase as per the original Overview DDP [5-1] are given in Table 5-10.

Table 5-10 Non-Nuclear Buildings Decommissioning Phases and Activities

Phase	Activities
Operational Shutdown Period	• Maintain non-nuclear buildings in operational state to support commercialization activities, research programs, decommissioning. • Develop licensing strategy/process for turnover of non-nuclear buildings to private tenants. • Support commercialization for targeted buildings by surveying to release state. • Turnover buildings to private use in accordance with strategy.
Phase 1	• Continue support to remaining research programs, commercialization effort. • Turnover buildings to private use in accordance with licensing strategy. • Complete differentiation between M&S facilities/infrastructure and commercialized buildings/infrastructure. The Phase 1 end state places all buildings no longer required for commercialization or to support the decommissioning activities in a secure M&S state.
Phase 2	• Remove redundant buildings/infrastructure. • Maintain M&S state for remaining infrastructure. The Phase 2 end state is continued M&S for remaining buildings and infrastructure.
Phase 3	• Final decommissioning work. • Decontaminate/remove radioactive waste (if any) to meet release criteria. • Demolish/remove any remaining non-nuclear buildings/infrastructures. • Finalize overall site end state and any survey required. • Secure regulatory approval for uncontrolled release of non-nuclear buildings/infrastructure. The Phase 3 end state achieves full decommissioning of all non-nuclear buildings and full release from regulatory control.

The schedule of completing decommissioning activities under the new Alternative 4 is provided in Figure 9-1.

5.5.2 Inactive Landfill

The inactive landfill remained fully operational for Phases 1 and 2. Waste processing operations and maintenance was consistent with that done prior to decommissioning. A plan for remediation of the landfill will be developed. Environmental, radiological and geotechnical evaluations will be carried out to provide inputs to the plan.

The landfill will be decommissioned to a final end state. The landfill will be capped and the surface restored to a more “natural” condition. Subsequent to closure, monitoring will be carried out to confirm that the landfill is fully stabilized.

The operation and decommissioning of the inactive landfill falls under federal jurisdiction. Manitoba Environment Act Regulation 150/91 on closure of landfills will be considered in developing the remediation plan for this facility.

The schedule of completing decommissioning activities under the new Alternative 4 is provided in Figure 9-1.

5.5.3 Sewage Lagoon

The sewage lagoons remained fully operational for Phases 1 and 2. Waste processing operations and maintenance were consistent with that done prior to decommissioning. A plan for remediation of the lagoon system will be developed.

Environmental, radiological and geotechnical evaluations will be carried out to provide inputs to the plan.

Decommissioning of the lagoon system to a final end state will be accomplished by backfilling and restoring to a more “natural” condition. Subsequent to closure, monitoring will be carried out to confirm the lagoon is fully stabilized. Interim domestic sewage facilities (e.g., septic tanks) will be required to meet operational needs.

The operation and decommissioning of the lagoon falls under federal jurisdiction. Manitoba Environment Act, Regulation 163/88 will be taken into consideration in developing remediation plans for this facility.

The schedule of completing decommissioning activities under the new Alternative 4 is provided in Figure 9-1.

5.5.4 Buried Services

The timing for reducing or terminating buried services is co-ordinated with the discontinued need for a service and/or with the demolition of individual buildings. For electrical, district heat, firewater and domestic water, the site service is maintained until all facilities are demolished/removed. As individual facilities are removed the service supply is terminated/ capped at the building footprint perimeter. Decommissioning of in ground services is planned as part of final site remediation. Much of the non-radioactive infrastructure will be disconnected/capped and abandoned in situ.

5.5.5 Affected Lands

The approach to decommissioning will be the same generally for each of the known specifically affected areas.

Any identified need for early remediation or stabilization will be completed. Since stabilization/remediation for these areas was incorporated as the first step in addressing the incident immediately after occurrence, only limited work is expected for these areas until final remediation.

Remediation will be completed to a level where any remaining contamination is within acceptable levels for unrestricted release. In some areas, institutional controls may be required after remediation has been completed.

5.5.6 River Sediments

Based on the evaluation in Appendix B.1 of [5-6], the decommissioning approach is to abandon the contaminated sediments in situ.

River sediment monitoring will be carried out as documented in [5-20]. Results from collection and analysis of Winnipeg River bottom sediments at three Target Areas in 2006 are reported in [5-21].

5.5.7 North Ditch/Creek

A full assessment of environmental monitoring data and of the original spill documentation will be conducted to confirm that the initial remediation following the incident was satisfactory and that no additional remediation is required.

5.6 Interim and Final End-State

End-State objectives for WL decommissioning are related to the finalization of the WL Closure Project's Land Use and End State Plan. The extent of the removal and remediation of the infrastructure and surrounding soil, as well as the restoration of the worksite at WL, will be determined in accordance with the land-use category designated for the area of the WL site and defined in the end-state objectives.

5.6.1 Interim End-State Objectives

Where a facility/building is decommissioned in a phased program, an interim end state report may be prepared to document the state of decommissioning so that information is readily accessible when final decommissioning takes place.

5.6.2 Final End-State Objectives

The land clearance criteria to which the WL site will be prepared for its Final End State depends on the long term land use objectives for the site.

At WL, LLW trenches in WMA, proposed Whiteshell Reactor Disposal Facility (WRDF), and inactive landfill/asbestos burial pit site will have a period of institutional control where the performance of these remaining in situ disposal components are monitored and controlled.

Canadian Nuclear Laboratories has laid out a plan for the WL site to identify the completion of decommissioning activities and transition of the site to institutional control. During the next licence period, CNL will prepare for a transition to an institutional control state, with an appropriate licence application/applications to the CNSC. The CNL's Environmental Protection Program includes effluent, environmental and groundwater monitoring, and the program evolves over the time period of the project transitioning into and being a part of the institutional controls.

For the WL site, other than the areas where the institutional control is applied, four post closure land use categories are being contemplated as the proposed end state land use: Agricultural, Residential, Industrial and Recreational. Each land use category has associated clearance levels and cleanup criteria for radioactive and non-radioactive contaminants. The land areas will be decommissioned, remediated and cleaned up to meet the cleanup criteria for the designated land-use category to achieve the applicable end states of the WL Closure Project that will be documented in the final Land-Use and End-State Plan [5-22].

To achieve the proposed end state, the following activities will have to be completed:

- All structures, systems and components including the buildings have been dismantled/demolished and removed from the site;
- All subsurface structures have been drained, de energized, and removed to a minimum depth of 1.5 m below grade (consistent with industry practices);
- All excavated areas have been backfilled with clean soil, graded with topsoil and sodded/seeded;
- Below-grade holes, voids or channels into the bedrock at a depth more than 1.5 m from the grade have been filled with grout, and the top 1.5 m layer backfilled and graded with clean soil and topsoil;
- All radioactive wastes, hazardous waste materials, and radiological and non-radiological contaminations in excess of the established clearance levels have been removed from the site;
- Environmental review to determine if in situ abandonment and/or in situ confinement and management is appropriate (i.e., supported by the WL CSR [5-6] and/or requires an additional environmental risk assessment and/or safety assessment);
- All spent fuel and the associated canister facility have been removed from the WL site; and
- WL site has been remediated/restored to conditions specified in the facility specific or building specific DDPs and is ready for alternative use.

Upon completion of the physical project work, the LLW trenches in WMA, proposed WRDF, and inactive landfill/asbestos burial pit site will remain under institutional control. During the institutional control period, administrative controls as well appropriate mitigation measures will be put in place to control and monitor these areas such as airborne, groundwater and surface water monitoring for a specified time period. The institutional control activities are designed to demonstrate that the in situ components perform in the manner predicted in the related safety assessments, and to ensure that there is no development or intrusion into affected areas until the hazards have been reduced to acceptable levels. For WL, this period is expected to extend for approximately 200-300 years beyond the physical project work.

The Final End State of the WL will be achieved when the following additional activities have been completed:

- Completion of the Final Status Survey of the site/area(s), which confirms that the concentrations of any remaining radiological or chemical contaminants in the impacted areas are below the release criteria for the proposed designation of the WL site/area(s);
- Completion of the Final End-state Report for the WL site/area(s) confirming successful completion of decommissioning; and
- Institutional controls, as applicable, are in place.

5.6.3 End-State Documentation

End-state documents will be prepared for the decommissioning work in accordance with WL Decommissioning QA Plan [5-8]. Appendix B of this document provides a Table of Contents, which will be used as guidance to document the end states for the completion of the work.

5.7 References

The following references were current at the time of development of this DDP. Where a reference is to be complied with, ensure the latest revision is used.

[5-1] RC-2143-1, *Whiteshell Laboratories Detailed Decommissioning Plan - Volume 1 – Program Overview*, Revision 4, 2002 January.

[5-2] CSA N294-09 (reaffirmed 2014), *Decommissioning of facilities containing nuclear substances*, 2014.

[5-3] https://ceaa-acee.gc.ca/default.asp?lang=En&xml=7CE78B85-3486-4BE8-957A-DE3054DC531B.

[5-4] WLD-508740-041-000, *Dose Impact Assessment for WL Accelerated Decommissioning Alternative Schedule*, Revision 0, 2020 July 30.

[5-5] Regulatory Guide, *Keeping Radiation Exposures and Doses "As Low As Reasonably Achievable (ALARA)"*, G-129, Revision 1, 2004 October.

[5-6] WLDP-03702-041-000-0008, *Whiteshell Laboratories Decommissioning Project Comprehensive Study Report Volume 1: Main Report*, Revision 2, 2001 March.

[5-7] WLD-508740-REPT-001, *Contamination Clearance Levels Used for WL Decommissioning*.

[5-8] WLD-508300-QAP-001, *Quality Assurance Plan Whiteshell Laboratories Decommissioning*.

[5-9] NRTEDL-W5-8.00/2024, *Nuclear Research and Test Establishment Decommissioning Licence Whiteshell Laboratories*.

[5-10] WLDP-508760-HBK-002, *Licence Conditions Handbook for Whiteshell Laboratories*.

[5-11] RC-1290-R1, *The WR-1 Reactor Phase I Decommissioning Interim End-State Report-Facility Description*, 1996 March.

[5-12] RC-1291-R1, *The Monitoring and Surveillance Plan for the WR-1 Deferment Period*, 1996.

[5-13] WLDP-26400-DDP-001, *Whiteshell Laboratories Detailed Decommissioning Plan: Volume 6 – Whiteshell Reactor # 1: Building 100*, Revision 3, 2015 February.

[5-14] 900-510400-PDD-001, *Occupational Safety and Health*.

[5-15] 900-509200-PDD-001, *Environmental Protection*.

[5-16] WLDP-26000-ENA-001, *Environmental Impact Statement: In Situ Decommissioning of Whiteshell Reactor # 1*, Revision 1, 2017 September.

[5-17] G-320, *CNSC Regulatory Guide – Assessing the Long Term Safety of Radioactive Waste Management*, 2006.

[5-18] WLDP-26000-SAR-001, *In situ Decommissioning of Whiteshell Reactor 1 Project – Decommissioning Safety Assessment Report*, Revision 2, 2017 September.

[5-19] 900-508600-PDD-001, *Waste Management*.

[5-20] WLDP-03704-ENA-002, *Whiteshell Laboratories EA Follow-Up Program Work Package #8, River Sediments, Enhanced Monitoring-Identification of Target Sampling Sites*, Revision 3, 2006 September.

[5-21] WLDP-03704-REPT-007, *Sampling and Analysis of Winnipeg River Bottom Sediments at Three Target Areas: Current Baseline Conditions*, Revision 0, 2008 April.

[5-22] WL-508350-PLA-001, *Whiteshell Laboratories Closure Land-Use and End-State Plan*, 2020 April (draft).

6. WASTE MANAGEMENT PLAN

6.1 Waste Management Practices

In essence, the decommissioning program is a process of managing the WL site waste streams to secure an end state where all wastes are dispositioned to offsite storage/disposal facilities or to in situ management. The decommissioning of the WL site will be performed in accordance with the requirements of the CNL's WM Program to ensure that all waste generated is dispositioned in a safe, environmentally-responsible, cost-effective and regulatory compliant manner [6-1] [6-2] [6-3]. The CNL's WM Program provides the WL specific processes and requirements for managing all classes of wastes that has been generated due to the past operations (i.e., stored waste) and will be generated due to current operation and ongoing decommissioning activities (i.e., operational waste and decommissioning waste respectively) of the WL site.

The CNL's WM Program facilitates and oversees all aspects of the waste management process which includes:

- Characterization;
- Segregation;
- Volume reduction;
- Packaging;
- Tracking;
- Transportation;
- Interim storage in the WL WMA of radioactive wastes;
- Disposal of non-radioactive waste (including hazardous) that meets CNL's unconditional clearance criteria; and
- Documentation all of the waste management activities.

The waste materials i.e., stored/operational/decommissioning wastes will be managed as follows:

- All waste will be managed in a safe and environmentally responsible manner that meets or exceeds applicable regulations and standards, and minimizes current and future environmental impacts and liabilities.
- All documentation referenced in the site licence, and any other licences granted by the CNSC (or other regulatory authorities, such as environment ministries) for the management of waste materials or radioactive nuclear substances will be complied with.
- All waste materials will be classified in accordance with the CNL's WM Program [6-1] [6-2].
- Waste for which there is no identified and approved treatment or storage/disposal facility will not be knowingly produced. Should waste be inadvertently generated for which there is no identified and approved treatment or storage/disposal, this shall be treated as a non-conformance and a plan will be developed and implemented to treat and/or safely store the waste, as per the WM Program.
- Decommissioning activities will be planned, developed and operated or conducted in a manner that minimizes both the volume and the level of hazard of all waste materials that are generated, to the extent practical.
- The quantity and hazard of waste materials generated at WL will be minimized, following the principles, in decreasing priority, of Prevent, Reduce, Reuse and Recycle, to the extent practical.

- Waste materials will be segregated into groups with common characteristics (i.e., physical, radiological and hazardous) and the same disposition pathway (i.e., reuse, recycle, disposal in a licensed provincial landfill, management as hazardous waste or management as radioactive waste).
- The radiological clearance of waste materials including buildings, lands and equipment shall be performed in accordance with CNL requirements.

6.2 Classification of Waste

According to CNL's WM Program [6-1], the waste can be broadly classified into two main categories i.e., non-radioactive waste and radioactive waste. The non-radioactive waste could be clean waste or hazardous waste while the radioactive waste has three classes i.e., HLW, ILW, and LLW. The mixed waste class arises from the hazardous waste. When hazardous waste contains radioactive contaminations then it is referred as a mixed waste. Table 6-1 provides the definitions of different classes of wastes that are adopted from CNL's WM Program.

Table 6-1 Classification of Waste

Waste Types	Description
Non-Radioactive Waste	**Clean Waste** - Non-hazardous material that is declared to be non-radioactive by its history, location and use; or non-hazardous material that has been determined to meet regulatory requirements for unconditional clearance by means of suitable radiological monitoring. **Hazardous Waste** - Solid, liquid or gaseous waste material, other than a radioactive material, that may pose a potential hazard to human health or the environment when improperly treated, stored, transported or disposed of, or otherwise managed, and as specified in applicable regulations.
Radioactive Waste	Any material (liquid, gaseous or solid) that contains radioactive "nuclear substances", as defined in Section 2 of the Nuclear Safety and Control Act [6-4] and which the Waste Generator has declared to be waste. The waste classification system is generally organized according to the degree of containment and isolation required to ensure safety in the short and long term. It also considers the hazard potential of the different types of radioactive waste. The three main categories are: **High Level Waste (HLW)** - Used (i.e., irradiated) nuclear fuel that has been declared as radioactive waste and/or is waste that generates significant heat (typically more than 2 kW/m^3) via radioactive decay. **Intermediate Level Waste (ILW)** - Waste which exhibits levels of penetrating radiation sufficient to require shielding but needs little or no provision for heat dissipation during its handling and transportation. ILW generally contains long-lived radionuclides in concentrations that require isolation and containment for periods greater than several hundred years (i.e., more than 300 to 500 years).

Waste Types	Description
	Low Level Waste (LLW) - Waste with radionuclide content above established clearance levels and exemption quantities, but that generally has limited amounts of long-lived activity. LLW requires isolation and containment for periods of up to a few hundred years. LLW does not require significant shielding during handling and transportation.
Mixed Waste	Radioactive waste that would also be classified as “Hazardous Waste” on the basis of its non-radiological characteristics.

6.3 Inventory of Stored Wastes

Radioactive laboratories and waste storage occupy approximately 1% of the site land (approximately 40 ha). The active area totals approximately 4 ha (0.1% of the site).

Radioactive wastes are stored in waste management facilities and are categorised into three levels.

- Low level waste (LLW), which includes used lab-ware, rubber gloves, shoe covers, wipe paper, and mops. The total accumulation of LLW is approximately 34,000 m^3 and is located in trenches, bunkers and storage buildings.
- Intermediate level waste (ILW), also referred as Medium Level Waste, is typically composed of scrap metal materials from experiments, filters, and radioactive liquid waste that has been solidified. This waste is stored in the standpipes and bunkers in the WMA. The total accumulation of ILW in the WMA is approximately 1,200 m^3; and
- High level waste (HLW), comprises irradiated reactor fuel and metals from nuclear reactor core components. The Concrete Canister Storage Facility (CCSF) provides storage for 29 metric tonnes of irradiated reactor fuel. Some fuel wastes (approximately 3 metric tonnes) from operations prior to 1975 are stored in standpipes in the WMA.

Two other categories of stored waste are:

- 450 L of Amine/TFRE active liquid waste processed to a solid form as part of shutdown operations, and
- a small volume of PCBs (16.6 L) is stored in B413 located at the main laboratory site. As storage of PCB waste is only permitted for one year, therefore depending on the number of buildings/areas decommissioned and demolished, the volume of PCBs fluctuates. The B570 also contains various classes of hazardous waste, excluding PCBs.

6.4 Inventory of Decommissioning Wastes

While performing decommissioning activities at WL site, all waste will be handled and processed in accordance with CNL’s established policies and procedures [6-1] [6-2] [6-3]. At the WL site, waste generated from the decommissioning activities will be identified and accounted for under the following five categories:

- Intermediate Level Waste (ILW)
- Low Level Waste (LLW)
- Mixed Waste
- Hazardous Waste
- Clean Waste

Table 6-2 provides a high level summary of the waste streams along with their quantities for the WL Decommissioning Project. The WL Decommissioning Project will produce a total of approximately 134,000 m^3 of the decommissioning waste. The decommissioning waste will comprise of approximately 1.0%, 24.3%, 0.4%, 8.3%, and 66.0% of ILW, LLW, mixed waste, hazardous waste, and clean waste respectively.

Nuclear facilities and radioisotope facilities will produce the largest component of radioactively contaminated waste estimated at approximately 1,068 m^3 of ILW and approximately 24,037 m^3 of LLW. In addition to this approximately 588 m^3 of mixed waste, approximately 5,846 m^3 of hazardous waste, and approximately 51,907 m^3 of clean waste will also be generated as a result of decommissioning nuclear and radioisotopes facilities.

The decommissioning of Whiteshell Licensed Site Supporting and General Infrastructure will produce approximately 2 m^3 of ILW, approximately 8,475 m^3 of LLW, approximately 5,238 m^3 hazardous waste, and approximately 36,817 m^3 of clean waste.

Contaminated soil waste will be produced from remediation of individual building sites and from remediation of affected lands (spill incident areas, active drain lines etc.). This category cannot be estimated until additional assessments are carried out during Phase 1 to delineate the extent of contamination.

The hazardous waste and mixed waste due to decommissioning is estimated to be approximately 11,084 m^3 (8 % of the total waste) and approximately 588 m^3 (0.4 % of the total waste) respectively. It is expected that the nuclear facilities will produce approximately 2,089 m^3, radioisotope facilities will produce approximately 3,757 m^3 and Whiteshell Licensed Site Supporting and General Site Infrastructure will produce approximately 5,238 m^3 of hazardous waste. The hazardous waste will include PCB-filled electrical components, ACMs, lead, etc. (see Section 4.2.2). The mixed waste will be produced by only nuclear facilities, which include WR-1 and B100 (approximately 285 m^3), ALWTC (approximately 20 m^3), and WMA (approximately 283 m^3).

Table 6-2 Summary of WL Site Decommissioning Waste Estimate

Facilities	Nuclear Facilities						Radioisotope Facilities			Whiteshell Licensed Site Supporting and General Site Infrastructure	Total Waste
Waste Stream (m^3)	Whiteshell Reactor-1 and B100	Shielded Facilities	Concrete Canister Storage Facility	ALWTC B200, B423	WMA	Total	R&D Facilities Complex B300	Health and Safety Facilities	Total	North Side Buildings South Side Buildings Site Services Affected Lands and Contaminated Structures	
Intermediate Level Waste	0	273	0	45	748	**1066**	0	2	**2**	2	**1070**
Low Level Waste	2490	6488	48	869	13521	**23416**	497	124	**621**	8475	**32512**
Mixed Waste	285	0	0	20	283	**588**	0	0	**0**	0	**588**
Hazardous Waste	2069	0	0	0	20	**2089**	2744	1013	**3757**	5238	**11084**
Clean Waste	13310	2385	900	532	3750	**20877**	26490	4540	**31030**	36817	**88724**
Total Waste	**18154**	**9146**	**948**	**1466**	**18322**	**48036**	**29731**	**5679**	**35410**	**50532**	**133978**

6.5 Operational Waste

In addition to stored waste and decommissioning waste, the routine operational (including decommissioning waste collection, processing, packaging and disposition) and maintenance activities also produced some waste which is called operational waste. The operational waste comprised of three main streams i.e., LLW, ILW, and Hazardous waste. It is estimated that operational and maintenance activities will generate about 129 m^3 of ILW, 244 m^3 of LLW, and 25 m^3 of Hazardous Waste.

6.6 Waste Streams

At WL site, all waste materials i.e., stored wastes/decommissioning wastes /operational wastes will be categorised into following classes of waste:

- Clean Waste
- Clearable Waste
- Hazardous Waste
  - Clearable Hazardous Waste
- Radioactive Solid Waste
  - LLW
  - ILW
  - HLW
- Radioactive Liquid Waste
  - LLLW
  - ILLW
- Mixed Waste

6.7 Radiological Characterization and Clearance Surveys

6.7.1 General

Radiological characterization and clearance surveys are required to assure the proper disposition of waste materials generated as a result of decommissioning of the buildings and lands, and prior to the final remediation and disposition of buildings and all lands that have the potential to be impacted by site nuclear operations [6-5].

The objectives of characterization and clearance surveys are to:

a. provide assurance that radioactive materials are identified and appropriately managed as radioactive waste, and
b. demonstrate that material declared as clean or non-radioactive:
    i. do not have surface contamination levels exceeding the maximum allowable values provided in CNL's RP Program Requirements [6-6],
    ii. do not have volumetric contamination levels exceeding the CNSC approved clearance levels [6-7], and
    iii. confirm that any residual levels of contamination are ALARA, economic and social factors taken into account.

Radiological characterization and clearance surveys will be designed and conducted in accordance with the WL Radiological Clearance Surveys of Materials procedure [6-8] and WL Radiological Disposition and Clearance of Buildings, Lands and Materials procedure [6-5] and by means consistent with the recommendations contained in US-NUREG-1575 (MARSSIM) [6-9] and US-NUREG-1575, Supp 1 (MARSAME) [6-10].

6.7.2 Clearance Criteria

Canadian Nuclear Laboratories policy on the release criteria of materials from the WL site is described in CNL's Radiation Protection Program Requirements [6-6] and program standard on contamination levels [6-11]. Reference [6-6] defines the surface contamination release limits for the maximum values for unrestricted use and reference [6-11] defines administrative release levels. These are shown in Table A-3.

The RP Program release limits represent the maximum values that can be allowed to be released for unrestricted use and the administrative release levels represent the level of residual contamination considered ALARA and acceptable to release without further justification. Every reasonable effort should be taken to meet the target clearance levels when it is technically practical, economically feasible and is considered safe and sound to do so. Surface contamination that exceeds the administrative release level but are less than the release limits will be evaluated on a case by case basis. Material or surfaces that cannot be decontaminated to below the administrative release levels and are below the release limits may still be released if decontamination is not feasible or the cost of and effort of decontamination will not result in a significant reduction in contamination levels. A Group 1 qualified Health Physicist will verify the evaluation of contamination levels, and approval will be obtained from the WL RP Program Manager. Materials that cannot be decontaminated to the levels below the release limits will not be released for unrestricted use.

Canadian Nuclear Safety Commission's unconditional clearance levels for bulk material [6-7] and the WL screening soil cleanup criteria [6-12] will be to the clearance of ground material in crawlspaces and exterior grounds of buildings.

6.8 Waste Processing Facilities

The anticipated interim processing facilities required are described briefly below.

6.8.1 Active Liquid Waste Treatment

The B100 and B300 LLLW treatment systems will continue to operate until no longer required. An ILLW treatment system is being designed and constructed in the WMA for use during the decommissioning of the WMA facilities.

6.8.2 WMA Retrieval, Reprocessing and Repackaging Facility

A retrieval, reprocessing and repackaging facility is being designed and constructed to remediate the standpipes and ILW bunkers.

6.9 Final Waste Disposition

6.9.1 Waste Disposition Paths

There are five main disposition paths for the site decommissioning waste. These are described briefly in the following subsections.

6.9.1.1 In Situ Disposal

The current plan is to complete decommissioning of the WL site by 2027 with the following areas expected to be managed in situ (subject to regulatory approval).

- WR-1 Reactor;
- 21 or 22 of the 25 LLW Trenches;
- Inactive (non-radioactive) Landfill; and
- Contaminated Outfall River Sediments.

Following ISD, institutional controls and surveillance activities will be required to monitor environmental performance at the WL site. The WL WR-1 EIS provides further details for proposed institutional controls for WR-1 ISD [6-13].

6.9.1.2 Engineered Off-Site Facilities

The engineered off-site facilities that are available in Canada will be engaged for disposal or safe storage of hazardous chemical wastes.

6.9.1.3 Off-Site Landfill

These are engineered sanitary landfills expected to be available within the Regional Study Area. It would likely be an off-site facility capable of handling building rubble.

6.9.1.4 River

Liquids are batch processed at the LLLW treatment systems to remove contamination and only released to the Winnipeg River if they meet release criteria. All releases to the environment will be controlled within administrative levels set well below the site DRLs.

6.9.1.5 CRL and Other Licensed Facilities

Currently, the most viable option for WL radioactive waste disposition is the CRL site, in alignment with CNL's Integrated Waste Strategy (IWS) [6-3] as shown in Table 6-3. Repetitive handling is minimized through sufficient characterization and appropriate packaging/waste form to facilitate transfer from CNL's Waste Management Areas to an eventual disposal facility. This ensures that managing radioactive waste is in line with nuclear safety principles, such as ALARA. These considerations are incorporated as part of the specific Waste Management Plans, which in turn meet the Waste Management suite of Management System documents. HLW, ILW, and LLW will be transferred to CRL for storage. The mixed waste will be transported either to CRL for treatment and long-term management or to an off-site mixed waste processing for treatment and conditioning, dependant on the hazardous constituent present in the waste.

Table 6-3 Key IWS Activities Relevant to WL Decommissioning

Major IWS activities from CNL's IWS relevant to WL	Method of addressing key IWS activities
Continuing to update and refine waste inventory and forecasting.	The waste inventory data and waste forecasting for WL decommissioning work packages will be prepared. The Phase 2 work will address the planning for the management of the collected waste inventory.
Continuing to develop characterization program and technical improvements.	To improve the inventory data, all waste material generated by WL decommissioning activities will be adequately characterized.
Continuing to Identify and improve transport capabilities across CNL.	All off-site transport of radioactive waste material generated by WL decommissioning activities will follow the CNL's Transportation of Dangerous Goods program requirements, which also provide compliance with the WL decommissioning licence conditions.
Ensuring sufficient LLW storage capability is maintained at CRL prior to proposed NSDF availability.	The storage capacity continues to be reviewed on an ongoing basis until the availability of NSDF. These activities are documented in the CRL ACMR. These mitigating actions and continual review ensure that sufficient storage space is available for CNL's decommissioning strategy and schedule, while also allowing for continuing operations at the CRL site.
Expanding HLW dry storage capability at CRL in a phased manner.	HLW dry storage capacity has been expanded to accept irradiated fuel from WL.

6.9.2 Waste Disposition Plan

The waste materials will be dispositioned in the following manner:

- Non-hazardous, non-radioactive waste will be reused, recycled or disposed of in a licensed provincial landfill.
- Hazardous non-radioactive wastes will be sent to a suitable off-site waste management facility for processing and disposal.
- Mixed wastes will be characterized and packaged into suitable containers and either transported to CRL for treatment and long-term management or to an off-site mixed waste processing facility for treatment and conditioning.
- Radioactive liquid wastes will be processed on-site through the WL LLLW processing system, or treated in the ILLW Treatment System to be installed in the WMA, solidified and stabilized for future management. If any liquid wastes cannot be treated on site, they will be shipped to an off-site licensed facility (e.g., CRL).

- Solid LLW will be characterized, processed and packaged into standardized containers and transported to an approved off-site facility for storage/disposal.
- Solid ILW will be characterized, processed and packaging into approved, licensed containers (which will, in some cases, include shielding) and transported to CRL for long-term storage and/or disposal.
- Solid HLW including spent fuel bundles will be transported to CRL for the interim storage.
- Interim on-site storage facilities (e.g., SMAGS) may be utilized to stage radioactive waste prior to shipment from WL to CRL.
- Options for off-site decontamination, volume reduction, recycling and/or disposal of contaminated materials (e.g., metals) will be evaluated on a case-by-case basis and may be utilized if the service is cost effective and practical.
- Inactive dismantling/demolition debris (e.g., concrete canisters) will be reused/recycled and/or dispositioned into inactive landfill facilities in accordance with CNL's procedures and applicable federal and provincial legislation.

6.10 References

The following references were current at the time of development of this DDP. Where a reference is to be complied with, ensure the latest revision is used.

[6-1] 900-508600-PDD-001, *Waste Management*.

[6-2] 900-508600-PRD-001, *Waste Management*.

[6-3] CW-508600-PLA-002, *Canadian Nuclear Laboratories Integrated Waste Strategy*.

[6-4] S.C. 1997, c.9, *Nuclear Safety Control Act*.

[6-5] WLD-508740-PRO-001, *Radiological Disposition and Clearance of Buildings, Lands and Materials*.

[6-6] 900-508740-PRD-001, *CNL Radiation Protection Program Requirements*.

[6-7] SOR/2000-207, Canadian Nuclear Safety Commission, *Nuclear Substance and Radiation Devices Regulation*.

[6-8] 191-508740-610-000-0002, *Radiological Clearance Surveys of Materials and Equipment from Buildings*.

[6-9] US NUREG-1575, *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)*, Revision 1.

[6-10] US NUREG-1575, *Multi-Agency Radiation Survey and Assessment of Materials and Equipment Manual (MARSAME)*, Supplement 1.

[6-11] 900-508740-STD-012, *Contamination Levels*.

[6-12] WL-509420-REPT-001, *WL Screening Soil Cleanup Criteria*.

[6-13] WLDP-2600-ENA-001, *Environmental Impact Statement: In Situ Decommissioning of Whiteshell Reactor # 1*, Revision 1, 2017 September.

7. REGULATORY AND ENVIRONMENTAL ASSESSMENT CONSIDERATIONS

Decommissioning of the WL nuclear facilities will be conducted in accordance with the requirements of the licence [7-1], applicable laws and regulations that are set out in a number of federal statutes and agreements, including the following:

- Nuclear Safety and Control Act
- General Nuclear Safety and Control Regulations
- Radiation Protection Regulations
- Class I Nuclear Facilities Regulations
- Canadian Environmental Assessment Act
- Canadian Environment Protection Act
- Nuclear Liability Act
- Transportation of Dangerous Goods Act
- Radiation Emitting Devices Act
- Access to Information Act
- Canada/IAEA Safeguards Agreements

The licensing basis contained in the licence [7-1] and in the accompanying LCH [7-2] sets the boundary conditions for acceptable performance at WL or for a regulated activity, and thus establishes the basis for the CNSC's compliance program with respect to WL or that regulated activity. Canadian Nuclear Laboratories will operate WL in accordance with the licensing basis. If any changes to the documents included or referenced in the licence [7-1] are required, CNL will assess them for impact on the licensing basis as related to the provision for the protection of the environment, the health and safety of persons and the maintenance of national security and measures required to implement international obligations to which Canada has agreed.

The work described in individual DDPs will comply with all applicable provincial and federal regulations, and align with current standards and best practices. The federal and provincial agencies involved in the WL decommissioning project include:

- AECL - oversight
- CNSC
- Natural Resources Canada
- Environment and Climate Change Canada
- Health Canada
- Department of Fisheries and Oceans
- Canadian Environmental Assessment Agency
- Transportation Canada
- Labour Program
- Manitoba Sustainable Development
- Manitoba Department of Transportation
- Manitoba Labour Board
- Indigenous and Northern Affairs Canada
- Canada Revenue Agency

Decommissioning of the WL nuclear facilities will also be conducted in accordance with the CSA Standard N288.6 [7-3], and the CNSC Regulatory Guide, G-219 [7-4], and will meet CNL requirements as specified in Decommissioning Program Description and Program Requirements Documents [7-5] [7-6], and the WL Decommissioning QAP [7-7]. Decommissioning activities will be undertaken only under approved decommissioning plans. With respect to the approved strategy for the WL site decommissioning project including WR-1 (i.e., complete removal), there is no further need for environmental assessments since the project is not likely to cause significant adverse environmental effects [7-8].

The WL Decommissioning Project addresses the entire site including all of the site facilities, buildings, infrastructure and land, and the current licence for WL [7-1] authorizes the project to carry out the decommissioning activities.

The current WL licence [7-1] would require an amendment to include the WR-1 ISD approach. This overview document is designed to serve as the licensing basis document to support decommissioning of the WL site. The Detailed Decommissioning Plans for individual facilities at WL will be prepared and submitted to the CNSC prior to undertaking decommissioning work.

To meet the requirements for an Environmental Assessment, a Comprehensive Study Report for the entire decommissioning project was prepared: Volume 1 – Main Report [7-9]; Volume 2 - Appendices [7-10]; and Volume 3 - Addendum [7-11], and was approved. This previously approved strategy was to completely remove all buildings and structures at WL, including WR-1. However, CNL recently proposed an ISD strategy for WR-1 and an EA is currently in progress to support and address this change [7-12].

7.1 References

The following references were current at the time of development of this DDP. Where a reference is to be complied with, ensure the latest revision is used.

[7-1] NRTEDL-W5-8.00/2024, *Nuclear Research and Test Establishment Decommissioning Licence for Whiteshell Laboratories*.

[7-2] WLD-508760-HBK-002, *Licence Conditions Handbook for Whiteshell Laboratories*.

[7-3] CSA Standard, N288.6-12, *Environmental Risk Assessments at Class I Nuclear Facilities and Uranium Mines*.

[7-4] Regulatory Guide, G-219, *Decommissioning Planning for Licensed Activities*.

[7-5] 900-508300-PDD-001, *Decommissioning and Demolition*.

[7-6] 900-508300-PRD-001, *Decommissioning and Demolition*.

[7-7] WLD-508300-QAP-001, *Whiteshell Decommissioning Quality Assurance Plan*, Revision 2.

[7-8] https://ceaa-acee.gc.ca/default.asp?lang=En&xml=7CE78B85-3486-4BE8-957A-DE3054DC531B

[7-9] WLDP-03702-041-0888-0008, *Whiteshell Laboratories Decommissioning Project Comprehensive Study Report, Volume 1: Main Report*, Revision 2, 2001 March.

[7-10] WLDP-03702-041-000-0009, *Whiteshell Laboratories Decommissioning Project Comprehensive Study Report, Volume 2: Appendices*, Revision 2, 2001 March.

[7-11] WLDP-03702-041-000-010, *Whiteshell Laboratories Decommissioning Project Comprehensive Study Report, Volume 3: Addendum*, Revision 0, 2001 November.

[7-12] https://ceaa-acee.gc.ca/050/evaluations/proj/80124?culture=en-CA

8. ENVIRONMENTAL MONITORING

Canadian Nuclear Laboratories' Environmental Policy, issued under the authority of the CNL Board of Directors, states CNL's commitment to protecting the environment and establishes the overall principles and goals for environmental responsibility and performance expected of all CNL employees. Canadian Nuclear Laboratories maintains a comprehensive Environmental Protection Program [8-1] [8-2], which is applicable to CNL operated sites including the WL site, and ensures compliance with legal and other environmental obligations. The program is designed to ensure that radiation doses, as a result of releases of radioactive material in site effluents, remain well below the annual dose limits for members of the public specified in CNSC Regulations [8-3], and ALARA, economic and social factors being taken into account. Canadian Nuclear Laboratories sets the standards and controls for monitoring radioactive and non-radioactive emissions at CNL operated sites.

Environmental performance at WL is assessed through an integrated Environmental Monitoring Program [8-4], which is comprised of three distinct programs: the Environmental Monitoring Program, the Effluent Verification Monitoring Program, and the Groundwater Monitoring Program. Together, these three Programs comprise contaminant pathway monitoring at WL, enabling the tracking of radiological and non-radiological contaminants throughout the different compartments of the geosphere, atmosphere, and biosphere. Environmental monitoring includes measurement of ambient gamma radiation, as well as sampling and analysis of drinking water, air, fish, wild game, garden produce, and river sediments. An integrated approach to environmental monitoring means that the evaluation of impacts on the environment from WL facilities and operations is carried out in a logical, comprehensive manner and is used to demonstrate compliance and protection of the environment and health and safety of the public.

8.1 Environmental Monitoring Program

Environmental Monitoring is performed to assist in determining the effect of emissions in the environment surrounding the site or facility, and consists of measuring or estimating nuclear and hazardous substances present in the environment.

The primary objectives of the WL Environmental Monitoring Program [8-4] are:

- To assess the level of risk on human health and safety, and the potential biological effects in the environment of the contaminants and physical stressors of concern arising from the facility.
- To demonstrate compliance with limits on the concentration and/or intensity of contaminants and physical stressors in the environment or their effect on the environment.
- To check, independently of effluent monitoring, on the effectiveness of containment and effluent control, and provide public assurance of the effectiveness of containment and effluent control.
- Further to the objective described above, which provides an indication on effectiveness of effluent control, where waste storage facilities and contaminated lands exist, the objective is to provide an indication of unusual or unforeseen conditions that might require corrective action or additional monitoring such as groundwater monitoring, and
- To verify the predictions made by an Environmental Risk Assessment (ERA) (or equivalent), DRL model, and/or EA, refine the models used in the ERA (or equivalent), DRL model and/or EA, or reduce the uncertainty in the predictions made by the ERA (or equivalent), DRL model and/or EA.

The following secondary objectives are also considered in the design of the Environmental Monitoring Program [8-4]:

- To provide data required to support site restoration programs, site operations or to plan for future stages of the facility lifecycle (e.g., decommissioning).
- To provide resources and data that can be of value during the response to an accident or upset, and in the recovery from such an event.
- To demonstrate due diligence.
- To meet a stakeholder commitment, and
- For other business purposes (e.g., monitoring emissions to support international treaties).

8.2 Effluent Verification Monitoring Program

The Effluent Verification Monitoring Program is intended primarily to verify that emissions are below regulatory limits and consists of measuring or estimating nuclear and hazardous substances being released into the environment by a site or facility.

The primary objectives of the Effluent Verification Monitoring Program [8-4] are:

- To demonstrate compliance with regulatory emission limits and any other regulatory requirements (e.g., Action Levels) concerning the emission of nuclear/hazardous substances from the source.
- To demonstrate adherence to internal levels set on emission amounts (e.g., Administrative Levels or Internal Investigation Levels), for purposes of effluent control.
- To confirm the adequacy of controls on emissions from the source.
- To provide an indication of unusual or unforeseen conditions that might require corrective action or additional monitoring.
- To provide data to assess the level of risk on human health and safety, and the potential biological effects in the environment of the nuclear/hazardous substances of concern released from the facility, and
- To confirm predictions in environmental assessments.

The following secondary objectives are also considered in the design of the Effluent Verification Monitoring Program [8-4]:

- To provide data for trend analysis.
- To provide assurance to employees and the public on the effectiveness of effluent control.
- To provide data which, when combined with the results of environmental monitoring and modelling, can be used to test or refine the models of the environment used in the ERA (or equivalent) or dose/exposure assessments.
- To provide baseline data and capability for monitoring and assessment in emergency conditions, and
- Other business purposes (e.g., demonstrating due diligence, meeting a stakeholder commitment, etc.).

Monitoring locations for airborne and liquid effluent streams are representative of the final discharge to the off-site environment, and may include the combined discharge from a number of facilities at WL. Additional monitoring points are maintained at upstream locations as an aid in identifying the specific sources of emissions. Sampling system design ensures that samples are representative of the total content of the stream at each location. The effluent monitoring locations/effluent streams at WL are shown in Figure 8-1.

Effluent streams at WL are monitored for all groups of radionuclides that are likely to be present. Air effluents from B100, B200 and B300 are sampled continuously throughout the year. The primary source of liquid radioactive effluents is the process water outflow (Outfall), which discharges continuously to the Winnipeg River. The discharge from the Outfall is composed of storm water runoff from paved roadways or around buildings, cooling water used in process facilities, and holding tank discharges including those from the active liquid waste treatment system tanks based in B100 and B300. The current airborne and liquid effluent monitoring locations are shown in [8-5].

For each of the monitored streams, routine reports provide information on:

- The period monitored.
- Total weekly effluent volume (m^3) discharged.
- Total release (loading) Bq of each monitored parameter for the week.
- A summary of any failures or unavailability of measurements or equipment.

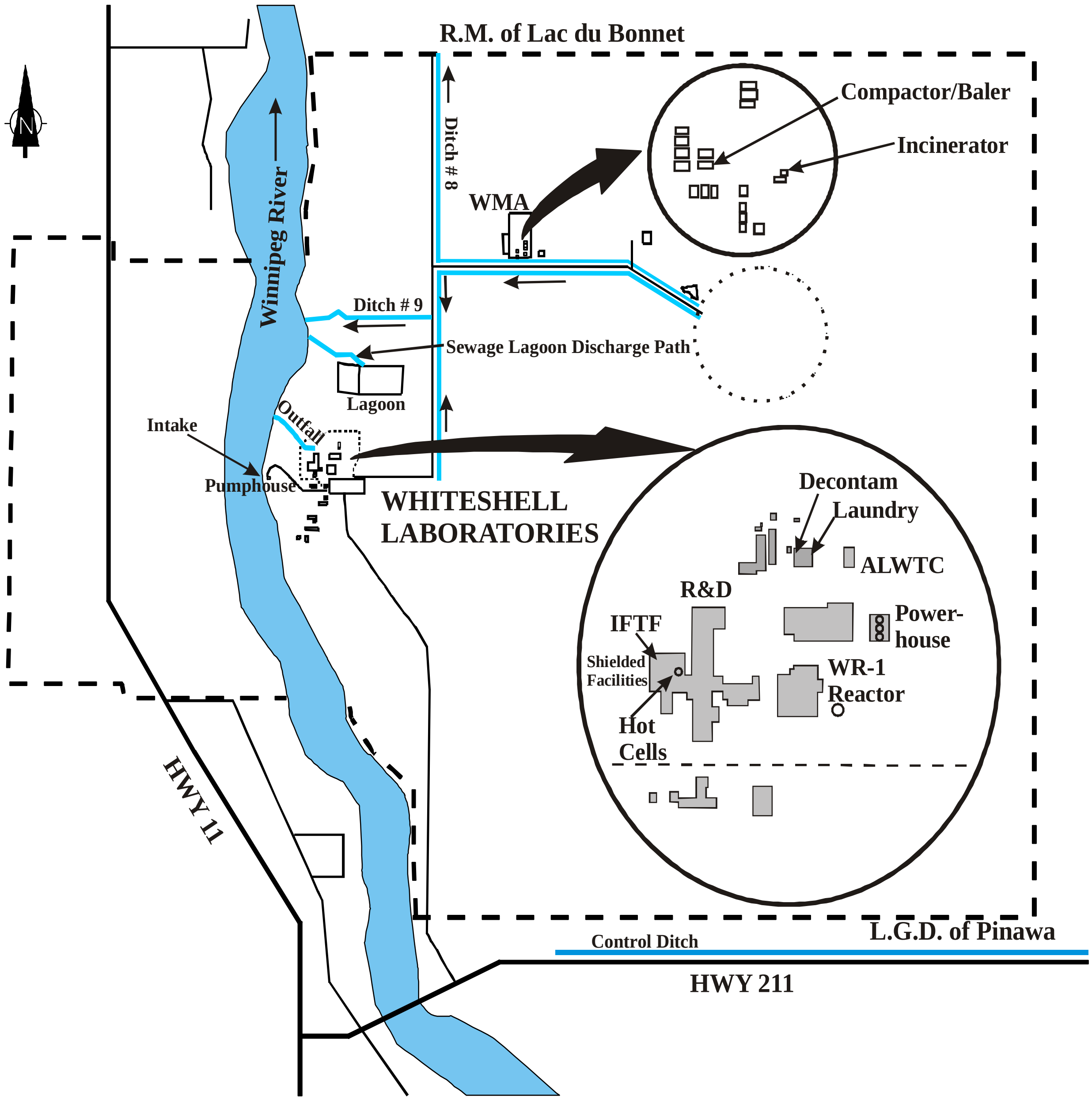

Figure 8-1 Effluent Monitoring Locations

8.3 Groundwater Monitoring Program

The groundwater monitoring plan includes a variety of activities focussed on producing a defensible program based on the hydrogeologic characteristics and an optimization strategy aimed at an efficient use of resources. The key aspects of the plan include:

- Evaluating regional influences of precipitation, Seven Sister's Dam, and Winnipeg River levels.
- Evaluating local influences, such as water withdrawals from any wells or structures within or outside the WMA.
- Documenting waste storage characteristics.

- Evaluating discharge/recharge gradients in the WMA.
- Optimizing radiological and non-radiological groundwater analysis locations.
- Program for the ongoing maintenance of the well network assets.
- Optimizing the water level program schedule and methodology, and
- Completing an annual monitoring program review.

The objective of the Groundwater Monitoring Program [8-6] is to:

- Develop a scientifically defensible monitoring plan that is linked to the hydrogeologic characteristics and regulatory requirements for the site and includes an optimization strategy for data collection, interpretation and reporting.

8.4 Monitoring and Surveillance

Environmental monitoring during the decommissioning period will be conducted in accordance with the Environmental Protection Program [8-1] [8-2].

A post-decommissioning monitoring program will be established for those areas where a potential need is identified, such as in remediated sites, or areas such as the WMA where low level radioactive materials may remain in situ. The degree of M&S established for each area will be commensurate with radiological hazards or other hazards.

While baseline information is available with respect to most of the decommissioning activities to be undertaken, in some circumstances, baseline information may need to be gathered in order to define and carry out follow-up activities. The Comprehensive Study Report [8-7] [8-8] [8-9] identifies follow-up monitoring programs requirements for the WMA, the Landfill and the Sewage Lagoons.

8.5 Factors Affecting Scope of Monitoring

Monitoring requirements will change in terms of monitoring frequency, duration, monitoring pathways, and type over the course of decommissioning and following the completion of decommissioning. Depending on the decommissioning project, monitoring requirements may also change from one decommissioning project to another in terms of contaminants of interest and decommissioning methods used. These changes will reflect not only changes in regulatory requirements and technological advancements, but also the characteristics of the effects being monitored. Air quality monitoring, for example, will have only relatively short term monitoring requirements because air quality generally is only affected during construction/demolition related activities. In addition, the type of air quality monitoring will depend on the specific activity being undertaken; remediating contaminated interior spaces requires a different type and scale of air quality monitoring than that required during demolition. The frequency and type of monitoring will continue to be evaluated over time. Monitoring will be adjusted to reflect findings from the monitoring activities. Cessation of a monitoring activity will occur once it can be shown that an effect has stabilized or has been reduced to a level where it is no longer considered significant by regulatory or other standards such as community concerns.

In the event that an unanticipated effect develops from the decommissioning activities, special surveys would be developed to assess and monitor the effect. Appropriate mitigation measures would evolve from the monitoring and surveying activities.

8.6 Environmental Effects

The EA requirements and the potential environmental effects of the proposed decommissioning program at WL are documented in WL Decommissioning Project Comprehensive Study Report [8-7] [8-8] [8-9]. In addition, the potential environmental effects of the proposed ISD of WR-1 is described in the Environmental Impact Statement [8-10].

All decommissioning work will be conducted in accordance with CNL's approved policies, programs and procedures to ensure the protection of the environment. Adherence to CNL's Environmental Protection Program [8-1] [8-2] will mitigate the above effects. Monitoring for dust and odour may also be carried out during the active decommissioning and remediation stages. The Environmental Assessment Follow-Up Program [8-11] includes provision for air and dust monitoring during decommissioning. Other types of monitoring (e.g., soil, surface water/vegetation and groundwater monitoring) will be routinely performed per requirements of the Comprehensive Study Report [8-7] [8-8] [8-9] and the Environmental Assessment Follow-Up Program [8-11].

The conclusion from the Comprehensive Study Report [8-7] [8-8] [8-9] is that this decommissioning project is not likely to cause significant adverse environmental effects, if all mitigation measures in the Comprehensive Study Report are implemented.

All environmental aspects of this project will be considered in the Environmental Evaluations pertaining to the decommissioning activities. Environmental Evaluations will indicate the required mitigation measures to deal with each environmental aspect or hazard.

It is an objective of CNL to have all work, including recycling work, performed in an environmentally responsible manner as per the Environmental Protection Program [8-1]. All decommissioning activities will be planned and implemented in accordance with federal and provincial regulations and guidelines.

8.7 References

The following references were current at the time of development of this DDP. Where a reference is to be complied with, ensure the latest revision is used.

[8-1] 900-509200-PDD-001, *Environmental Protection*.

[8-2] 900-509200-PRD-001, *Environmental Protection*.

[8-3] SOR/2000-202, *General Nuclear Safety and Control Regulations*.

[8-4] WL-509200-OV-001, *Whiteshell Laboratories' Integrated Monitoring Program Framework*.

[8-5] WL-00583-ACMR-2018, *Whiteshell Laboratories Annual Compliance Monitoring Report for 2018*, Revision 0, 2019 April.

[8-6] WLDP-03705-041-000-0022, *Monitoring Plan for the Ongoing Assessment of the WMA, Lagoon and Landfill Physical and Chemical Hydrogeological Conditions*.

[8-7] WLDP-03702-041-000-0008, *Whiteshell Laboratories Decommissioning Project Comprehensive Study Report, Volume 1: Main Report*.

[8-8] WLDP-03702-041-000-0009, *Whiteshell Laboratories Decommissioning Project Comprehensive Study Report, Volume 2: Appendices*.

[8-9] WLDP-03702-041-000-0010, *Whiteshell Laboratories Decommissioning Project Comprehensive Study Report, Volume 3: Addendum*.

[8-10] WLDP-26000-ENA-001, *Environmental Impact Statement – In Situ Decommissioning of WR-1 at the Whiteshell Laboratories Site, Pinawa, Manitoba*.

[8-11] 03704-001, *Environmental Assessment Follow-Up Program for Whiteshell Laboratories*, Revision 1, 2002 June.

9. PROGRAM MANAGEMENT

9.1 Organization

Canadian Nuclear Laboratories' organizational structure is established by the Canadian National Energy Alliance (CNEA) Board of Directors on recommendation of CNL's President and Chief Executive Officer (CEO). Responsibility for the management and operations of each element of its structure is assigned to Executives and senior management reporting to the President and CEO. CNL's current organizational structure is provided in CNL's Annual Compliance Monitoring Report (e.g., Reference [9-1]).

Projects within the WL Decommissioning Project will be executed under the responsibility of the WL Closure Project within CNL's Environmental Remediation Management Organization.

The overall organizational structure is described in the CNL Management System Manual [9-2] and the Whiteshell Laboratories Organization [9-3]. A depiction of the current WL project management structure is presented in [9-3].

The WL Site Head & General Manager is the Site Licence Holder for the WL site. The responsibilities of the Site Licence Holder are described in the CNL Management System Manual [9-2].

The current list of individuals with responsibility for nuclear and non-nuclear facilities and buildings at WL is maintained in Responsibility for Facilities and the Safety of Operations at the Whiteshell Laboratories [9-4].

9.2 Schedule

A preliminary project schedule for the WL decommissioning activities is presented in Figure 9-1. More detailed schedule of decommissioning activities will be provided in the subsequent volumes of DDPs.

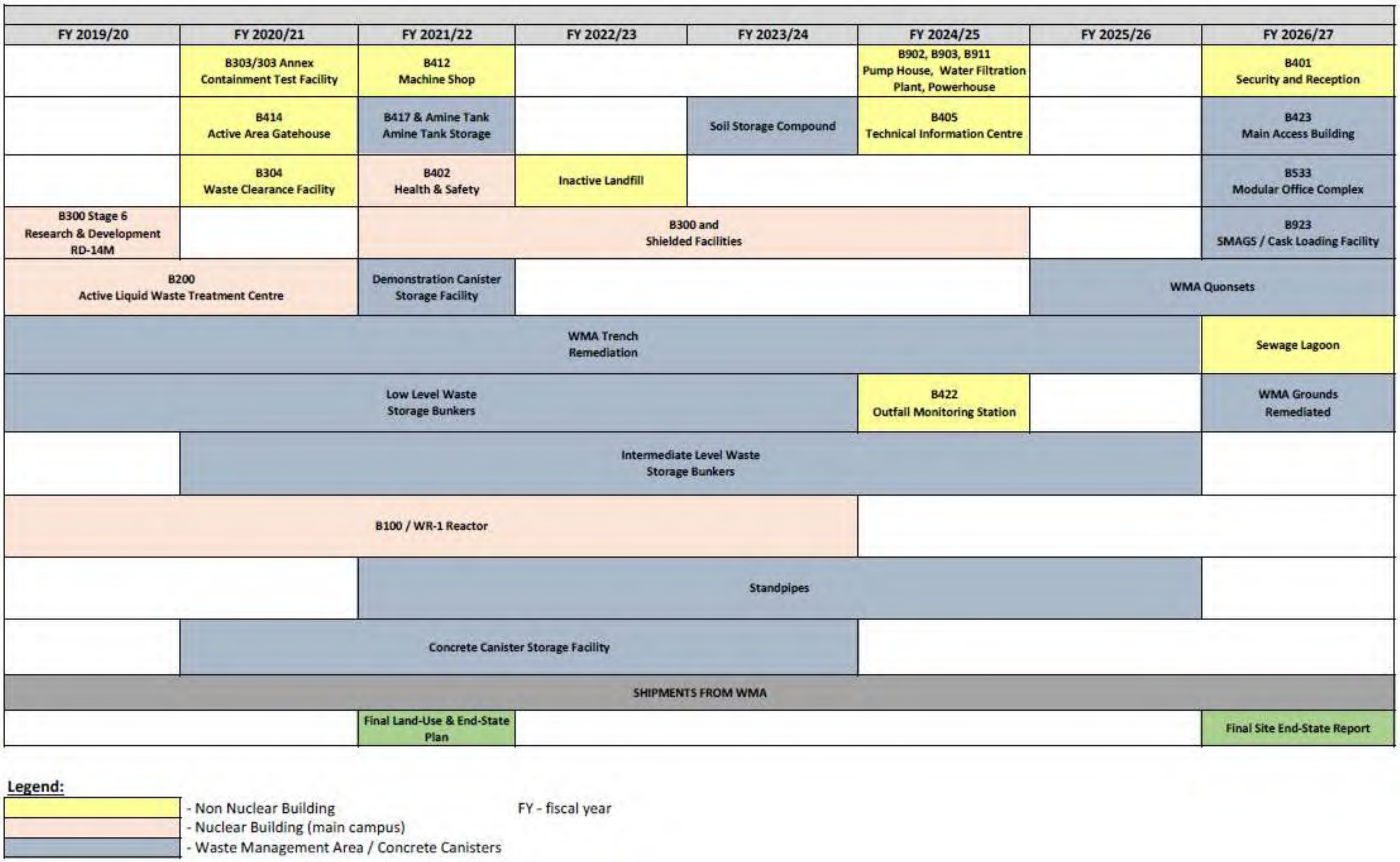

Figure 9-1 Preliminary Whiteshell Project Schedule

9.3 Funding, Cost Estimate and Financial Guarantee

The Whiteshell Laboratories Closure Project is funded by the Government of Canada through AECL. A private consortium, Canadian National Energy Alliance, was awarded a contract in 2015 to complete the project. A baseline cost estimate was prepared for the project and documented in the Performance Baseline Plan.

Cost estimates for this and other decommissioning work at WL is provided in Reference [9-5].

Pursuant to Licence Condition 1.5 of the Whiteshell Nuclear Research and Test Establishment Decommissioning Licence, NRTEDL-W5-8.00/2024 [9-6], CNSC was previously sent a letter from the Honorable G. Rickford [9-7], advising that as an agent of Her Majesty in Right of Canada, AECL's liabilities associated with the decommissioning of WL are ultimately liabilities of Her Majesty in Right of Canada (note: AECL retains ownership of the lands, assets and liabilities associated with CNL's licences).

9.4 References

The following references were current at the time of development of this DDP. Where a reference is to be complied with, ensure the latest revision is used.

[9-1] 145-00583-ACMR-2019, *Annual Compliance Monitoring Report for Canadian Nuclear Laboratories for 2019*.

[9-2] 900-514100-MAN-001, *CNL Management System Manual*.

[9-3] WL-514100-ORG-002, *Whiteshell Laboratories Organization*.

[9-4] WL-508200-PRO-212, *Responsibility for Facilities and the Safety of Operations at the Whiteshell Laboratories*.

[9-5] WL-508760-PLA-002, *Whiteshell Laboratories Cost Estimate Submission to Support Licence Conditions Related to Financial Guarantee*.

[9-6] NRTEDL-W5-8.00/2024, *Whiteshell Nuclear Research and Test Establishment Decommissioning Licence*.

[9-7] Honorable G. Rickford, P.C., M.P., Minister of Natural Resources Canada, Letter to M. Binder, President and Chief Executive Officer, Canadian Nuclear Safety Commission, 2015 July 31.

10. PUBLIC INFORMATION

10.1 Public and Indigenous Communication

Canadian Nuclear Laboratories is committed to organizational transparency, ensuring that Indigenous communities, the general public, local communities, elected and appointed government officials and other industry stakeholders are properly informed about activities carried out at all CNL's sites including Whiteshell Laboratories. This commitment is met through CNL's Public Information Program (PIP) [10-1]. CNL's PIP fulfils the requirements of the CNSC's Regulatory Document REGDOC-3.2.1, Public Information and Disclosure [10-2]. CNL's PIP includes specific communications to stakeholders and public access to information related to routine activities, radiological and non-radiological emissions, non-routine items or events and environmental and performance reporting.

The WL site maintains the public information program to ensure that the general public and Indigenous communities have access to information on the proposed decommissioning program. The WL specifically communicates with:

- WL based CNL Employee Unions;
- Emergency Measures Manitoba Organization;
- Sagkeeng First Nation;
- Brokenhead Ojibway Nation;
- Black River First Nation;
- Hollow Water First Nation;
- Wabaseemoong Independent Nations;
- Grand Council of Treaty 3;
- The Public Liaison Committee;
- Manitoba Metis Federation (MMF);
- Local business partners (e.g., Pinawa Chamber of Commerce and Lac du Bonnet and district Chamber of Commerce);
- Local government officials/committees:
  - Local Government District (LGD) of Pinawa
  - Town of Lac du Bonnet
  - Rural Municipality (RM) of Lac du Bonnet
  - Community of Whitemouth
  - Town of Beausejour
  - Town of Powerview Pine Falls
  - RM of Alexander
  - Government of Canada – Minister and Department of Natural Resources, local Members of Parliament, Provincial; and
- Environmental Groups & Organizations (ENGOs) and citizens groups (Concerned Citizens of Manitoba, Whiteshell Cottagers Association, Manitoba Cottagers Association, Eastman Tourism, and the Whiteshell Laboratories Community Economic Regeneration Partnership).

10.2 Communication Modes

Canadian Nuclear Laboratories uses various communication modes to reach specific audiences (e.g., neighbouring communities, industry, customers, employment prospects, etc.). All communication products are maintained and kept up to date, this includes the dedicated corporate website (www.cnl.ca), posters, advertisements, recruitment materials, and related products. These communication products also serve to record comments and feedback received, and any actions taken to address them. Additionally, WL prepares engagement reports and share them with neighbouring Indigenous communities and the regulators.

10.3 Whiteshell Public Liaison Committee

The Public Liaison Committee (PLC) of WL is an independently facilitated council and comprised of regional representatives, members designated by local councils, and representatives from CNL. The PLC provides opportunities to key stakeholder for dialogue and feedback. The council openly discusses a broad range of matters of mutual interest to both CNL and the community and provides ongoing and consistent two-way interactions with community stakeholders on the decommissioning activities of the WL. The PLC meets two times a year. The information about routine activities, radiological and non-radiological emissions and non-routine items or events is shared with PLC members through email notifications, regularly scheduled meetings, and briefings, tours of the WL site, reports, news, and community meetings.

10.4 Whiteshell Closure Project

CNL has been engaging and will continue to engage Indigenous communities, the general public, local communities, elected and appointed government officials and other industry stakeholders about the Whiteshell Closure Project activities.

In April of 2000, CNL submitted a draft of the Comprehensive Study Report to the CNSC covering safety aspects of the proposed decommissioning approach of complete dismantlement and removal of all buildings, structures, systems and components including WR-1. This Comprehensive Study Report was also made available to and consultations took place with the public, Indigenous and expert federal departments. The comments received from the federal experts, Indigenous communities and the public were addressed and included in the Comprehensive Study Report. The updated Comprehensive Study Report Volume 1 was submitted to the public and Indigenous communities again [10-3]. The comments received and their dispositions were captured in Volume 2 of the Comprehensive Study Report [10-4]. An addendum to the Comprehensive Study Report (Volume 3) [10-5] was prepared and submitted to the federal Minister of the Environment for decision. On 2002 April 02, the Environment Minister made the decision that the proposed Whiteshell Laboratories Decommissioning project is not likely to cause significant adverse effects, and that no further environment assessment by a review panel or mediation is warranted [10-6].

In recent years, CNL has consulted and engaged the public and Indigenous groups on activities related to the WL Closure Project. The long-standing Public Liaison Committee mentioned above has been engaged twice yearly to provide an update on decommissioning activities at WL, and an opportunity for facilitated discussion and feedback on activities and plans for site closure.

There have been a multitude of public information sessions in the region regarding the proposed in situ disposal of the WR-1 reactor. Included in these sessions have been information poster boards on other site closure activities, and CNL had staff available to engage on this topic. At First Nations and Métis engagements, CNL provided an overview of the WL site that included information on site closure activities. CNL also fielded questions at these engagements on site closure plans and had the appropriate staff available to answer these questions.

CNL has also participated in numerous public events, such as the Lac du Bonnet trade fair where material and staff were available to engage on site closure activities.

CNL has provided numerous public, Indigenous, government and other stakeholder tours. On these tours, CNL included an introductory presentation and had the appropriate staff on hand. Environmental monitoring is a key concern expressed by Indigenous communities. CNL has invited the MMF and First Nations Peoples to directly observe components of the WL Environmental Monitoring program. CNL has also sought input on valued species.

In the summer of 2019, WL hosted a public open house with over 300 attendees. There were posters and other displays related to the decommissioning activities on site. As part of this open house, CNL provided a narrated bus tour that included the main parts of the site.

Throughout all these engagements, there were no concerns raised specific to the scope of this DDP, other than what is being documented as part of the Environmental Assessment for the proposed in situ disposal of the WR-1 reactor.

10.5 References

The following references were current at the time of development of this DDP. Where a reference is to be complied with, ensure the latest revision is used.

[10-1] CW-513430-REPT-001, *Public Information Program for Canadian Nuclear Laboratories (CNL)*.

[10-2] CNSC Regulatory Document, REGDOC-3.2.1, *Public Information and Disclosure, Public and Aboriginal Engagement*, 2018 May.

[10-3] WLDP-03702-041-000-0008, *Whiteshell Laboratories Decommissioning Project Comprehensive Study Report Volume 1: Main Report*, Revision 2, 2001 March.

[10-4] WLDP-03702-041-000-0009, *Whiteshell Laboratories Decommissioning Project Comprehensive Study Report Volume 2: Appendices*, Revision 2, 2001 March.

[10-5] WLDP-03702-041-000-0010, *Whiteshell Laboratories Decommissioning Project Comprehensive Study Report Volume 3: Addendum*, Revision 0, 2001 November.

[10-6] https://ceaa-acee.gc.ca/default.asp?lang=En&xml=7CE78B85-3486-4BE8-957A-DE3054DC531B.

11. RECORDS MANAGEMENT

Canadian Nuclear Laboratories maintains a Records Management System to ensure that records are categorized, registered, retrievable, and properly managed in a controlled environment. The records management process ensures that essential (permanent) and non-essential (non-permanent) records are identified, maintained, stored, retained, and routinely inspected to ensure their preservation and protection from loss, deterioration, or destruction in accordance with CNL requirements. As well, retention periods that meet regulatory requirements are assigned to each record and these determine whether a record is a permanent or non-permanent record. Records generated during the planning and execution of a project are filed in CNL's Electronic Document Records Management System (EDRMS). To ensure the traceability of requirements and documentation, EDRMS parent/child associations are used and a hierarchy of project documents and records is created.

11.1 Decommissioning Records

All project records and documentation will be prepared, issued, and archived as per the WL Decommissioning QA Plan [11-1].

11.2 References

The following references were current at the time of development of this DDP. Where a reference is to be complied with, ensure the latest revision is used.

[11-1] WLD-508300-QAP-001, *Quality Assurance Plan Whiteshell Decommissioning*.

APPENDIX A RADIOLOGICAL SAFETY ZONE DESCRIPTION

To allow for the effective provision of radiation protection within Controlled Areas, workplaces are organized into radiological safety zones, based on anticipated radiation dose rates and contamination levels during routine operation. The zoning level reflects the type and level of radiation and contamination hazards in a workplace and the extent that access control and radiation protection measures are required to control contamination and radiation exposure.

The CNL zoning system categorizes work areas into 1 of 5 radiological safety zones that reflect the external radiation and contamination hazards in a work area. The greater the level of the zone, the greater the potential hazard and the degree operational measures needed to control radiation exposures and contamination. The overall zoning is the highest of the radiation zoning and contamination zoning level.

Table A-1 provides a general description of each zone level and Table A-2 summarises the levels of radiation and contamination that could be encountered in each zone. Table A-3 gives the CNL RP Program maximum allowable surface contamination levels for unrestricted use of materials, equipment and clothing.

Table A-1 Radiological Safety Zone Description

Zone	Description
1	No radiological hazard work place: • Contamination and radiation hazard free zone. • Normally contains no radioactive material or sources. • Considered suitable for unrestricted and full-time occupancy for all employees. • Examples include hallways, washrooms, non-radiological labs, roadways, outside buildings.
2	Low radiological hazard workplace: • Normally free of radioactive contamination, but may contain sources of contamination exposures. May be subject to infrequent cross-contamination from work activities or higher numbered zones. Efforts are made to eliminate removable contamination upon discovery. • Low level whole-body dose rates may exist. • Considered to be suitable for full-time occupancy for Nuclear Energy Workers. • Examples includes low level radioisotope labs, nuclear facility main work areas.
3	Moderate radiological hazard workplace: • Regular entry and work restricted to nuclear energy workers with suitable RP training. • Activities may permitted that generate low level loose surface contamination in localized areas, and for short periods of time. May require the use of personal protective clothing and respirators. Areas decontaminated to the extent possible following completion of work. • Considered a zone of medium occupancy, and such occupancy is subject to continuing review by line management and Group 1 employees. • Examples include moderate and high radioisotope laboratories, decontamination areas, active liquid tank rooms, contaminated crawlspaces, reactor bays, low level solid radioactive waste storage bunkers.

Zone	Description
4	High radiological hazard workplace: • Entry and work only if justified and restricted to nuclear energy workers with suitable RP training. • High radiation dose rates and loose surface and airborne contamination hazards may exist. • Well established procedures and practices required to prevent workers receiving significant radiation exposures and internal contamination intakes. This includes use of personal alarming dosimeters and personal protective clothing and respirators. • Considered a zone of restricted occupancy, with access and work controls enforced. • Examples include hot cell isolation rooms, intermediate level liquid waste process rooms, intermediate level solid radioactive storage bunkers, reactor loop rooms.
5	Very High radiological hazard workplace: • Normally not an area suitable for human occupancy. • Entry is normally by exception and requires action to reduce or mitigate radiation and contamination hazards prior to entry. • All entries require radiological work planning in which the radiological assessments and radiation protection measures are approved by a Group 1 Health Physicist. In addition, all such entries shall require the constant attention and direction of a Group 1 RP Surveyor. • Examples include interior of hot cells, warm cells or Pu handling glove boxes; reactor lower access areas when operating.

Table A-2 Classification of Radiological Safety Zones

Zone	Radiation Hazard Description	General (Accessible) Whole Body Dose Rate Levels	General (Accessible) Removable Surface Contamination Levels*
1	Very Low	≤ 0.5 µSv/h (50 µrem/h)	< values in Table A-3**
2	Low	> 0.5 µSv/h (50 µrem/h) ≤ 10 µSv/h (1 mrem/h)	< values in Table A-3**
3	Moderate	> 10 µSv/h (1 mrem/h) ≤ 1.0 mSv/h (100 mrem/h)	≤ 10 times values in Table A-3
4	High	> 1.0 mSv/h (100 mrem/h ≤ 100 mSv/h (10 rem/h)	>10 times values in Table A-3
5	Very High	> 100 mSv/h (10 rem/h)	> 10 times values in Table A-3 and where based on a Group 1 Health Physicist judgement airborne contamination levels and/or external beta radiation fields present an acute hazard such that unplanned doses could realistically exceed regulatory limits or deterministic threshold level.

Note:

* Removable radioactive surface contamination levels higher than those specified in Table A-3 should only be allowed for zones within a Controlled Area. Exceptions shall only be short-term in nature and shall be individually justified to and authorized by the responsible RP Program Manager. Neither removable nor fixed contamination higher than the values in Table A-3 is allowed in Zone 1 areas.

** Maximum permissible Levels on any surface.

Table A-3 Administrative Release Levels and Maximum Release Limits for Surface Contamination

Radionuclide	Removable[1] (Bq/cm^2)	Total Surface Activity (Bq/cm^2)	
		Administrative Level[2]	Maximum Limit[3]
Alpha emitters, except U-nat, depleted U, LEU[4], Th-nat	0.01	0.2	0.4
U-nat, depleted U, LEU[4], Th-nat	0.2	1.0	4.0
Sr-90[5], radioiodines	0.05	1.0	4.0
Beta-gamma emitters[6], except pure beta emitters with E_{max}≤0.15 MeV	0.2	1.0	4.0
H-3, C-14, pure beta emitters with E_{max}≤0.15 MeV	2	10	40

[1] Removable means the surface contamination removed by and measured on a swipe. For comparison to values in this table, the removable surface contamination is determined by swiping a surface and assessing the amount of radioactive material on the swipe, divided by the area over which the swipe was taken (i.e., the total area covered by the actual physical path of the swipe, not the area bounding the extent of the area swiped).

[2] Target surface activity values apply to the average activity measured over the survey unit. Activity in any 100 cm^2 area can exceed the target values if the activity is less than 3 times the target values and the average surface activity within 1 m^2 around the area of elevated activity (including the area of elevated activity) is less than the target value. Removable surface activity measurements should be over a 100 cm^2 area.

[3] Maximum surface activity values applies to the surface activity averaged over any 300 cm^2 area over the surface unit or the entire object if the area is less than 300 cm^2. For floors, walls and large containers may be applied to the surface activity averaged over any 1,000 cm^2 area.

[4] LEU = Low-Enriched Uranium (<20% by weight of U-235).

[5] This category of radionuclides applies to Sr-90 and radioiodines that have been separated from other fission products and mixtures where the Sr-90 has been enriched. It does not include mixed fission products that have Sr-90 and radioiodines present in them.

[6] This category of radionuclides includes mixed fission products, including the Sr-90 and radioiodines which are present in them. It does not apply to Sr-90 and radioiodines which have been separated from the other fission products or mixtures where the Sr-90 has been enriched.

APPENDIX B TABLE OF CONTENTS FOR FINAL END-STATE REPORT

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    - 2.2 Summary of Work Completed
    - 2.3 Deviations from Detailed Decommissioning Plan
    - 2.4 Deviations from Work Plan
    - 2.5 Hazards and Dose Summary
        - 2.5.1 Radiological Hazards
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6. REMAINING ENTITIES
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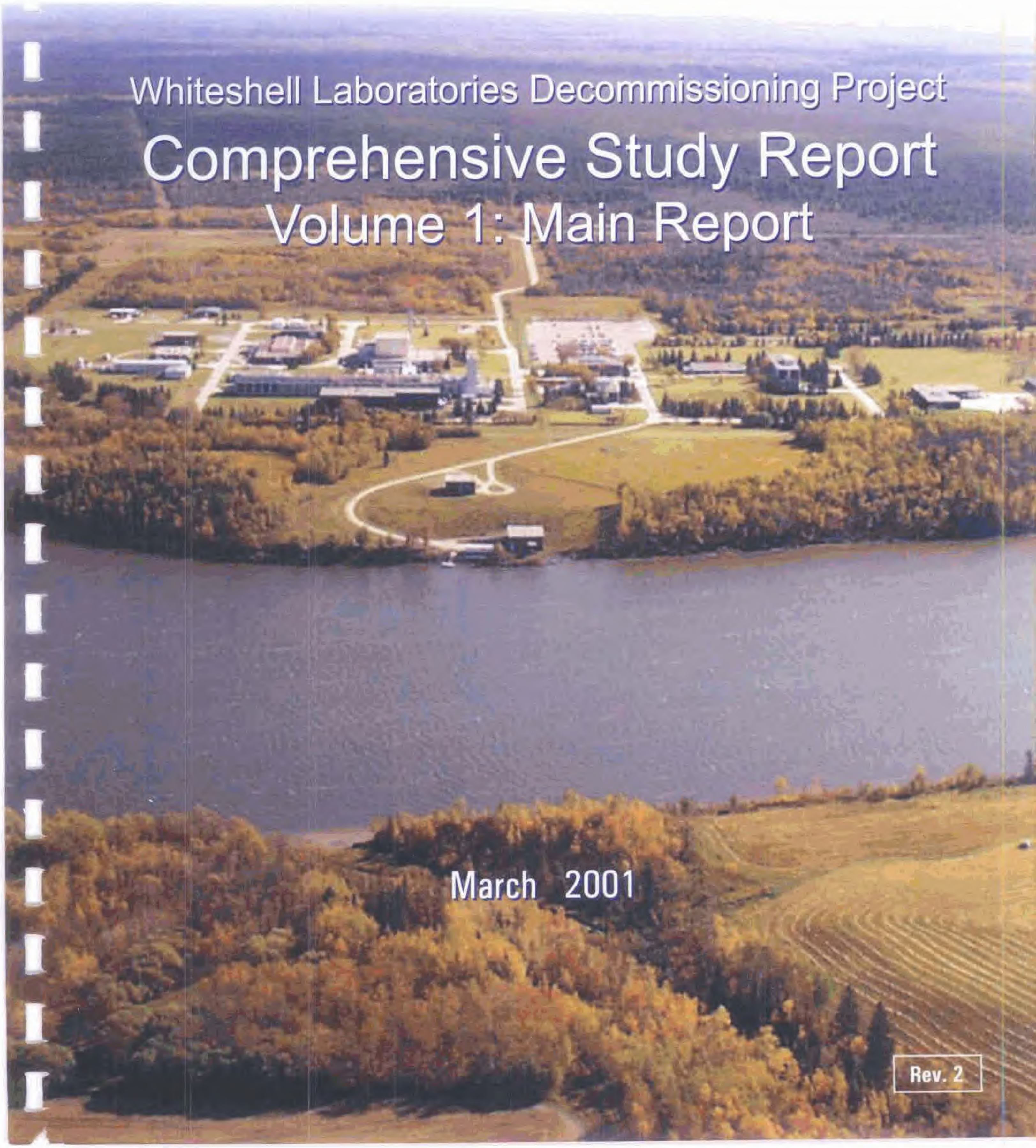
9. REFERENCES

[A-15] Whiteshell Laboratories Decommissioning Project Comprehensive Study Report, Volume 1: Main Report, Volume 2: Appendices, Volume 3: Addendum, WLDP-03702-041-000, 2001

AECL EACL



Whiteshell Laboratories Decommissioning Project

Comprehensive Study Report

Volume 1: Main Report

March 2001

Rev. 2

CSR PREPARATION TEAM

AECL	Whiteshell Laboratories Pinawa, MB	Project Direction
SENES Consultants Limited	Richmond Hill, ON	Project Management, Environmental Assessment and Technical Input
ECOMatters Inc.	Pinawa, MB	Technical Input
Barbara Connell Advisory Services	Winnipeg, MB	Public Consultation
Wardrop Engineering Inc.	Winnipeg, MB	Environmental Assessment and Technical Input

EXECUTIVE SUMMARY

BACKGROUND

Purpose and Need

Whiteshell Laboratories has provided research facilities for the Canadian nuclear industry since the early 1960's. As a result of the financial impact of the federal government's program review process, Atomic Energy of Canada Limited (AECL) made a business decision in 1997 to discontinue research programs and operations at Whiteshell Laboratories. Because no private sector sponsor was found to assume financial responsibility for the facility, in 1998, the federal government concurred with AECL's decision to decommission the Whiteshell Laboratories. The decommissioning project may proceed only with the prior licensing approval of the Canadian Nuclear Safety Commission (CNSC). Furthermore, and depending on the final conclusions made with respect to the effects on the Winnipeg River, aspects of the project may also be contingent on approvals issued pursuant to the *Fisheries Act*. In 1999, AECL began to prepare plans for the safe and effective decommissioning of the Whiteshell Laboratories, that would meet the regulatory requirements.

The Canadian Environmental Assessment Act; Responsible Authorities, Procedures and Schedule

Before the responsible federal authorities can permit the Whiteshell Laboratories Decommissioning Project to proceed, a decision must be made on the results of an environmental assessment prepared pursuant to the *Canadian Environmental Assessment Act* (CEAA). Under the Act, the CNSC and the Department of Fisheries and Oceans (DFO) are the Responsible Authorities. The Responsible Authorities determined that a *comprehensive study* under the CEAA was required. A document outlining the scope of the project and assessment was issued in December 1999 following consultation with the public and other federal and provincial government departments. The other expert federal authorities with an interest in the project include Environment Canada, Health Canada, Natural Resources Canada and Western Economic Diversification Canada. A number of departments and agencies of the Province of Manitoba participate through a special Technical Advisory Committee.

As required by the CEAA, a Public Registry was established for the Whiteshell Laboratories Decommissioning Project. This involves the registration of the project on the *Federal Environmental Assessment Index* (FEAI ref. No. 18737) and maintaining public access to all documents related to the environmental assessment. The FEAI can be accessed through the Canadian Environmental Assessment Agency and the CNSC and AECL web sites. The document list, copies of the documents, can be obtained by contacting the CNSC. Manitoba Conservation also established a public registry for the project (File no. 4479.00) with registry locations at the Pinawa Library, Winnipeg Centennial Library and Manitoba Conservation Resource Centre in Winnipeg.

A draft CSR (Rev.1) was submitted to the CNSC in April of 2000. The draft was also made available to the public and distributed to expert federal departments. The comments from the expert departments and responses to these comments are included in Appendix F of the CSR.

During the summer and fall of 2000, additional studies were carried out in the Winnipeg River and in the Waste Management Area (WMA) to confirm the appropriateness of the decommissioning proposals for those areas. These studies are presented in Appendices B and C. respectively.
This document (Rev. 2) is now being submitted by the RAs to the public for comment. Following a review of the comments, the RAs will submit the CSR with appropriate addenda and recommendations to the Canadian Environmental Assessment Agency for review and then a decision by the federal Minister of the Environment as to whether the project should be referred back to the responsible authorities for action, or requires further environmental assessment by a mediator or review panel.

SCOPE OF PROJECT

What is included?

The Whiteshell Laboratories Decommissioning Project encompasses all of the site facilities, buildings, infrastructure and land defined as the area affected by nuclear development and operation. Figure ES.1 shows the Licensed Study Area and the Unaffected Lands.

What is not included?

The total area that is under CNSC licence is approximately 4,375 hectares or 10,800 acres. Approximately 3,000 hectares (7,400 acres) of the licensed area is identified as land which was not used for or impacted by nuclear development or operations, and is excluded from the assessment scope.

The Underground Research Laboratory (not licensed by CNSC) and the Whiteshell Irradiator (which is under an CNSC licence held by ACSION) are also excluded.

CONSTRAINT

The long-term management of nuclear wastes is contingent upon finding a nationally acceptable solution consistent with federal policy on waste management. At present, no options or sites have been defined or approved that will provide such a solution. The availability of off-site national disposal facilities is essential to completing the decommissioning of the Whiteshell Laboratories' site. Provision of national waste disposal facilities is not within the Whiteshell Laboratories Decommissioning Project scope. Until a national facility is available, the wastes arising from the decommissioning project will remain in other secure interim waste management facilities licensed by the CNSC.

SCOPE OF ASSESSMENT

The environmental assessment of the proposed project includes a consideration of factors detailed in CNSC's Scope of Assessment document and of the following factors identified in the *Canadian Environmental Assessment Act*:

- purpose of the project (Section 1.0);

- alternative means of carrying out the project that are technically and economically feasible (Section 3.0);
- environmental effects of the project, including the environmental effects of malfunctions or accidents that may occur in connection with the project and any cumulative

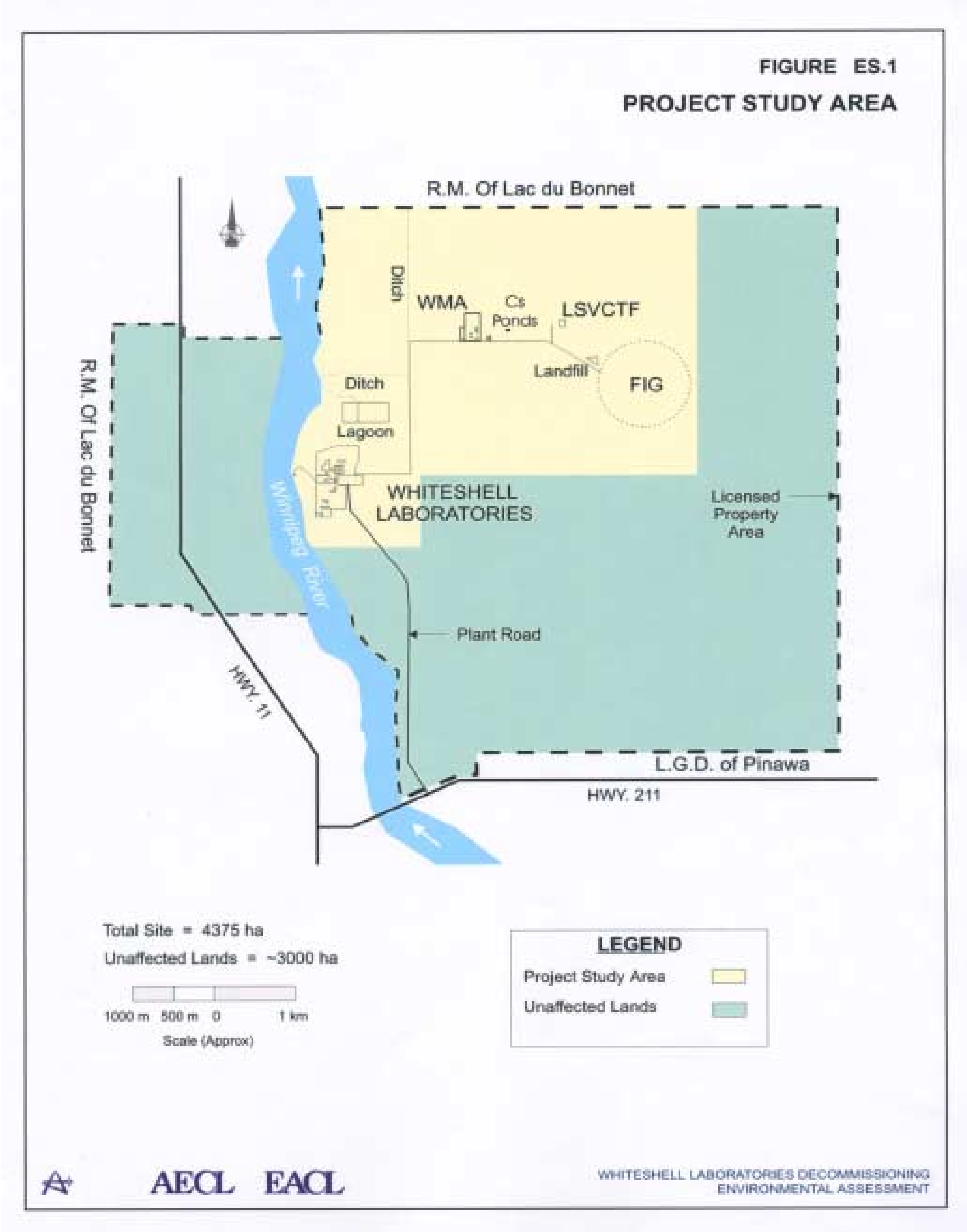


FIGURE ES.1
PROJECT STUDY AREA
R.M. Of Lac du Bonnet
R.M. Of Lac du Bonnet
Ditch
WMA
Cs
Ponds
LSVCTF
Landfill
FIG
Ditch
Lagoon
WHITESHELL
LABORATORIES
Winnipeg River
Licensed
Property
Area
Plant Road
HWY. 11
L.G.D. of Pinawa
HWY. 211
Total Site = 4375 ha
Unaffected Lands = ~3000 ha
1000 m 500 m 0 1 km
Scale (Approx)
LEGEND
Project Study Area
Unaffected Lands
AECL EACL
WHITESHELL LABORATORIES DECOMMISSIONING
ENVIRONMENTAL ASSESSMENT

environmental effects that are likely to result from the project in combination with other projects or activities that have been or will be carried out (Section 6.0);
- socio-economic effects caused by a change in the environment due to the project (Section 6.0);
- sustainability of renewable resources (Section 6.0);

- mitigation measures that are technically and economically feasible (Section 6.0);
- significance of the effects (Section 7.0);
- cumulative effects (Section 8.0);
- requirements of a follow-up program (Section 9.0); and
- comments received from the public (Section 10.0).

ALTERNATIVES

CEAA requires that the CSR address alternative means to achieve the decommissioning program. Our review of alternative means indicated that the main difference would be the time period required to complete the decommisssioning program. That is, the same steps and the same activities have to be carried out to achieve decommissioning. It was recognized from the beginning that the public would prefer decommissioning to be carried out in as short a period as possible. The minimum period given the time frame to deliver the decommissioning program and the availability of waste disposal was determined to be 20 years. Three alternatives were analyzed:

- Alternative 1 - End state in a Short time period (20 years).
- Alternative 2 - End state in a Long Time Period (100 years).
- Alternative 3 - End state in a Moderate Time Period (60 years).

Alternative 1 is based on the assumption that an off-site radioactive waste disposal repository would be available within 10 years. This would give time for evaluating wastes and preparing detailed decommissioning programs. Wastes would be removed to disposal throughout the subsequent 10-year time period. Alternative 2 is based on the assumption that the longest time the process necessary to implement a national waste disposal policy could take would be 100 years. Alternative 3 proposes that Whiteshell Laboratories would be decommissioned over an intermediate time frame (approximately 60 years). This time frame is based on the concept that safety and costs can be optimized by taking advantage of natural radioactive decay and by decommissioning buildings as they come to the end of their economic and structural life. It is also based on the assumption that national waste disposal facilities would be available for low-level waste by the year 2025 and high-level waste by 2050.

While it is understood that public preference is for an early decommissioning process, that is, Alternative 1, this approach has two limitations, namely occupational health and safety and costs. The safety issue arises from early handling of highly activated material from WR-1 which currently produces high radiation fields. Working in these fields requires the highest level of local shielded handling facilities as well as expensive and highly automated remote handling. Since an off-site disposal facility is not likely to be available within the 20-year time frame, the highly radioactive wastes from the disassembly of the reactor, and the low and intermediate-level wastes from the other site nuclear facilities would also have to be accommodated in interim storage facilities. This means additional safety risks to workers (double the amount of handling) and associated cost increases of between $50M and $130M.

Alternatives 2 and 3 avoid some of these problems. The likelihood that a national waste disposal facility is established is greatly improved. Postponing the dismantling of WR-1 for fifty years following shut-down provides a thousand-fold decrease in radiation fields. The risk of environmental problems developing over the deferment period is minimized since the site will remain under CNSC license and a follow up/monitoring program will be in place throughout the implementation period.

Alternative 2 is inferior to Alternative 3 providing that national waste facilities become available within the planning time frames of Alternative 3. The decrease in radioactivity resulting from a longer period of natural radioactivity decay in Alternative 2 does not significantly enhance worker safety. In addition, most of the buildings housing nuclear facilities will have gone beyond their economic and structural lives and will have to undergo extensive replacement increasing the costs of Alternative 2. Alternative 3 also reduces the amount of waste ultimately requiring disposal and produces more benign environmental effects than Alternative 2. Table ES.1 summarizes the incremental costs of Alternatives 1 and 2 as compared with the Alternative 3. The table shows that Alternative 3 is the least cost option - $50 to $130 million less expensive than Alternative 1 and $108 million less expensive than Alternative 2. Alternative 3 therefore is chosen as the reference alternative.

Table ES.1
Comparison of Costs for Decommissioning Alternatives

Alternative	**Time Frame (Years)**	**Base Cost ($M)**	**$M Reductions Provided by Option**	**$M Additional Costs of Option**	**$M Total Incremental Cost of Option**
1	20	reference project cost	-40	90 – 170	50 to 130
2	100	reference project cost	0	108	108
3	60	reference project cost	0	0	0

The basic rationale for decommissioning Whiteshell Laboratories is to move site waste only when off-site disposal is available or when the safety of managing wastes in existing facilities is compromised. For analytical purposes, based on technical, economic, public and environmental considerations, Alternative 3 was identified as the preferred alternative. It should be noted that if off-site waste disposal becomes available earlier, all site facilities except those which provide radioactivity decay benefits (e.g. WR-1 and some WMA wastes) could be decommissioned earlier. On the other hand, should off-site waste disposal availability take longer than assumed, the contingency would be to revert to Alternative 2.

Decommissioning Options within the Preferred Alternative

The general strategy is to remove facilities entirely from the site. For two project components, it was determined that the most environmentally sound and cost-effective solution was in-situ disposal, in other words, managing the wastes in the existing location. These two cases were the river sediments and Low Level Waste (LLW) in trenches in the Waste Management Area. In the case of the river sediments, after extensive sediment surveys, it was shown that even if the contaminants detected near the outfall to the Winnipeg River were somehow exposed or resuspended there was no risk to human or ecological health (see Appendix B). Analyses were also carried out for the waste in the trenches (see Appendix C). These analyses indicated that there has been no significant transport of contaminants beyond the trench boundaries. The analysis concluded that there was no likelihood that contaminants could move beyond the boundary of the Waste Management Area before the period of institutional control (now estimated at 200 years) is complete. These conclusions are based on the following observations:

1. The trenches were deliberately located in a water discharge area. This means that water moves upward preventing contaminants from migrating down into the sand aquifer overlying the bedrock and eventually reaching the Winnipeg River.
2. The clay soils around the trenches dramatically inhibit the movement of contaminants.
3. Under the most conservative assumptions the decay period for the dominant radionuclides (^{90}Sr and ^{137}Cs) in the trenches is shorter than the time it would take to migrate to the boundary of the WMA.

During the course of the decommissioning program, there will be additional monitoring and analysis to verify these findings. During Phase 3, a supplementary environmental assessment and safety analysis will be conducted to support the final in-situ end state.

PROJECT DESCRIPTION

Facilities

The following facilities will be decommissioned.

Table ES.2
Facilities to be Decommissioned

Nuclear Facilities	Radioisotope Facilities	General Infrastructure

• Shielded Facilities • Van de Graaff Accelerator • Neutron Generator • Active Liquid Waste Treatment Centre • Whiteshell Reactor -1 • Concrete Canister Storage Facility • Waste Management Area	• Building 300 • Decontamination Centre • Building 402	• Non-nuclear Buildings • Landfill • Sewage Lagoon • Buried Services • Contaminated Lands ("Affected Lands")

Phasing

The proposed Whiteshell Laboratories Decommissioning Project will be implemented through a phased approach (See Figure ES.2) preceded by operational shut down work. The activities planned in each phase are:

- ***Phase 1*** *(approximately 5 years)* – activities directed toward nuclear and radioisotope buildings and facilities to place them in a safe, secure, interim end state. The Van de Graaff Accelerator and the Neutron Generator will be completely decommissioned.

- ***Phase 2*** *(approximately 10 years)* – regular monitoring and surveillance of all buildings and facilities. Most project activity will be focussed on the Waste Management Area. Most waste management facilities will be placed in a passive operational state and interim processing, handling and storage facilities, required during monitoring and surveillance and decommissioning project activities, will be established.

- ***Phase 3*** *(approximately 45 years)* – activities directed to bringing the site to a final end state that will fulfil all pertinent regulatory and national policy requirements. The timing and sequence of decommissioning activities will be determined largely by the availability of disposal facilities and by the age and condition of engineered structures and buildings.

Following the completion of Phase 3, part of the site, namely, the Waste Management Area, will remain under institutional control for an additional 200 year period.

Management of Waste

The decommissioning program essentially is a process of managing the Whiteshell Laboratories' site waste. The inventory of stored waste from Whiteshell Laboratories includes approximately 21,000 m^3 of low-level radioactive waste, approximately 1,400 m^3 of medium level radioactive waste and approximately 28 metric tonnes of irradiated reactor fuel. The decommissioning program will produce an additional approximately 12,000 m^3 of low-level radioactive waste, approximately 1,400 m^3 of medium level radioactive waste and approximately 50,000 m^3 of deminimis (below regulatory concern) waste. TFRE/Amine radioactive liquid waste stored at the site will be processed to a solid waste form. The result of the decommissioning program will be an end state where all wastes are dispositioned to off site disposal facilities or, in the case of river sediments and the LLW trenches, to management in-situ.

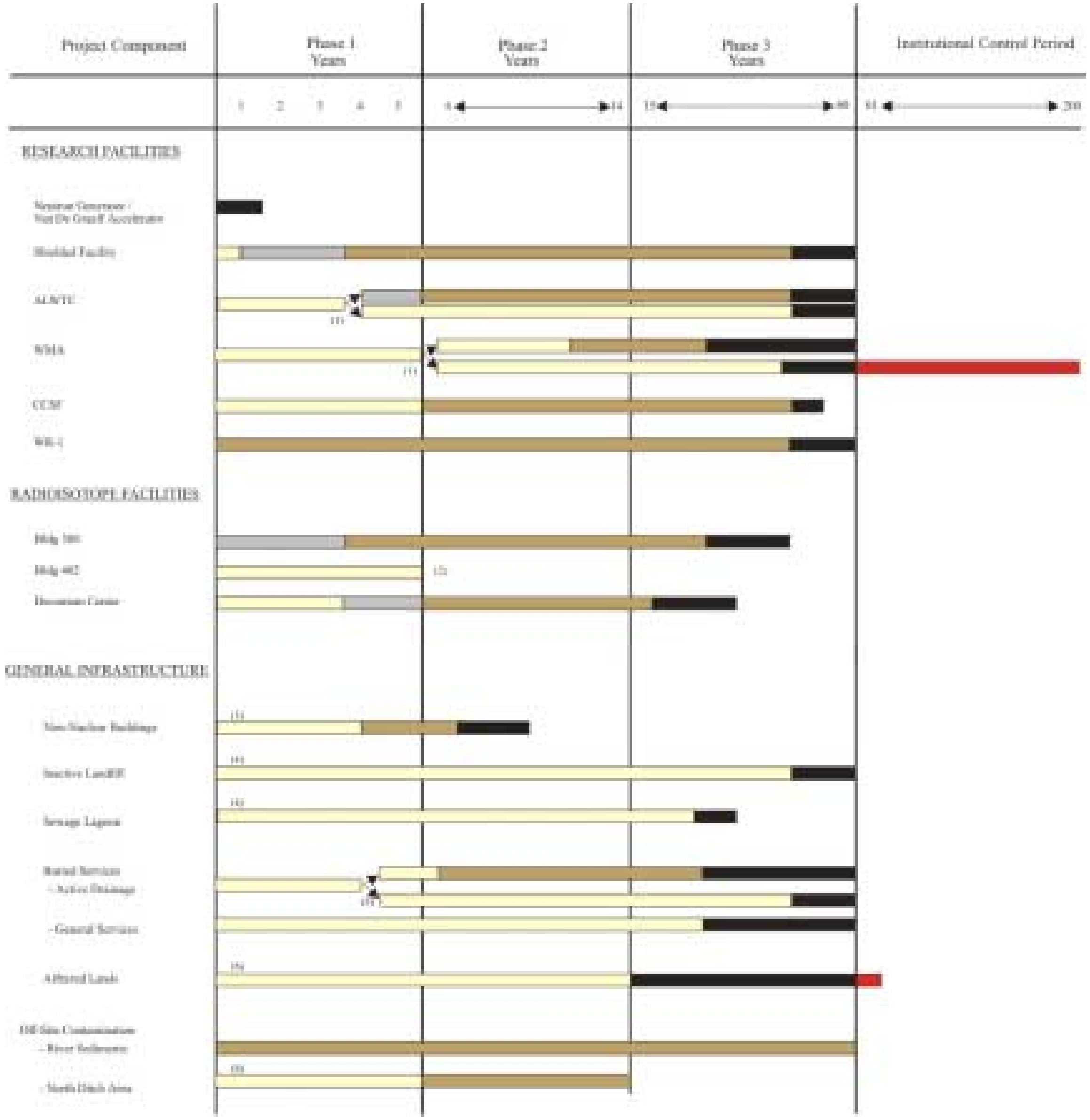
Figure ES.2

Whiteshell Laboratories Decommissioning Project Component Timelines

- Operating
- Achieve M&S State
- M&S State
- Achieve Final Endstate
- Institutional Control Period

Notes

1. Reduced facility operation to support M&S state and future decommissioning projects
2. Endstate timing/direction based on commercial activity
3. For non-nuclear buildings transition to M&S and final decommissioning may include transfer to a new owner for commercial use
4. Plans for remediation developed during Phase 2
5. Operational component of active drains identified for M&S period
6. Characterization and development of remediation plans completed in Phase 1. Each requirement for remediation addressed in Phase 2



THE ENVIRONMENT

The Site

The Whiteshell Laboratories' site is located on the east bank of the Winnipeg River approximately 100 km east northeast of Winnipeg. The site lies approximately 267 m above sea level within a broad zone where prairie grassland to the southwest merges with boreal forest to the northeast. It is on the western edge of the Precambrian Shield and is surrounded by cleared land, which supports agriculture, interspersed with peat bog. Forty-three percent of the site is forested or leased farmland.

Environmental Indicators and how effects can be transmitted at Whiteshell Laboratories

The following are some key characteristics of the site:

- ***Radioactive Emissions:*** The estimated dose to the most exposed members of the public (assumed to be living at the site boundary) is a negligible percentage of the typical background radiation dose in Canada.

- ***Air Quality:*** Indicators of air quality in the area range from 0 to 17% of provincial and/or federal standards for non-radiological contaminants. Air in the area may be described as "very clean".

- ***Soils and Groundwater:*** Groundwater in the area is generally regarded as "potable". The water tends to move toward the Winnipeg River except at the Waste Management Area which is a water discharge zone where water tends to flow upward to the surface. The site consists of overburden soils (derived from glacial deposits) overlying Precambrian bedrock. Silt, silty clay, fine sand and clay till dominate the Local and Project Study Areas.

- ***Surface Water and the Winnipeg River:*** In general, most surface water from the site flows to the Winnipeg River. Water quality in the Winnipeg River is good and radioactivity is well within the Maximum Acceptable Concentrations for radioactivity in drinking water in Canada, as specified by Health Canada. Appendix B shows that concentrations of radioactivity in the sediments near the outfall present no risk to human or ecological health.

- ***Terrestrial Biota:*** There are many types of vegetation, some of which are rare in the area but common elsewhere in Manitoba. There may be more than 50 species of mammals living on the site but none of them are considered "rare or endangered." The white tailed deer is quite common. The local study area ***may*** support several endangered birds including peregrine falcon, burrowing owl, piping plover and loggerhead shrike. ***Vulnerable*** species in the area may include the least bittern, short-eared Owl, Caspian tern and red-headed Woodpecker.

- ***Aquatic Biota:*** The Winnipeg River has a wide variety of fish species including walleye, pike, red and white sucker, whitefish and the “at risk” and protected sturgeon. There is no significant aquatic vegetation on the site.

- ***Socio-Economics:*** The area around Whiteshell Laboratories has a population of about 18,000. Although Whiteshell Laboratories employed as many as 1,100 people at its peak, it currently employs about 350. When shut down is complete employment will decrease to approximately 30. Other industries now provide the bulk of employment in the area. Traditional employers are mining and forest products but the percentage of employment in the retail trade and tourism is growing.

- ***Land and Resource Use:*** The area supports farming, hunting and fishing and a growing recreational industry based on these activities, as well as swimming and a growing cottage community. The Winnipeg River is particularly important to all these activities.

<u>*Valued Ecological and Social Components*</u>

Valued Ecological Components (VECs) and Valued Social Components (VSCs) are a way of focussing on potential environmental effects. These components are protected by law or regulation; recognized by the scientific communities as important within the ecosystem; and/or recognized by the public as being important due to their social importance, commercial economic value or role in maintaining quality of life within the community. The following VECs and VSCs were identified in the assessment:

- The Winnipeg River and its Shoreline.
- Sturgeon, Walleye, Northern Pike and Mooneye.
- Whitetail Deer and Moose.
- Gullies and Ravines.
- Coniferous Forest.
- Habitat Diversity.
- The Sport Fishery.
- Provincial Park and Natural Forest Areas.
- The Model Forest.
- The Field Irradiator Gamma (FIG).

EFFECTS OF THE PROJECT ON THE ENVIRONMENT

Approach

Residual effects were determined through a review of decommissioning activities and interactions with environmental components.

Contaminant migration pathways were evaluated and possible receptors along the pathways identified. Where mitigation measures were required they were applied to determine the net residual effect. Special attention was paid to the geographical extent of the effect e.g. the area around the activity, the Project Study Area or the Local or Regional Study Areas (see Figure ES.3).

Residual Effects

In general, there will be an improvement to the environment as a result of the decommissioning program. This is because:

- the achievement of operational shutdown will continue to reduce emissions, ultimately emissions will fall to zero;
- decay of any material on the site will continue;
- there will be no new sources of contaminants; and
- the site will ultimately be restored to a natural condition.

Accordingly, there will be some effects although they will be generally small and in many cases, undetectable. In that regard it should be noted that releases to the environment are not continuous and they are controlled (so that effects are minimal from the start). It should also be noted that the site will remain under license which means that monitoring subject to CNSC review will continue for the entire program. Certain parts of the site will be under institutional control for as long as 200 years.

The following is a summary of residual, but not necessarily significant effects that may be associated with the program.

Air Quality and Noise

Air quality issues were related to most decommissioning activities including decontamination, building demolition and site remediation. Air quality effects ranged from the release of very small amounts of radioactive airborne particulates to nuisance dust and noise. Several observations may be made:

- airborne radioactive emissions are controlled to be below permissible Derived Release Limits (DRL). The target for total emissions is a small fraction of the DRL. HEPA filters effectively control radioactive particulates. Where greater control is required, additional HEPA filters can be added. The result is that the release of radioactive particulates is negligible;

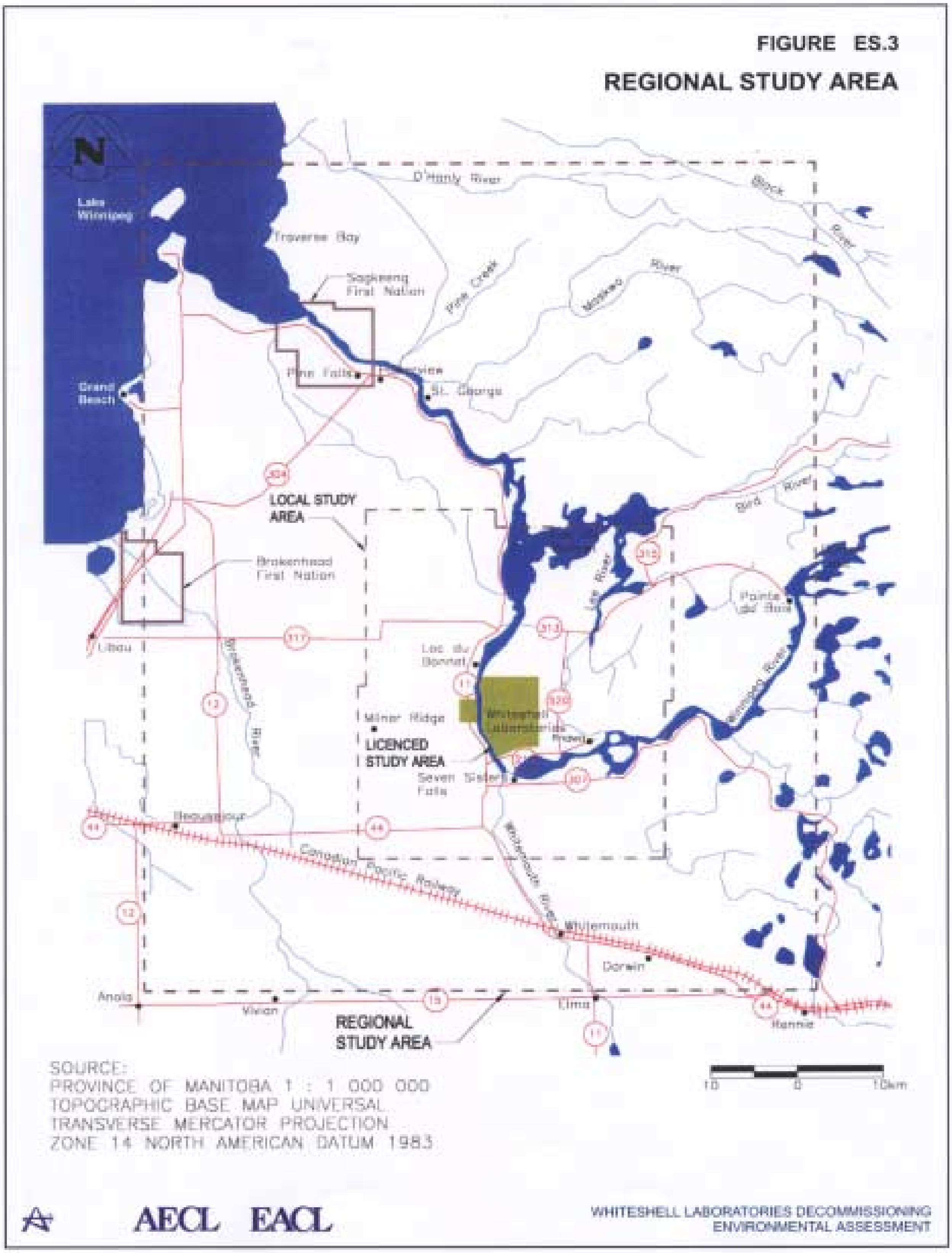


FIGURE ES.3
REGIONAL STUDY AREA
N
Lake Winnipeg
Traverse Bay
Sagkeeng First Nation
D'Hanly River
Black River
Pine Creek
Maskwa River
Pine Falls
St. Georges
Grand Beach
LOCAL STUDY AREA
Bird River
Brokenhead First Nation
Lee River
Pointe du Bois
Libau
Lac du Bonnet
Brokenhead River
Winnipeg River
Whiteshell Laboratories
Miner Ridge
LICENCED STUDY AREA
Seven Sisters Falls
Beausejour
Canadian Pacific Railway
Whitemouth River
Whitemouth
Darwin
Anola
Vivian
Elma
Rennie
REGIONAL STUDY AREA
SOURCE:
PROVINCE OF MANITOBA 1 : 1 000 000
TOPOGRAPHIC BASE MAP UNIVERSAL
TRANSVERSE MERCATOR PROJECTION
ZONE 14 NORTH AMERICAN DATUM 1983
10 0 10km
AECL EACL
WHITESHELL LABORATORIES DECOMMISSIONING
ENVIRONMENTAL ASSESSMENT

- radioactive materials will be removed from all structures through a decontamination process. HEPA filters used during decontamination will remove a high level of radioactively contaminated dust (99.97%). As a result virtually no radioactivity will be released during the decontamination process;
- experience at other sites suggests that from time to time nuisance dust will be generated. Recent work (Watson and Chow 1999) suggests that the fine fraction (PM_{10}) of fugitive dust, generated by construction-type activities, will remain in the lowest 2 m of the atmosphere and that the local deposition losses and impaction losses (trees) will reduce the amount transported beyond 50 metres by over 90%;
- under extremely windy conditions, when there is a possibility that emissions may leave the site, decommissioning activities will be curtailed; and
- the preservation of the dense tree coverage across the site provides a natural noise barrier between site activities and potential noise receptors within the Project Study Area. Vibration effects would likely only be of concern within the Project Study Area to adjacent buildings and structures.

The assessment has concluded that the spatial extent of the residual effects from emissions to the air and noise will be limited to the Project Study Area.

Surface Water (Hydrology)

Residual effects on surface water, particularly the Winnipeg River, were identified from discharges from the Active Liquid Waste Treatment Centre and the sewage lagoon. These discharges, currently well below applicable standards, will gradually diminish to almost zero by the time decommissioning is complete. The discharges that will occur will be controlled so that there will be some, but very small, residual effects on the River.

Soil and Groundwater (Geology and Hydrology)

Small amounts of contamination may remain in the soils where leaks have occurred around buried services and where active buildings or facilities, such as the Shielded Facilities have been removed. Very small amounts of leachate from these sources as well from the Inactive landfill may migrate into the groundwater. The main area of concern was the LLW to be managed in-situ in the Waste Management Area. As noted in the discussion in alternative methods, it was determined that the likelihood of contaminant transport beyond the Waste Management Area was extremely low and no effects on groundwater were anticipated from in-situ disposal of the trenches. Monitoring of this area will continue well beyond the decommissioning program until the beginning of the 23rd century. The analysis concluded that effects on groundwater would be limited to the Waste Management Area.

Terrestrial Biota

No effects were identified on terrestrial biota and it is expected that natural vegetation will re-establish itself.

Aquatic Biota

The only potential effects were related to the possibility of exposure of aquatic biota to the Winnipeg River contaminated sediments. An ecological risk assessment (Appendix B) indicated that even under the most unfavourable assumptions, there would be no effect on aquatic biota.

Worker Health and Safety

Workers are exposed to radiation during many of the decommissioning activities. Adherence to AECL's radiation protection and occupational health and safety programs will ensure that exposures are controlled and kept within regulated limits. Furthermore, the application of the radiation protection program ensures that exposures are justified and kept as low as reasonably achievable (ALARA), social and economic factors taken into account. No residual effects on worker health and safety are anticipated.

Public Health

No residual effects on public health are expected. The main risk is associated with possible contamination of the Winnipeg River as a water supply. This risk is minimized through control of releases to ensure that there is no effect. The risk analysis described in Appendix B has indicated that there is no risk to human health from contaminated sediments. There is a possibility of radiation exposure from accidents associated with the transport of radioactive waste off-site. Approaches to ensuring the safety of radioactive transport have been developed and include contingencies for accidents and spills.

Physical and Cultural Heritage/Archaeology

Physical and cultural heritage refers to use by First Nations and others of the land over time. In particular, these groups have used the area and especially the Winnipeg River for hunting, fishing and many other traditional activities. The concern is the possible loss of buried artifacts. To avoid such losses, archaeologists will be present during any significant shoreline excavations. Effects can therefore be prevented.

Land and Resource Use

A residual effect is the long-term restriction on land use. The amount of land likely to be involved is very small, relative to the large area of the site.

Socio-Economics

Because there are not likely to be any effects on the biophysical environment, effects on the area's socio-economic conditions are unlikely.

Aboriginal Interests

Activities of specific interest to aboriginal communities are associated with historical and current uses of the Winnipeg River, the disturbance of sacred lands and artifacts. No particularly valuable historical site has been identified in the Project Study Area and First Nations will be kept apprised of any findings during excavations as well as being kept abreast of the decommissioning activities as the project proceeds. This process will ensure that aboriginal interests are not affected.

EFFECTS OF THE ENVIRONMENT ON THE PROJECT

The assessment reviewed the effects of non-routine events including floods, tornadoes, earthquakes and fire. The assessment concluded that if such events were to occur, AECL's existing contingency plans and emergency preparedness plans will be implemented and the effect on the project will be adequately controlled.

ACCIDENTS AND MALFUNCTIONS

These events include equipment failure, fire, explosion, spills and leaks, loss of services and off-site transportation accidents. The assessment confirmed that all of the accidents and malfunctions reviewed have avoidance and contingency plans in order to mitigate potential environmental effects. Mitigation measures to reduce the potential hazards during decommissioning will be developed in the decommissioning plans for individual facilities. Accident mitigation is based on prevention, early detection, remediation and accommodation. AECL is committed to having the necessary trained staff available for these purposes.

ASSESSMENT OF SIGNIFICANCE

The significance of residual effects was assessed using a two-step approach. Step one involved a comparison with specific criteria such as contravening a standard; displacing or endangering a designated environmental feature; or adversely affecting an established treaty and/or aboriginal right. For those effects that met the criteria of the first step, their significance was determined in a second step using a scoring system addressing factors such as magnitude, duration, occurrence, geographical extent and reversibility. No effect was considered significant using either level of evaluation and the analysis determined that the Whiteshell Laboratories Decommissioning Project was not likely to cause significant adverse environmental effects.

CUMULATIVE EFFECTS

Cumulative effects are changes to the environment that are caused by an action (this project) in combination with other past, present and future human actions (other projects or activities in the area).

A total of 30 actions/physical works were identified of which 10 were considered to have the potential to interact with the project.

The effects analysis indicated that the only VEC that could be affected was the Winnipeg River. In all cases, either small amounts of effluent were involved or the discharge points were remote from the stretch of the Winnipeg River affected by the Decommissioning Project. Hence, no cumulative effects were identified.

FOLLOW-UP

The purpose of follow-up is to:

- optimize the monitoring and surveillance program;
- confirm that appropriate mitigation measures are implemented;
- develop appropriate responses to unforeseen effects; and
- identify effects of the project that may not have been predicted.

Follow-up activities include monitoring, surveillance, inspection, data collection, analysis, evaluation, and reporting.

Components of the follow-up program include:

- the preparation of detailed decommissioning plans for each nuclear facility. Each plan addresses environmental control issues and describes control procedures;
- the maintenance of existing site and effluent verification monitoring programs throughout the decommissioning program;
- program updates to meet new requirements identified from implementing the monitoring and surveillance program;
- additional wells and monitoring around the WMA, sewage lagoon and inactive landfill
- the maintenance of regular reporting procedures; and
- support for and co-operation with any independent Public Advisory Committee that may be created to assist the Whiteshell Laboratories Decommissioning Project.

In addition to the above, independent audits can be conducted by the AECL Safety Review Committee and by the CNSC.

PUBLIC CONSULTATION

A public consultation program was designed and implemented to solicit public comments on the Whiteshell Laboratories Decommissioning Project. The program sought the involvement of the stakeholders, First Nations, and interested members of the public that would endure throughout and beyond the entire decommissioning program. Public consultation activities undertaken are shown below:

Activities	1999	2000
Key-person Interviews	July – September	
Interviews (VECs/VSCs)	July – August	
Newsletter	October	June
Letter to Contact List	October	June
Open House	October	
Information Sessions	October	June
Follow-Up Presentation	November	

This approach reached a large a number of people in the area. For example:

- the newsletter was sent out to 7,627 post boxes in the Regional Study Area;
- 121 people attended the open house at Whiteshell;
- another 43 people attended information sessions;
- contacts have been made with the Sagkeeng First Nation, Brokenhead Ojibway First Nation, Treaty 3 First Nations and the Manitoba Metis Federation;
- a communication protocol has been established with the Sagkeeng First Nation, and
- presentations were made to interest groups, local Councils, the Community Leaders Group, the TAC and others.

A number of issues were raised with respect to the project. All of these issues have been addressed in the Comprehensive Study Report.

COMMITMENT

AECL, as holder of the Whiteshell Laboratories' site licence, is committed to:

- conducting all decommissioning activities to ensure health and safety of workers, the public and protection of the environment;
- ensuring that the funding to meet the Whiteshell Laboratories decommissioning requirements is identified as a component of the segregated appropriation for decommissioning from the Treasury Board;
- meeting all applicable regulatory, safety and environmental requirements throughout the decommissioning process;
- retaining key individuals to develop and initiate its decommissioning program. AECL is committed to maintaining required resources on its decommissioning team;
- maintaining fully trained and qualified staff to meet security requirements;

- maintaining an environmental monitoring program for as long as wastes requiring management remain at the site;
- the involvement of local communities in the environmental monitoring program;
- implementing mitigation measures for project activities where an evaluation of decommissioning activities has determined the need for mitigation;
- maintaining monitoring and surveillance programs for all nuclear facilities and affected lands until the final end state is achieved; and
- an ongoing communication program with area communities and other stakeholders and supports the establishment of a Public Advisory Committee during the decommissioning program.

CONCLUSIONS

The following conclusions may be drawn from the Comprehensive Study Report:

- the Whiteshell Laboratories Decommissioning Project is not likely to cause significant adverse environmental effects taking into account the mitigation measures recommended in the report;
- the cumulative effects analysis indicates that there are not likely to be any cumulative effects associated with the project; and
- public concerns raised to date about the project have been addressed in the CSR (Section 10.0).

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GLOSSARY

Active

Active signifies radioactive. It does not indicate whether the facility is operational.

Active Area

The Whiteshell Laboratories (WL) active area (Figure 2.2) includes all WL nuclear and radioisotope facilities. The CCSF and WMA are included as a part of the active area.

Active Drain Lines

Active drain lines are pipes which transfer contaminated liquids from laboratories, hot cells and buildings to the ALWTC collection tanks. A typical drain configuration consists of a drain in a fumehood or sink, a drainage pipe, a tank, a pump and a double pipeline (pipe within a pipe) to the ALWTC.

Active Ventilation

Active ventilation is the exhaust system used to remove air which may contain radioactive particles from a structure such as a laboratory, hot cells, or vented enclosures. A typical configuration in a radioisotope or nuclear facility consists of a lab fume hood, ductwork, a HEPA filter bank, an exhaust fan and an exhaust stack.

AECL

Atomic Energy of Canada Limited, a Crown corporation set up by the Canadian government in 1952 to develop peaceful uses of nuclear energy. AECL develops, markets, sells and builds CANDU power reactors and research reactors and provides engineering and other technical services to nuclear utilities.

Affected Lands

The Affected Lands (Figure 2.1) is defined as the lands where nuclear development, or operations, or supporting activities were conducted. As well, lands potentially impacted by such activities are included as being “Affected”.

Air Kerma

Air kerma is an approximation of dose from gamma radiation.

Alpha Radiation

The least penetrating but most strongly ionizing of the three principal forms of radiation from radioactive materials. It is halted by the outer layer of skin cells in human skin.

ALARA

As Low As Reasonably Achievable. ALARA refers to radiation exposures that are kept as far below regulatory limits as possible, taking into account current technology and the costs of improvement related to three areas: the benefits and risks to the environment and public health and safety; societal and socio-economic factors; and the use of radioactive materials for public benefit, such as in research, medical diagnosis and the production of electricity by nuclear power.

Amine Tank

A tank in the WMA containing radioactive liquid waste from an experiment in which an irradiated CANDU natural uranium fuel bundle was dissolved.

Background Radiation

Radiation that occurs in the natural environment, including cosmic rays and radiation from naturally occurring radioactive elements.

Bequerel (Bq)

The standard international unit of radioactivity equal to 1 radioactive disintegration per second. 37 billion becquerels is equal to 1 curie (Ci).

CANDU

A nuclear power reactor developed in Canada. The term stands for Canadian Deuterium Uranium. The moderator is deuterium or heavy water and the fuel source is natural uranium.

Canister

A steel-lined concrete structure used to store spent nuclear fuel.

Characterization Survey

A radiological survey carried out to characterize radiation hazards and estimate the level of radiation. See interim end state survey definitions.

CEAA

The *Canadian Environmental Assessment Act (CEAA)* sets out responsibilities and procedures for the environmental assessment of projects involving the federal government. The Act applies to projects for which the federal government holds decision-making authority whether as proponent, land administrator, source of funding, or regulator. It was proclaimed on January 19, 1995. The Canadian Environmental Assessment Agency administers the *Act*.

CNSC

The Canadian Nuclear Safety Commission (CNSC) is the federal regulatory body which regulates the use of nuclear energy and nuclear substances to protect health, safety and security and the environment and to respect Canada's international commitments on the peaceful use of nuclear energy. Parliament passed the Nuclear Safety and Control Act in 1997, updating the older Atomic Energy Control Act (1946) and paving the way for the former Atomic Energy Control Board (AECB) to become the CNSC on May 31, 2000.

Comprehensive Study Report (CSR)

An environmental assessment report prepared under the *Canadian Environmental Assessment Act*. A comprehensive study is required for projects listed in the Comprehensive Studies Regulations under the *Act*.

Controlled Area

An area controlled in accordance with Radiation Protection practices. The controlled area is often referred to as the active area.

Critical Group

For a given radionuclide and source, a uniform or generic group of people whose location, age, habits, diet etc cause them to receive doses higher than the average received by people in all other groups in the exposed population.

Curie (Ci)

A unit used to measure the level of radioactive decay. One curie equals 37 billion disintegrations per second, or approximately the radioactivity of one gram of radium.

Deferment Period

A period of monitoring and surveillance when no significant decommissioning work is in progress.

Deminimis Waste

Waste which has activity levels below regulatory requirements for unrestricted release. This material is releasable to an off-site landfill or is recyclable.

Detailed Decommissioning Plans (DDP)

A plan to decontaminate/remediate redundant nuclear facilities to a condition which establishes a final end state that fulfills all pertinent regulatory and national policy requirements.

Duration

The time period over an environmental effect will last.

Environmental Effect

A change in the natural and/or social environment that occurs as a result of project activities.

Final End State

The target final condition of the decommissioned site. Normally this is the state achieved when release from regulatory control or establishment of continuing controls is approved.

Fission

The break-up of the nucleus of an atom into two major fragments, plus smaller fragments and free neutrons, when the nucleus is struck by a slow-moving free neutron.

Fixation (Fixing)

The process of stabilizing contamination through methods such as the application of spray or brushed-on paint or paint-like products. Fixation is done to ensure that any loose surface contamination is stabilized for a long period.

Flask

A CNSC approved containment system for transfer of radioactive materials. It is commonly used for transport of radioactive material from one licensed facility to another licensed facility.

Fuel (Nuclear)

Fissionable material used to power a nuclear reactor.

Gamma radiation

Radiation with the greatest penetrating power but least ionizing of the three principal forms of radiation. Gamma radiation can completely penetrate and damage all body organs.

Geographical Extent

The area over, or throughout which, the environmental effects are likely to occur.

Gray (Gy)

Standard International unit for absorbed radiation dose, equal to the absorption of one joule of radiation energy per kilogram of material.

Hazard

A source of danger to worker health and safety or the environment. Typical conventional industrial hazards include PCB's, asbestos, dust, propane and lead-based coatings. Typical radiological hazards include radiation sources, samples, contaminated materials and irradiated fuel.

HEPA Filters

High Efficiency Particulate Air filters used to filter radioactive dusts from the air.

HLW

High Level Waste comprises irradiated reactor fuel and metals from nuclear reactor core components.

HVAC

This refers to the Heating, Ventilation and Air Conditioning systems. At Whiteshell the heating system includes the powerhouse, district heating distribution system and building heating coils. Typical ventilation for most buildings includes supply and exhaust air duct work and ventilation fans. Air conditioning includes the B100 chiller, distribution lines and the building coils.

Hydrocarbon

An organic compound containing carbon and hydrogen.

Inactive

Not radioactive: as with "active" this does not mean that the facility is non-operational.

Inactive (Supervised) Area

The inactive area boundary is shown in Figure 2.1. The inactive area is generally the support infrastructure that has not been directly impacted by nuclear operations and is considered free of radioactive contamination.

In-Situ

A term referring to the management of radioactive material, waste or a facility in its existing location.

Interim End State

A temporary end state achieved to place a facility in safe monitoring and surveillance until final decommissioning is implemented.

Interim End State Survey

Radiological characterization done to identify hazards and estimate the level of radiation. This would be a documented detailed survey. It would include a review of historic information, gridded surveying, swipe sampling and photographic documentation.

Institutional Control

Institutional controls are requirements placed on AECL by the CNSC to ensure long-term safety from residual contamination of a decommissioned facility.

Isopleth

Line drawn on a diagram, delineating areas with similar ranges of numerical value for a parameter of interest.

Leachate

The water that percolates through a porous medium such as soil and transports any salts or other dissolvable materials which may be found in the soil.

LLW

Low-level (radioactive) Waste is generated from laboratories and the nuclear fuel cycle as well as the nuclear fuel cycle. It comprises paper, rags, tools, clothing, filters etc. which contain small amounts of mostly short-lived radioactivity. It is not dangerous to handle, but must be disposed of more carefully than normal garbage.

Loss of Function

Inability to use the environmental component in a way that serves its ecological role.

Magnitude

Size or degree of the impact compared to existing environmental conditions.

Mitigation

Measures applied to prevent or minimize harm that would otherwise occur to the environment or workers or the public. For example, the use of respirators by workers to eliminate ingestion of airborne contamination is mitigation.

MLW

Medium (or intermediate) level Waste contains higher amounts of radioactivity and may require special shielding. It typically comprises resins, chemical sludges and reactor components, as well as contaminated materials from reactor decommissioning.

Moderator

Moderators are used to lower ("moderate") the energies of the neutrons emitted by fissioning uranium atoms, to increase their probability of hitting another uranium atom to cause further fissioning. Graphite and light water are frequently used as moderators. CANDU reactors use heavy water as the moderator.

Monitoring and Surveillance

Monitoring and surveillance (M&S) is applied to a facility that has been decommissioned to an interim end state but has not been demolished. M&S includes radiological surveying, and inspection and maintenance of building and facility systems.

Natural End State

A state in which lands are released for unconditional public use by the CNSC and where radiation levels approximate background levels in the area.

Occurrence

The rate of recurrence of the environmental effect.

Operational Shutdown

Shutdown operations involve the closing of operations and the removal of unfixed items including furniture, chemicals and laboratory apparatus otherwise necessary to the normal operation of the facility.

Outer (Uncontrolled) Area

The outer area at Whiteshell Laboratories consists of the balance of the property outside the active and inactive areas. There should be no radiation hazards within the outer area, except while material or waste is being transported to the WMA or off-site.

Passive Operating State

This condition is instituted when a facility or system is placed in an operating state where the inventory of radiological or other hazards is managed and controlled, but no new operations are carried out involving additional inventory.

Phase

For the purposes of the Whiteshell decommissioning program, phases are time periods. For Whiteshell Laboratories, there are three proposed phases spanning a time period of sixty years and at the end of the third phase, decommissioning will be complete.

Public Registry

The public registry is a physical and electronic repository of all public information on the CSR. The maintenance of the public registry is the responsibility of the Responsible Authorities (RAs).

Radiation

Radiation refers to energy that is given off by atoms when they move or change state. It can take the form of electromagnetic waves, such as heat, light, x-rays or gamma rays and streams of particles such as alpha particles, beta particles, neutrons and protons.

Radioactive

The condition of a material exhibiting the spontaneous decay of an unstable atomic nucleus into a stable or unstable nucleus.

Radioisotopes

Atoms of chemical elements may have many isotopes (different forms) with different atomic numbers and different atomic weights. If an isotope is radioactive, it is sometimes referred to as a radioisotope.

Refurbishment

Refurbishment involves repairs and replacement of building system components integral to maintenance of a building envelope and the maintenance of its original use.

Rem

A unit of dose equivalent and effective dose equivalent. It is the non-SI unit that has been superseded by sievert. It is equal to 0.01 Sv.

Remediation

Corrective measures that are applied to reduce or eliminate an effect after an incident has occurred. For example, containing and cleaning up a spill is remediation. Remediation techniques are also used to return an uncontaminated site to a natural state.

Renewable Resources

Resources that can naturally regenerate such as forests or fisheries. With effective use and management, these resources can be harvested today while maintaining viability for continued use in the future.

Responsible Authority (RA)

The federal agency or department that is responsible under the *Canadian Environmental Assessment Act* for ensuring that the environmental assessment is conducted in accordance with the requirements of the *Act*.

Reversibility

The degree to which the effect can or will be reversed (usually measured in time it will take to restore the environment).

Roentgen (R)

A unit of exposure equal to 2.58 x 10-4 Ci/kg.

Sediment

Particulate matter that has been transported by wind, water or ice and subsequently deposited.

Scoping Survey

A radiological survey carried out to identify hazards and to estimate the level of radiation to establish safe work practices. Only a moderate amount of detail and effort are required for a scoping survey.

Scope of Environmental Assessment

The subjects identified by the RA to be addressed in the CSR.

Shutdown Operations

See Operational Shutdown.

Sievert (Sv)

A Standard International unit of measurement that is used to describe the absorption of radiation by the human body.

Site Remediation

Refers to cleaning and removal of contaminants from the soil. A remediated site has no contaminants above specified release levels.

Site Restoration

Involves returning a site insofar as is possible to its unperturbed or pre-development condition and may include re-vegetation.

Stabilization

Stabilization is a part of the remediation process. It typically refers to placement of a piece of ground into a state where it will not be affected by erosion or other physical influences.

Standpipe

Standpipes consist of vertically reinforced concrete containers lined with carbon steel pipe and covered with a concrete shielding plug. Smaller standpipe units are 0.6 m I.D. and 1.0 m O.D. with 0.5 m extension above the ground surface. Larger units are about 0.9 m I.D. and 1.3 m I.D. Older units have no steel liners. Standpipes are used to store fuel, MLW and HEPA filters.

Storm Drain System

This network of catch basins, pipes and an outfall is used to drain surface water from the site into the Winnipeg River.

Sump

A pit, depression or other structure in which water collects before being bailed or pumped out.

TLD - Thermoluminescence Dosimeter

A crystalline material, which, when heated after being exposed to radiation, emits light in proportion to the radiation dose previously received. TLD's are used to measure direct dose received by workers.

Trench

Holes of varying lengths and widths, typically 4 m in depth excavated in the WMA until about 1985 and used for storage of low-level radioactive waste.

Tritium

A radioactive isotope of hydrogen with two neutrons and one proton in the nucleus. It is both naturally occurring and produced in nuclear reactors. As well, significant amounts were generated by nuclear weapons testing in the 1950's and 60's. Its uses include biomedical research and self-illuminating devices. It has a radioactive half-life of 12.33 years.

Unaffected Land

The Unaffected Land (Figure 2.1) is the portion of the site that was not used for or impacted by nuclear operations.

Unrestricted Release

A term used to apply to buildings or real estate which the CNSC has certified as no longer requiring radiological controls.

ACRONYMS

AAF	Active Area Fence
AECL	Atomic Energy of Canada Limited
AES	Atmosphere Environment Service
ALARA	As Low As Reasonably Achievable
ALWTC	Active Liquid Waste Treatment Centre
ARMS	Ambient Radiation Monitoring Stations
CANDU	Canadian Nuclear Reactor (CANadian DeUterium)
CAP	Canister Area Perimeter
CCSF	Concrete Canister Storage Facilities
CEAA	Canadian Environmental Assessment Act
CNSC	Canadian Nuclear Safety Commission
CSR	Comprehensive Study Report
DDP	Detailed Decommissioning Plan
DFO	Department of Fisheries and Oceans
DIAND	Department of Indian Affairs and Northern Development
DRLs	Derived Release Limit
EA	Environmental Assessment
EDAW	Economic Development Authority of Whiteshell
FA	Federal Authority
FEAI	Federal Environmental Assessment Index
FIG	Field Irradiator Gamma
HEPA	High Efficiency Particulate Air
HCF	Hot Cell Facility
HLW	High Level Waste
IAEA	International Atomic Energy Agency
ICRP	International Committee on Radiation Protection
IFTF	Immobilized Fuel Test Facility
LGD	Local Government District
LLD	Lower Limit of Detection
LLLW	Low Level Liquid Waste
LLW	Low Level Waste
LSVCTF	Large Scale Vented Combustion Test Facility
M	Million as in millions of dollars
MAC	Maximum Acceptable Concentrations
MLLW	Medium Level Liquid Waste

MLW	Medium Level Waste
M&S	Monitoring and Surveillance
NO_x	Nitrogen Oxides
NRTE	Nuclear Research & Test Establishment
OCR	Organic Cooled Reactor
PCB	Polychlorinated Biphenyl
PM_{10}	Particulate Matter less than 10 microns diameter
$PM_{2.5}$	Particulate Matter less than 2.5 microns in diameter
QA	Quality Assurance
RA	Responsible Authority
RM	Rural Municipality
SF	Shielded Facility, includes the hot cell area and the IFTF
SO_2	Sulphur Dioxide
TAC	Technical Advisory Committee
TLD	Thermoluminescent Lithium fluoride Dosimeter
TSP	Total Suspended Particulate
VEC	Valued Ecosystem Component
VOC	Volatile Organic Compound
VSC	Valued Social Component
WMA	Waste Management Area
WR-1	Whiteshell Reactor-1 (organically-cooled)
ZEUS	Zoological Environment Under Stress

1.0 INTRODUCTION

1.1 BACKGROUND

Atomic Energy of Canada Limited (AECL) was established in 1952 by the Canadian government for the purposes of developing peaceful uses of nuclear energy. AECL has a staff of more than 3500 and has its head office and design and engineering centre in Mississauga, Ontario and major research laboratories in Chalk River, Ontario along with branch offices worldwide. It also has facilities at the Whiteshell Laboratories near Pinawa, Manitoba, in Montreal, Quebec and an office in Ottawa, Ontario.

Whiteshell Laboratories was established at Pinawa, Manitoba (Figure 1.1) in the early 1960s to carry out nuclear research and development activities for higher temperature versions of the Canada Deuterium Uranium (CANDU) reactor. The initial focus of research was the Whiteshell Reactor-1 (WR-1) and Organic Cooled Reactor (OCR), which began operation in 1965. The OCR program was discontinued in the early 1970s in favour of the heavy-water-cooled CANDU system. WR-1 continued to operate until 1985 in support of AECL research programs. Other programs carried out at Whiteshell Laboratories included the Nuclear Fuel Waste Management Program, SLOWPOKE Demonstration Reactor Project and various accelerator activities. Whiteshell Laboratories has a range of nuclear facilities that provided support for these and other research and development programs.

As a result of the financial impact of the federal government's program review process, AECL made a business decision in 1997 to discontinue research programs and operations at Whiteshell Laboratories. AECL and the federal government attempted unsuccessfully to find an alternative private sector sponsor that would assume the financial responsibility for site operations, facilities and programs. Subsequently, AECL received government concurrence in 1998 to proceed with actions to achieve closure of Whiteshell Laboratories. Planning is now in progress to achieve the transition from an operational state at Whiteshell Laboratories, in support of AECL's business, to a shutdown and decommissioned state that meets regulatory requirements for a licensed nuclear site.

1.2 PROJECT OVERVIEW

The Whiteshell Laboratories' decommissioning program encompasses all of the site buildings and facilities except for unaffected lands (land not used for or impacted by nuclear development or operations), where early release may be requested to meet commercialization or privatization objectives. The first task is to achieve operational shutdown of redundant nuclear research facilities. This shutdown has been initiated and will include operational cleanup and safe shutdown of redundant facilities, preparation and submission to the Canadian Nuclear Safety Commission (CNSC) of Detailed Decommissioning Plans (DDP) for approval, and preparation and submission of an environmental assessment report (i.e. this report). The Active Liquid Waste Treatment Centre (ALWTC) as well as the Waste Management Facilities, Concrete Canister Storage Facility (CCSF) and Waste Management Area (WMA), will remain in operation throughout the operational shutdown period and for the first phase of decommissioning.

The primary objective of the decommissioning program is to leave the site in a safe and environmentally sound manner. The implementation plan for the decommissioning program is highly dependent upon a number of factors. The most important is the availability of disposal facilities which dictates the time frame within which the Whiteshell Laboratories decommissioning program can be carried out to achieve a final end state (see Section 2.3.2).

1.3 PROJECT NEED AND PURPOSE

1.3.1 Need

As a result of the federal government's program review process that significantly reduced funding to nuclear research in Canada, AECL subsequently made a business decision to discontinue research programs and operations at the Whiteshell Laboratories. This closure requires a change in the nature of the licence by the CNSC to reflect the transition from Site Operations to Site Decommissioning.

1.3.2 Purpose

The purpose of the project is to safely and effectively transform the Whiteshell Laboratories from an operational state that supports AECL's business, to a shutdown and decommissioned state that meets regulatory requirements for the unrestricted release of a decommissioned nuclear site.

1.4 REGULATORY REQUIREMENTS

Whiteshell Laboratories Decommissioning Project will be required to comply with applicable federal and provincial environmental legislation and adhere to relevant environmental policies, guidelines and standards.

1.4.1 Federal Government

The Whiteshell Laboratories is owned and operated by the Crown (AECL) and is therefore subject to federal environmental legislation. The three most applicable Acts and regulations are as follows:

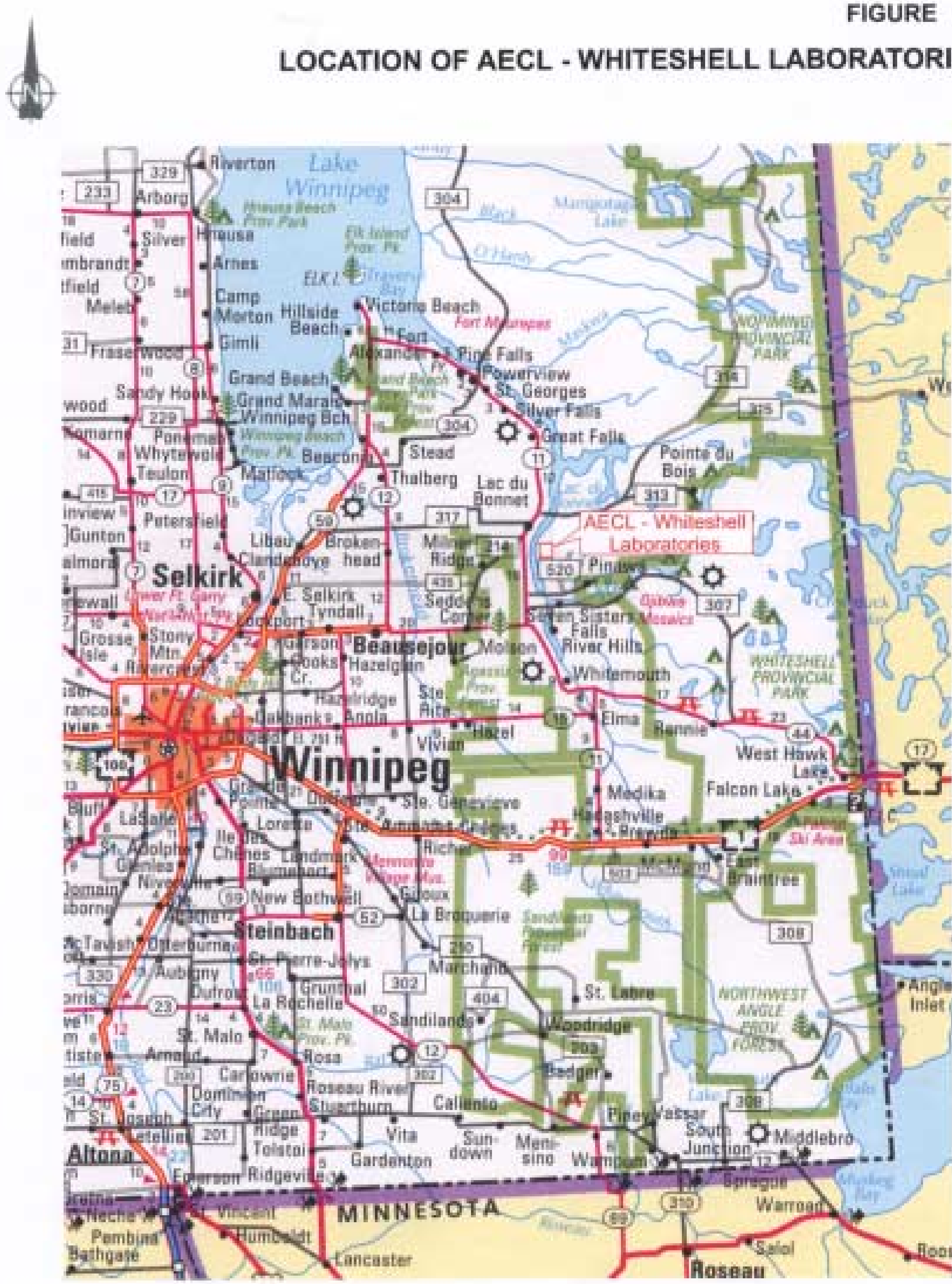
1.4.1.1 Nuclear Safety Control Act

The *Nuclear Safety and Control Act (NSCA)* took effect on May 31, 2000 and replaced the *Atomic Energy Control Act*. The CNSC regulates the use of nuclear energy and materials in Canada to protect human health, safety, security and the environment, and to respect Canada's international commitments on the peaceful uses of nuclear energy. The mandate of the CNSC has evolved from national security concerns to the control of the health, safety and environmental consequences of nuclear activities.

With the *Nuclear Safety and Control Act* taking effect, the Atomic Energy Control Board became the Canadian Nuclear Safety Commission. Relevant regulations under the *Nuclear Safety and Control Act* include:

FIGURE 1.1

LOCATION OF AECL - WHITESHELL LABORATORIES



- General Nuclear Safety and Control Regulations.
- Radiation Protection Regulations.
- Class I Nuclear Facilities Regulations.
- Nuclear Substances and Radiation Devices Regulations.
- Packaging and Transport of Nuclear Substance Regulations.
- Nuclear Security Regulations.

The document *Decommissioning Planning for Licensed Activities*, Regulatory Guide G-219, describes the CNSC's requirements concerning the planning of decommissioning activities.

1.4.1.2 Canadian Environmental Assessment Act

The *Canadian Environmental Assessment Act (CEAA)* establishes the process to assess the environmental effects of projects requiring federal actions or decisions. *CEAA* is designed to ensure that the environmental effects of projects are considered as early as possible in a project's planning stage. Application of *CEAA* to the Whiteshell Laboratories Decommissioning Project is discussed below.

Whiteshell Laboratories Decommissioning Project

Decommissioning of the Whiteshell Laboratories is an activity in relation to a physical work (i.e. a project) under *CEAA* and is subject to environmental assessment requirements of the *CEAA*. Where *CEAA* applies, the responsible authority must make a decision on the results of an environmental assessment before it can exercise a power, function or duty of a type set out in section 5 of the *CEAA*, such as issuing a prescribed regulatory approval, or providing federal funds or lands that would allow the project to proceed.

Proponent

The proponent of the Whiteshell Laboratories Decommissioning Project is AECL.

Section 5 Trigger

The amendment to the Whiteshell Laboratories licence to allow for decommissioning of the Whiteshell Laboratories will be made under subsection 24(2) of the *NCSA*.

With the advent of the NSCA, consequential amendments to the regulations under the *CEAA* will be needed to replace references to the *Atomic Energy Control Act* and its regulations by appropriate references to the provisions of the NSCA. Until these amendments are put in place, Section 44 of the Interpretation Act deems references to the former legislation to be references to the analogous provisions of the NSCA.

In this case, the former provision authorizing the licence amendment was subsection 27(1) of the Atomic Energy Control Regulations, which was listed as a *CEAA* trigger under the Law List Regulations. Reading the NSCA in analogous fashion, the present renewal is a trigger for the *CEAA* under the Law List Regulations.

Furthermore, should the assessment determine that the project is likely to harmfully alter, disrupt or destroy fish habitat, an authorization under section 35(2) of the *Fisheries Act* may be required. The granting of such an approval is also prescribed in the *CEAA* Law List Regulations as a trigger for an environmental assessment.

Responsible Authority

The Responsible Authorities (RAs) for the Whiteshell Laboratories Decommissioning Project are the CNSC and the Department of Fisheries and Oceans (DFO). The Canadian nuclear industry is monitored and regulated by the CNSC, a federal nuclear control agency, answerable to the Canadian Parliament. DFO's interest lies in possible effects on the Winnipeg River. There are no other RAs for the project.

Environmental Assessment Track

Decommissioning of the Whiteshell Laboratories has been determined by the CNSC to require a Comprehensive Study environmental assessment under *CEAA*. Decommissioning of the WR-1 nuclear reactor, which is included in the project scope, is referenced under Part VI, Section 19, Subsection (d) of the Comprehensive Study List Regulations of *CEAA*. The environmental assessment is required to address Section 16 (1) and (2) factors under the *Act*.

Expert Federal Authorities

Pursuant to the Federal Co-ordination Regulations under the *CEAA*, the following expert federal authorities likely to have an interest in the decommissioning project include:

- Environment Canada.
- Health Canada.
- Natural Resources Canada.
- Western Economic Diversification Canada.

Public Registries

The CNSC, as the lead RA, established and maintains a public registry for the Whiteshell Laboratories Decommissioning Project in accordance with *CEAA* requirements. This involves the registration of the project on the Federal Environmental Assessment Index (FEAI reference no. 18737) and maintaining public access to all documents related to the environmental assessment. The FEAI can be accessed through the *CEAA*, CNSC and AECL web sites. Manitoba Conservation also established a public registry for the project (File no. 4479.00) with registry locations at the Pinawa Library, Winnipeg Centennial Library and Manitoba Conservation Resource Centre in Winnipeg.

1.4.1.3 Fisheries Act

The *Fisheries Act* is administered by the Ministers of Fisheries and Oceans. The *Fisheries Act* regulates the protection of fishes and fish habitat and prohibits deposition of deleterious substances into waters frequented by fish. Disturbance to or alteration of fish habitat in the Winnipeg River may require issuance of an authorization under the *Fisheries Act*.

1.4.2 Provincial Government

The Manitoba Conservation Department has been notified of the federal environmental assessment to be conducted for this project. Decommissioning of the Whiteshell Laboratories is not considered by Manitoba Conservation to be a development under the *Manitoba Environment Act*. However, under the Canada-Manitoba Agreement for Environmental Assessment Harmonization, information on the decommissioning project has been provided to Manitoba Conservation by the Canadian Environmental Assessment Agency, and provincial technical staff have been invited to participate in the technical review of the assessment. Manitoba Conservation has formed a Technical Advisory Committee (TAC) to maintain awareness of the environmental and socio-economic implications of the decommissioning activities and to provide advice to the Director and the Minister of Manitoba Conservation.

There are some restrictions on the storage of radioactive waste in Manitoba. *The Manitoba High Level Radiation Waste Act* limits the interim or permanent storage of radioactive wastes to those produced from research conducted in Manitoba.

Decommissioned lands released for unrestricted use will be transferred to the Manitoba provincial government and will be subject to provincial legislation. Developments proposed for these lands that are listed in the Classes of Development Regulations under the *Manitoba Environment Act* require licensing under that *Act*. Environmental assessments will be required for listed developments.

1.5 AECL COMMITMENTS

AECL, as holder of the Whiteshell Laboratories site licence, has made the following commitments:

- AECL is committed to conducting all decommissioning activities to ensure health and safety of workers, the public and protection of the environment.
- AECL is committed to ensuring that the funding to meet the Whiteshell Laboratories decommissioning requirements is identified as a component of the segregated appropriation for decommissioning from the Treasury Board.
- AECL is committed to meeting all applicable regulatory, safety and environmental requirements throughout the decommissioning process.
- AECL has retained key individuals to develop and initiate its decommissioning program. AECL is committed to maintaining required resources on its decommissioning team.

- AECL is committed to maintaining fully trained and qualified staff to meet security requirements.
- AECL is committed to maintaining an environmental monitoring program for as long as wastes requiring management remain at the site.
- AECL is committed to the involvement of local communities in the environmental monitoring program.
- AECL will implement mitigation measures for project activities where an evaluation of decommissioning activities has determined the need for mitigation.
- AECL is committed to maintaining monitoring and surveillance programs for all nuclear facilities and affected lands until the final end state is achieved.
- AECL is committed to an ongoing communication program with area communities and other stakeholders and supports the establishment of a Public Advisory Committee during the decommissioning program.

1.6 SCHEDULE

1.6.1 Comprehensive Study Report

The technical work supporting the preparation of the draft Comprehensive Study Report (CSR) was completed in December 1999. From January through March 2000 the document underwent project team review and review by the AECL Safety Review Committee. Following a technical review of the draft report by the CNSC, Federal Authorities and Manitoba Conservation, the CSR was revised to address technical comments. Written comments from the public were requested and incorporated into the draft report as appropriate. The final Comprehensive Study Report is then submitted to the Canadian Environmental Assessment Agency for further public review. In turn, the Agency makes a recommendation regarding approval of the CSR to the Minister of the Environment.

1.6.2 Decommissioning

The initial requirement for Whiteshell Laboratories is to achieve operational shutdown of redundant research facilities, prepare a submission of detailed decommissioning plans to the CNSC for approval and prepare the comprehensive study environmental assessment report. On completion of operational shutdown, AECL will need to have resolved any revisions to the licensing structure for the site and have received approval of the detailed decommissioning plans taking into account mitigation measures and follow-up requirements of the environmental assessment.

1.7 LICENSING

The Whiteshell Laboratories are currently regulated under CNSC Operating Licence NRTEOL-2.00-2002. This licence contains conditions for operation of nuclear and other related facilities. Decommissioning of any facilities at the Whiteshell Laboratories will require the prior approval of the CNSC. The future licensing strategy includes revocation of the current Operating Licence and the issuance of a Decommissioning Licence that will allow decommissioning and designated operating activities to proceed.

1.8 Planning Responsibilities (AECL)

Detailed planning and execution of the decommissioning program is carried out by AECL's Facilities and Nuclear Operations Unit. The organization implementing the decommissioning plan consists of a Program Manager, Licensing Manager, Decommissioning Operations Manager, Project Team Leaders and representatives from key AECL support functions. Once decommissioning of a facility is implemented, responsibility for safety of that facility is transferred from the Facility Authority to the Decommissioning Authority.

1.9 Report Organization

The Comprehensive Study Report is organized into the following sections:

1.0 – Introduction: Provides an overview of the Whiteshell Laboratories Decommissioning Project, describes the need and purpose for the project, outlines regulatory requirements and AECL's commitments, presents the schedule for the Comprehensive Study Report and for decommissioning licensing requirements and responsibilities.

2.0 – Scope of Assessment: Discusses the scope of the project and assessment, identifies issues to be addressed in the Comprehensive Study Report and describes spatial and temporal boundaries for the environmental assessment.

3.0 – Alternatives: Discusses alternative means of carrying out the project and presents a preferred alternative.

4.0 – Project Description: Describes Whiteshell Laboratories' site and associated buildings and facilities, describes the proposed decommissioning project, and presents the approach for decommissioning.

5.0 – Description of Existing Environment: Describes the biophysical and socio-economic environment in which the decommissioning project will be carried out and identifies Valued Ecosystem Components and Social Components to be assessed.

6.0 – Assessment of Environmental Effects and Mitigation: Evaluates environmental and socio-economic effects by environmental component for the preferred alternative including effects of accidents and malfunctions and effects of the environment on the project. Mitigation measures to address any adverse environmental effects are outlined and a statement of residual effects is presented.

7.0 – Significance of Residual Effects: Analyzes significance of residual environmental effects for the Whiteshell Laboratories Decommissioning Project.

8.0 – Cumulative Environmental Effects: Assesses environmental effects of decommissioning project in conjunction with effects from other activities in the area.

9.0 – Follow-up Program: Describes the follow-up program for the decommissioning project including monitoring, surveillance and inspection, as well as responsibilities for implementation and reporting.

10.0 – Public Consultation: Outlines the public consultation program developed for the Whiteshell Laboratories Decommissioning Project, describes public and First Nation consultations carried out and discusses issues raised and responses provided.

11.0 – Conclusions: Discusses the acceptability of residual environmental effects, identifies outstanding issues and proposes actions to address them.

2.0 SCOPE OF PROJECT AND ASSESSMENT

The scope of the project, and scope of the assessment were defined by the CNSC in accordance with Sections 15 and 16 of *CEAA* (Appendix A).

2.1 SCOPE OF THE PROJECT

The scope of the project refers to the various components of the proposed undertaking that will be considered as the project for the purposes of the environmental assessment. The project is the decommissioning of the Whiteshell Laboratories, which includes the following nuclear facilities (listed in Appendices A and C of the site licence NRTEOL-2.00-2002):

- Shielded Facility.
- Concrete Canister Storage Facility.
- Waste Management Area.
- Active Liquid Waste Treatment Centre.
- Van de Graaff Accelerator.
- Neutron Generator.
- Whiteshell Reactor (WR-1).

All buildings and infrastructure on the site are included in the project.

Land under CNSC licence, identified as being affected or potentially affected by nuclear development and/or operations, is also included in the project scope. Land which is not connected or associated with any nuclear development or operations and which is not linked to the decommissioning project is not within the scope of the project. This includes a large portion of land currently under the CNSC licence. The approximately 4375 ha (10,800 acres) currently under CNSC licence, was originally selected to provide an appropriate exclusion zone when the WR-1 reactor and site facilities were in full operation. The use of this area for that purpose is no longer required. The Project Study Area map (Figure 2.1) defines the boundaries between the decommissioning project and the licensed project study areas.

Decommissioning activities consist of the dismantling and/or decontamination and refurbishment of all structures, infrastructure and services and the remediation of all lands in the project area, except for 8 ha where continued management of radioactive waste under CNSC licence is proposed to continue in the future. Decommissioning is intended to render the aforementioned facilities, buildings and lands to a condition acceptable for release from CNSC licensed control. The project also includes on-site sorting, segregation, decontamination and interim storage of all materials either currently in storage, or arising from decommissioning activities. Areas where waste management activities are proposed to continue will remain under a CNSC licence and will not be released for unrestricted use.

The project does not include the Underground Research Laboratory (not licensed by CNSC), nor does it include the Whiteshell Irradiator (which is under a CNSC licence held by ACSION).

The CSR does not include the analysis of environmental effects from investigations to identify, delineate or evaluate potential existing contamination that is required to maintain site safety and conduct the environmental assessment. It also does not include the various operations, monitoring and surveillance activities currently authorized under the operating licence.

The long-term management of nuclear wastes is contingent upon finding a nationally acceptable solution consistent with federal policy on waste management. No options or sites have been defined or approved that will provide such a solution. Consequently, it is not possible to examine long-term waste management alternatives as part of the scope of the Whiteshell Laboratories Decommissioning Project.

2.2 SCOPE OF THE ASSESSMENT

The environmental assessment of the proposed project includes a consideration of factors detailed in the CNSC's Scope of Assessment document (CNSC 1999) and of the following factors identified in paragraphs 16(1)(a) to (d) and 16(2)(a) to (d) of *CEAA*:

- purpose of the project;
- alternative means of carrying out the project that are technically and economically feasible and the environmental effects of any such alternatives;
- environmental effects of the project, including the environmental effects of malfunctions or accidents that may occur in connection with the project and any cumulative environmental effects that are likely to result from the project in combination with other projects or activities that have been or will be carried out;
- socio-economic effects caused by a change in the environment due to the project;
- significance of the effects;
- comments from the public that are received in accordance with *CEAA* and its regulations, during the scoping, conduct and review of the environmental assessment;
- measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the project;
- requirements of a follow-up program in respect of the project; and
- sustainability of renewable resources, including effects on the capacity of renewable resources that are likely to be affected by the project.

In accordance with subsection 16(1)(e) of the *CEAA*, the assessment also includes a consideration of the following matters considered relevant by the CNSC:

- description of the decommissioning project;
- description of the existing environment which may reasonably be expected to be affected by the project; and
- program for consultation with the community and other stakeholders on the project, and for addressing issues raised by the public that are within the scope of this assessment.

2.3 BOUNDARIES

2.3.1 Spatial

The environmental assessment of the proposed Whiteshell Laboratories Decommissioning Project was conducted based on four geographic study areas as follows.

2.3.1.1 Project Study Area

The Project Study Area encompasses all facilities, buildings and infrastructure, including lands, that are directly connected or associated with the decommissioning project as described under the scope of the project (Figure 2.1). This area includes the active and controlled areas as well as the Waste Management Area and Concrete Canister Storage Facility.

2.3.1.2 AECL Licensed Study Area

The Licensed Study Area is the area within the property boundaries of Whiteshell Laboratories (Figure 2.2). The property is located approximately 10 km west of Pinawa and north of Highway 211, and includes lands on both the east and west side of the Winnipeg River. The property covers 4375 ha. The eastern area's southern boundary starts just north of Highway 211 and the property line extends north for about 7.1 km. Across the river, Highway 11 passes through the centre of the western area, which is directly across from the hub of the facility's buildings and stretches 3.5 km along the riverbank. The majority of the Whiteshell Laboratories facilities fall within a 40 ha area, adjacent to the east shore of the Winnipeg River. The lagoon is 300 m north of the main laboratory. The Waste Management Area (WMA), Large Scale Vented Combustion Test Facility (LSVCTF), landfill, and Field Irradiator Gamma (FIG) areas fall between 1 and 3 km north-east of the main area of buildings.

2.3.1.3 Local Study Area

The Local Study Area includes the Rural Municipality of Lac du Bonnet, the Local Government District of Pinawa and the north part of the Rural Municipality of Whitemouth (Figure 2.2). The area includes the communities of Pinawa, Seven Sisters Falls, River Hills, McArthur Falls, and Lac du Bonnet. It includes a north-south reach of the Winnipeg River, the Pinawa Channel and the Underground Research Laboratory.

2.3.1.4 Regional Study Area

The Regional Study Area is the area approximately bounded by the east-west extension of Highway 15 in the south, Traverse Bay of Lake Winnipeg in the north, Highway 12 north of Anola to Grand Beach in the west and north of Rennie to Pointe du Bois in the east (Figure 2.3). The area includes the Local Study Area communities, as well as Beausejour, Pine Falls, Great Falls and Whitemouth, and Sagkeeng and Brokenhead First Nations. It includes parts of Whiteshell and Nopiming Provincial Park, Grand Beach Provincial Park, and a portion of the Winnipeg River watershed.

2.3.2 Temporal

The time frame for the environmental assessment is dependent on the duration of the decommissioning program, as well as the subsequent period of control over the wastes and facilities proposed to remain on site prior to transfer to a permanent disposal facility or other nationally acceptable long-term solution to the management of radioactive wastes.

The implementation plan for the decommissioning program is highly dependent on a number of key factors, namely:

- identification, characterization and safety assessments for site hazards;
- development of detailed plans and procedures;
- waste management policy and structure which allows definition of a suitable end-state; specifically, availability of waste disposal or suitable storage alternatives;
- satisfactory completion of the regulatory approvals process, including an environmental assessment; and
- implementation and control of the decommissioning process.

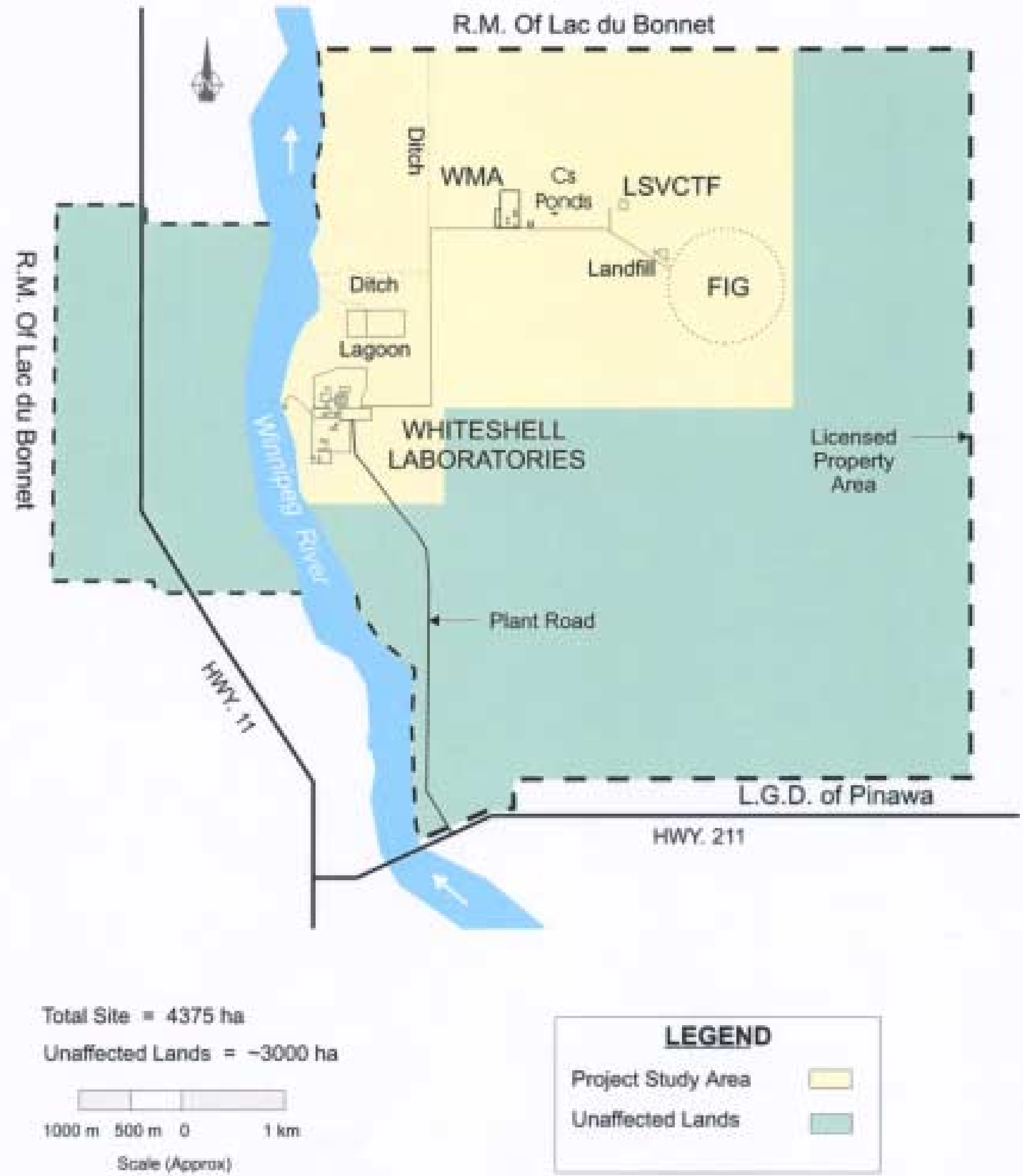
These factors dictate the time frame within which the decommissioning program can be carried out to achieve a final end-state. Many project components must be addressed in a sequential manner since support facilities (waste management areas, decontamination facilities, site service infrastructure) are required to remain in operation to support the initial decommissioning activities. This requires optimization of resources/project teams to develop the hazards characterizations, plans and approvals necessary to implement the project in a sequential manner. Since disposal is not available, the remaining life cycle of the existing buildings and infrastructure is taken into account to control liabilities/hazards for an interim period.

Depending on the alternative selected for decommissioning, the time frame for the project ranges from 20 years to 100 years.

In addition to the time frame of the project as described above, the temporal boundaries of the assessment were considered to be flexible to ensure that the duration of any significant effects beyond the project time frame would be fully characterized.

FIGURE 2.1

PROJECT STUDY AREA



AECL EACL

WHITESHELL LABORATORIES DECOMMISSIONING
ENVIRONMENTAL ASSESSMENT

FIGURE 2.2

LOCAL STUDY AREA

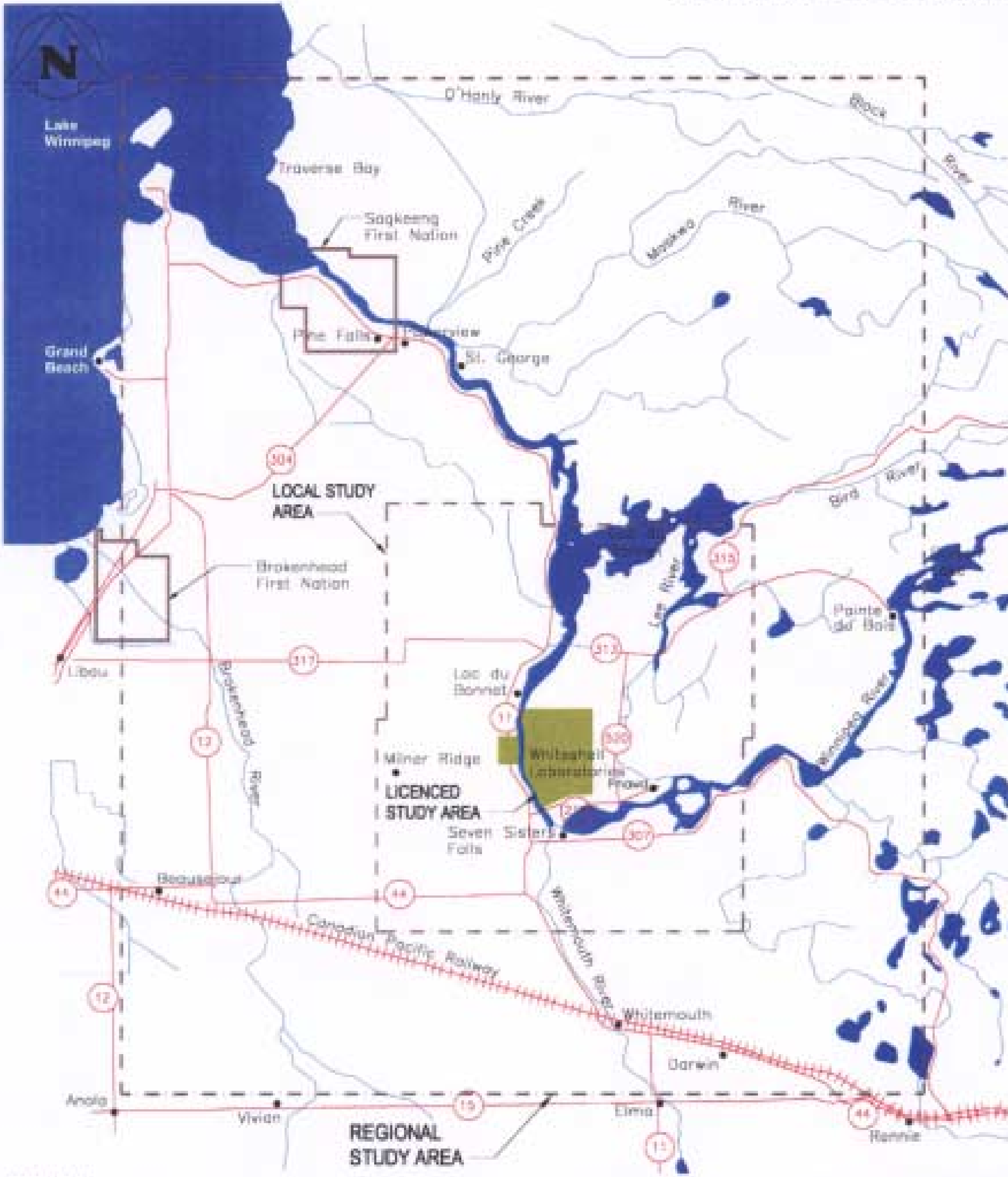
SOURCE:
PROVINCE OF MANITOBA 1 : 1 000 000
TOPOGRAPHIC BASE MAP UNIVERSAL
TRANSVERSE MERCATOR PROJECTION
ZONE 14 NORTH AMERICAN DATUM 1983

AECL EACL

WHITESHELL LABORATORIES DECOMMISSIONING
ENVIRONMENTAL ASSESSMENT

FIGURE 2.3

REGIONAL STUDY AREA



SOURCE:
PROVINCE OF MANITOBA 1 : 1 000 000
TOPOGRAPHIC BASE MAP UNIVERSAL
TRANSVERSE MERCATOR PROJECTION
ZONE 14 NORTH AMERICAN DATUM 1983

AECL EACL

WHITESHELL LABORATORIES DECOMMISSIONING
ENVIRONMENTAL ASSESSMENT

3.0 ALTERNATIVES

3.1 INTRODUCTION

CEAA identifies two types of alternatives which can be considered in an environmental assessment; these are "alternatives to" the project and "alternative means" of carrying out the project. Alternatives to the project are functionally different ways to meet the need and achieve the project purpose. "Alternative means" of carrying out the project are methods of a similar technical character or methods that are functionally the same. They illustrate the variety of ways a project can be undertaken and refer to such factors as location, technologies, designs, and economic feasibility.

Since shutdown facilities cannot remain in a monitoring state indefinitely, their ultimate decommissioning is unavoidable. Moreover, the CNSC's regulatory policy on decommissioning imposes obligations on the licensee to retire facilities permanently in the interest of health, safety, security and protection of the environment. Therefore, decommissioning of the Whiteshell Laboratories is necessary and there is no alternative to that undertaking. Thus, only alternative means of carrying out the project have been assessed in this study. The primary difference between alternative means is the implementation time for individual phases. The only difference in delivery is in the optimization of individual project components which are described in Section 4.0.

3.2 ALTERNATIVE MEANS OF CARRYING OUT THE PROJECT

Public input in the local area indicated interest in a rapid (5 years or less) decommissioning program for Whiteshell Laboratories. This approach was not considered for further assessment, since it was deemed to be unrealistic in terms of the time frame to deliver the decommissioning program, optimization of resources and the availability of waste disposal (Helbrecht 1999). Consequently three alternative means were established and evaluated for economic and technical feasibility, public concern and environmental effects.

- Alternative 1 - End state in a Short time period (20 years).
- Alternative 2 - End State in a Long Time Period (100 years).
- Alternative 3 - End-state in a Moderate Time Period (60 years).

All alternatives include a period of waste storage on site with transfer to an off-site waste disposal facility when it becomes available. The establishment of an off-site waste disposal facility is not within the scope of this project. Table 3.1 provides criteria for assessing alternatives.

Table 3.1
Criteria for Assessing Alternatives

Criteria	Definitions
Economic Feasibility	How does each alternative compare in relation to the cost of the project activity? Economic Feasibility Good, Moderate, or Poor
Technical Feasibility	Are off-site waste disposal facilities available? Are there different occupational safety risks associated with each alternative? Technical Feasibility – Yes, No or Undetermined
Public Concern	Is there public concern for each alternative? Public Concern – High, Medium or Low
Environmental Effects	What are the likely environmental effects associated with each alternative? Include the time for which the alternative to the project will satisfy the need and purpose of the project. Environmental Effects – Adverse, Beneficial or Undetermined

Source: Canadian Environmental Assessment Agency 1998.

An outline of each of the alternative means is provided in Sections 3.2.1 to 3.2.3.

3.2.1 Alternative 1 - End State in a Short Time Period

This alternative proposes that Whiteshell Laboratories be decommissioned over a relatively short time period (approximately 20 years). The time frame provides sufficient time to meet characterization, safety assessment and planning/approval requirements needed to implement the project work. Twenty years would allow time to assess wastes and to differentiate the wastes that can be managed in-situ at the site from those that will require removal to disposal or alternate storage.

The approach assumes that a radioactive waste disposal repository would be available within 10 years. The Whiteshell Laboratories' facilities would initially be decommissioned to a safe monitoring and surveillance state. Once waste disposal facilities are available, the final decommissioning phase would be completed. The waste would be removed to disposal throughout the subsequent 10-year time period.

This alternative presents substantial risks in that waste disposal facilities which are outside the control of the Whiteshell Laboratories management program, may not be available.

3.2.2 Alternative 2 – End State in a Long Time Period

This alternative proposes decommissioning of Whiteshell Laboratories over as long a period as necessary to implement national waste disposal policies. The assumption is that the longest this process would take is 100 years. As in Alternative 1, the initial work would involve placing site facilities in a secure monitoring and surveillance state. It is likely that all waste disposal requirements could be optimized as part of the national program. Implementation would occur in three phases followed by an institutional control period:

Phase 1 – Activities directed toward nuclear and radioisotope buildings and facilities in order to place them in a safe, secure, interim end state. The Van de Graaff Accelerator and the Neutron Generator would be completely decommissioned. Phase 1 would be completed in approximately six years.

Phase 2 – Regular monitoring and surveillance of all buildings and facilities project activity would be focussed on the Waste Management Area (WMA). Most waste management facilities would be placed in a passive operational state and interim processing, handling and storage facilities, required during monitoring and surveillance and decommissioning project activities, would be established. Phase 2 would be followed by a deferment period of approximately 45 years during which site monitoring and surveillance would be maintained.

Phase 3 – Activities directed to bringing the site to a final end state that would fulfil all pertinent regulatory and national policy requirements. Phase 3 would involve decommissioning to a final end-state within 100 years. The site would be decommissioned to an unrestricted release state except for some parts of the Waste Management Area which would be disposed of in-situ. Some infrastructure refurbishment and rebuilding may be required to maintain the facilities under monitoring and surveillance for the 45 year deferment period and beyond, resulting in increased volumes of rubble during the final decommissioning.

Institutional Control Period – The three phases of decommissioning activities will be followed by a period of institutional control where the performance of the remaining in-situ disposal components (low-level waste trenches) are monitored and controlled. The institutional control activities are designed to demonstrate that the in-situ components perform in the manner predicted in the related safety assessments and to ensure that there is no development or intrusion into affected areas until the hazards have been reduced to acceptable levels. For Whiteshell Laboratories, this period is expected to extend for approximately 200 years beyond the physical project work.

3.2.3 Alternative 3 - End State in a Moderate Time Period

This alternative proposes that Whiteshell Laboratories be decommissioned over an intermediate time frame (approximately 60 years). The time frame is based on the concept that safety and costs can be optimized by taking advantage of natural radioactive decay and by decommissioning buildings as they come to the end of their economic and structural life. It is also based on the assumption that national waste disposal facilities would be available for low-level waste by 2025 and high level waste by 2050. Decommissioning would be carried out in three phases.

The phasing for Alternative 3 is identical to that for Alternative 2 with the following exceptions:

- the deferment period following Phase 2 would be eliminated;

- Phase 3 decommissioning would be carried out over the period 2015 to 2060; and
- the timing and sequence of decommissioning activities would be determined largely by the availability of disposal facilities and by the age and condition of engineered structures and buildings.

This alternative has the advantage of presenting a feasible approach that is planned in accordance with assumptions for disposal space for Whiteshell Laboratories waste. The approach also achieves maximum cost-efficiency since it capitalizes on existing engineered services and building envelopes to (i) monitor liabilities in the interim, and (ii) schedule final decommissioning for individual facilities based on the expected life span of structures. It also minimizes the production of new waste from refurbishment or construction required to maintain facilities over a lengthy deferment period.

If off-site waste disposal becomes available earlier, all site facilities except those which provide radioactivity decay benefits (e.g. WR-1 and some WMA wastes) could be decommissioned earlier. On the other hand, should offsite waste disposal availability take longer than assumed, the contingency would be to revert to Alternative 2.

3.3 COMPARISON OF ALTERNATIVES

Results of a comparative evaluation of economic feasibility, technical feasibility and public concern are summarized in Table 3.2. The qualitative terms “high”, “medium” and “low” are applied to public concerns; “good”, “moderate”, and “poor” are applied to economic feasibility. Technical feasibility is expressed as either feasible (Yes) or not feasible (No). The relative environmental effects of the three alternatives are evaluated and compared in Section 3.4.2.

Table 3.2
Comparison of Alternative Means of Carrying Out the Project

Alternatives	**Criteria**		
	Economic Feasibility	**Technical Feasibility**	**Public Concern**
Alternative 1 **End-State in a Short Time Period**	***Poor*** Very high decommissioning costs Property maintenance costs low.	***No*** Off-site disposal facility unlikely to be available. Shorter time for radioactivity decay results in high occupational safety risk.	***Low*** Meets public request to clean-up site as soon as possible. Maximizes availability of land for re-development.
Alternative 2 **End-State in a Long Time Period**	***Moderate*** Reduced decommissioning costs High site maintenance costs Increased waste handling costs.	***Yes*** Off-site waste disposal most likely to be available. Longest time for radioactive decay. Lowest occupational safety risk.	***High*** Wastes remain on site for long period - Perceived safety issues. Delays availability of some site land of redevelopment.

Alternative 3 **End-State in a Moderate Time Period**	***Good*** Lowest decommissioning costs Moderate site maintenance costs Lowest waste handling costs.	***Yes*** Off-site waste disposal likely to be available Sufficient time for radioactive decay Low occupational safety risk.	***High*** Wastes remain on site for long period - Perceived safety issues Delays availability of some site land for redevelopment

The main difference between the three alternative means of decommissioning the Whiteshell Laboratories is the time involved. The steps to completing decommissioning of the site and the proposed end-state are virtually the same for the three alternatives considered. It is understood that the public preference is for an early and complete decommissioning, that is, Alternative 1. That approach appears to have two limitations. One relates to the short period for deriving benefits from natural radioactive decay; the other to the unavailability of a site or facilities for disposal of radioactive wastes. Alternatives 2 and 3 offer longer time frames to complete the project, allowing optimization of radioactivity decay and the avoidance of double handling by moving wastes directly to disposal facilities.

It should be noted that although WR-1 is used as the example for the safety and cost discussion relative to project implementation, the same argument can be made for intermediate-level wastes stored in engineered facilities at the Waste Management Area and for decommissioning waste arising from other nuclear facilities. This constitutes an additional volume of ~ 2800 m^3 of waste which was produced through the WR-1 experimental program. This waste has the same characteristics as the WR-1 decommissioning waste and presents similar benefits from optimization of radioactivity decay.

At shutdown in 1985, radiation fields of reactor vault components in WR-1 were approximately 500 Gy/h (50,000 R/h). The radiation levels were estimated by activation calculations based on the irradiation history of the reactor and were verified through direct measurements taken in representative fuel channel locations (McIlwain 1992). The radiation fields resulted from the activation of the main reactor core materials, the stainless steel calandria, the mild steel of the reactor thermal shield and from the stainless steel ozhenite and zirconium-niobium fuel channels.

There are varying degrees of benefit from natural radioactivity decay dependent on the proposed handling and disposition of individual component materials. For example, the most significant decay from fuel channels has already been achieved during the first 15 years following shutdown. On average, the radioactivity decays by a factor of over 1,000 commencing at shutdown through a deferment period of ~ 50 years. Approximately one-tenth of that decay has already been achieved. However, the reactor thermal shield and the stainless steel calandria vessel radiation levels will decrease by an additional factor of about 100 by 2050. These two components are particularly important from a decay benefit perspective since handling these materials to disposal is extremely labour intensive. The material must be segmented to remove it from the core. Therefore, the radiation levels at the time the work is implemented are critical in controlling the project cost and in managing worker doses. The availability of disposal facilities is also a critical factor to consider. Without a disposal facility double handling occurs resulting in additional dose to workers since materials are initially transferred to storage facilities and ultimately to disposal.

Figures 3.1, 3.2 and 3.3 show the decay curves for the core component materials. The reference material (McIlwain 1992) provides additional detail on the radioactivity decay characteristics.

The main benefit of a radioactivity decay period is provided through the decay of the shorter half-life radioisotopes ^{60}Co, ^{55}Fe, ^{54}Mn, ^{125}Sn, and ^{125m}Te. After about 50 years, the radiation fields in the reactor vault are dominated by the long-lived radioisotopes, ^{94}Nb, ^{63}Ni, ^{14}C and there is limited benefit to further deferment.

It is important to note that the reactor vault is a highly shielded structure which provides a high integrity storage location for the activated components until waste disposal is developed in Canada. In fact there are currently no available storage structures in Canada which can accommodate the activated WR-1 vault components. Consequently the best storage location for the fuel channels is the reactor vault until optimum decay is achieved for the entire activated inventory. Radiation fields outside the reactor vault are generally low (< 10 mrem/hr) and are easily manageable during the monitoring and surveillance period.

Handling of the highly radioactive materials places economic and safety limitations on the implementation of the decommissioning program. Although doable, removal of highly radioactive material prior to optimizing radioactive decay, dramatically increases the cost to maintain worker safety. The additional shielding and remote handling required is estimated to add between \$40M and \$80M to the reference project cost.

Similarly, the unavailability of disposal facilities impacts cost and worker safety. To provide interim storage space requires the construction of high integrity shielded facilities estimated to add between \$20M and \$40 M to the reference cost of the decommissioning project. The double handling to move materials to disposal adds an additional \$10M to \$20M to the reference cost of the project and contributes to significant additional dose to workers.

Figure 3.1
Decay Curves to the Stainless Steel Calandria Vessel and The Mild Steel Radial Thermal Shield (per kg Steel)
(Reactor shutdown in 1985)

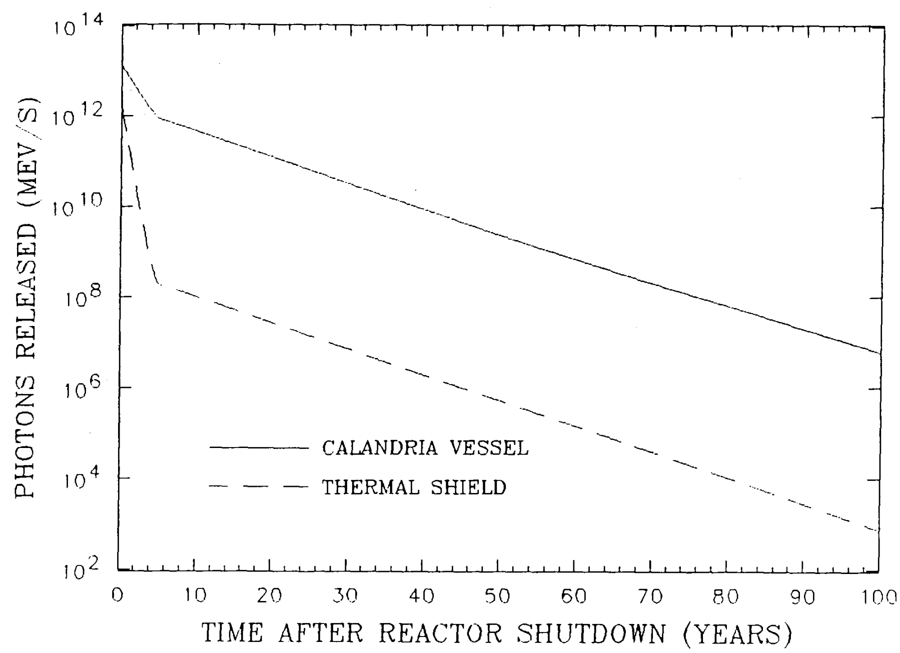


Figure 3.2
Decay Curves for the Steel Fuel Channels and the Steel Calandria Vessel (per kilogram)
(Reactor shutdown in 1985)

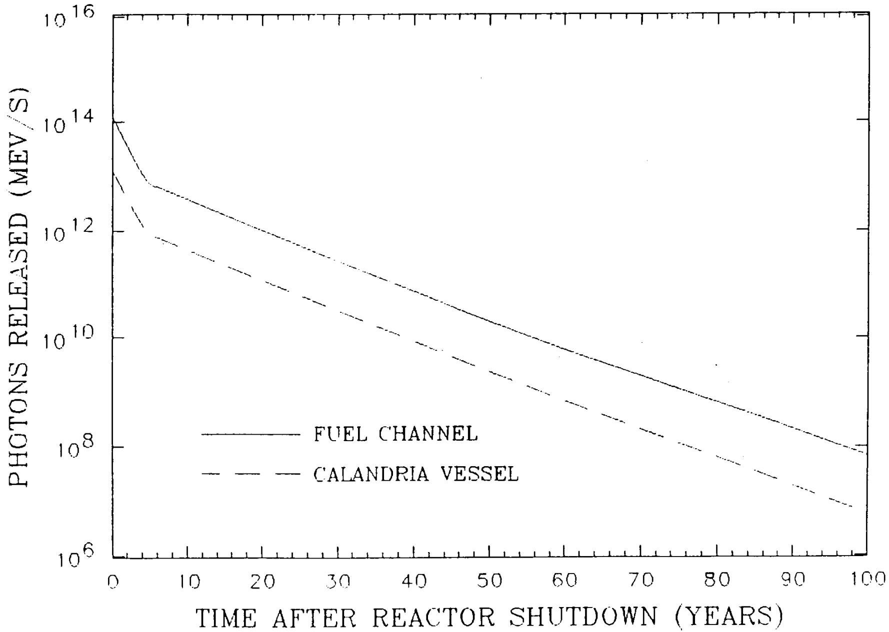
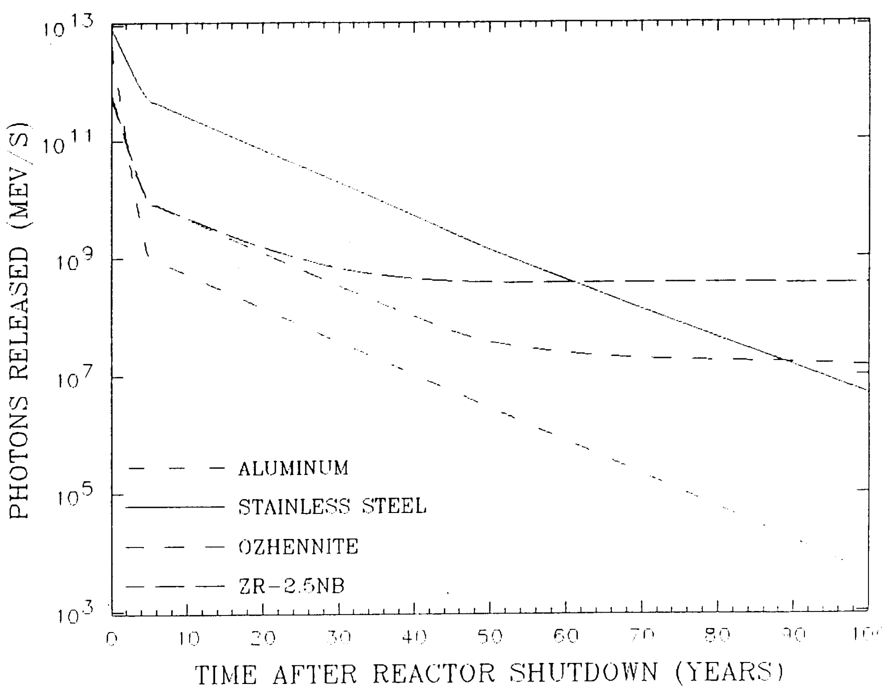


Figure 3.3
Decay Curves for the Fuel Channel and Calandria Tubes (per centimetre height)
(Reactor shutdown in 1985)



The management of the irradiated fuel inventory currently stored in concrete canisters at Whiteshell Laboratories until disposal facilities become available also provides an economic benefit. The canister life safely extends to at least 2050. Although, handling equipment does exist to allow transfer to another location, the construction of replacement interim storage and the associated double handling would add approximately \$20M to \$30M to the reference project cost.

Alternative 3, (60 years) is the reference option and represents the baseline project cost. Alternative 1 (20 years) would incur the highest overall additional cost to complete the project. Although the M & S cost (approximately \$2M/a) would be lower by ~ \$40M, the remote handling and interim storage costs would increase the reference project cost in the range of \$90M to \$170M for an overall increase of between \$50M and \$130M.

Alternative 2 (100 years), would incur no additional cost for interim storage or remote handling beyond those already estimated in the reference option because there is limited benefit from additional radioactivity decay. However, the M & S costs (approximately \$2M/a) would be higher by ~ \$80M because of the increased project time frame. As well, most buildings housing nuclear facilities on the site would have exceeded their economic and structural life span and would require extensive replacement. This would add ~ \$28M to overall project cost (estimated at about \$2000/m^2 for the basic building footprint space of 14,000 m^2 occupied by nuclear facilities). The rebuilding would also increase the amount of waste which ultimately requires disposal. The cost of Alternative 2 is higher than the reference alternative by at least \$108M. A cost comparison for the three alternatives is presented in Table 3.3.

The three alternatives involve virtually identical decommissioning steps. As a result, the main differences relate to overall project cost and the greater risk to worker health and safety associated with the dismantling of WR-1 before radioactivity levels have been lowered naturally over time.

Table 3.3
Comparison of Costs for Decommissioning Alternatives

Alternative	Time Frame (Years)	Base Cost (\$M)	\$M Reductions Provided by Option	\$M Additional Costs of Option	\$M Total Incremental Cost of Option
1	20	reference project cost	-40	90 – 170	50 to 130
2	100	reference project cost	0	108	108
3	60	reference project cost	0	0	0

The foregoing discussion indicates that Alternative 3 provides the best worker dose optimization and is the lowest cost approach. This approach is summarized as follows:

1. The achievement of a monitoring and surveillance state for the site nuclear facilities within 6 years of project implementation.

2. Monitoring and surveillance of the nuclear facilities with decommissioning activities scheduled to coincide with the end of building structural life and the expected availability of national disposal facilities.
3. Movement of wastes only when off-site disposal is available or when safety in existing structures is compromised.
4. In-situ management for selected low-level waste trenches in the Waste Management Area.

3.4 COMPARATIVE EVALUATION OF ENVIRONMENTAL EFFECTS OF ALTERNATIVES

3.4.1 Overview of Environmental Effects of the Three Alternatives

The focus on environmental effects addresses the likely differences between alternatives. The effects analysis of the preferred alternative is given in Section 6.0. In general, the same activities occur for all three alternatives so any difference would relate either to:

- changes in the intensity of the activity; or
- the risk of leaving a potential contaminant in-situ.

Two comments can be made:

- Notwithstanding the different time frames of the three alternatives, decommissioning still occurs over a lengthy period – at least 20 years. As a result, the intensity of any activity is not likely to be much different between alternatives. Overlap of activities is unlikely.
- Institutional control remains in effect throughout the decommissioning period – whatever alternative is chosen and will include monitoring activities (see Section 9.5). As a result, risk of undetected contaminant migration from the Study Area will be very low for all alternatives.

The following provides a qualitative comparison of the environmental effects of the three alternatives:

Air Quality and Noise

No differences in air quality effects are anticipated for the three alternatives.

Groundwater

The potential for groundwater contamination relates to in-situ disposal. Any permanent in-situ disposal must be safe for all time. In that context, the time differences between alternatives are insignificant and the differences in environmental effects probably not measurable. The potential for groundwater impact is discussed in Appendix C.1. The conclusion, at least for the decommissioning period, was that there is little likelihood of contaminant migration. As a result, there will be no difference between alternatives.

Surface Water

Effects from all three alternatives should be essentially the same. Alternative 1 may result in slightly higher effluent emissions to the river due to the short project duration. However, for all three alternatives, effluent emissions are expected to be lower than in the past when Whiteshell Laboratories was operating.

Aquatic Biota

The effect from all three alternatives should be essentially the same. The risk to aquatic biota is related to the release of contaminants to the Winnipeg River. Alternative 1 may result in the higher effluent emissions. However, for all three alternatives, effluent emissions are expected to be lower than in the past when Whiteshell Laboratories was operating.

Socio-Economics

There has been public pressure to have the site released for other uses as soon as possible. Alternative 1 will achieve this sooner than Alternative 3 while Alternative 2 takes the longest time.

Worker Health and Safety

The prime worker health and safety concern is the decommissioning of WR-1. Alternative 3 allows sufficient time for radioactive decay to occur for the safe handling of radioactive material. Alternative 1 subjects workers to much higher radiation fields. Alternative 2 results in slightly lower radiation fields than Alternative 3 in decommissioning WR-1, but contributes additional radioactivity dose through the refurbishment of facilities and the relocation of wastes to interim storage to manage the project over such a long period.

Public Health

The operation of Whiteshell Laboratories has had no measurable effect on public health. Clearly the longer radioactive decay is allowed, the lower will be the risk of an accident when handling high level waste. Thus although small, Alternative 1 has the potential for creating more significant public health effects because of the risk associated with the early off-site transportation of more highly radioactive wastes. Alternatives 2 and 3 benefit from additional radioactive decay and do not result in the same concerns over off-site transportation.

Physical and Cultural Heritage; Land and Resource Use; Archaeology; and Aboriginal Interests

The effects from all Alternatives would be essentially the same.

3.4.2 Comparison of Alternatives

The Canadian Environmental Assessment Agency (1998) describes four criteria for comparing alternatives: economic feasibility, technical feasibility, public concerns and environmental effects. Table 3.2 provides a preliminary comparison of the alternatives using the first three of these criteria. Based on the environmental effects analysis described above, the fourth criteria can now be added as presented in Table 3.4.

Table 3.4
Comparison of Alternatives

Criteria / Alternatives	**Economic Feasibility (1)**	**Technical Feasibility (1)**	**Public Concerns (1)**	**Environmental Effects**
Alternative 1 **End-State in a Short Time Period**	Poor	No	Low	Beneficial Best on socio-economics, highest risk to worker health and safety
Alternative 2 **End-State in a Long Time Period**	Moderate	Yes	High	Beneficial Worst on socio-economics
Alternative 3 **End-State in a Moderate Time Period**	Good	Yes	High	Beneficial Best on worker health and safety

(1) More details are given in Table 3.2

All three alternatives were found to benefit the environment since the property is decommissioned to a clean condition compared to its current state.

Environmental effects from each alternative are expected to be similar with the exception of higher risk to Worker Health and Safety for Alternative 1 than for Alternatives 2 and 3.

Of the three alternatives, Alternative 3 is the preferred option. Alternative 1 was dismissed because of the poor economic feasibility and the higher risk to worker health and safety. Alternative 3 was preferred over Alternative 2 because of:

- Socio-economics – The public would like to see the site released as soon as possible making Alternative 3 preferable over Alternative 2.
- Economic feasibility – Decommissioning costs for Alternative 3 are expected to be lower than for Alternative 2.

3.5 DECOMMISSIONING ALTERNATIVES WITHIN THE PREFERRED TIME PERIOD

Within the preferred option, Alternative 3, it is recognized that various strategies, approaches and technologies will be available to achieve the end-state. It is expected that an optimization exercise will be conducted for each facility and the results will form the basis for the individual detailed decommissioning plans. Because of the technical developments that will be achieved over the lifetime of the project, it is not possible to speculate on what new processes or techniques will be available to those implementing the decommissioning plans. When the detailed decommissioning plans are developed in the future, the regulator will be able to verify that the optimization process took place and that the applicable standards will be met.

That said, there exist two fundamental alternatives that apply to project components or facilities. One such option is complete removal. It applies to most of the facilities at Whiteshell Laboratories. When complete removal is achieved, the land will become available to other uses.

However, for some other components or facilities, the advantages of complete removal are not easily demonstrated. For those components, in-situ management is an option that warrants consideration. Therefore, a decision has to be made on whether a facility or component can be managed in-situ or if it merits full removal. A number of criteria need to be established to make that decision. These may include:

- Nature and level of contaminants still present.
- Exposure pathways (workers and public).
- Potential environmental effects.
- Technical feasibility of remediation.
- Economic feasibility of remediation.
- Level of public concern.

The two areas involving possible in-situ disposal include the river sediments downstream of the outfall and the low-level radioactive waste (LLW) trenches at the Waste Management Area. The option for permanent disposal is discussed in 4.3.1 and will be subject to regulatory review and approval. Descriptions of the river sediments and of the Waste Management Area are provided in Sections 4.3.3 and 4.3.1 respectively.

During the assessment, it was established that additional fieldwork was necessary to gain enough information to make that decision.

The investigation work for the river sediments is provided in Appendix B and sediment quality data is provided in Section 5.4.7. Appendix C contains the information on the LLW trenches investigation. Key information on the groundwater flow regime in the vicinity of the WMA is provided in Section 5.4.4.

The results of the assessment for those two components are summarized in Section 6.3. It was demonstrated that safe in-situ abandonment of the sediments is feasible. Safe in-situ management of the Waste Management Area is considered feasible. However, as mentioned above, the final safety case for in-situ disposal of WMA waste must be prepared to support the final decision on in-situ disposal.

Table 3.5 provides an overview of factors considered in deciding whether to manage the LLW trench contaminants in-situ or to fully remove them.

Table 3.5
Comparison of Alternative Methods

Criteria	River Sediments	LLW Trenches
Contamination	1.3 GBq in a small area immediately downstream of outfall	Limited to trench area. No evidence of upward or lateral migration
Technical feasibility of removal	Feasible	Feasible
Economical feasibility	Feasible	Prohibitive cost associated with retrieval, interim storage facilities and final disposal of site.
Main environmental impacts – In-situ	Insignificant	Not significant due to low inventory, favorable groundwater flow regime and controls
Main environmental impacts – Removal	Re-suspension of contaminants. Need for site to store dredgate.	Doses to workers, interim storage facility and transport to off-site disposal.
Public Concern	Protection of water quality and fish resources is important	Complete removal preferred

Based on the available information, AECL selected in-situ abandonment of the river sediments. There is currently a very small area of contamination immediately downstream of the outfall and the inventory in the sediments is quite small (1.3 GBq). Given that the estimated doses to humans and non-human biota is extremely low, remediation poses a greater risk through re-suspension of the contaminated sediments and cannot be justified.

AECL also believes that the LLW currently stored in the waste management area can be managed in-situ and that this approach represent no significant risk to workers or members of the public. This conclusion is based on the relatively small contaminant inventory, a favorable groundwater flow regime and the absence of pathways that could lead to significant exposure to hazardous levels of contaminants. There is no merit in recovering the LLW and moving it to another storage facility. The removal would unnecessarily expose workers handling the waste. The waste management area will continue to be monitored closely for any change in the current conditions.

4.0 PROJECT DESCRIPTION

4.1 INTRODUCTION AND OVERVIEW

The Whiteshell Laboratories is a nuclear research facility located approximately 100 km northeast of Winnipeg near Pinawa, Manitoba. The site occupies approximately 4375 ha of land owned by AECL, adjacent to the Winnipeg River. Whiteshell Laboratories consists of ten major buildings and a number of smaller support facilities. The Waste Management Area (WMA), the Concrete Canister Storage Facilities (CCSF) and the Large Scale Vented Combustion Test Facility (LSVCTF) are located approximately 1 km northeast of the main laboratory site. The main laboratory site layout is shown schematically in Figure 4.1.

4.1.1 History

The Whiteshell Laboratories site was established by AECL to carry out research and development of higher temperature versions of the CANDU reactor during the early 1960s. The site originally included Whiteshell Reactor-1 (WR-1) an Organic Cooled Reactor (OCR), which was brought on-line in 1965. The OCR program was eliminated in the early 1970s to focus on the heavy water-cooled CANDU reactor system. Development of programs including the Nuclear Fuel Waste Management Program, SLOWPOKE Demonstration Reactor, CANDU Reactor Safety research projects and accelerator projects maintained Whiteshell Laboratories as a diverse centre for research. Many other support facilities were required over the years to support the research programs. These included the WMA, CCSF and Active Liquid Waste Treatment Centre (ALWTC) in 1963, Hot Cell Facilities (HCF) in 1965, the Immobilized Fuel Test Facility (IFTF) in 1984, the Van de Graaff Accelerator in 1970 (upgraded in 1979) and the Neutron Generator Facility in 1975.

AECL decided to discontinue research programs at Whiteshell Laboratories as a result of the federal program review process that significantly reduced funding to nuclear research. The federal government examined various alternatives for the site and recommended privatization. Subsequent attempts to attract a private owner to take over the facility were unsuccessful. Subsequently, AECL made the business decision in 1998 to close Whiteshell Laboratories and to decommission the facilities to meet regulatory requirements. Certain operations at the site are presently in various stages of operational shutdown. Experimental work except for processing of active liquid wastes (TFRE/Amine) was concluded in the Shielded Facilities (SF) Cleanup and removal of research equipment has also been completed. Both the Neutron Generator Facility and the Van de Graaff Accelerator have been shutdown and detailed decommissioning plans have been prepared. The WR-1 reactor was permanently shutdown in 1985 and Phase 1 decommissioning, which started in 1989, was completed in 1995. This shutdown involved removal of sources and readily-removable radioactive materials, such as irradiated reactor fuel, from the facility and loose contamination from the main floor (600 level) and first sub-level (500 level) space. The completion of Phase 1 prepared WR-1 for a long deferment period during which radioactivity levels will be reduced significantly through natural decay prior to implementing further decommissioning work. At present, WR-1 is under a monitoring and surveillance program.

4.1.2 Project Components

To define the scope of the Whiteshell Laboratories Decommissioning Project, the site has been segregated into affected and unaffected lands. The affected lands are defined as the lands where nuclear development, operations or supporting activities are conducted and also includes land potentially affected by such activities. The unaffected lands are the balance of the site which have not been associated with AECL nuclear operations, and are not linked to or required for the decommissioning project.

The Whiteshell Laboratories decommissioning program encompasses all of the site facilities, buildings and land within the affected lands. Project components were identified from an examination of the Whiteshell Laboratories Detailed Decommissioning Plan, discussions with decommissioning project staff, and review of Whiteshell Laboratories' reports. Project components were finalized at a workshop in August 1999 attended by AECL and consultant team representatives, and were determined to be as outlined in Table 4.1.

Table 4.1
Project Components

Nuclear Facilities	Radioisotope Facilities	General Infrastructure
Shielded Facilities Van de Graaff Accelerator Neutron Generator Active Liquid Waste Treatment Centre Whiteshell Reactor -1 Concrete Canister Storage Facility Waste Management Area	B300 Decontamination Centre B402	Non-nuclear Buildings Landfill Sewage Lagoon Buried Services Contaminated Lands ("Affected Lands") Off-site Contamination including River Sediments

Project activities for each of the project components were identified for the three phases of the decommissioning project at the workshop in August 1999. Subsequently, project component activities were documented for Alternative 3, the Preferred Alternative, by Whiteshell Laboratories decommissioning program staff. The source documents are Whiteshell Laboratories Detailed Decommissioning Plan Volume 1: Program Overview (Helbrecht 1999) and The Whiteshell Laboratories Decommissioning Project Descriptions for the Comprehensive Study Report (Ridgway 1999).

FIGURE 4.1

MAIN LABORATORY SITE LAYOUT

WHITESHELL LABORATORIES
LIST OF BUILDINGS

100	REACTOR OPERATIONS
200	ACTIVE LIQUID TREATMENT
300	RESEARCH AND DEVELOPMENT
303	GAS DYNAMICS RESEARCH LABORATORIES
304	GAS DYNAMICS RESEARCH LABORATORIES
305	ACCELERATOR APPLICATIONS RESEARCH FACILITY
306	GAS DYNAMICS EQUIPMENT STORAGE
307	DIFFUSION FLAME FACILITY
312	STEAM GENERATOR STORAGE
400	ENGINEERING AND ADMINISTRATION
401	SECURITY AND RECEPTION
402	HEALTH AND SAFETY
403	VEHICLE GATE HOUSE
404	METEOROLOGICAL TOWER
405	TECHNICAL INFORMATION CENTRE
406	CAFETERIA
408	MATERIAL HANDLING
409	ACTIVE AREA STORES
411	DECONTAMINATION CENTRE
412	MACHINE SHOP AND MAINTENANCE
413	WASTE CHEMICAL STORAGE
414	CONTROLLED AREA 2 ENTRANCE
415	MATERIAL WAREHOUSE
416	STORAGE
420	MOBILE EQUIPMENT STORAGE
422	OUTFALL MONITORING STATION
424	WR-1 ORGANIC MONITOR BUILDING
426	CIVIL STORAGE #1
427	MECHANICAL SHOP STORAGE #1
428	MECHANICAL SHOP STORAGE #2
429	CIVIL STORAGE #2
500	INTERNAL FRICTION LABORATORY
501	AQUATIC TOXICOLOGY LABORATORY
504	ENGINEERING DEVELOPMENT AND TEST
505	SOILS RESEARCH LABORATORY
509	CIVIL UTILITY BUILDING
511-1	ACTIVE WASTE STORAGE #1 (Bldg. 100)
511-2	ACTIVE WASTE STORAGE #2 (Shield Facility)
511-3	ACTIVE WASTE STORAGE #3 (Bldg. 300)
511-4	ACTIVE WASTE STORAGE #4 (Bldg. 411)
511-5	ACTIVE WASTE STORAGE #5 (Bldg. 411)
525	METEOROLOGY TRAILER #2
526	BOREHOLE INSTRUMENTATION TEST FACILITY
527	INFLAMMABLE LIQUID STORAGE BUILDING
529	EXERCISE FACILITY
530	INTERNAL FRICTION LABORATORY ANNEX 500
900	PUMPHOUSE
903	WATER FILTRATION PLANT
907	SEWAGE LIFT STATION AND LAGOONS
911	POWER HOUSE
913	MAIN SUBSTATION
921	PEDESTRIAN LINKS BETWEEN BUILDINGS

100 50 0 50 100M

AECL EACL

WHITESHELL LABORATORIES DECOMMISSIONING
ENVIRONMENTAL ASSESSMENT

4.2 DECOMMISSIONING PROJECT

4.2.1 Decommissioning Strategy

Plans are being developed to transform Whiteshell Laboratories safely and effectively from an operational state to a shutdown and decommissioned state. The shutdown and decommissioning of Whiteshell Laboratories address business objectives, and operational and decommissioning constraints as follows.

Business Objectives

- Ensure an orderly consolidation of remaining CANDU programs so as not to jeopardize CANDU business.
- Continue to fulfil management responsibilities for the Nuclear Fuel Waste Management Program until privatization or termination of the program occurs.
- Minimize the operational costs for Whiteshell Laboratories by aligning site operational activities with the level of activity in the remaining programs.
- Fulfil management responsibilities for the decommissioning program and provide operational support to the decommissioning program.

Operational Constraints

- AECL's Reactor Safety Research Program will continue to operate at Whiteshell Laboratories until December 2003 and will require continued operations in three active area buildings.
- The Nuclear Fuel Waste Management Program will continue to operate out of Whiteshell Laboratories and/or the Underground Research Laboratory until an as yet undefined date and will require continued operations in one active area facility (B300).
- The Whiteshell Laboratories Waste Management Area will need to continue as an operational facility for the initial decommissioning work to support continuing AECL programs and decommissioning of buildings no longer required by AECL.
- AECL assets not required for continuing CANDU programs will be made available for commercialization purposes.

Decommissioning Constraint

- Currently there is no nuclear waste disposal facility in Canada, thus limiting the decommissioning activities to achieving and maintaining a secure monitoring and surveillance state for the nuclear facilities until such a facility is available.

4.2.2 Overview of the Decommissioning Program

The decommissioning program proposed for Alternative 3, AECL's preferred alternative for Whiteshell Laboratories, is described in the document by Helbrecht (1999) and is part of a series of planning actions now in progress. With the exception of radioisotope facilities that will have shutdown plans, there is, or will be, a separate detailed decommissioning plan for each major component or facility. The detailed decommissioning plans will meet the requirements of the Canadian Nuclear Safety Commission's *Decommissioning Planning for Licensed Activities* (CNSC 2000a). A generic outline of a Detailed Decommissioning Plan (DDP) is provided in Table 4.2.

Table 4.2
Elements of a Detailed Decommissioning Plan

Brief description of the components and structure to be decommissioned
History of operation
Statement of the final end-state objectives
Description of specific requirements for institutional control
Result of radiological and hazardous chemical survey
Overview of decommissioning strategy
Description of each work package
Schedule
Description of waste management plan
Assessment of potential environmental effects (this document)
Conservative cost estimate
Description of public consultation (included in this document)
Description of project management structure
Quality Assurance plan
Emergency response plan
Site security program
Radiation protection program
Environmental protection and monitoring program
Personnel training program
Human factors program
Summary of health and safety issues and plan to address them
Listing of governmental agencies involved in the decommissioning program
Listing of operational and decommissioning record

It is fully expected that the level of detail to be included in the DDP will reflect the characteristics of the facility to be decommissioned. The DDP will also provide a mechanism to address uncertainties where decommissioning is deferred well into the future.

The proposed Whiteshell Laboratories decommissioning program will be implemented through a phased approach preceded by operational shutdown work. Actual decommissioning cannot proceed until the Comprehensive Study Report (CSR) is approved. The operational shutdown work which can be conducted in parallel with the preparation of the CSR will require a period of approximately 15 months. Preparatory work for the initial phase of decommissioning will be completed as follows:

- prepare and submit facility-detailed decommissioning plans for approval;

- secure transfer of the listed facilities addressed in Phase 1 to a site licence structure recognizing the decommissioning on acceptance of the CSR and approval of detailed decommissioning plans; and
- establish the licensing requirements for the remainder of site facilities.

Shutdown operations for the research facilities at Whiteshell Laboratories are in progress and occur in parallel with decommissioning planning. Operational shutdown work for the ALWTC and the Decontamination Centre will commence following shutdown of those facilities.

There is a logical series of steps needed to decommission a nuclear, radioisotope, or general infrastructure facility. Decommissioning work includes the following activities:

- assessing and characterizing hazards;
- decontaminating/remediating contaminants;
- packaging/dispositioning of waste (radiological, industrial, chemical and clean);
- surveying to document interim end-state or final surveying for unrestricted use;
- monitoring and surveillance during a deferment period;
- dispositioning of structures (i.e. for demolition or reuse); and
- surveying, characterizing and monitoring at the final end-state.

Some of the steps outlined above may be skipped or duplicated, depending on the facility. As an example of skipping a step, final decommissioning of the Neutron Generator and the Van de Graaff Accelerator will be carried out shortly after the conclusion of this environmental assessment and issuance of a decommissioning licence by the CNSC. There will be no need for documentation of an interim end state or for monitoring and surveillance because the final end-state is achieved in Phase 1.

Conversely, there may be the need to repeat decontamination steps in some radioisotope facilities. Decontamination and remediation of contaminants will be carried out shortly after assessment of hazards. Later on, duct work and active drain lines will be disconnected and capped. During this process, pieces of duct work and drain lines will be removed, potentially causing recontamination. Therefore, additional decontamination work may be needed.

Phased Approach

The decommissioning project proposes a phased approach over a sixty-year time period. Within each phase, and, therefore, over the entire program, the decommissioning activities are of a discontinuous nature (i.e. flow from the ALWTC will not be continuous, air emissions from decontamination and demolition activities will be intermittent and there are considerable periods of monitoring and surveillance).

Decommissioning is planned in three phases followed by an institutional control period:

> **Phase 1** – Activities will be directed toward nuclear and radioisotope buildings and facilities to place them in a safe, secure interim end state. The Van de Graaff Accelerator and the Neutron Generator will be completely decommissioned (approximately 5 years).

Phase 2 – Regular monitoring and surveillance of all buildings and facilities. Most of project activity is focussed on the WMA. Most waste management facilities will be placed in a passive operational state meaning that no further waste can be added but facility monitoring is maintained. Interim processing, handling and storage facilities, required during monitoring and surveillance and decommissioning project activities, will be established (approximately 10 years).

Phase 3 – Activities directed to bringing the site to a final end state will fulfil all pertinent regulatory and national policy requirements. The timing and sequence of decommissioning activities will be determined largely by the availability of disposal facilities and by the age and condition of engineered structures and buildings (approximately 45 years).

Institutional Control Period – The three phases of decommissioning activities will be followed by a period of institutional control where the performance of the remaining in-situ disposal components (low-level waste trenches) is monitored and controlled. The institutional control activities are designed to demonstrate that the in-situ components perform in the manner predicted in the related safety assessments and to ensure that there is no development or intrusion into affected areas until the hazards have been reduced to acceptable levels. For Whiteshell Laboratories this period is expected to extend for approximately 200 years beyond the physical project work.

Contingency Long-Term Waste Storage

The decommissioning program described above is based on an assumption that Canadian nuclear waste disposal facilities will be available for low-level waste by 2025 and for high-level waste by 2050. Given the uncertainty of when those facilities will actually be available, the decommissioning program includes contingency provisions for longer-term waste storage on the site and/or at other interim locations until the permanent disposal facilities are available. Any such interim waste storage facilities will be designed, constructed, operated and monitored using proven technologies for protecting people and the environment. All long-term storage facilities will remain under CNSC licensing controls for as long as is necessary to protect people and the environment.

4.3 DESCRIPTION OF FACILITIES

The following sections provide descriptions of the project components listed in Table 4.1, as well as a brief discussion of the decommissioning approach for each component. Details regarding decommissioning activities for each of the three phases for each component are provided in Helbrecht (1999) and Ridgway (1999).

4.3.1 Nuclear Facilities

The decommissioning approach is similar for nuclear facilities and radioisotope facilities, and has been summarized below. A description of each project component under the category of "Nuclear Facilities" follows.

In Phase 1, nuclear facilities and radioisotope facilities, with the exception of the waste management facilities and part of the ALWTC, will be placed in a safe, secure interim end state. Decommissioning operations will ultimately be conducted from the B100 supervised area. Heating, ventilation and air conditioning of this facility will remain at the current level and will be reduced in all remaining buildings and facilities. By the end of Phase 1, all of the remaining buildings will have been prepared for monitoring and surveillance. Phase 1 decommissioning activities will be completed and the buildings will be shutdown. All buildings and facilities will be advanced to an interim end state. The laboratory site nuclear and radioisotope facilities will be administered under a decommissioning licence structure.

In Phase 2, there will be regular monitoring and surveillance of all buildings and facilities. Most of the project activity will be focused on the WMA. This work will include decommissioning the incinerator, relocating irradiated fuel waste from standpipes and high-level waste from trench 6 and placing most of the WMA bunkers and buildings in a monitoring and surveillance state. A new facility will be constructed to accommodate radioactive solid waste arising from TFRE/Amine waste processing and decommissioning operations in Phase 2 and Phase 3. By the end of this phase, there will only be a small operating area for processing packaging and storage of waste. This work is scheduled to be completed in about 10 years. However, part of the ALWTC aqueous waste processing facility will be retained until the end of Phase 3.

In Phase 3, the site will be brought to a final end state. This will occur over a time frame of approximately 45 years. Work will begin in the WMA, then continue in the nuclear and radioisotope facilities and for the Active Drainage system. The Building Decontamination Centre will be relocated to B100 and interim domestic sewage facilities will be installed to replace the sewage lagoon. The Shielded Facility, WR-1, and the CCSF will be the last to be decommissioned. Some low-level waste in the WMA will be disposed of in-situ. There will be the need for a period of institutional control for the WMA.

Shielded Facilities

a) Description

The Shielded Facilities (SF) includes the Hot Cell Facility (HCF) and the Immobilized Fuel Test Facility (IFTF), both of which form the west extension of the Research and Development Building (B300).

The HCF began operation in 1965, and was used to provide shielded, remote handling facilities in support of the CANDU reactor safety research programs including post-irradiation examination of fuels and reactor core components, post-experimental examination of radioactive materials used in waste management studies and services for other AECL programs or industrial work involving radioactive materials.

The HCF is a single-storey structure with a main floor area of about 1200 m^2 and a ceiling height of 9.5 m. A 1-2 m deep crawl space is located beneath the main floor Operating Area and a full basement is located beneath the balance of the HCF.
The main floor of the HCF consists of the Cells, the Decontamination Area, the Horizontal and Vertical Storage Blocks, the Manipulator Decontamination and Repair Facility, the Operating Area, a Scanning Microscope facility, a workshop, a photographic laboratory, office areas, hallway, a change room and a shipping room. The Cells consist of 11 steel-lined, ilmenite-concrete shielded cells (Cells 1-11) and one steel-lined lead-shielded cell (Cell 12). All cells are equipped with remote manipulators and lead-glass shielding windows.

The IFTF began operation in 1984 and was used to provide space and facilities for a wide range of experiments using radioactive materials in support of the Canadian Nuclear Fuel Waste Management and CANDU Reactor Safety research programs.

The IFTF is a building extension located at the northwest corner of the HCF. It is a single-storey structure and has a main floor area of about 1300 m^2, with a high-ceiling area 9.5 m high and a low-ceiling area 3.5 m high. A 3 m deep crawlspace is located beneath the high-ceiling area and a full basement is located beneath the low-ceiling area.

The main floor of the IFTF consists of six Cells, the Decontamination Vestibule, the Operating Area, the Canister Storage Area, the Mock-Up and Mechanical Maintenance Area, five laboratories, change rooms and several offices.

b) Decommissioning Approach

Operational Shutdown

Experimental work has been terminated in both facilities and operational cleanup of Cells and work areas to remove research program equipment, materials and wastes is in progress as part of operational shutdown. The operational shutdown work also focuses initially on the processing of two active-liquid waste volumes stored at the site. 270 L of Thorium Fuel Reprocessing Experiment (TFRE) waste, stored in a tank in the HCF and 180 L of Amine Experiment waste (Amine), stored at the WMA will be processed to a solid waste form for interim storage at Whiteshell Laboratories. This work will emphasize identification, design, construction and operation of a processing facility in the HCF to solidify these wastes in an acceptable form for interim storage. The work includes the transfer of the amine wastes to the HCF. Processing of these wastes requires the continued operation of the HCF remote handling and safety systems (Cells 1, 2 and 3) identical to the requirements during the routine operating period. Therefore, this work is planned to be conducted under the existing Facility Authorization under SF operating licence. However, some decommissioning work activities, in other areas of the SF, may be implemented in parallel with the waste processing.

Decommissioning

Phase 1 decommissioning work will address decontamination and/or fixation of contamination, sealing of the shielded cells and operating areas. Minimum building heating and ventilation, to maintain building structural integrity meeting safety needs, will be established and the facility will be placed in a monitoring and surveillance state.

The SF will remain under monitoring and surveillance throughout Phase 2 and well into Phase 3. Final decommissioning to achieve a cleanup level suitable for releasing the facility from regulatory control will commence in about 2040.

Van de Graaff Accelerator

a) Description

The Van de Graaff Accelerator operated from 1970 to 1997, initially in the electron-beam mode and following an upgrade in 1979 exclusively in a proton continuous-beam mode. The facility is contained in four laboratories in B300 with the accelerator in two rooms separate from the target room and the control room. The facility occupies approximately 170 m^2 of space.

b) Decommissioning Approach

The facility is permanently shutdown and a Detailed Decommissioning Plan has been prepared. A scoping survey of the facility indicates very low radiation fields. No radioactive contamination is indicated in the accelerator work areas.

The equipment in this facility will be fully decommissioned in Phase 1. Decommissioning includes dismantling and removal of the system components and the associated support systems. All that will remain at the end of Phase 1 are the bare walls. Rooms will be decontaminated and released for monitoring and surveillance. In Phase 2, monitoring and surveillance work will be integrated with monitoring and surveillance operations for B300.

Subsequent demolition of the space occupied by these facilities will be part of B300 Final Demolition Plan.

Neutron Generator

a) Description

The 14 MeV Neutron Generator Facility is located in the Research and Development Complex (B300) rooms B-152/153. The facility was built in 1975 and was used in the development of methods for the assay of fissile and fertile materials in reactor fuels and components. Usage eventually shifted to fast neutron activation analysis.

The facility shutdown in 1988 and a Detailed Decommissioning Plan has been prepared. The tritium target was replaced with a blank target and all vacuum pumps were shutdown.

b) Decommissioning Approach

The equipment comprising this facility will be fully decommissioned in Phase 1. Decommissioning includes dismantling and removal of the system components and the associated support systems. All that will remain at the end of Phase 1 are the bare walls. Rooms will be decontaminated and released for monitoring and surveillance. In Phase 2, monitoring and surveillance work will be integrated with monitoring and surveillance operations that are planned to be carried out in the SF.

Subsequent demolition of the space occupied by these facilities will be part of the SF Final Decommissioning Plans.

Active Liquid Waste Treatment Centre

a) Description

The ALWTC, which is located in B200, began operation in 1963, receiving low-level liquid waste effluent from operating nuclear facilities (WR-1, SF, B300 Research Laboratories, Laundry/ Decontamination). The liquid effluents are transferred via underground piping connecting existing facilities to the ALWTC.

The ALWTC includes a medium-level liquid waste processing system which concentrates the waste stream originating from the SF. The resulting concentrate is solidified and stored at the WMA.

The ALWTC is a two-storey building, with external dimensions of 24.7 m by 12.8 m and a height of 7.6 m. Exterior walls from grade to 3.0 m above grade are constructed of 0.30 m thick reinforced concrete on the inside, followed by 25 mm of rigid insulation and 0.10 m thick brick facing. A thicker wall (0.46 m reinforced concrete) is used in Room 1-07. The upper part of the building is similar except that 0.20 m thick hollow concrete blocks are used rather than reinforced concrete. Two-storey shielded process cells run along both sides of the ground-floor pump gallery and second-floor operating gallery. The process cells contain holding tanks which are provided to store liquid wastes as follows:

Room 1-04	Laundry Tanks Cell
Room 1-05	Decontamination Tanks Cell
Room 1-07	Evaporator Cell
Room 1-08	B300 Tanks Cell
Room 1-09	B100 Tanks Cell

The evaporator cell (Room 1-07) and the adjacent areas of the building house the medium-level waste concentration and solidification system.

The decommissioning of the aqueous waste collection system connecting WR-1, B300 and the Decontamination Centre to the ALWTC is addressed as part of that plan. The in-ground collection system is a double containment system consisting of small diameter polyethylene piping inside a larger diameter polyurethane pipe. The system is equipped with leakage detection wells.

b) Decommissioning Approach

For the first part of Phase 1, the ALWTC will remain fully operational. By the end of Phase 1, most of the facility will be decommissioned to an interim end state. The process systems required for managing the reduced amount of aqueous Low-Level Waste from building sumps and small amounts of aqueous Medium-Level Waste generated from monitoring and surveillance and site decommissioning operations will be retained in an operational state beyond Phase 1 as follows:

- seven existing waste collection tanks will be consolidated into two tanks to collect building sump wastes during the monitoring and surveillance period; and
- a replacement waste concentration system will be designed and constructed to process medium level aqueous waste arising from WMA waste processing operations (e.g. standpipe waste retrieval). The existing method of treatment using an evaporator is worker radiation dose intensive and was eliminated as an option.

Phase 1 decommissioning of the unused portion of the ALWTC will include sealing active systems and active drainage. For example, drainage and ventilation systems will be removed or modified. Any systems remaining in place, which are not being used, will be capped off. Rooms will be decontaminated, hazards assessed and remediation applied where needed. In some areas contamination may be sealed/fixed in place until the final decommissioning in Phase 3. Radiological surveying will be carried out to document the facility condition for the interim end state.

In Phase 2, the unused portion of the ALWTC will remain in a monitoring and surveillance state. Liquid waste processing operations will be continued in a portion of the building. The design and operation of the remaining facility will be controlled to ensure the impact of operation is well within regulatory requirements.

The ALWTC will be decommissioned to an unrestricted use level in Phase 3. However, the decommissioning will not be completed until all decommissioning work is done for WR-1 and the WMA.

Whiteshell Reactor 1

a) Description

The WR-1 reactor was placed in service in 1965 to demonstrate the organic-cooled reactor concept using heavy water as the moderator. The system also provided a facility for engineering tests on alternative fuels, fuel channels and reactor coolants.

WR-1 operated from 1965 to 1985, accumulating 120,000 operating hours during its lifetime. The reactor was permanently shutdown in 1985 and placed in a secure shutdown state in preparation for decommissioning. The shutdown activities included defueling the reactor, placing the irradiated fuel in the storage bays and removing bulk heavy water to storage. Bulk organic coolant was removed from the reactor cooling circuits and transferred to the WMA for incineration. Reactor control systems were isolated. All building services required for decommissioning were maintained in an operating mode.

b) Decommissioning Approach

The initial decommissioning work for WR-1 commenced in 1989 and was completed in 1995. This work addressed the removal of easily mobilized radioactivity (fuel, fluids, etc.) from the facility and decontamination of the main floor (600 level) and first sub-level (500 level) space with potential for reuse by Whiteshell Laboratories. Phase 1 work substantially decreased potential hazards from the facility and reduced the monitoring and surveillance requirements for the deferment period. The Phase 1 end state prepared WR-1 for a deferment period during which significant radioactivity decay will reduce the postulated dose commitment associated with future decommissioning work.

- WR-1 will remain under monitoring and surveillance throughout Phases 1 and 2. Final decommissioning will be implemented as part of Phase 3 in about 2050.

The approach for WR-1 is to fully remove and package all activated and contaminated components for disposal in offsite facilities, to decontaminate the facility structure and then to demolish the building to achieve unrestricted release criteria. The dismantling and remediation activities include:

- removal of reactor vault components;
- removal of process piping and equipment;
- transfer of radioactive waste to off-site facilities;
- decontamination of building structure;
- demolition of the building structure; and

- remediation of the site to a "natural" state.

Concrete Canister Storage Facility

a) Description

The Concrete Canister Fuel Storage Program was developed at Whiteshell Laboratories to demonstrate that dry storage is a feasible alternative to water pool storage for irradiated reactor fuel. Because of the success of the demonstration program, concrete canisters have been used to store all remaining WR-1 used fuel. The CCSF is composed of two storage areas: (1) the main canister site adjacent to the WMA; and (2) the demonstration canister site within the site laboratory area.

The main canister site is located on a prepared site about 1000 m to the northeast of the plant site. The site was excavated to a depth 0.6 m and then backfilled with gravel to the original elevation. The centre-to-centre canister spacing is 7.5 m within a row and the canister rows are 9 m centre-to-centre apart. Each canister is located on a pad of reinforced concrete 3.66 m square and 0.2 m thick.

The main canister site is surrounded by a heavy duty galvanized chain link fence 2.5 m high, with three strands of barbed wire on top. Locked gates restrict access to the canisters. Control B425, located within the CCSF, houses the necessary instrumentation, electrical, monitoring, sampling and alarm equipment for the canisters.

The demonstration canister site is located within the present Whiteshell Laboratories site active area approximately 140 m east of B100 and 85 m southeast of the central powerhouse. There are two canisters, located in a north - south row immediately adjacent to an existing access road running along the east boundary of the plant active area. The demonstration canister site is surrounded by a 2.4 m fence topped with three strands of barbed wire. The canisters are placed on 3.048 m square reinforced concrete pads, 0.2 m thick. These pads rest on 46 cm of compacted granular fill (replacing the excavated topsoil) over undisturbed native soil. Fuel from these canisters has already been transferred into the main canister facility and both demonstration canisters are empty.

b) Decommissioning Approach

The CCSF will remain in operation throughout Phase 1 under the current facility authorization.

In Phase 2 the continuing operational requirements will be assessed and the CCSF will be placed in a passive operational state. The design life of the canisters will be confirmed as part of the Phase 2 assessments.

Monitoring and surveillance will be carried out during most of Phase 3. Once a disposal facility has been established for the fuel inventory, the fuel will be transferred (planned for 2050). All canisters then will be decontaminated and demolished. The canister rubble will be disposed of or recycled and the CCSF sites will be rehabilitated to unrestricted release.

Waste Management Area

a) <u>Description</u>

The WMA is located approximately 1 km northeast of the Whiteshell Laboratories site. The area is approximately 148 m by 312 m. The WMA has been in operation since 1963, providing storage for low- and medium-level radioactive wastes. Other materials also stored here include irradiated fuel waste placed in standpipes, high level wastes in trench no. 6, high level liquid waste in a dedicated storage tank and hazardous chemicals in bunker no. 4.

The WMA is surrounded by a 2.5 m-high wire mesh fence. Personnel access is through B423, and road access is through a normally locked gate west of B423.

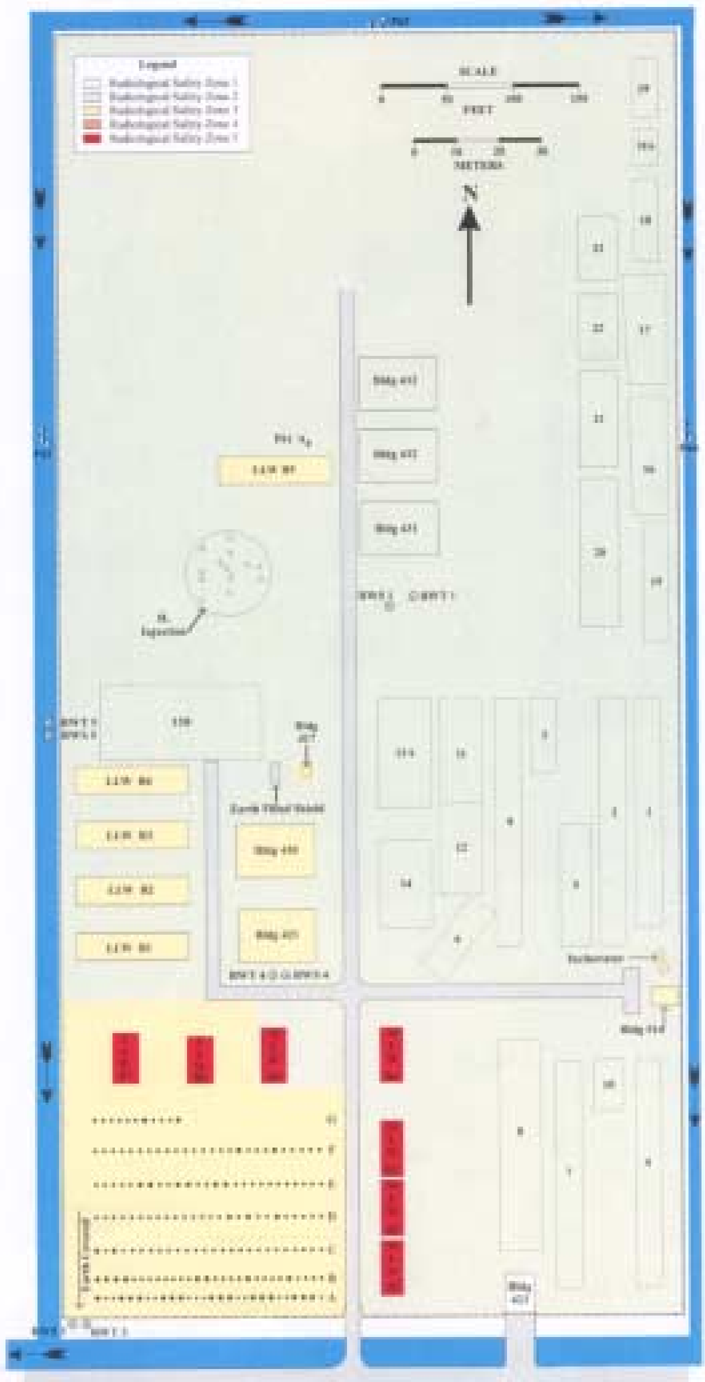
The following facilities are located within the WMA:

1. the main access building, (B423);
2. the organic incinerator (B514);
3. the organic drum storage building (B430);
4. the LLW processing building (B421);
5. the LLW storage bunkers (LLW #1,2,3,4);
6. LLW storage buildings (B431, B432, B433);
7. LLW unlined earth trenches (#1-23);
8. MLW in-ground concrete bunkers (101-01 to 20);
9. MLW storage bunkers (ILW #6,7);
10. HLW/MLW in-ground concrete standpipes; and
11. Amine storage tanks (B417).

The location of these facilities is illustrated schematically in Figure 4.2.

FIGURE 4.2

WASTE MANAGEMENT AREA LAYOUT SCHEMATIC



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b) Decommissioning Approach

The WMA will remain fully operational during Phase 1. Surveying/assessment will be carried out in the latter part of this phase. This work will be used to characterize the waste inventory and determine if there are any associated contaminant plumes.

In-situ disposal is proposed to manage low-level wastes stored in earthen clay trenches in the WMA. The case for in-situ disposal is presented in Appendix C.

Phase 1 work will include the design and implementation of an enhanced hydrogeological and environmental monitoring program to collect additional site data to support a final decision on in-situ disposal. Throughout Phase 1, 2 and much of Phase 3 the wastes will continue to be managed under CNSC licensing conditions which provide an audit and review mechanism to ensure that any additional monitoring or environmental assessment required to support a final decision is conducted.

Phase 1 activities are:

- Acceptance of low-, medium- and high-level radioactive waste generated from decontamination of the site research facilities (e.g. Shielded facility, B300). Waste includes:
  - solidified TFRE/Amine active liquid waste;
  - decontamination waste;
  - contaminated laboratory equipment; and
  - contaminated building service system components.
- Construction of additional bunker storage space to meet capacity requirements for Phase 1 decommissioning waste.
- Maintenance of the WMA facilities and grounds.
- Design and implementation of an enhanced monitoring system for the LLW trenches to collect data in support of the final in-situ disposal decision.

In Phase 2, waste processing operations will be implemented to address wastes which cannot remain in existing storage structures until waste disposal becomes available. This work will specifically address irradiated fuel waste in standpipes and high level waste in trench 6. The key activities to be carried out are:

- Establishing the remaining operating area required to process, package and provide interim storage throughout Phases 2 and 3. New facilities will be constructed to meet regulatory requirements and will include retrieval, processing, segregation and interim storage for waste which cannot be managed in existing facilities until waste disposal facilities become available.
- Placing the WMA facilities, no longer receiving or processing waste, into a passive operational state. This may include modification to facilities and some relocation of waste within facilities.
- Recovering and processing the fuel waste from the standpipes and the irradiated reactor components from Trench 6.

- Constructing facilities in the remaining operating area to meet Whiteshell Laboratories' requirements for managing waste from decommissioning activities.
- Carrying out enhanced monitoring in support of trench in-situ disposal.

Several new facilities will be designed and constructed in the newly defined operating area located within the existing WMA boundary. New facilities comprise:

- interim storage bunker for solidified TFRE/Amine active liquid waste;
- interim bunker storage for routine monitoring and surveillance waste;
- interim storage for processed waste arising from WMA retrieval operations and from any site decommissioning work required prior to the availability of off-site disposal;
- a deminimis segregated facility to process waste into appropriate handling categories for off-site disposal; and
- transport equipment (shielded tanker) to accommodate transfer of aqueous waste to the ALWTC.

WMA storage facilities which are not required for Phase 2 activities will be transitioned to a passive operational state.

In Phase 3, the waste processing operations for wastes being generated from the remainder of the site will focus on preparation and packaging of waste for immediate transfer to disposal facilities, since the major site decommissioning activities are planned in accordance with assumptions on waste disposal facility availability. Monitoring and surveillance will be carried out in the passive operational area until the wastes are removed to disposal facilities or in-situ management controls are in place.

Low-Level Trenches

The final safety case for in-situ disposal of trench wastes must be prepared to support the final decision on in-situ disposal. The final safety case will consider any enhancements or additional actions which may be required to manage these wastes in-situ. Optimization of the disposal plan will consider:

- removal/remediation of trench waste unsuitable for in-situ disposal;
- engineered barriers;
- surface drainage patterns;
- additional monitoring locations; and
- institutional controls following Phase 3.

Remaining activities for Phase 3 are:

- processing final decommissioning project wastes as required to accommodate transport to disposal facilities (e.g. segregation of contaminated waste from clean waste, packaging, loading shipping containers);
- retrieving and transfer all WMA waste that cannot be managed in-situ at the site to final disposal;
- stabilizing/capping/securing the low-level trench area to manage waste in-situ and establish institutional controls; and
- remediating the balance of the WMA to a more "natural" condition.

4.3.2 Radioisotope Facilities

The decommissioning approach for radioisotope facilities was discussed in Section 4.3.1. A description of these facilities is provided below.

Building 300 (B300)

a) Description

B300 is the primary research laboratory for the Whiteshell Laboratories site, which provided support to the full range of nuclear research and development programs conducted at Whiteshell Laboratories during the operating period. The building comprises an area of approximately 17,000 m^2 and was built in six stages over the period of 1964 to 1982. Most of the building was used to provide general laboratory work areas and contains 68 laboratories designed to handle various levels of radioactivity. The south end of the building is a high bay area which supported experimental activities requiring large room areas and significant head room. The RD-14M experimental loop is located in the south high bay. Although the SF is part of the B300 complex, it is addressed separately as a listed facility. Two other facilities in the building, the Van de Graaff Accelerator and the Neutron Generator, are similarly addressed as individual listed facilities.

Research program work remains in progress in two significant areas of B300, the north extension utilized by the Nuclear Fuel Waste Management Program and the south high bay utilized by the Reactor Safety Research Program.

b) Decommissioning Approach

All research activities are currently being consolidated into the two operating areas noted above to allow progress on operational shutdown and decontamination of the building between the south high bay and the north extension. Building service systems (ventilation, heating) for this area can be isolated from the balance of the building to minimize impacts of decontamination on the continuing operational research programs. Since the emphasis of continuing research program work is on non-radioactive work, no increase in radioactive inventory is anticipated for the continued operation areas. Phase 1 decommissioning of the continued operation area of B300 is planned for year four of the project.

The Phase 1 work for B300 includes decontamination and/or fixation of contamination throughout the facility. Fumehoods will be isolated from the exhaust ventilation system and active drainage lines will be drained and capped. Active drainage system connections to the ALWTC will be maintained to manage building sump waste water. Minimum heating and ventilation will be established and the facility will be placed under Monitoring and Surveillance.

Monitoring and surveillance will be maintained throughout Phase 2 and in Phase 3 the facility will undergo final decommissioning to an unrestricted release state commencing in about 2030.

Decontamination Centre

a) Description

The Decontamination Centre (B411) provides a decontamination service for maintaining research and development experimental rigs, equipment and tools in a safe useable state. It also provides a laundry service for radioactively contaminated clothing. The building comprises an area of approximately 850 m^2. The decontamination area contains eight fumehoods and the work area is designed to accommodate a broad range of contaminated equipment cleanup. The laundry contains four fumehoods to accommodate sorting of contaminated clothing, and laundry equipment consists of six industrial washing machines and four dryers.

b) Decommissioning Approach

This facility will be retained in service to support the first phase of decommissioning, as well as shutdown and decontamination activities in B300. Shutdown and decontamination activities for the Decontamination Centre will be conducted in the final two years of Phase 1 of the decommissioning program. The facility will be placed in Monitoring and Surveillance at the end of Phase 1. Decontamination processes required to meet monitoring and surveillance and future decommissioning operations will be established in B100. These comprise a small laundry operation and respirator decontamination equipment.

Final decommissioning of the Building Decontamination Centre to an unrestricted release state is planned for 2025.

Building 402 (B402)

B402 will operate throughout Phase 1 to provide dosimetry services to AECL and to accommodate commercialization activities such as ACSION. Space within this building is currently being marketed to privatization interests. B402 is suitable for low-level radioactive work. It is designated as zone 1 (considered a "clean zone", dose levels do not exceed 1 mSv/a) suitable for use as routine laboratory space.

The decommissioning approach for the building is dependent on the extent of continued commercial use beyond Phase 1. The options include:

- characterization and environmental audit to provide for turnover of the facility to a new owner; or
- characterization and decontamination activity similar to the Decontamination Centre to prepare the building initially for monitoring and surveillance and ultimately for decommissioning to an unrestricted release level.

If commercialization activity is discontinued, B402 could undergo final decommissioning as early as the first part of Phase 2.

4.3.3 General Infrastructure

The other buildings and infrastructure at Whiteshell Laboratories are administered under the general terms of the site licence and include a total of nearly 40 buildings or structures that were used for a variety of purposes. Such uses have included:

- general and administrative offices;
- cafeteria and coffee areas;
- laboratories;
- storage;
- workshops;
- receiving docks; and
- other service buildings.

In general, the only work that will be done in Phase 1 is characterization of the building spaces to ensure safety during the deferment period. Very little decontamination work is expected to be needed. Heating and ventilation will be retained, as required, in some buildings.

The demolition of the other buildings and infrastructure will begin in Phase 3, targeted for completion by 2020. If commercialization is unsuccessful, demolition of some buildings may occur much sooner (e.g. 2005 and onward). Prior to demolition, the buildings will be surveyed and remediated to unrestricted release requirements. Finally, once a building has been demolished, the building footprint area will be returned to green state conditions. As well, B405 and connectors between B100 and B300 will be retained until B300 laboratories are fully decommissioned.

Alternatively, certain buildings may be transferred to private ownership. The long-term use of non-nuclear buildings is entirely dependent on economic development activity at the site. Planning to develop an industrial park to utilize the buildings outside the controlled active area of the laboratory site is in progress. It is anticipated that redundant buildings which are not commercialized within a timeframe of 5 to 10 years will be demolished.

Non-Nuclear Buildings

a) Description

The most significant buildings and services that are part of the non-nuclear buildings and infrastructure of the supervised and controlled area are:

- Gas Dynamics Research Laboratory (B303).
- Gas Dynamics Research Laboratory (B304).
- Engineering and Administration (B400).
- Security and Reception (B401).
- Technical Information Centre (B405).
- Cafeteria (B406).
- Material Handling (B408).
- Active Area Storage (B409).
- Machine Shop (B412).
- Material Warehouse (B415).
- Pumphouse (B902).
- Large Scale Vented Combustion Test Facility (B308, B309, B310).

There are a number of additional smaller buildings of various classifications. Table 4.3 lists non-nuclear buildings and provides a brief description of their function.

Table 4.3
Description of Non-Nuclear Buildings

Building (B) Number	Description	Building (B) Number	Description
300	Thermal hydraulics Annex	427	Mechanical Shop Storage No. 1
301	FIG Control	428	Mechanical Shop Storage No. 2
302	ZEUS Control	429	Civil Materials Storage
303	Containment Test Facility (CTF)	500	Internal Friction Lab
304	Gas Dynamics Research Labs	501	Aquatic Toxicity Lab
306	Gas Dynamics Research Lab	503	Ecology Lab
307	Diffusion Flame Facility	504	Inactive Lab/Offices
308	Large Scale Vented Combustion Test Facility	505	Soils Research Lab

Building (B) Number	Description	Building (B) Number	Description
309	LSVCTF-Local Services	509	Civil Materials Storage
310	LSVCTF-Remote Control	515	Drill Site Office
311	LSVCTF-Hydrogen Storage	518	B300 Coffee Room
312	Steam Generator Storage	523	Controlled Environment Building
400	Engineering and Administration	526	Borehole Instrumentation
401	Security and Reception	527	Flammable Liquid Storage Shed
403	Vehicle Gate House	530	Internal Friction Lab Annex
404	Meteorological Tower	902	Pumphouse
405	Technical Information Centre	903	Water Filtration
406	Cafeteria	904	Fire Protection Water System
408	Stores Workshop and Garage	905	Process Water System
409	Active Area Storage	906	Storm Drainage System
410	Cafeteria Garbage Storage	907	Sewage Lift Station and Lagoons
412	Engineering Products and Services	911	Powerhouse
413	Waste Chemical Storage	913	Main Substation
414	Controlled Area to Entrance	914	Main Power Distribution
415	Unheated Storage	916	Communications System
416	Storage	917	Supervisory Control and Alarm
420	Mobile Equipment Storage	918	Clarified Water System
426	Civil Material Storage	921	Pedestrian Links Between Buildings

(Adapted from Helbrecht 1999)

Although not among buildings listed as nuclear, B503 has laboratories where radioactive and bio-hazardous materials were previously used. Cleanup of this contamination may be undertaken as part of the operational cleanup. Other buildings will only have incidental contamination, if any, resulting from their proximity to the nuclear facilities.

b) Decommissioning Approach

During the operational shutdown period, non-nuclear buildings will be prepared for demolition or for transfer to other (commercial) owners.

The general site buildings are maintained in an operational state to support continuing research programs (e.g. B303, B304), the decommissioning program, commercialization opportunities (e.g. B400, B408, B401,) or to support the site operation generally (e.g. Powerhouse B911, Pumphouse B902). An assessment will be made of the timing of the decommissioning of the general site service facilities by the end of Phase 1.

The Whiteshell Laboratories' Irradiator in B305 is excluded from the Shutdown and Decontamination Plan because it is administered by the CNSC under a separate licence with ACSION, a private business operation at the site.

Inactive Landfill

a) Description

The inactive (i.e. non-radioactive) landfill was placed in operation when the Whiteshell Laboratories site was established to contain non-radioactive and non-hazardous wastes, excluding food waste. It is located at a high point in the local terrain approximately 2 km east of the main site at the end of a service road and next to the entrance gate to the Field Irradiator Gamma (FIG) facility. The surficial geology in this area is mainly sand and gravel. The area is a recharge zone, and groundwater will move either toward the river or northeast toward a large black spruce and sphagnum bog.

The landfill is less then 10 m in height and less then 1 ha in area. Typical materials placed in the landfill include plastic, paper, wood, cardboard, glass, and building materials. Standard activities include dumping, ditching, and capping with sand and gravel from surrounding borrow pits.

b) Decommissioning Approach

The inactive landfill will remain fully operational for Phases 1 and 2. Waste processing operations and maintenance will be consistent with that done prior to decommissioning. A plan for remediation of the landfill will be developed during Phase 2. Environmental, radiological and geotechnical evaluations will be carried out to provide inputs to the plan.

The landfill will be decommissioned to a final end state toward the end of Phase 3. The landfill will be capped and the surface restored to a more “natural” condition. Subsequent to closure, monitoring will be carried out to confirm that the landfill is fully stabilized.

The operation and decommissioning of the inactive landfill falls under federal jurisdiction. *Manitoba Environment Act* Regulation 150/91 on closure of landfills will be considered in developing the remediation plan for this facility.

Sewage Lagoon

a) Description

The lagoon system, placed in operation when the Whiteshell Laboratories site was established, is located north of the main plant site. It comprises a primary settling pond, a secondary pond, an outlet and the sewage lift station (B907). The lagoon receives liquid wastes from lavatories, showers and non-active drains. The lagoon water is retained for approximately six months to allow for settling and biodegradation. It is analyzed for fecal coliform and biochemical oxygen demand and if within limits may be released in May and October each year to the Winnipeg River.

The lagoon was constructed of low permeability clay embankments placed on a prepared clay surface, with no additional lining. The primary and secondary ponds are connected to each other via a culvert.

There are levees around each lagoon, with a roadbed at the top. At various times of the year the water level in the lagoons is higher than the surrounding land surface. Emergent macrophytes (primarily cattail) vegetate the water's edge. Water is released from the pond every spring and fall and flows from the lagoon to the Winnipeg River through a drainage way that is about 400 to 500 m in length.

b) Decommissioning Approach

The sewage lagoons will remain fully operational for Phase 1. Waste processing operations and maintenance will be consistent with that done prior to decommissioning. A plan for remediation of the lagoon system will be developed in the early part of Phase 2. Environmental, radiological and geotechnical evaluations will be carried out to provide inputs to the plan.

In Phase 3, the lagoon system will be decommissioned to a final end state by 2020. The lagoon will be backfilled and restored to a more "natural" condition. Subsequent to closure, monitoring will be carried out to confirm the lagoon is fully stabilized. Interim domestic sewage facilities (e.g. septic tanks) will be required to meet Phase 3 operations needs.

The operation and decommissioning of the lagoon falls under federal jurisdiction. *Manitoba Environment Act* Regulation 163/88 will be taken into consideration in developing remediation plans for this facility.

Buried Services

a) Description

Buried services run through the entire site and include:

- drainage systems;
- district heating;
- electrical;
- fire (250 mm diameter pipe) and process water (600 mm diameter pipe); and
- domestic water (200 mm diameter pipe).

The most significant buried services from a decommissioning perspective are the three types of drainage systems:

- *Sanitary drains* (250 mm diameter pipe): collect waste water from toilets, showers, sinks etc., and discharge it to the site sewage lagoon.
- *Aqueous radioactive waste collection drains* (38 mm diameter pipe enclosed in 200 to 300 mm diameter pipe): collect wastewater containing radioactive (and chemical) contaminants. The waste is pumped through double walled pipes to tanks in the

ALWTC. The low-level tank waste is sampled and if radioactivity levels are acceptably low, the waste is pumped to the process drain/storm sewer at a maximum rate of 8 L/s. Medium radioactivity level aqueous wastes are concentrated and solidified for storage at the WMA. Any leaks in the active lines would be contained within the outer wall of the transfer pipes and flow to leak collection points (man-holes or sumps) located at low points along the route. No leaks have been detected since the system was placed in operation.

- *Storm drains* (process drains, 1200 mm diameter pipe): collect cooling water from experimental facilities, site runoff water, low-level radioactive liquid waste from the ALWTC following sampling and monitoring, inactive effluent from non-active building sump floor drains and laboratory sinks, and process water that is used to maintain a minimum flow (50 L/s) at the outfall for a flow measurement. The storm drain water is discharged via the outfall to the Winnipeg River.

The aqueous radioactive waste collection system was replaced by the existing double pipe system in the mid-1980s. The old system had failed and leakage from some lines adjacent to the ALWTC had occurred. The area was partially remediated through removal of excavated soil; however, in subsequent years, the vegetation in the spill area was found to have elevated levels of beta and gamma emitting radioactivity, in particular ^{137}Cs and ^{90}Sr. Routine monitoring of the area is maintained to provide an indication of mobility which would require early remediation.

b) <u>Decommissioning Approach</u>

The buried services will remain fully operational for the first part of Phase 1. In the latter part of Phase 1, drains will be assessed, remediated and capped. In Phase 2, monitoring and surveillance and maintenance will be conducted as required. Most systems, other than parts of the active drainage, will remain functional during Phase 2. The active drain lines required to collect monitoring and surveillance building sump wastes for transfer to the ALWTC will be identified and retained.

The buried services and soil contamination associated with the old active drainage system leakage will be remediated in Phase 3. Removals will be staged because certain parts of the system (e.g. fire water) will be needed until WR-1, the last major project component, is fully decommissioned.

"Affected" Lands

a) <u>Description</u>

The affected lands are those lands within the Whiteshell Laboratories' site (the Licensed Property Study Area) that are contaminated, potentially contaminated or affected by nuclear operation and are more than 1 m away from buildings. Decommissioning of land within 1 m of the buildings is considered part of the decommissioning of the building.

Figure 4.3
Affected Lands

The affected lands may contain contamination because of proximity to facilities and unusual occurrences. Known contamination areas identified in the affected lands are shown in Figure 4.3:

Active Area Soil Contamination

Surface contamination attributed to releases from the HCF exhaust stack was detected in 1971 and 1972. The releases were at very low-levels and there is no detectable contamination remaining in these areas.

Leakage to topsoil has occurred as a result of active drain line failures, particularly in the ALWTC area, where 3 incidents released about 65 GBq of mixed fission product contamination. About 9 GBq of ^{137}Cs and ^{90}Sr are estimated to remain in the ground and the area is routinely monitored. There is no indication of contamination movement from the area.

Cesium Ponds

This area is located directly east of the WMA. The ponds were developed to study the distribution of dose received by organisms living at the water-mud interface. 0.5 Ci of ^{137}Cs were injected into the pond in the 1960's. This has decayed to approximately half of the original injection and elevated levels of ^{137}Cs remain detectable but limited to the pond area.

Field Irradiator Gamma (FIG)

This project was conducted in the late 1970s to early 1980s to study the ecological effects on a mixed boreal forest ecosystem from continuous exposure to gamma radiation. Only sealed sources were used. These have been removed and there is no radioactive contamination in the FIG area.

Zoological Environment Under Stress (ZEUS)

The ZEUS project studied the effects of ionizing radiation on small mammals. Only sealed sources were used. These have been removed and there is no radioactive contamination in the area.

Deep Borehole Site

The borehole site is located north of the CCSF. Small amounts of short half-life tracers were injected into three wells to study radionuclide transport in bedrock. The radioactivity has decayed to background.

A summary of release quantities and current radiological status is given in Section 5.3.3.

b) <u>Decommissioning Approach</u>

The approach to decommissioning will be the same generally for each of the known affected areas. In Phase 1, the emphasis will be on surveying, assessing and developing remediation plans. Any identified need for early remediation or stabilization will be completed late in Phase 1 or early in Phase 2. Stabilization/remediation is the first step in addressing each incident or the termination of an experiment. Therefore, only limited work is expected for these areas as an interim measure. Final remediation in Phase 3 will be focused on the active areas soil contamination and on the cesium ponds contamination.

In Phase 3, remediation will be completed to a level where any remaining contamination is within acceptable levels for unrestricted release. In some areas, institutional controls may be required after Phase 3 has been completed.

Off-Site Contamination

Off-site contamination resulting from the operation of the Whiteshell Laboratories has occurred in two areas. Routine releases (well within regulatory limits) and some spill incidents have resulted in contamination of river sediments. The north property ditch and the natural drainage creek northwest of the AECL site boundary was contaminated as the result of a spill in the WMA. These off-site contamination areas are described below.

River Sediments

a) Description

The Whiteshell Laboratories is situated on the east bank of the Winnipeg River. The river in this area is wide and flows rapidly several metres below the level of the surrounding land. The average flow is approximately 950 m^3/s, although this is controlled by Manitoba Hydro control stations, and may vary from time to time according to Manitoba Hydro policies.

Liquid effluent from the ALWTC is discharged to the Winnipeg River via the process sewer at the sewer outfall located about 8 m offshore in 5 m of water. The ^{137}Cs (the dominant radionuclide) concentration in downstream river water is 0.005 Bq/L, which is well within the 10 Bq/L Canadian Drinking Water Quality Guidelines (Canadian Council of Ministers of the Environment 1999a).

A reduction in the effluent particulate load was accomplished in 1998-99 by the installation of filter stations to collect the larger particulate for the most critical waste streams. The effluent from the WMA sumps is routinely filtered through 5 micron filters before being transferred by tanker to the ALWTC. In 1995, a decision was made to reduce the concentration control point for ALWTC waste by reducing the Administrative Level from 1 GBq/m^3 to 0.1 GBq/m^3. By these means the overall level of releases was reduced and a significant fraction of the larger particulate (settable solids) was collected, and therefore prevented from being released to the river.

Elevated sediment contamination has been measured in the local outfall area (an area 20m wide by 80m downstream). The total inventory is very low, approximately 1.3 GBq. A detailed evaluation of the sediment contamination is presented in Appendix B.1. The assessment concludes that using the most conservative dose estimation methods, doses to non-human biota and humans are below accepted guidelines.

b) Decommissioning Approach

Based on the evaluation in Appendix B.1, the decommissioning approach is to abandon the contaminated sediments in-situ.

Environmental monitoring of sediments will take place throughout Phase 2 and most of Phase 3 to determine if contaminants deposited as a result of the decommissioning project require remediation to achieve the final end-state objectives.

North Ditch/Creek

a) Description

A spill incident at the WMA in 1979 led to fission product contamination of a 2 km ditch system, (including the west ditch, the north ditch, and a small creek). The creek is located in the public domain north of Whiteshell Laboratories, and discharges into the Winnipeg River. A follow-up ditch sampling program indicated radioactivity was deposited throughout the 5 to 10 cm of clay-silt soil in the ditch system near the WMA. Surface water was present in the ditches at the time, and contamination of the water flowing down the drainage system exceeded the maximum permissible concentration in drinking water for continuous consumption.

The ditch flowing west from the WMA was excavated to remove contaminated soil. The entire ditch/creek system was surveyed to determine the immediate remediation required. Routine monitoring continues to be carried out in this ditch/creek system.

b) Decommissioning Approach

A full assessment of environmental monitoring data and of the original spill documentation will be conducted to confirm that the initial remediation following the incident was satisfactory and that no additional remediation is required.

4.3.4 Timing for Decommissioning Activities

The general decommissioning approach for the various facilities and components was outlined in the preceding sections. The timing of the decommissioning activities are summarized in Table 4.4 and illustrated in Figure 4.4.

There is a logical flow of decommissioning work commencing with nuclear facilities and nuclear support facilities to handle the most significant hazards while maintaining the site infrastructure. Service systems are addressed subsequent to nuclear facilities decommissioning. This also tends to avoid overlapping or conflicting effects between individual project components.

The decommissioning work is concentrated in Phase 1 and the latter half of Phase 3. For the interim period, most of the facilities will be under monitoring and surveillance. The figure also shows the remaining operating period for the site infrastructure and support facilities required during the decommissioning activities.

Table 4.4
Whiteshell Laboratories Decommissioning Schedule

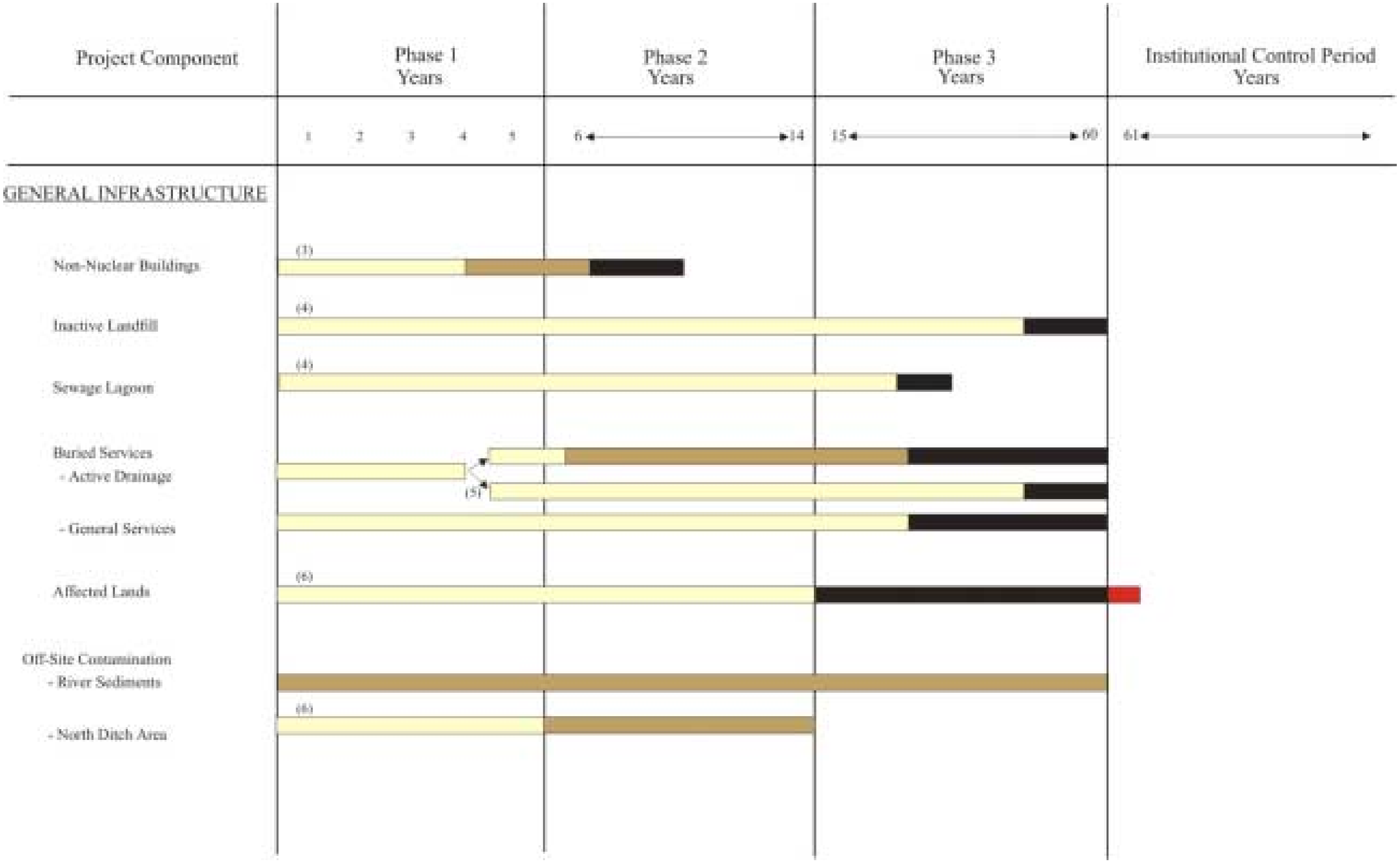
Facility	Decommissioning Activity/State	Phase
Shielded Facilities	Operational - processing of high level liquid waste	Phase 1
	Decontamination	Phase 1
	Monitoring and surveillance	Phases 2 and 3
	Final Decommissioning	Phase 3
Van De Graaf Accelerator	Final Decommissioning	Phase 1
Neutron Generator	Final Decommissioning	Phase 1
Active Liquid Waste (ALWTC)	Part of facility remains operational through to Phase 3	Phase 1, 2 and 3
	Decommissioning of unused portion	Phase 1
	Monitoring and Surveillance	Phase 2
	Final Decommissioning	Phase 3
Concrete Canister Storage Fac.	Operational	Phase 1
	Placed in a Passive Operational State	Phase 2
	Monitoring and Surveillance	Phase 2 and 3
	Final Decommissioning	Phase 3
WMA	Operational	Phase 1
	Define and operate remaining facility	Phase 2 and 3
	Storage of monitoring and surveillance wastes	Phase 2 and 3
	Recover and process stored waste from facilities requiring upgrading	Phase 2
	Placing retrieved waste into new upgraded facilities	Phase 2
	Transfer WMA storage facilities not required for Phase 2 activities to a passive operational state	Phase 2
	Monitoring and Surveillance in the Passive Operational State until wastes are removed to disposal facilities.	Phase 3
	Maintain institutional controls until in-situ waste is acceptable for unconditional release	Institutional control period
	Preparation and transfer of waste to disposal facilities	Phase 3
Building 300	Decontamination and or Fixation of Decontamination	Phase 1
	Monitoring and Surveillance	Phase 2 and 3
	Final Decommissioning to an unrestricted release state	Phase 3
Decontamination Centre	Shutdown and decontamination in the final 2 years of Phase 1	Phase 1
	Monitoring and surveillance	Phase 2 and 3
	Final Decommissioning to an unrestricted release state	Phase 3
B402	Operational throughout Phase 1 Decommissioning. Approach is dependent on the extent of continued commercial use of B402 beyond Phase 1	Phase 1
	Final decommissioning as early as the first part of Phase 2 (if commercialization is discontinued)	Phase 2
Non-Nuclear Bldgs	An assessment will be made of the decommissioning of the general site service facilities by the end of Phase 1	Phase 1
	Final decommissioning	Phase 2 and 3

Facility	Decommissioning Activity/State	Phase
Inactive Landfill	Operational throughout Phases 1 and 2	Phase 1and 2
	Development of a remediation plan	Phase 2
	Final Decommissioning	Towards the end of Phase 3
Sewage Lagoon	Operational throughout Phase 1and 2	Phase 1 and 2
	Development of a remediation plan	Phase 2
	Final Decommissioning	Phase 3
Buried Services	Operational	First part of Phase 1
	Drains will be assessed, remediated and capped	Phase 1
	Monitoring and Surveillance	Phase 2
	Most systems, other than parts of the active drainage, will remain functional during Phase 2 Remediation of buried services and soil contamination associated with the active drainage system	Phase 2 and 3
Affected Lands	Surveying, assessing and developing remediation plans	Phase 1
	Monitoring and surveillance	Phase 2 and 3
	Remediation to levels acceptable for unrestricted release	Phase 3
River Sediments	Monitoring and surveillance	Phase 1, 2 and 3
	Re-evaluation to confirm final in-situ end state	Phase 3
North Ditch	Identification of contamination above levels acceptable for unconditional release.	Phase 1
	Preparation of a remediation plan	Phase 1
	Remediation if necessary	Early in Phase 2

Figure 4.4

Whiteshell Laboratories Decommissioning Project Component Timelilnes

Figure 4.4 (continued)
Whiteshell Laboratories Decommissioning Project Component Timelilnes



4.4 KEY DECOMMISSIONING ACTIVITIES

The specific decommissioning activities related to each facility, as detailed in Ridgway (1999), were used in the assessment of potential environmental effects. Several of these activities which are common to many of the facilities, have the potential to result in environmental effects. Brief descriptions of these key decommissioning activities are provided below.

4.4.1 Decontaminating

<u>Interior</u>

Decontamination will be used to remove radioactive contamination from contaminated surfaces or materials. Removal of chemical hazards (e.g. asbestos, PCBs) will be undertaken prior to or in parallel to decontamination activities. Typical decontamination activities include vacuuming, cleaning, washing, washing with high pressure, swabbing, scabbling, chemical treatment and CO_2 blasting (Table 4.5). This will be carried out for individual rooms and on areas of the walls, ceiling and floors to remove loose contamination.

Table 4.5
Decontamination Activities

ACTIVITY	DESCRIPTION
1. Washing	Washing is an important method for removal of loose contamination. For floors, a cotton mop is typically used with a decontamination cleaner.
2. Cleaning	Aggressive cleaning is used to remove embedded contaminants.
3. High Pressure Washing	High pressure washing is used to remove embedded contaminants. A jet spray (1000 - 1200 psi) is used with detergent and a cleaner.
4. Jack Hammer	An air-powered jack hammer (1000 psi) is used to remove deeply embedded contaminants (e.g. those embedded in concrete).
5. Scabbling	An air-powered (80 – 90 psi) hammering system is used for light percussive work (e.g. cracks or pores in concrete). The three main tools are hand-held, a corner tool and a floor tool. The system includes a HEPA vacuum that sucks the debris and dust created by scabbling action.
6. Swabbing	Mopping floors for removal of contamination (see washing).
7. Vacuuming	A high-capacity air-operated industrial vacuum, complete with a HEPA filtration system, is used for heavy duty vacuuming. This includes removal of concrete, plaster dust and other rubble.
8. Carbon Dioxide Blasting	Pressurized CO_2 is used with a variety of tools for percussive work.

Note: Wherever possible, the use of water is avoided. This reduces formation of secondary waste.

Minor decontamination activities may be required when building services are handled and removed. Work will be directed to the active ventilation and drainage systems. For example, the process for removal of ventilation ductwork will likely follow these steps:

- opening a sealed section of ductwork;
- decontaminating ductwork to a level that is safe for handling;

- disassembling the piece of ductwork that has been decontaminated;
- further decontaminating the piece of ductwork;
- packaging the piece of ductwork, and
- sending the ductwork to the WMA for storage.

If a portion of a machine cannot be easily decontaminated, the machine may be disassembled and the contaminated portion sent for storage in the WMA. The remaining uncontaminated portion of the equipment will be sent for reuse or recycle following surveying in the deminimis segregation facility to be located in the WMA.

Exterior

Most contamination originates inside the building and occasionally works its way through to the exterior walls. The normal decontamination process is to work from the inside out removing material until release levels are achieved. This means that the internal control systems to prevent loss of material remain in effect even when the work affects outside surfaces. Exterior contamination can also occasionally be found around vents and exhausts and on roofs. Cleaning of these surfaces is conducted under enhanced local contamination controls.

4.4.2 Removing Fixed Surplus Equipment (Interior)

Any remaining fixed equipment will be removed from the various rooms, facilities or laboratories. Typical fixed equipment includes:

- machinery;
- equipment;
- benches and tables;
- ovens and dryers;
- experimental apparatus;
- electrical components;
- grinders; and
- hoists.

Unfixed surplus items such as furniture, chemicals, laboratory apparatus and computers would already have been removed as part of the shutdown operations.

Work related to removal of equipment includes:

- removing and capping water supply and drain lines;
- disconnecting, isolating and sealing power to these units; and
- removing and sealing any other mechanical services.

4.4.3 Fixing in Place (Interior)

Fixing is the process of stabilizing contamination through methods such as the application of spray or brushed-on paint or paint-like products. Fixing is done to ensure that any loose, surface contamination is stabilized for any planned deferment period.

4.4.4 Demolishing

Buildings and structures will be dismantled and demolished in an orderly manner. For example, a building would likely be stripped to the bare shell, with all of the wood, plaster and room dividers removed. The metal roof would then be removed, leaving the concrete structure available for final demolition. If feasible, the building material and structure will be reused or recycled.

4.4.5 Remediating the Building Sites

Building sites will be remediated, stabilized and rehabilitated. This work will include:

- removing the building foundations; and
- excavating any remaining contaminated soil with concentrations above applicable guidelines.

4.4.6 Rehabilitating

Rehabilitation is aimed at returning the building sites to a more “natural” condition. Work activities will include:

- backfilling the building area with clean soil or fill;
- re-grading the area to “natural” condition;
- establishing an appropriate drainage arrangement (e.g. ditching, berm construction); and
- re-vegetating the building site and the area.

4.4.7 Transporting Radioactive Waste Off-Site

The transport of radioactive waste is regulated under the *Packaging and Transport of Nuclear Substances Regulations* (CNSC 2000c). Transported waste includes High-Level Waste (fuel, solidified active liquid waste and irradiated reactor components) as well as Medium and Low-Level waste. Key activities consist of:

- loading the waste into an approved shipping container;
- loading the container onto the vehicle;
- monitoring the vehicle for contamination and cleaning it if necessary; and
- driving the transport vehicle to an approved facility.

4.5 WASTE MANAGEMENT PRACTICES

In essence, the decommissioning program is a process of managing the Whiteshell Laboratories' site waste streams to secure an end state where all wastes are dispositioned to off-site disposal facilities or to in-situ management. The following sections describe the proposed approach to waste management for the decommissioning project.

4.5.1 Inventory of Stored Wastes

Radioactive laboratories and waste storage occupy approximately 1% of the site land (approximately 40 ha). The active area totals approximately 4 ha (0.1% of the site). Radioactive wastes are stored in waste management facilities. These wastes are categorized in three levels according to AECL procedures defined in Barnard et al. (1985) and as approved by the CNSC.

1. Low-level waste (LLW), which consists of used lab-ware, rubber gloves, shoe covers, wipe paper, and mops. The total accumulation of LLW is approximately 21,000 m^3 and is located in trenches (40 TBq as an upper limit), bunkers and storage buildings;

2. Medium-level waste (MLW), which is typically composed of scrap metal materials from experiments, filters, and radioactive liquid waste that has been solidified. This waste is stored in the standpipes and bunkers in the WMA. The total accumulation of MLW in the WMA is approximately 1,400 m^3; and

3. High-level waste (HLW), comprises of irradiated reactor fuel and metals from nuclear reactor core components. The Concrete Canister Storage Facility (CCSF) provides storage for 25 metric tonnes of irradiated reactor fuel. Some fuel wastes (approximately 3 metric tonnes) from operations prior to 1975 are stored in standpipes in the WMA.

Two other categories of stored waste are:

- 450L of active liquid waste processed to a solid form as part of shutdown operations; and
- a small volume of PCBs (16.6 L) is stored in B413 located at the main laboratory site.

4.5.1.1 Inventory of Decommissioning Wastes

The decommissioning project will handle waste from five broad categories. Preliminary estimates of the waste generation are summarized as follows:

1. Nuclear facilities and radioisotope facilities will produce the largest component of radioactively contaminated waste estimated at approximately 10,400 m^3 of LLW and approximately 1,400 m^3 of MLW. Deminimis waste from these facilities is estimated at approximately 20,000 m^3 and about 10-15% is expected to be recyclable.

2. Non-nuclear buildings and services will produce approximately 30,000 m^3 of deminimis waste and approximately 2,000 m^3 of suspect LLW.
3. Contaminated soil waste will be produced from remediation of individual building sites and from remediation of affected lands (spill incident areas, active drain lines etc.). This category cannot be estimated until additional assessments are carried out during Phase 1 to delineate the extent of contamination.

4. Another category of waste is hazardous chemicals. Some PCB-filled electrical components remain in operation at the site and many nuclear facilities contain asbestos insulation on process piping systems. Most building floor and ceiling tiles contain some asbestos. Estimates for asbestos waste volumes will be prepared as part of detailed decommissioning planning. Some laboratory chemicals may be encountered; this is expected to be negligible because Whiteshell Laboratories has continuously disposed of redundant or waste chemicals through contract firms. Also, laboratory chemicals remaining on shutdown have been disposed of in that manner as part of shutdown operations.

Table 4.6 summarizes the site waste inventory.

Table 4.6
Whiteshell Laboratories Total Waste Inventory (Preliminary Estimate)

Facility/Storage	ALW (L)	HLW (metric tonnes)	MLW (m^3)	LLW (m^3)	DEMINIMIS[1] (m^3)	Hazardous Chemicals
Stored Inventory						
WMA	180	3 25	1,400 -	21,000 -	- -	• 3000 lbs. of arsenic • 1800 lbs. of lead • DDT, glycol, solvents • Small Volume of Carcinogens[2]
CCSF		-	-	-	-	-
B413						• -16.6 L of PCB's
Decommissioning Waste						
Nuclear/Radioisotope Facilities - AD-TK3	270	-	1,400	10,400	20,000	• Asbestos[3] • Insulation • Lead Shielding[4]
Non-nuclear Buildings/ Infrastructure		-	-	2,000[5]	30,000	• Asbestos[3] • Floor and Ceiling Tiles
Chemical Wastes from in-Service Facilities						
PCB's Freon [7]						332 L 3,014 kg
Total Waste Inventory	**450**	**28**	**2,800**	**33,400**	**50,000**	**348.6L PCB's[6]** **3,014 kg Freon** [7]

(1) Approximately 10-15% of deminimis waste is expected to be recyclable.
(2) Small volumes of carcinogenic chemicals are stored in dedicated quadrant of Bunker B-4.
(3) Asbestos insulation was used on much of the WR-1 process systems and on some building service systems (High Temperature Hot Water Lines). Also building ceiling and floor tiles contain asbestos. Waste estimates will be prepared as part of detailed decommissioning planning.

(4) Lead shielding exists on many experimental/lab work areas. Estimates are being produced as part of detailed decommissioning planning.
(5) Suspect LLW which may be cleared for inactive landfill disposal.
(6) Storage of PCB materials is managed with in accordance with the Federal "Storage of PCB Materials Regulations".
(7) Ozone-depleting substances consist of Halons, CFCs, HCFCs and HFCs.

4.5.2 Waste Streams and Disposal Pathways

Figure 4.5 indicates the various decommissioning waste streams, disposal pathways and additional/new facilities which will be required to manage wastes arising from monitoring and surveillance activities and from decommissioning work at the site, until national waste disposal facilities become available. The waste sources (i.e. the various existing site facilities) are indicated in the left column. The interim processing and storage facilities are in the centre column and final disposal location or facility is indicated on the right. The primary waste sources requiring interim treatment and handling are:

- aqueous waste collected from sumps in monitoring and surveillance buildings;
- processing of site TFRE/Amine active liquid waste to a solid form;
- MLW and LLW retrieved from existing waste management facilities where enhanced packaging and storage is required prior to the availability of a waste disposal facility;
- wastes produced from carrying out monitoring and surveillance activities; and
- wastes produced from decommissioning activities prior to the availability of disposal facilities.

Figures 4.6 and 4.7 indicate the timing for shutdown and decommissioning of existing waste management facilities and the replacement facilities required to manage liquid and solid waste, respectively, produced from monitoring, surveillance and decommissioning project activities.

The upper half of the figures indicate which waste management facilities will be available over the duration of the project, whereas the lower half shows the nature of the wastes arising from decommissioning activities as well as the period when they are to be generated. The same colour codes are used in the upper and lower halves and show the destinations of the wastes.

4.5.2.1 Active Liquid Waste Processing

As indicated previously, 450 L of TFRE/Amine active liquid waste are stored at Whiteshell Laboratories. As part of operational shutdown, these wastes will be immobilized in steel containers in the Shielded Facilities, and placed into steel baskets which will be stored in a new interim storage bunker located in the WMA. These wastes will be transferred to off-site waste disposal facilities when such facilities are available.

4.5.3 Waste Processing Facilities

As indicated by the boxes in the centre column of Figure 4.5, modification of existing facilities and several new facilities are needed to process waste and provide interim storage until final disposal facilities are available. The anticipated interim processing and storage facilities required are described briefly as follows:

- Deminimis Segregation Facility

  This facility will be used to monitor wastes that are identified for off-site disposal. Wastes having radioactivity levels above free-release requirements will be segregated and placed in interim storage until disposal facilities are available. Materials below free-release levels will be transported off-site for recycling or disposal.

- Reduced Active Liquid Waste Treatment Centre

  By about year 4 of Phase 1, most of the ALWTC will be decommissioned to an interim end state. A small portion of the facility will be retained in an operational state to process aqueous LLW collected from the building sumps and small amounts of aqueous LLW and MLW originating from WMA retrieval, processing and interim storage operations.

- WMA Retrieval, Reprocessing and Repackaging Facility

  A retrieval, reprocessing and repackaging facility will be required to process waste generated from monitoring and surveillance activities and from decommissioning project work implemented prior to the availability of disposal facilities.

  Retrieval of wastes which cannot be accommodated in existing storage facilities until disposal becomes available (e.g. fuel waste in standpipes and trench 6 MLW) will require portable shielded processing facilities.

- New WMA Interim Storage Facilities

  New interim storage facilities will be required for interim storage of LLW and MLW until disposal becomes available. This will likely be composed of a segregated storage area within the WMA and include or be adjacent to the reprocessing facilities. The wastes expected to require new interim storage are:

  - solidification waste from the processing of HLW and aqueous wastes arising from WMA retrieval and processing operations;
  - monitoring and surveillance waste;
  - contaminated building maintenance materials; and
  - retrieved, processed and repackaged (WMA) waste.

Construction of new storage facilities will be subject to review and approval by AECL Safety Review Committee and the CNSC.

4.5.4 Final Waste Disposal

The final waste disposal paths are shown on the far right of Figure 4.5. There are five main disposal paths for the site decommissioning waste. These are described briefly as follows:

- In-Situ Disposal

  Waste items may be left in place for permanent disposal. In-situ disposal is proposed as the reference option for most of the LLW trenches in the WMA and for contaminated sediments at the outfall.

- Chemical Safe Storage/Disposal

  These are engineered off-site facilities expected to be available in Canada for disposal or safe storage of hazardous chemical wastes.

- Off-Site Landfill

  These are engineered sanitary landfills expected to be available within the Regional Study Area. It would likely be an off-site facility capable of handling building rubble.

- River

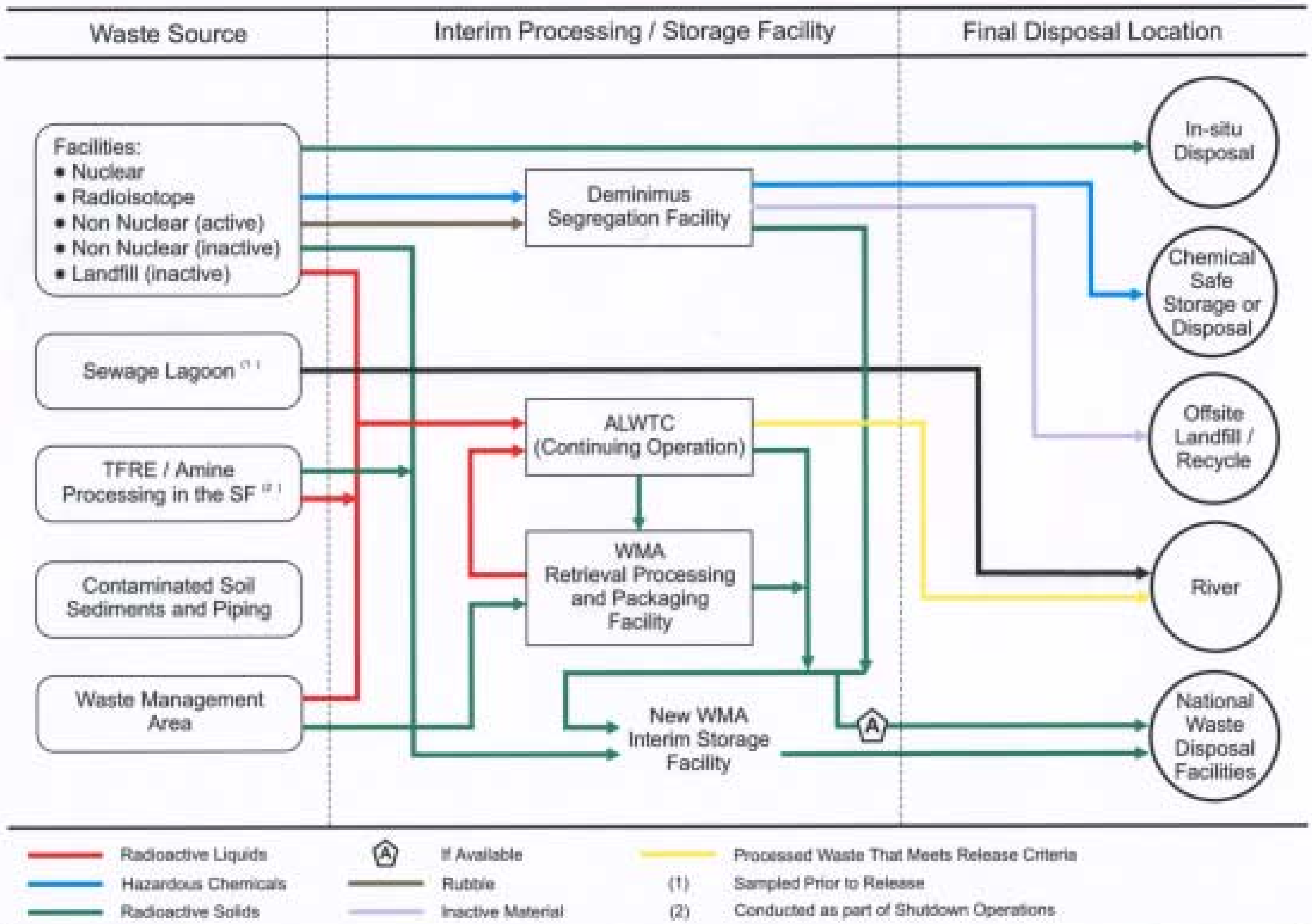
  Liquids are batch processed at the ALWTC to remove contamination and only released to the Winnipeg River if they meet release criteria. All releases to the environment will be controlled within administrative levels set well below the site Derived Release Limits (DRLs) (Soonawala 1998). Aqueous wastes above these levels are processed and stored as a solid product at the WMA. It is expected that liquid releases will be gradually reduced approaching the deferment period (end of Phase 1), and will remain at low levels throughout the deferment period.

- National Waste Disposal Facility

  A national waste disposal facility or series of facilities is required for all of the radioactive waste materials at Whiteshell Laboratories, except for the WMA low-level wastes which may be managed in-situ. Separate facilities may be required for the three main categories of solid waste. These categories are low-level, medium-level and high-level radioactive waste.

FIGURE 4.5

PROJECT WASTE STREAM AND INTERIM HANDLING FACILITIES



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WHITESHELL LABORATORIES DECOMMISSIONING
ENVIRONMENTAL ASSESSMENT

FIGURE 4.6

TIMING FOR MANAGEMENT OF RADIOACTIVE LIQUID WASTE

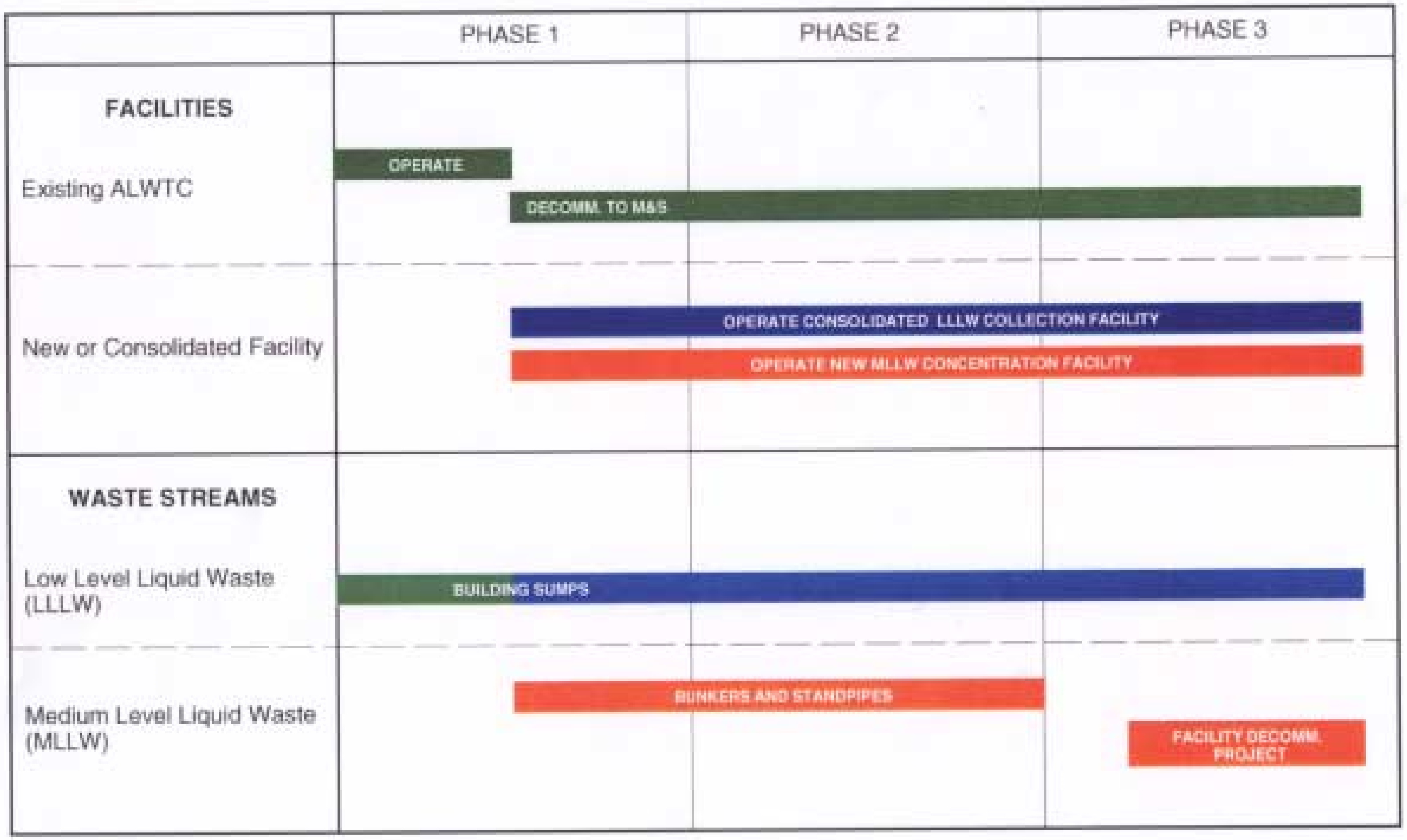
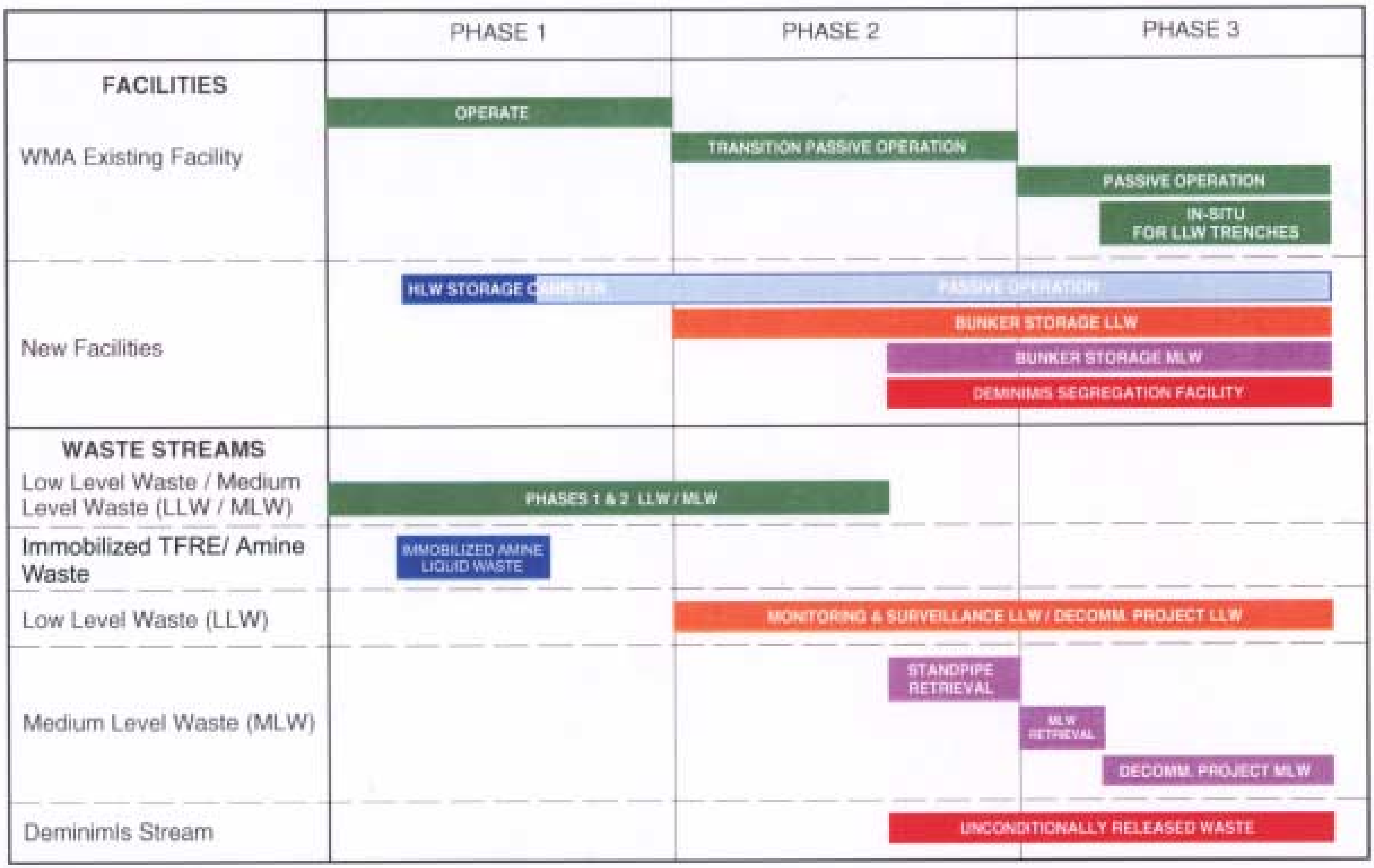


FIGURE 4.7

TIMING FOR MANAGEMENT OF RADIOACTIVE SOLID WASTE



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5.0 DESCRIPTION OF THE EXISTING ENVIRONMENT

5.1 LOCATION

5.1.1 Geographic Setting

The Whiteshell Laboratories site is located on the east bank of the Winnipeg River (50º 11'N; 96º 03'W), approximately 100 km northeast of Winnipeg, approximately 10 km west of Pinawa and 9 km upstream of the Village of Lac du Bonnet (Figure 1.1). The site lies approximately 267 m above sea level (Reimer 1966), within a broad zone where prairie grassland to the southwest merges with boreal forest to the northeast. It is on the western edge of the Precambrian Shield and is surrounded by cleared land, which supports agriculture, interspersed with peat bog (Canada Land Inventory 1968, 1975).

Forty-three percent of the site is forested and leased farmland, 46% is occupied by buildings, facilities and developed lands, and the remaining 11% is a fenced area for nuclear and non-nuclear buildings and facilities. The fenced area contains ten major buildings, and a number of small support facilities.

5.1.2 Study Areas

Regional Study Area

The Regional Study Area (Figure 2.3) is partially a Canadian Shield landscape. A large number of shield lakes (approximately 25 lakes) and connecting rivers are found in the area. The Winnipeg River, which has its outlet in Traverse Bay at the southern end of Lake Winnipeg, is among these rivers. The area includes approximately 60 km of Lake Winnipeg's shoreline, and a small portion of the lake, consisting mostly of Traverse Bay and Elk Island Heritage Park. There are a number of provincial parks in the region: Whiteshell Provincial Park (approximately one quarter of the eastern edge), Nopoming Provincial Park (the south-eastern tip), and Grand Beach Provincial Park. Also falling within the study area are the Agassiz, Whiteshell, Brightstone Sand Hills, and Belair Provincial Forests (Manitoba Highways and Transportation 1999).

Local Study Area

The Local Study Area (Figure 2.2) falls primarily within the Canadian Shield. The area includes a public airport just north of Lac du Bonnet, a hospital at Pinawa, the Seven Sisters Dam, two government picnic grounds, and a government campsite. The La Verendre Trail, connecting a number of communities in Eastern Manitoba near Whiteshell Provincial Park, passes through the centre of the Local Study Area (Manitoba Highways and Transportation 1996).

Licensed Property Study Area

The licensed Property Study Area (Figure 2.2) of Whiteshell Laboratories consists of land on both sides of the Winnipeg River. The developed and larger portion is on the east-side of the river, roughly 10 km from the Town of Pinawa. This east side of the licensed area is composed of all Whiteshell Laboratories facilities and the Field Irradiator Gamma (FIG) area. However, the vast majority of the east side is undeveloped and comprises bush land, swamp and undeveloped river frontage. All land on the west side of the river is leased to farmers for agricultural purposes.

Project Study Area

The Project Study Area consists of approximately 1340 ha of the licensed Property Study Area which has been used and/or affected by AECL nuclear development and operations.

The majority of the Whiteshell Laboratories facilities fall within a 40 ha area, adjacent to the east shore of the Winnipeg River. The Project Study Area is identified in Figure 2.1.

5.2 EXISTING CONDITIONS FOR THE CURRENT OPERATION OF THE WHITESHELL LABORATORIES FACILITY

Extensive data is collected for radiological and non-radiological conditions in and around Whiteshell Laboratories. The most recent emissions monitoring data describing the current operation of the Whiteshell Laboratories facility is presented in the 1998 Annual Report of Radiological Monitoring - Volume 2 (Niemi and Soonawala 1999a). This report summarizes radioactive emissions from Whiteshell Laboratories and compares effluent release data to the Derived Release Limit (DRL). A DRL is derived from regulatory dose limits by analytical modelling of all significant pathways to an individual in the most exposed group (the critical group). A DRL is, therefore, the upper limit of a single radionuclide for a facility in airborne and/or liquid effluents. Continued release of any radionuclide at a rate equal to the DRL would, in theory, result in an annual radiation dose equal to the regulatory limit. The operation of Whiteshell Laboratories has consistently maintained releases well below the DRL and has never resulted in adverse effects on the environment or human health.

The 1999 operations have resulted in lower emissions due to shutdown of a majority of the facilities.

Standards for Radiological and Non-Radiological Effluents

(a) *Radiological Effluents*

Standards followed for radiological effluents are based on dose limits for members of the general population prescribed by the CNSC, which in turn are based on ICRP recommendations. The current dose limit is 1 mSv per annum (CNSC 2000b). These dose limits are used to back-calculate the DRLs for every source of radiological effluents, liquid or gaseous, and for every radionuclide, released on a site. DRLs, in units of Bequerels per week or month, are approved by the CNSC and subsequently published by AECL. Critical groups and contaminant transfer pathways are important components of models used to calculate DRLs. Dose limits are shown in Table 5.1.

Table 5.1
Recommended Dose Limits

Application	Annual Dose Limits *	
	Atomic Radiation Worker	**Public**
Effective Dose: Current Limits	20 mSv (averaged over 5 years)	1 mSv

* This limit is the same as the current Administrative Control Limit effective dose per year.

In addition, the facility is operated in accordance with administrative controls as specified in AECL RC-2000-633-1. This document in part addresses the responsibilities and procedures for monitoring employee dose accumulation and restricting exposure to ionizing radiation. It sets out the Administrative Control Limits which are below the levels set by ICRP and the CNSC (See Table 5.2).

Table 5.2
Current Administrative Control Levels mSv (rem) for Atomic Radiation Workers

Organ or Tissue	Per 4 Weeks or Longer Monitoring Period	Per Year
Effective Dose	4 (0.4)*	20 (2)
Shallow Dose	50 (5)	200 (20)
Extremity Dose	50 (5)	----------

* Administrative Control Limits for workers who have declared pregnancy shall be 0.3 mSv. (0.03 rem) per two weeks and 5 mSv (0.5 rems) to the abdomen for the remainder of the pregnancy.

(b) Non-Radiological Effluents

Guidelines are followed for determining acceptable concentrations of various elements and pH in non-radiological effluents from AECL sites. These guidelines are listed in the AECL Environmental Protection Manual (RC 2000-021-00). Guidelines are for daily releases and monthly releases, the latter being the more restrictive of the two. The guidelines were obtained or derived from the following existing federal and Ontario guidelines:

- Environment Canada - Guidelines for Effluent Quality and Wastewater Treatment at Federal Facilities: EPS 1-EC-76-1, 1976 April.
- Environment Canada - Environmental Codes of Practice for Steam Power Generation: Design Phase and Operation Phase. EPS 1/PG/1 (1985 March) and EPS 1/PG/5 (1992 November).
- Ontario Ministry of the Environment - Objectives for the Control of Industrial Waste Discharges in Ontario. 1988.
- Environment Ontario - The Development Document for the Effluent Monitoring Regulation for the Electric Power Generation Sector. 1990 February.

- The MISA protocol is followed for sampling and analysis of non-radiological effluents.

Non-radiological monitoring data for Whiteshell Laboratories is documented in Atomic Energy of Canada Limited (1998).

5.2.1 Whiteshell Laboratories Airborne Effluents

The major sources of airborne radioactive effluents from Whiteshell Laboratories in 1998 were:

- the reactor building (B100) stack;
- the Active Liquid Waste Treatment Centre (B200);
- the Hot Cell Facility;
- the Immobilized Fuel Test Facility;
- Laboratory 2-136 in B300; and
- the Incinerator and the Compactor/Baler in the Waste Management Area.

A summary of air effluent monitoring results for Whiteshell Laboratories are provided in Table 5.3. Results for 1998 and the three previous years are also shown.

Table 5.3
Radionuclides in Air Effluents from Whiteshell Laboratories – 1995 to 1998

		Average Weekly Release								
	DRL * (Bq/wk)	1995 (Bq/wk)	1995 (% DRL)	1996 (Bq/wk)	1996 (% DRL)	1997 (Bq/wk)	1997 (% DRL)	1998 (Bq/wk)	1998 (% DRL)	1998 Max Weekly Release (% DRL)
Tritium										
Reactor Building	9.76E+15	4.8E+09	4.9E-05	9.7E+09	9.9E-05	2.0E+09	2.1E-05	1.9E+09	1.9E-05	5.7E-05
Beta**										
Reactor Building	3.21E+10	7.9E+03	2.5E-05	5.8E+03	1.8E-05	7.1E+03	2.2E-05	3.8E+03	1.2E-05	2.3E-05
ALWTC	9.83E+09	5.6E+03	5.7E-05	1.1E+04	1.1E-04	3.6E+03	3.6E-05	1.7E+03	1.8E-05	5.1E-05
Hot Cell Facility	1.05E+10	1.7E+04	1.6E-04	1.0E+04	9.7E-05	8.0E+03	7.7E-05	6.1E+03	5.8E-05	1.3E-04
IFTF	1.05E+10	4.8E+03	4.6E-05	4.9E+03	4.7E-05	3.0E+03	2.8E-05	4.1E+03	3.9E-05	1.0E-04
Incinerator	1.50E+11	7.1E+02	4.7E-07	1.5E+04	9.9E-06	2.7E+03	1.8E-06	2.9E+04	1.9E-05	6.5E-04
Compactor/Bailer	4.64E+09	2.8E+02	6.0E-06	2.1E+02	4.5E-06	3.4E+02	7.4E-06	3.9E+02	8.4E-06	1.6E-04
Total Beta		3.6E+04	2.9E-04	4.7E+04	2.9E-04	2.5E+04	1.7E-04	4.5E+04	1.5E-04	
^{131}I										
ALWTC	6.82E+09	2.96E+03	4.33E-05	<	<	<	<	<	<	<
Hot Cell Facility	7.25E+09	3.13E+04	4.29E-04	<	<	<	<	<	<	<
IFTF	7.25E+09	2.46E+03	3.40E-05	3.8E+05	5.3E-03	1.4E+04	1.9E-04	9.6E+04	1.3E-03	3.4E-02
Total ^{131}I		3.7E+04	5.1E-04	3.8E+05	5.3E-03	1.4E+04	1.9E-04	9.6E+04	1.3E-03	
TOTAL			0.0009		0.0057		0.0004		0.0015	

DRL * for members of the public at the Whiteshell Laboratories boundary.
** The DRL for ^{90}Sr is applied to beta activity.

Average emissions, in Becquerels per week and as a percentage of DRLs and the maximum weekly emissions as a percentage of DRL are shown for tritium, gross beta and ^{131}I for facilities in B300, B200 and B100. The releases from the various sources at Whiteshell Laboratories for various radionuclides, expressed in percentages of DRLs, are added to provide an indicator of the overall performance of the site. The highest such sum is 0.0057% for 1996, whereas the corresponding sum for 1998 is 0.0015%. The conclusion is that releases are very small, well below one thousandth of the DRL, and that this situation has been stable over several years. The year to year variations within these extremely small numbers are of no consequence.

5.2.2 Whiteshell Laboratories Liquid Effluents

The primary source of liquid radioactive effluents at Whiteshell Laboratories is the process water outfall (Outfall) which discharges continuously to the Winnipeg River. The discharge from the outfall is composed of tank discharges (including discontinuous discharges from the Active Liquid Waste Treatment Centre), storm water run-off, and miscellaneous cooling water. The secondary source of liquid effluents is the sewage lagoon which is discharged twice a year (usually June and October) to the Winnipeg River. The sewage lagoon collects sanitary sewage and wastewater from most buildings on the site.

Some drainage ditches also discharge to the Winnipeg River, but their contribution to the radioactivity in the effluent from the site is insignificant compared to the outfall and the lagoon.

Table 5.4 provides a summary of radioactive contaminants in liquid releases from Whiteshell Laboratories for the years 1995 to 1998. The average monthly releases, expressed as a percent of DRLs, are added for the various sources on site to provide a quantitative indicator of the performance of the site. In all cases, the releases were well below one thousandth of the DRL.

Table 5.4

Radionuclides in Liquid Effluents from Whiteshell Laboratories 1995-1998

			Average Monthly Release							
	DRL * (Bq/month)	**1995 (Bq/month)**	**1995 (% DRL)**	**1996 (Bq/month)**	**1996 (% DRL)**	**1997 Bq/month**	**1997 (% DRL)**	**1998 Bq/month**	**1998 (% DRL)**	**Max 1998 (%DRL)**
OUTFALL										
Gross Alpha	3.30E+11	1.1E+07	3.3E-03	8.3E+06	2.5E-03	7.96.E+06	2.4E-03	7.9E+06	2.4E-03	7.0E-03
Gross Beta	~~	3.4E+08	~~	2.1E+08	~~	2.38E+08	~~	6.1E+07	~~	~~
^{60}CO	3.18E+12	8.7E+05	2.7E-05	6.1E+05	1.9E-05	7.96E+05	2.50E-05	8.2E+04	2.6E-06	1.7E-05
^{90}Sr	4.11E+12	9.0E+07	2.2E-03	6.7E+07	1.6E-03	8.46E+07	2.06E-03	1.5E+07	3.7E-04	1.4E-03
^{134}Cs	1.12E+12	3.0E+06	2.7E-04	3.0E+06	2.8E-04	8.52E+05	7.61E-05	<	<	<
^{137}Cs	1.59+12	2.0E+08	1.2E-02	1.2E+08	7.2E-03	1.12E+08	7.06E-03	4.2E+07	2.7E-03	6.0E-03
SEWAGE LAGOON										
Gross Alpha	3.30E+11	2.4E+05	7.3E-05	1.5E+05	4.5E-05	3.2E+05	9.8E-05	9.1E+04	2.8E-05	3.3E-04
Gross Beta	~~	3.7E+06	~~	2.4E+06	~~	2.27E+06	~~	1.6E+06	~~	~~
^{90}Sr	4.11E+12	7.1E+05	1.7E-05	5.9E+05	1.4E-05	4.87E+05	1.18E-05	4.6E+05	1.13E-05	9.5E-05
^{137}Cs	1.59E+12	1.0E+05	6.5E-06	9.0E+05	5.6E-05	5.18E+04	3.26E-06	<	<	
TOTAL			0.018		0.012		0.012		0.006	

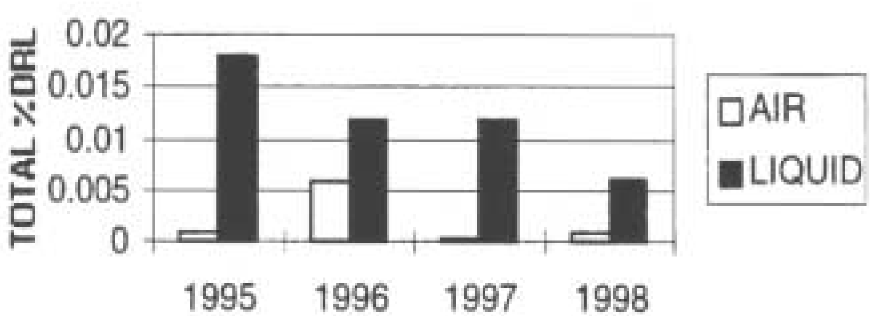
Notes:

1. Averages shown for sewage lagoon equal the total of 2 releases divided by 12.
2. DRL for ^{241}Am is applied to alpha. In previous reports DRL for ^{239}Pu was applied to alpha. Percent DRL values for 1995 to 1997 have been recalculated.
3. DRLs are for members of public at the site boundary.

In summary, expressed as DRLs, the airborne and liquid emissions from Whiteshell Laboratories have been low in 1998 and previous years. It can be noted that over this time period, the highest sum of the site-wide DRL, is about 0.02% of the cumulative DRL (liquid emissions in 1995).

Figure 5.1 summarizes annual monitoring results for airborne and liquid effluents from the Whiteshell Laboratories site from 1995 to 1998, as percent of DRL.

Figure 5.1
Radioactive Emissions from Whiteshell Laboratories 1995-1998



Non- radiological Contaminants in Liquid Effluents

A table from AECL-MISC-390-99 presented below, show the trends for 1995 to 1999 for average annual concentrations, conformance with daily emission limits, conformance with monthly emission limits and loadings. Data are presented for the two effluent release points from the site, the lagoon and the outfall. The monthly and daily emission limits adopted by AECL are also shown.

Table 5.5
Trends in Average Annual Concentrations, 1995 to 1999

Parameter	Unit	Monthly Limit (Average)	Daily Limit (Any Single Sample)	Lagoon					Outfall				
				1995	1996	1997	1998	1999	1995	1996	1997	1998	1999
pH	pH	6 to 9	5.5 to 9.5	9.10	8.5	8.3	8.1	8.3	7.5	7.8	8.1	7.4	7.56
Phosphorus	mg/L	1.0	5.0	1.03	0.74	0.60	0.61	0.50	0.03	0.05	0.09	0.00	0.02
Total Susp.Solids	mg/L	25	125	4.00	65.6	7.70	3.50	7.00	6.65	5.9	4.6	1.92	4.10
Chromium	mg/L	0.5	2.5	0.01	0	0.00	0.01	0.0005	0.00	0.01	0.01	0.01	0.003
Copper	mg/L	0.5	2.5	0.01	0.01	0.00	0.02	0.07	0.01	0.04	0.02	0.02	0.05
Iron	mg/L	1.0	5.0	0.17	0.36	0.20	0.18	0.17	0.34	0.41	0.29	0.24	0.27
Lead	mg/L	0.1	0.5	0.00	0.01	0.00	0.00	< 0.002	0.00	0.01	0.10	0.00	0.00
Nickel	mg/L	0.5	2.5	0.00	0.01	0.00	0.05	0.009	0.00	0.01	0.00	0.00	0.003
Zinc	mg/L	0.5	2.5	0.00	0	0.00	0.01	0.02	0.01	0.03	0.00	0.01	0.01
Mercury	ug/L	n/a	0.001	0.32	0.01	0.00	0.20	0.030	0.06	0.07	0.00	0.05	0.047
Phenolics	mg/L	0.02	0.1	0	0.5	0	0.008	< 0.001	N/A	N/A	N/A	N/A	N/A
Oil & Grease	mg/L	15	75	1.18	0.5	0.9	4.30	0.60	1.05	0.82	1.1	1.33	1.10

5.2.3 Estimated Dose from Whiteshell Laboratories Effluent Emissions

Environmental monitoring data (Niemi et al. 2000) have been used to estimate the incremental dose that could be caused to members of critical groups by operations at Whiteshell Laboratories. The estimates take into account water, fish and vegetable ingestion and beach exposure. Immersion in air and ingestion of wildlife (game) are not considered because of the extremely low radioactivities associated with those two sources.

Table 5.6 shows the reported dose estimates for 1997 to 1999.

Table 5.6
Estimated dose from Whiteshell Laboratories Liquid Effluents

	ADULT (mSv/a)			**INFANT (mSv/a)**		
Pathway	1997	1998	1999	1997	1998	1999
Water Ingestion	2.1E-04	3.19E-04	2.10E-04	5.6E-05	2.82E-04	1.82E-04
Fish Ingestion	1.0E-04	1.46E-04	8.32E-05	5.0E-06	7.28E-06	3.84E-06
Vegetable Ingestion	NA	5.95E-05	1.18E-04	NA	3.0E-04	2.12E-05
Beach Exposure	4.6E-05	3.69E-05	2.42E-05	7.1E-05	5.57E-05	3.63E-05
Total	3.6E-04	5.61E-04	4.35E-04	1.3E-04	6.45E-04	2.43E-04

NA: not analyzed

For comparison, typical radiation doses to adults from major natural sources and from medical diagnostic procedures amount to about 3.2 mSv/a. Actual background doses vary as a function of various factors such as elevation, local geology and housing material.

5.3 GENERAL RADIATION ENVIRONMENT

The following section provides an overview of the general radiation environment in the Pinawa area. The radiation data presented consists of routine ambient gamma radiation measurements made at 12 ambient air monitoring stations, gamma radiation survey data for various locations in the area and gross alpha/beta data for surface water, sediment and vegetation. Specific radionuclide data are presented in Section 5.3, Biophysical Conditions. The data in this section is drawn from the 1998 Annual Report of Radiological Monitoring – Volume 3 (Niemi and Soonawala 1999b). In most cases, the 1998 results of gross radiological parameter monitoring are presented along with 1994 – 1998 data in order to identify any trends.

5.3.1 Ambient Gamma Radiation Level

In 1998, ambient gamma radiation in air was monitored by means of thermoluminescent dosimeters (TLDs) at 12 locations in the three following general areas:

- at 5 locations near the perimeter of the Whiteshell Laboratories site;
- at the Pinawa hospital, Pinawa Resort (Kelsey House), Pinawa town yard; and

- at 4 locations on the Controlled Area fence.

The annual TLD readings for years 1994 to 1998 for each of the 12 TLD monitoring locations are shown in Table 5.7 in units of milligray per year (mGy/a). Figure 5.2 shows the mean of the readings from the TLDs at the site perimeter, Pinawa and Whiteshell Laboratories site Controlled Area fence areas, respectively, for the years 1994 to 1998. The reported readings include the gamma background exposure.

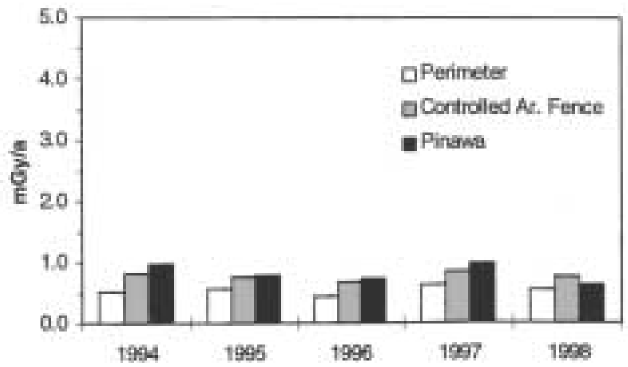
Data in Table 5.7 and Figure 5.2 show that ambient gamma radiation at all locations has remained stable over the period 1994 to 1998. The 1998 levels are marginally lower than the 1997 levels, but such small variations are of no particular significance.

Table 5.7
Ambient Gamma Radiation

Location	**Total Gamma Dose (mGy/a)**				
	1994	**1995**	**1996**	**1997**	**1998**
Perimeter					
1 North	0.530	0.603	0.503	0.719	0.668
2 East-southeast	0.390	0.482	0.381	-	0.511
3 South-southeast	0.523	0.617	0.497	0.636	0.526
4 West	0.588	0.605	0.410	0.628	0.466
5 Northwest	0.520	0.570	0.403	0.540	0.559
Mean (Perimeter)	0.510	0.575	0.439	0.631	0.546
Pinawa					
Town Yard	1.134	0.699	0.527	0.831	0.609
Resort (Kelsey House)	0.956	1.044	1.116	1.173	N/A
Hospital	0.852	*0.601	0.532	0.877	N/A
Mean (Pinawa)	0.981	0.782	0.725	0.960	0.609
Controlled Area Fence					
South Fence	0.712	0.727	0.662	0.634	0.735
East Fence	0.732	0.849	0.699	0.771	0.673
North Fence	0.683	0.732	0.694	0.874	0.931
West Fence	1.066	0.734	0.664	1.079	0.661
Mean (Fence)	0.798	0.761	0.680	0.839	0.750

N/A Data not available because of vandalism of TLDs.
* Sum of 3^{rd} and 4^{th} quarter readings multiplied by two.
Natural background, caused by cosmic and terrestrial sources, is included in the TLD readings.

Figure 5.2
Ambient Gamma Radiation 1994-1998



5.3.2 Gamma Radiation Survey Data

The dose rate due to ambient gamma radiation was measured once during 1998 at control points on road routes along a 16 km radius surrounding the Whiteshell Laboratories site. Results for 13 points in the off-site public area and 10 points within the Whiteshell Laboratories site are shown in Table 5.8 for the years 1994 to 1998. The results for 1998 are similar to those for previous years.

Table 5.8
Land Gamma Radiation Survey Data for Whiteshell Laboratories and Vicinity

Control Point	Mean Gamma Dose Rate (µGy/h)				
	1994	**1995**	**1996**	**1997**	**1998**
Public Area (16 km Route)					
Plant Road & HWY. 211	0.06	0.10	0.12	0.11	0.10
HWY. 211 & Rifle Range	0.07	0.11	0.11	0.12	0.09
Pinawa Stage 1	0.07	0.14	0.13	0.11	0.11
Pinawa Stage 2	0.07	0.13	0.14	0.12	0.12
Junction HWY. 11 & HWY. 307	0.05	0.09	0.15	0.11	0.11
Bridge to Seven Sisters	0.06	0.11	0.12	0.13	0.12
Town Circuit at Dam	0.05	0.11	0.13	0.12	0.10
Junction HWY. 214 & HWY. 111	0.08	0.06	0.08	0.10	0.09
Lac du Bonnet Circuit	0.09	0.08	0.09	0.09	0.09
West Side of LDB Bridge	0.11	0.09	0.08	0.11	0.08
HWY. 520 at Old Pinawa	0.14	0.11	0.13	0.14	0.11
Riverland School	0.12	0.11	0.12	0.12	0.12
Road at ARMS #1	0.14	0.13	0.15	0.12	0.11
Whiteshell Laboratories Site					
B401 into Active Area	0.08	0.09	0.11	0.12	0.13
Road South side of 300	0.12	0.09	0.13	0.19	0.10
Road West side of 300	0.12	0.07	0.15	0.13	0.16
South Side of 200 & 411	0.23	0.13	0.40	0.19	0.20
East of 100	0.19	0.07		0.14	0.16
East gate	0.13	0.09	0.10	0.11	0.14
North Road at Lagoon Road	0.12	0.06	0.12	0.09	0.09
Rd. East of Canister Area	0.19	0.10	0.16	0.17	0.17
East Rd. at WMA Gate	0.11	0.12	0.20	0.18	0.15
East Rd. at Landfill site	0.12	0.06	0.10	0.09	0.11

5.3.3 Affected Lands

Information on the nature and extent of potential contamination on the affected lands, resulting from some of the more significant unplanned events as well as planned tests and experiments, is presented in Table 5.9.

Table 5.9
Contamination in Affected Lands at Whiteshell Laboratories

Date	Event	Purpose/Scope	Release Quantity	Current Status	Reference
67 May	Cesium Pond experiment	Study of dose distribution in a pond containing Cs	18.5 GBq (0.5 Ci)	Elevated levels of Cs-137	Guthrie & Scott, 1969
71 May	Contamination of lawns near B300, and north side of B402 due to fission product release from Hot Cells stacks.	N/A	Max I-131 concentration in grass was 2.07E4 dpm/m^2	No detectable contamination	Acres, 1971
72 May	Contamination of grass north of B300, due to fission product release from Hot Cells stacks	N/A	92.5 MBq (25 mCi) of old fission products	No detectable contamination	Plunkett, C.H., 1972
73 March	Field Irradiator Gamma (FIG) facility	Study of ecological effects of gamma exposure on boreal forest ecosystem.	No activity released. Sealed source of 370 TBq Cs-137	No radioactivity above background	Guthrie and Dugle, 1983
1976	Zoological Environment Under Stress (ZEUS) facility	Study effects of ionizing radiation on small mammals	No activity released. Sealed source of 0.22 PBq (6000 Ci) Cs-137	No radioactivity above background	Turner and Iverson, 1976
79 May	Water containing fission products dumped at WMA into the North Ditch that discharges into the Winnipeg River.	N/A	7 GBq of fission products	Elevated levels of gross beta, about 1.25 to 2.5 times activity in West Ditch	Guthrie and Acres, 1980
80 Aug	Contamination of ground and roadway south of B200 caused by pumping of ALWTC Tank 801 into a leaking line.	N/A	65 GBq (total of 3 incidents)	About 9 GBq of Cs-137 and Sr-90 remain in ground	Ridgway et al., 1997
91 Feb and Mar	Tracer Experiment in deep boreholes, Whiteshell Laboratories borehole site	Study of radionuclide transport in rock.	1.4 GBq (37.6 mCi) of Br-82, I-131, Sr-85 and Cs-134.	Negligible activity-- short half-lives.	Frost, L.H. et al. 1995

Note: Units of radioactivity used in references have been retained. 1 Ci = 37 GBq.

An airborne gamma survey was performed to assist with site wide characterization of ground-level radiation and to verify that any significant manmade contamination was restricted to the Whiteshell Laboratories site (Gamma Bob and Sander Geophysics Ltd. 2000). Airborne gamma ray maps of the Project Study Area were produced (Figures 5.3, 5.4 and 5.5) and show ^{137}Cs and ^{60}Co gamma radiation and the total due to all sources of gamma radiation (nGy/h).

Four localized sources of ^{137}Cs were detected within the affected lands. Three of these areas are associated with the Whiteshell Laboratories nuclear facilities and the remaining area is the site of the cesium pond experiment. One of the sources associated with the Whiteshell Laboratories nuclear facilities also showed the presence of ^{60}Co and ^{232}Th. ^{137}Cs was also detected throughout the affected lands and was attributed to atomic weapons testing carried out in the 1950s and early 1960s. The ^{137}Cs activities ranged from 0 to 15 Bq/kg and are typical of those found in southeast Manitoba. No other areas with elevated levels of manmade radiation were detected within the affected lands.

It is important to note that the ^{60}Co map reveals concentrations in the WMA and not in WR-1, although there are much higher levels of ^{60}Co in WR-1. The reason for this is the integrity of the WR-1 reactor shielding structure, which attenuates the gamma radiation from ^{60}Co. This supports the argument presented in Section 3.3 that the best storage location for the WR-1 components is the reactor vault until radioactivity decay is optimized.

5.3.4 Unaffected Lands

Environmental monitoring data, (i.e. ambient gamma radiation and vegetation monitoring) referenced in Atomic Energy of Canada Limited (2000) indicate that the unaffected lands at the Whiteshell Laboratories have not been utilized, impacted or affected by Whiteshell Laboratories' operations. This was verified through a detail radiological survey in the summer of 2000 (Gamma Bob and Sander Geophysics Ltd. 2000). Until the release of unaffected lands is authorized by the CNSC, the lands will remain under CNSC licenced control.

5.4 BASELINE CONDITIONS: BIOPHYSICAL

Biophysical conditions are described for climate and meteorology, air quality, geology, hydrogeology, hydrology, terrestrial biota and habitats, aquatic biota and habitats, regional land and resource use, and valued ecosystem components.

5.4.1 Climate and Meteorology

<u>Site</u>

Meteorological measurements were made at the Whiteshell Laboratories' climate station located on a 50 m x 50 m grass field located about 200 m west of the Whiteshell Laboratories' plant site and 200 m east of the Winnipeg River, which runs approximately north-south of the site. The field is located within a 2 ha clearing with the nearest trees or buildings at least 100 m distant. The Whiteshell Laboratories' climate station consisted of a louvered shelter used to house two liquids in glass thermometers, as well as two precipitation gauges. The Whiteshell Laboratories station was closed in 1998. Also on the field are a 61 m tower operated by Whiteshell Laboratories and a 10 m tower operated by Environment Canada. The 61 m tower is instrumented at the 61, 25, 6 and 1.5 m levels with wind and air temperature sensors. Environment Canada monitors instruments mounted on or near a 10 m tower to measure air temperature, wind, rainfall, snow cover on the ground, dewpoint temperature and barometric pressure.

Period of Record

The climate station has data covering the 34 year period from 1964 to 1997 inclusive for temperature and precipitation. Wind data are available for 21 years from 1978 to 1997. Summary data in Table 5.10 covers 32 years from 1964 - 1995.

Temperature

The near surface temperature affects the reaction rates of contaminants as well as atmospheric stability.

Table 5.11 presents the temperature variations by month over the 32 year period of record. The daily minimum ranges from a high of 12.9°C in July to a low of –23.8°C in January, while the daily maximum ranges from a high of 24.7°C in July to a low of –13.0°C in January. The daily mean temperature varies from a low of –18.4°C in January to a high of 18.8°C in July.

Over the 32 year period of record, the extreme maximum temperature was 37.5°C recorded on 17 June 1995 and the extreme minimum was –47.8°C recorded on 19 February 1966.

Table 5.10
Whiteshell Laboratories Normals and Extremes 1964-1995 for Temperature

Parameters	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual	32-Year Extreme
Temperature														
Daily Maximum (°C)	-13.0	-8.9	-1.0	9.3	17.7	22.0	24.7	23.4	17.2	9.6	-1.5	-9.9	7.5	
Daily Minimum (°C)	-23.8	-21.2	-12.9	-2.8	4.4	9.7	12.9	11.4	6.1	0.4	-8.7	-19.1	-3.6	
Daily Mean (°C)	-18.4	-15.0	-7.0	3.2	11.1	15.9	18.8	17.4	11.7	5.0	-5.0	-14.5	1.9	
Extreme Maximum (°C)	7.8	9.5	20.0	29.9	34.6	37.5	35.0	35.6	36.0	27.2	23.3	10.0		37.5
Extreme Minimum (°C)	-43.9	-47.8	-39.4	-28.9	-13.9	-3.9	-0.6	-1.6	-6.7	-14.5	-34.5	-40.0		-47.8
Degree-Days														
Monthly Degree-Days (below 18°C)	1125.1	929.6	772.1	444.6	224.4	90.8	29.5	59.6	197.8	404.0	688.0	1005.0	5971.0	
Sunshine Hours														
Monthly Hours of Sunshine	112.6	133.7	172.8	205.9	346.2	243.6	287.6	249.0	148.5	106.6	83.0	94.2	2083.6*	

* 16 Year Normal.

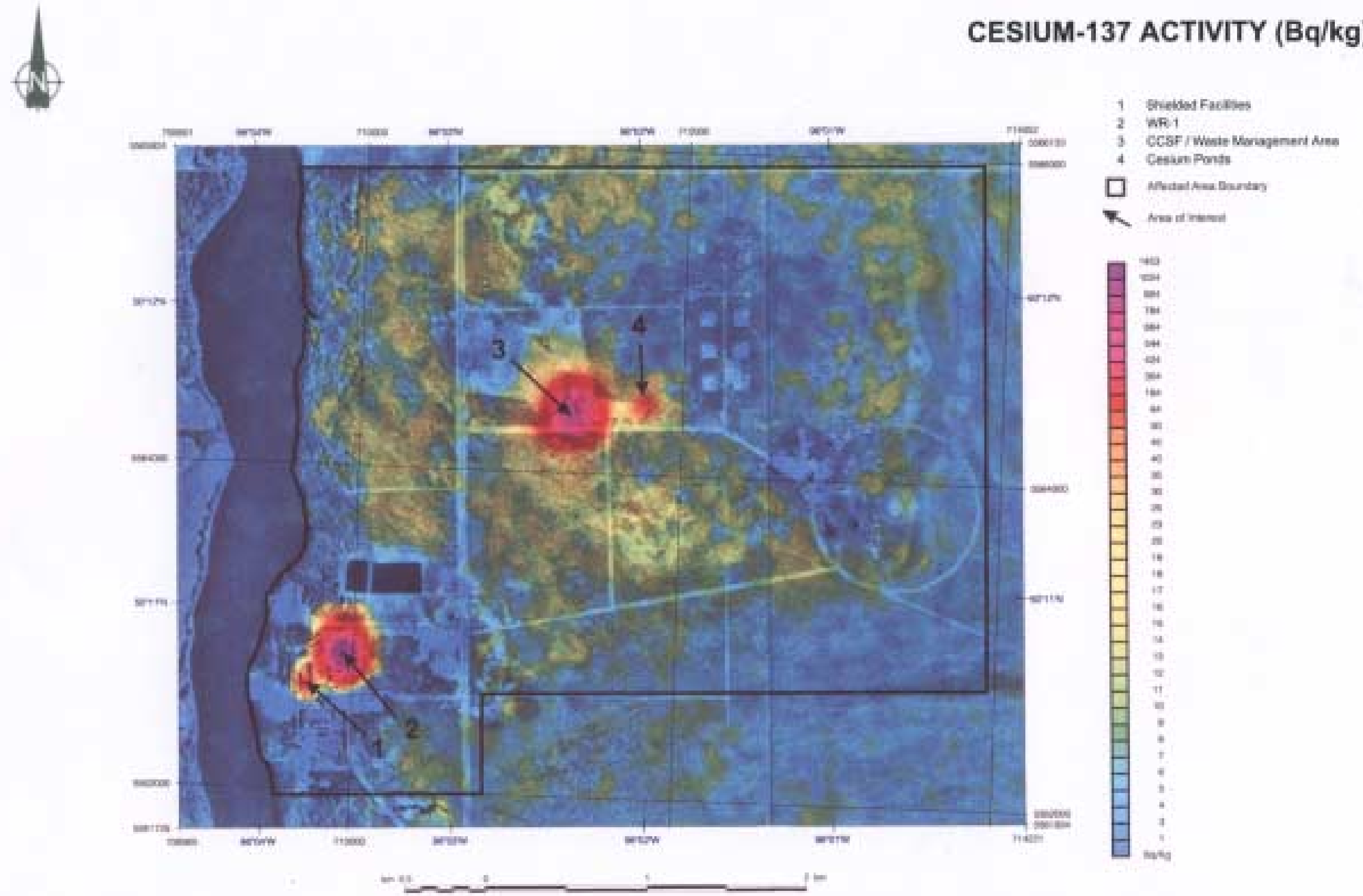
Precipitation

Contaminants in the atmosphere can be deposited to the Earth's surface by precipitation. This can contribute to contaminant levels in soil and groundwater.

Table 5.11 shows that Whiteshell Laboratories receives an average of 562 mm of precipitation per year, including an average of 127.1 cm of snowfall. The mean maximum monthly rainfall is 91.3 mm in June. Both July and August also have relatively high rainfall of 77.8 mm and 72.5 mm, respectively.

FIGURE 5.3

CESIUM-137 ACTIVITY (Bq/kg)



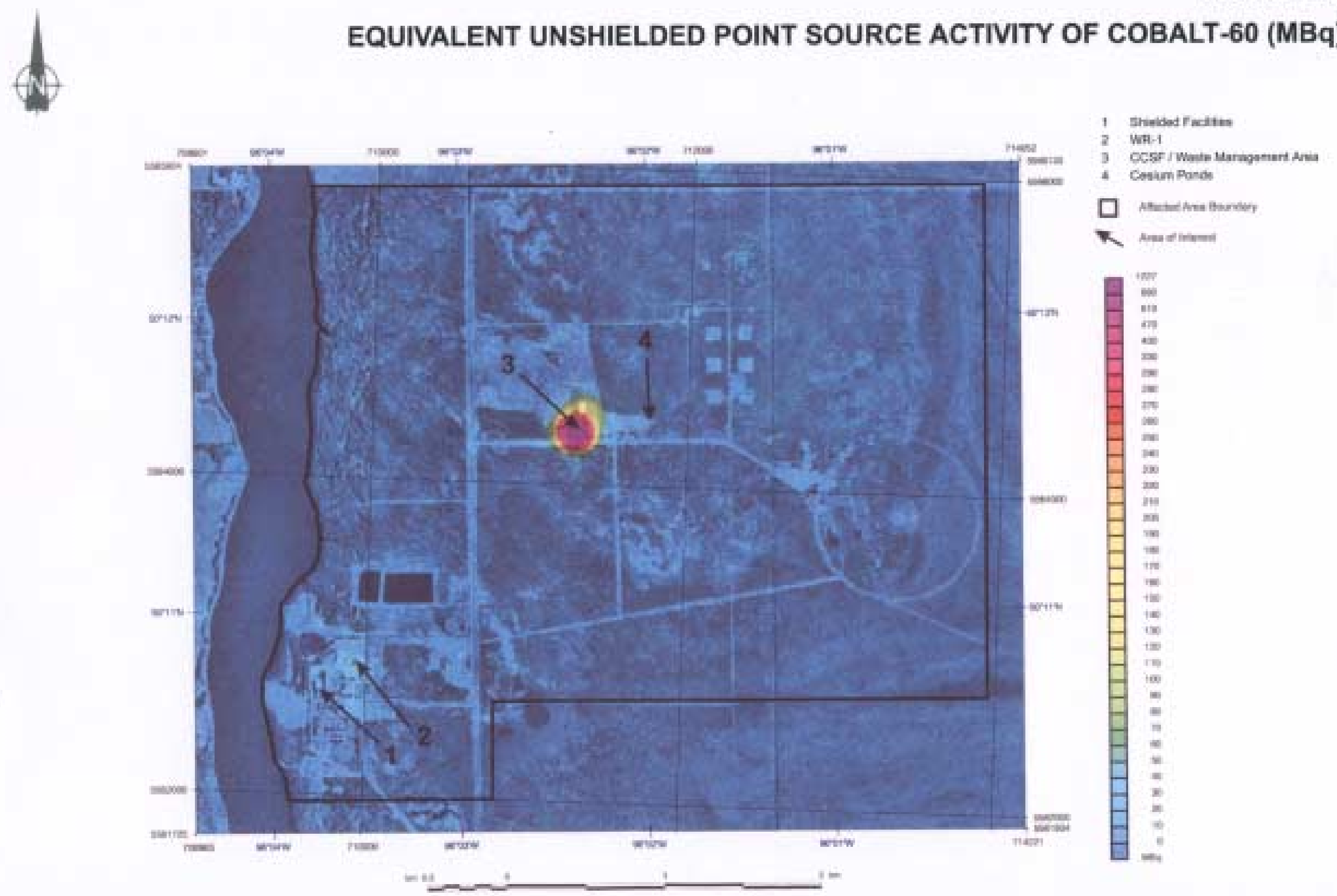
SOURCE: Adapted from Gamma Bob and Sander Geophysics, 2000

AECL EACL

WHITESHELL LABORATORIES DECOMMISSIONING
ENVIRONMENTAL ASSESSMENT

FIGURE 5.4

EQUIVALENT UNSHIELDED POINT SOURCE ACTIVITY OF COBALT-60 (MBq)



SOURCE: Adapted from Gamma Bob and Sander Geophysics, 2000

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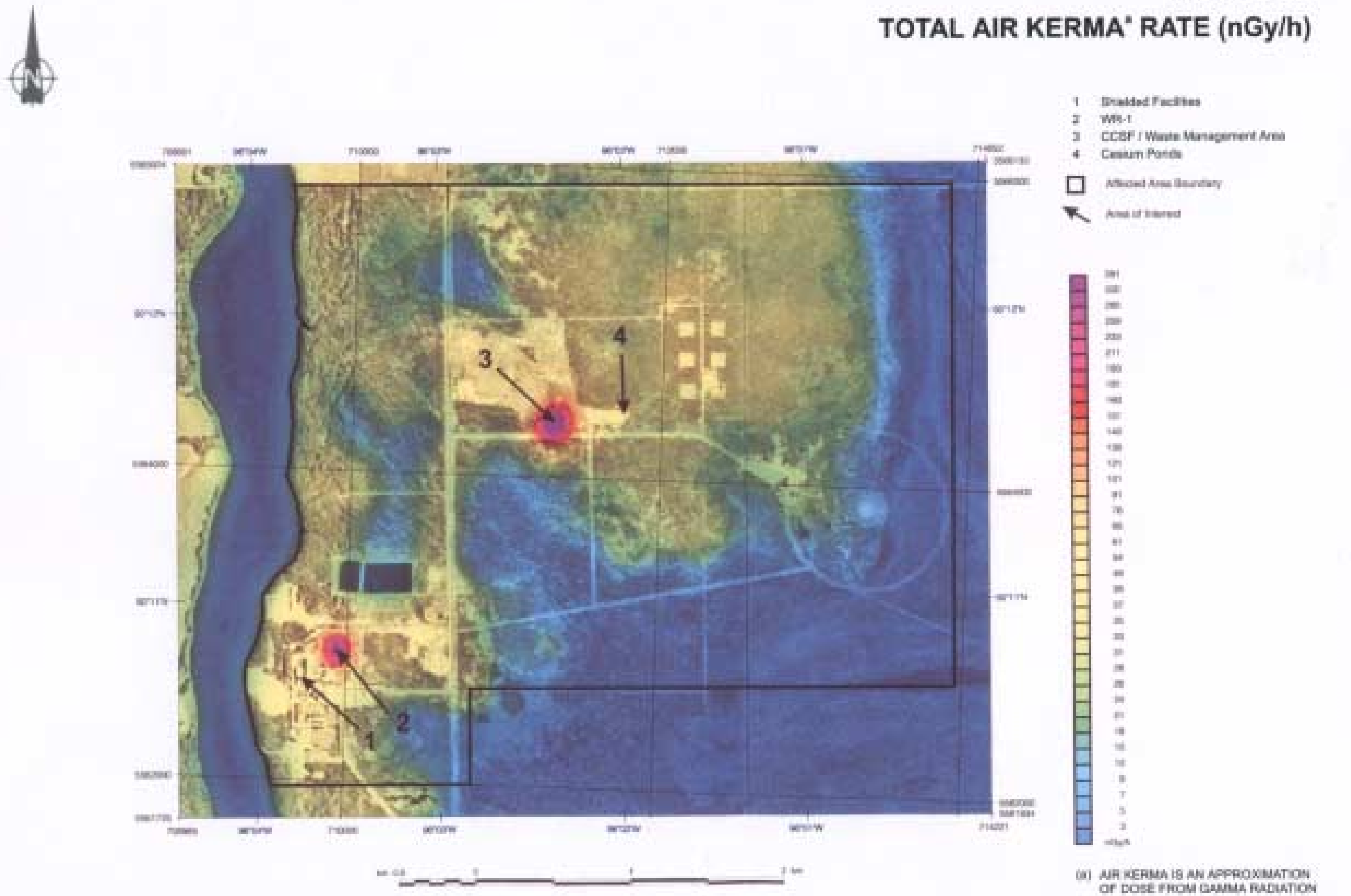
FIGURE 5.5

TOTAL AIR KERMA* RATE (nGy/h)



(*) AIR KERMA IS AN APPROXIMATION OF DOSE FROM GAMMA RADIATION

SOURCE: Adapted from Gamma Bob and Sander Geophysics, 2000

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WHITESHELL LABORATORIES DECOMMISSIONING ENVIRONMENTAL ASSESSMENT

The maximum 24-hour accumulation of rainfall occurred on 15 June 1973 when 168.4 mm was measured. The maximum snowfall in one day was 36.8 cm on 31 October 1971.

Measurable precipitation occurs on an average of 128 days per year based on the Environment Canada Whiteshell Station over the period 1961 to 1990 (Environment Canada 1993).

Table 5.11
Whiteshell Laboratories Normals and Extremes 1964-1995 for Precipitation

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual	32-Year Extreme
Rainfall (mm)	0.4	0.4	7.0	24.6	55.2	91.3	77.8	72.5	62.6	36.5	5.5	1.0	434.9	
Snowfall (cm)	23.3	14.6	20.4	10.5	1.9	0.0	0.0	0.0	0.6	8.4	23.1	24.3	127.1	
Total Precipitation (mm)	23.8	15.0	27.4	35.1	57.1	91.3	77.8	72.5	63.2	44.9	28.6	25.3	562.0	
Greatest Rainfall in 24 Hours (mm)	5.1	3.3	17.4	32.0	65.0	168.4	60.0	77.2	75.2	56.5	18.4	17.6		168.4
Greatest Snowfall in 24 Hours (cm)	23.9	15.7	34.3	32.5	10.0	0.0	0.0	0.0	4.0	36.8	20.8	20.8		36.8

Wind Speed

Figure 5.6 presents the average wind speed and shows that at Whiteshell Laboratories, the wind speed varies from 8 to 9 km/h near the surface (6 m) to 17 to 20 km/h at a height of 61 m. The annual average wind speed at the reference 10 m height is 14 km/h (Environment Canada 1982).

Dilution of airborne emissions increases with wind speed.

Figure 5.6
Average Wind Speed vs Height for the Period 1978 to 1995

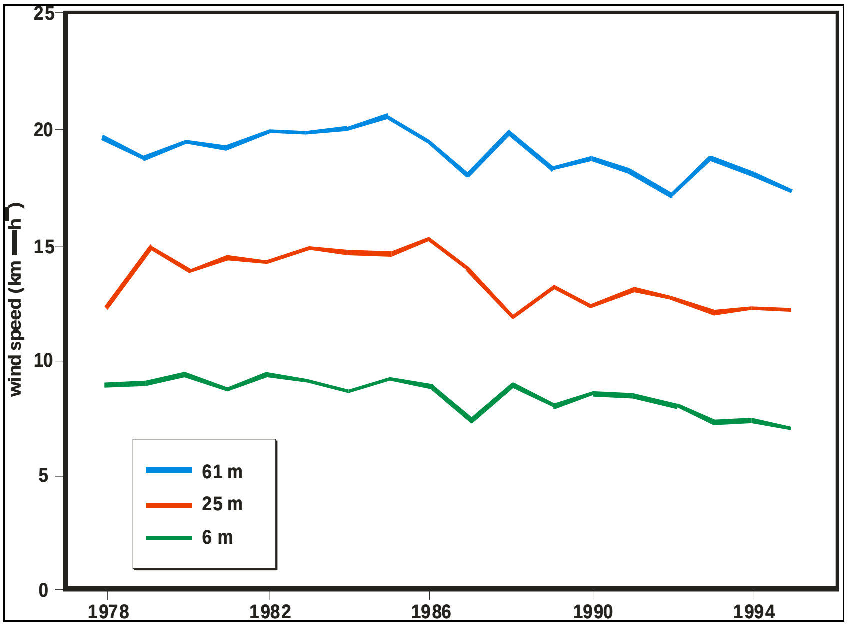


Table 5.12 presents the percentage frequencies of various wind speed categories as a function of wind direction. Wind speed data were divided into four classes: calm, 1.5 to 12, greater than 12 to 20, and greater than 20 km/h. Calm was defined as any wind speed less than 1.5 km/h.

Table 5.12
Wind Rose Data (6 m) for 1978 – 1995

Wind Direction	Hourly Observations of Wind Speed (km/hr)				Totals
	<1.5 (calm)	>1.5 to 12	>12 to 20	>20	
N	0.89%	4.81%	1.32%	0.17%	7.19%
NNE	0.35%	2.58%	0.72%	0.06%	3.72%
NE	0.23%	1.31%	0.57%	0.09%	2.20%
ENE	0.31%	1.35%	0.37%	0.05%	2.08%
E	0.39%	1.87%	0.70%	0.12%	3.09%
ESE	0.66%	2.36%	0.76%	0.06%	3.84%
SE	1.00%	3.42%	1.05%	0.06%	5.54%
SSE	1.12%	6.59%	3.03%	0.43%	11.17%
S	1.62%	6.89%	1.60%	0.18%	10.29%
SSW	1.75%	4.25%	0.38%	0.01%	6.39%
SW	1.52%	3.11%	0.31%	0.02%	4.96%
WSW	1.45%	3.32%	0.59%	0.07%	5.44%
W	1.22%	3.51%	1.49%	0.33%	6.55%
WNW	0.92%	2.71%	2.01%	0.99%	6.63%
NW	0.76%	3.23%	2.85%	1.59%	8.43%
NNW	0.76%	5.66%	2.57%	0.73%	9.72%
Totals	**14.94%**	**56.98%**	**20.32%**	**4.98%**	**97.22%**

Missing Data = 2.78%.
Source: Johnston 1996.

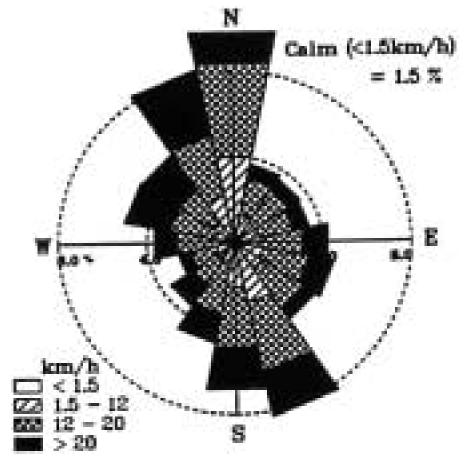
Table 5.12 shows that only about 5% of the wind speeds are above 20 km/h which is the wind erosion threshold speed. This indicates that there is a very low potential that fugitive dust resulting from decommissioning will be resuspended and carried off-site.

Wind Direction

Wind direction is reported as the direction from which the wind blows. In general terms, if the wind does not blow toward a receptor, there is no air quality problem. However, at most locations the wind blows in all directions with varying frequencies. Certain directions occur more frequently than others, and these are known as the prevailing winds.

Table 5.12 presents the wind rose data for the 6 m level at Whiteshell Laboratories. It shows that the prevailing wind directions are SSE, S and NNW. This bi-directional prevailing wind characteristic is caused by a channelling of the wind by the local topography (the river valley).

Figure 5.7
Whiteshell Laboratories Windrose, 1998
for 61 m Height



Recent Wind Data

The 1998 data from the Whiteshell Laboratories' observing station shows a similar pattern to the 17 year summary presented in Table 5.12. The data presented in Figures 5.7, 5.8, 5.9 and 5.10 show an increasing percentage of calms and a shift to lower windspeeds as the surface is approached. This is consistent with theory. The high level of calms near the surface (20.5%) means that any dusts generated tend to stay on or near the site.

Figures 5.7, 5.8, 5.9 and 5.10 also show a shift in the predominant wind directions from SSE-NNW near the surface (6 m) to N-S aloft (61 m). Again, this is consistent with boundary layer physics with a clockwise rotation due to the coriolis forces as one moves away from the earth's surface.

Figure 5.8
AES/Whiteshell Laboratories Windrose, 1998
for 25 m Height

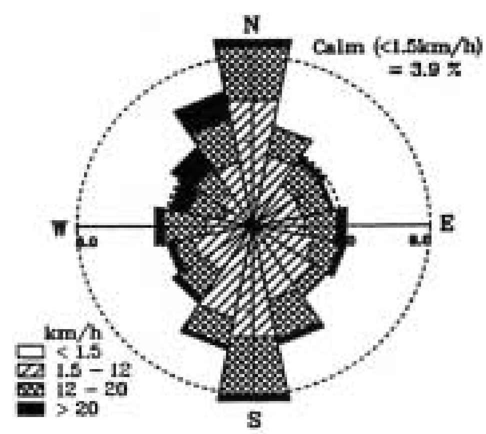


Figure 5.10 presents the 1998 wind rose data from the Environment Canada tower. It is very consistent with the Whiteshell Laboratories' data except that it shows lower wind speeds and a high frequency of occurrence of winds from the NW and SE sectors.

5.4.2 Air Quality

Figure 5.9
Whiteshell Laboratories Windrose, 1998 for 10 m Height

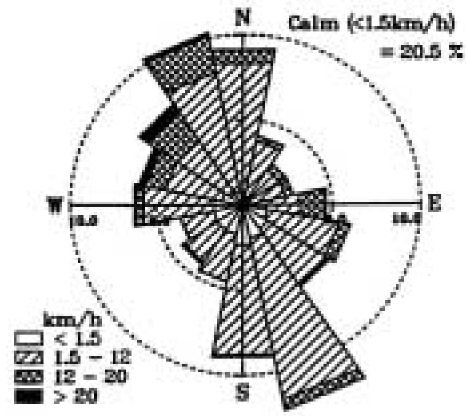
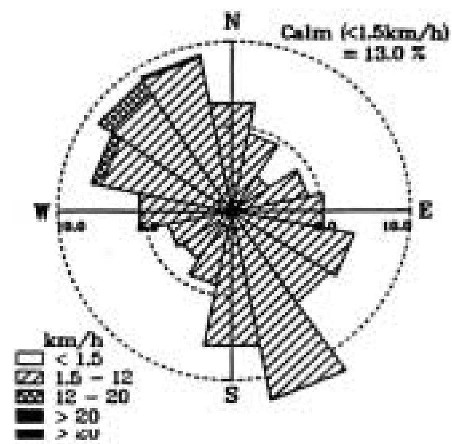


Figure 5.10
AES/Whiteshell Laboratories Windrose, 1998 for 6 m Height



Introduction

The existing air quality is being documented to provide a baseline against which the effects of the decommissioning of Whiteshell Laboratories can be assessed. The decommissioning will generate dust (particulate matter) with varying particle sizes. These are generally categorized into three forms:

- PM_{10} is the fraction of the particulate matter that is less than 10 µm in diameter. PM_{10} will remain in the atmosphere longer since the particles are smaller. Particles of this size have been linked with increased cardiopulmonary effects in humans.
- $PM_{2.5}$ is the fraction of particulate matter that is less than 2.5 µm in diameter. This size of particle can be breathed deep into the lungs and behaves like a gas, remaining in the atmosphere for days to weeks before being deposited.
- Dustfall which is made up primarily of larger dust particles that can collect on flat surfaces.

Regional Study Area

There is no air quality monitoring in the region (Van Dusen 2000). The closest data available are from the following stations:

- Stations 9118 and 9119 in Winnipeg, MB.
- Stations 62030, 62032 and 62035 in Fort Frances, ON.
- Stations 63200, 63046, 63120 and 63121 in Thunder Bay, ON.

These stations have been set up primarily as significant local source monitors and as such will not be representative of conditions in the Regional Study Area. The lowest 10th percentile of the observations will, however, represent background air quality. These data can be used to estimate the background air quality at the study area as this level is fairly constant from site to site. Data from the above stations for 1995 were reviewed and the 10th percentile values are presented in Table 5.13.

Table 5.13
1995 10th Percentile Air Quality Data Summary

Parameter	Units	Averaging Time	Station Location ID #								
			Winnipeg, MB		Fort Frances, ON			Thunder Bay, ON			
			9118	9119	62030	62032	62035	63200	63046	63120	63121
CO	ppm	1 hour	0.20	0.40	nd	nd	nd	nd	0.00	nd	nd
NO_2	pphm	1 hour	0.30	0.70	nd	nd	nd	0.00	nd	nd	nd
NO	pphm	1 hour	0.00	0.00	nd	nd	nd	0.00	nd	nd	nd
NO_x	pphm	1 hour	0.30	0.80	nd	nd	nd	0.00	nd	nd	nd
O_3	ppb	1 hour	2.00	2.00	12.70	nd	nd	2.60	nd	10.10	nd
SO_2	ppm	1 hour	nd	nd	nd	nd	nd	0.00	nd	nd	nd
COH	COH units	1 hour	0.00	0.00	0.00	nd	nd	0.00	0.00	nd	nd
PM_{10}	$\mu g/m^3$	24 hours	nd	8.20	nd	nd	nd	6.00	nd	nd	nd
TSP	$\mu g/m^3$	24 hours	14.00	15.00	nd	10.00	14.00	16.00	21.00	nd	12.00
Lead (Pb)	$\mu g/m^3$	24 hours	0.03	0.03	nd	nd	nd	0.01	nd	nd	nd
SO_4	$\mu g/m^3$	24 hours	0.85	0.97	nd	nd	nd	1.48	nd	nd	1.46
NO_3	$\mu g/m^3$	24 hours	0.08	0.14	nd	nd	nd	nd	nd	nd	nd
TRS	ppb	1 hour	nd	nd	0.00	0.00	nd	0.00	0.00	nd	nd

Note: nd = no data.

Table 5.14 shows regional air quality background concentration levels in the following range:

Table 5.14
Air Quality Background Concentration Levels

Parameter		Concentration Range (various units)	Concentration Range ($\mu g/m^3$)	Air Quality Standard ($\mu g/m^3$)	Range (%)
CO	(1 hour average)	0 – 0.4 ppm	0 – 466	36200	0 – 1.2
NO_2	(1 hour average)	0 – 0.7 pphm	0 – 13	400	0- 3.3
NO	(1 hour average)	0 pphm	0	ns	-
NO_x	(1 hour average)	0 – 0.8 pphm	0 – 15	400	0 – 3.4
O_3	(1 hour average)	2 – 13 ppb	4 – 26	160	2.5 – 16.3
SO_2	(1 hour average)	0 ppm	0	690	0
TRS	(1 hour average)	0.00 ppb	0	40	0
PM_{10}	(24 hour average)		6 – 8	50	12 – 16
TSP	(24 hour average)		10 – 21	120	8.3 – 17.5
Pb	(24 hour average)		0.01	2	0.5
$SO_4^{=}$	(24 hour average)		0.85 – 1.48	ns	-
NO_3^{-}	(24 hour average)		0.08 – 0.14	ns	-

In summary, the regional air quality ranges from 0 to 17% of the relevant provincial and/or federal standards. Therefore, this area is classified as “very clean”.

Local Study Area (Including the Licensed Study Area)

The 1998 Annual Report of Radiological Monitoring - Volume 3 (Niemi and Soonawala 1999b) was used to develop the baseline air quality for the Whiteshell Laboratories site. Levels of non-radiological pollutants including dust (Particulate Matter less than 10 µm in diameter (PM_{10}), Particulate Matter less than 2.5µm in diameter ($PM_{2.5}$), Sulphur dioxide (SO_2), Nitrogen oxides (NO_x) and Volatile Organic Compounds (VOCs), in the Project Study Area are not expected to differ from the regional levels.

Radioactivity and Air Quality

The monitoring data collected for the above mentioned 1998 report shows consistently low levels of radioactivity at all monitoring stations both within the Project Study Area and in the Local Study Area (Niemi and Soonawala 1999b). It concludes that *"…monitoring of potential atmospheric effluent exposure pathways did not indicate any measurable contribution in excess of natural background levels from Whiteshell Laboratories operations. This is consistent with effluent monitoring results which indicated that airborne emissions were very small."*

The estimated dose to the most heavily exposed members of the public (assumed to be living at the site boundary) was a negligible percentage of the typical background radiation dose in Canada.

5.4.3 Geology

Bedrock Geology

Regional Study Area

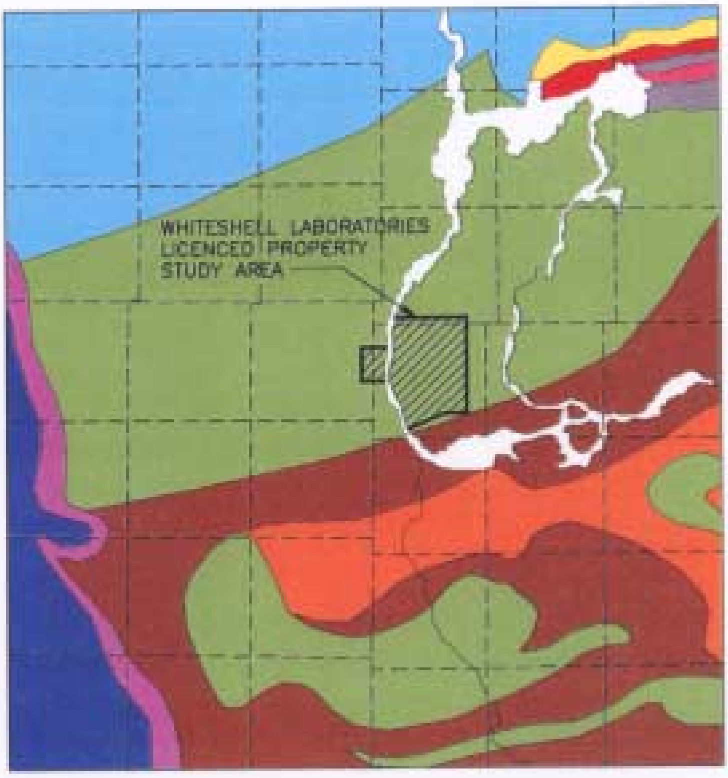
In the eastern portion of the Regional Study Area, the chief rock types consist of predominately acidic to intermediate gneisses that have been extensively intruded by granitic to granodioritic rocks. In the western region, Precambrian rocks are overlain by gently dipping (to the west) Paleozoic sediments forming the eastern margin of the Western Canadian Sedimentary Basin. The basal unit of this formation is the Winnipeg Formation, comprising inter-bedded shales and sandstones, which lie unconformably on the Precambrian surface. Overlying the Winnipeg Formation is the Red River Formation, comprising limestones and dolomites. To the northeast lies a series of Archean sedimentary, volcanic and intrusive rocks, which include the large Bernic Lake pegmatite (Guthrie and Scott 1988).

Local Study Area

In the vicinity of the Whiteshell Laboratories (Figure 5.11), the Lac du Bonnet batholith is the dominant igneous body in the area, and forms part of the English River Subprovince of the Superior Province of the Precambrian Shield. The Lac du Bonnet batholith is a large, flat, sheet-like body with steeply dipping walls (Guthrie and Scott 1988), and where outcrops occur (mostly on the east side of the Winnipeg River), jointing is evident. The northern and southern contacts of the Lac du Bonnet batholith consist of granodioritic gneisses and undifferentiated grantitic rocks, respectively.

FIGURE 5.11

GEOLOGY OF LOCAL STUDY AREA



PALEOZOIC

ORDOVICIAN

- WINNIPEG FORMATION, BASAL SANDSTONE
- DOLOMITES, DOLOMITIC LIMESTONE, AND LIMESTONE

ARCHEAN

LATE INTRUSIVE ROCKS

- GRANITE, MINOR GRANODIORITE
- GRANODIORITE, MINOR TONALITE, AND MIGMATITE
- GREYWACKE, CONGLOMERATE, ETC.
- WHITESHELL LABORATORIES LICENCED PROPERTY STUDY AREA (APPROXIMATE LOCATION)

METAMORPHOSED EARLY INTRUSIVES, ETC.

- TONALITIC AND GRANODIORITIC GNEISS, MIGMATIC GNEISS, AND AUGEN GNEISS
- UNDIFFERENTIATED GRANITIC ROCKS

EARLY METAVOLCANIC AND METASEDIMENTARY ROCKS

- GREYWACKE, MUDSTONE, CONGLOMERATE, ETC.
- PYROCLASTIC VOLCANIC ROCKS
- BASALTS, MINOR ANDESITES, ETC.

5 0 5 10 15 20km

NOTE:

Modified from the Geological Map of Manitoba, 1:1,000,000 in Guthrie and Scott, 1988

Surficial Geology

Regional Study Area

The regional surficial geology comprises widespread deposits of till and glacio-fluvial and glacio-lacustrine materials. Tills of predominantly sandy and/or clayey composition are widespread in the western portions of the region, but are less widespread in the central and eastern portion, where they are generally confined to bedrock depressions between bedrock outcrops. End-moraine and outwash complexes (comprising mostly sand and gravel) are evident just west of the Winnipeg River. Extensive deposits of lacustrine clay, mud and silt, are found over the existing glacial deposits in the western portion of the region, but are less widespread in the central and eastern areas (Betcher et al. 1988). In general, the Winnipeg River divides the area into two basic subregions with regard to surficial geology: (i) calcareous tills to the west, and (ii) sandy tills and glacio-fluvial deposits to the east (Guthrie and Scott 1988). Finer glacio-lacustrine deposits are evident along the drainage depressions of the Winnipeg River and Pinawa Channel (Lee River).

Local Study Area

On either side of the Winnipeg River, extending for 2 to 3 km, a continuous surficial unit of clay is present, broken in only a few places by occasional bedrock outcroppings and slightly elevated and coarser materials overlying the clay unit (Figure 5.12). Further east of the Winnipeg River, the overburden soils become thinner, and the bedrock outcrops more numerous (Shawinigan Engineering Company 1960).

Project Study Area

In the immediate vicinity of the Whiteshell Laboratories, there are approximately 10 to 20 m of surficial overburden soils overlying the Precambrian bedrock. These overburden soils include glacial, glaciofluvial and alluvial deposits. A low alluvial terrace exists along the banks of the Winnipeg River comprising mostly silt material.

Two major silty clay horizons overlying clay till were noted in test boreholes undertaken at the site in the late 1950s (prior to development of the site). The upper silty clay horizon has been described as hard, while the lower silty clay horizon was noted to be stiffer and containing less silt. The upper silty clay sequence is approximately 4 to 6 m thick at the eastern portion of the site, but was noted to be thinner to the west, towards the Winnipeg River. There were also instances of fine sand lenses encountered in some test holes (Shawinigan Engineering Company 1960).

At the Waste Management Area (WMA) of the Whiteshell Laboratories, and where extensive test hole drilling has taken place prior to, and since site development, the overburden soils were found to comprise 0.5 m of organic-rich soil horizon overlying 1.5 m of silt, 2.5 m of clay, 5 m of clayey till, and 3 to 5 m of stratified sand (Cherry and Robertson 1988). The upper silt, clay and clayey till units are noted to thicken in an eastward direction. The upper silt, clay and clayey till units were also noted to be vertically fractured throughout, possibly due to both historically drier climates and lower water tables, and subsurface geochemical processes causing shrinking and swelling of clay minerals in the till. The surficial geology in the immediate vicinity of the WMA is shown in Figure 5.12 and Figure 5.13 Stratigraphic cross-sections of the overburden geology at the WMA are presented in Figures 5.14.

Soil Characterization

The two major factors that influence soil formation are drainage and parent material. The surficial soil types in the Local Study Area are presented in Figure 5.15. In general, the surficial soil distribution in the low-lying areas to the northwest and west, and away from major streams, comprise peats in areas of poor drainage. Improved drainage conditions in these areas leads to the development of humic gleysols and brunisols, while underlying outwash sands and gravels lead to the development of brunisols. Soil development near the Winnipeg River includes peaty humic gleysols on lacustrine silts and clays, but the inherently more effective surface drainage at these locations generally retards peat development. Precambrian bedrock outcrops generally have only partial lichen and moss cover, although peat soil is common in depressions (Guthrie and Scott 1988).

5.4.4 Hydrogeology

Bedrock Aquifers

The Winnipeg and Red River Formations form important and extensive bedrock aquifers in the western part of the region, while Precambrian rocks form the main bedrock aquifer east of the Winnipeg and Whitemouth Rivers, where surficial deposits are generally thin and scattered (Betcher et al. 1988). The limestone and dolomites of the Red River Formation are generally well fractured and provide moderate to high well yields (up to 50 L/sec), while the sandstone sequences of the Winnipeg Formation will typically yield somewhat less. These two aquifers are effectively separated by shale sequences comprising the upper portion of the Winnipeg Formation. Groundwater in the Precambrian bedrock aquifer is obtained primarily from fracture zones in otherwise competent rock of very low permeability. Yields are highly variable, from effectively no groundwater at all, up to 5 L/sec (Betcher et al. 1988).

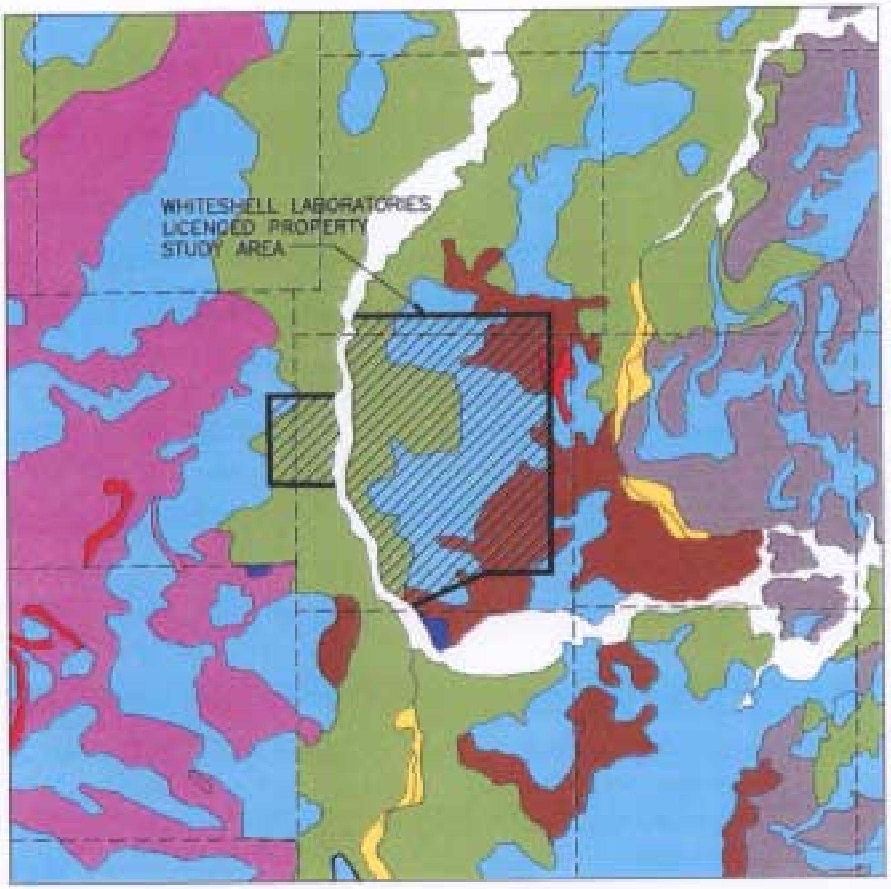
Shallow and Perched Aquifers

Regional Study Area

Carbonate-rich sand and gravel aquifers overlying Pre-Cambrian bedrock are widespread near the Milner Ridge moraine, at the centre of the Regional Study Area, and represent a major recharge area for the sedimentary bedrock aquifers underlying the western portion of the Regional Study Area. Elsewhere in the Local Study Area, localized sand and gravel aquifers are found (at the Waste Management Area, for example), but are generally interstratified with finer grained deposits within till sheets or at the bedrock-till contact. The till aquifers generally have low water-bearing capacities, although some sandy till zones are exploited through the installation of specially designed, large-diameter wells (Guthrie and Scott 1988).

FIGURE 5.12

SURFICIAL GEOLOGY OF LOCAL STUDY AREA



POSTGLACIAL

- SWAMP (PEAT)–INCLUDING STANDING WATER AND ALLUVIAL MUD
- ALLUVIUM–MAY INCLUDE SOME LACUSTRINE CLAY OR SILT

LATE GLACIAL & GLACIOLACUSTRINE

- BEACH RIDGES
- LACUSTRINE CLAY–SILT OR PEBBLE RICH
- LAKE MODIFIED MORAINE SANDY SURFACE

GLACIAL & GLACIOFLUVIAL

- OUTWASH AND ESKER SEDIMENTS
- CARBONATE RICH CLAY FILL

PRECAMBRIAN BEDROCK OUTCROPS

- WAVEWASHED OUTCROPS WITH MINOR LACUSTRINE CLAY OR CALCAREOUS CLAY TILL
- WHITESHELL LABORATORIES LICENCED PROPERTY STUDY AREA (APPROXIMATE LOCATION)

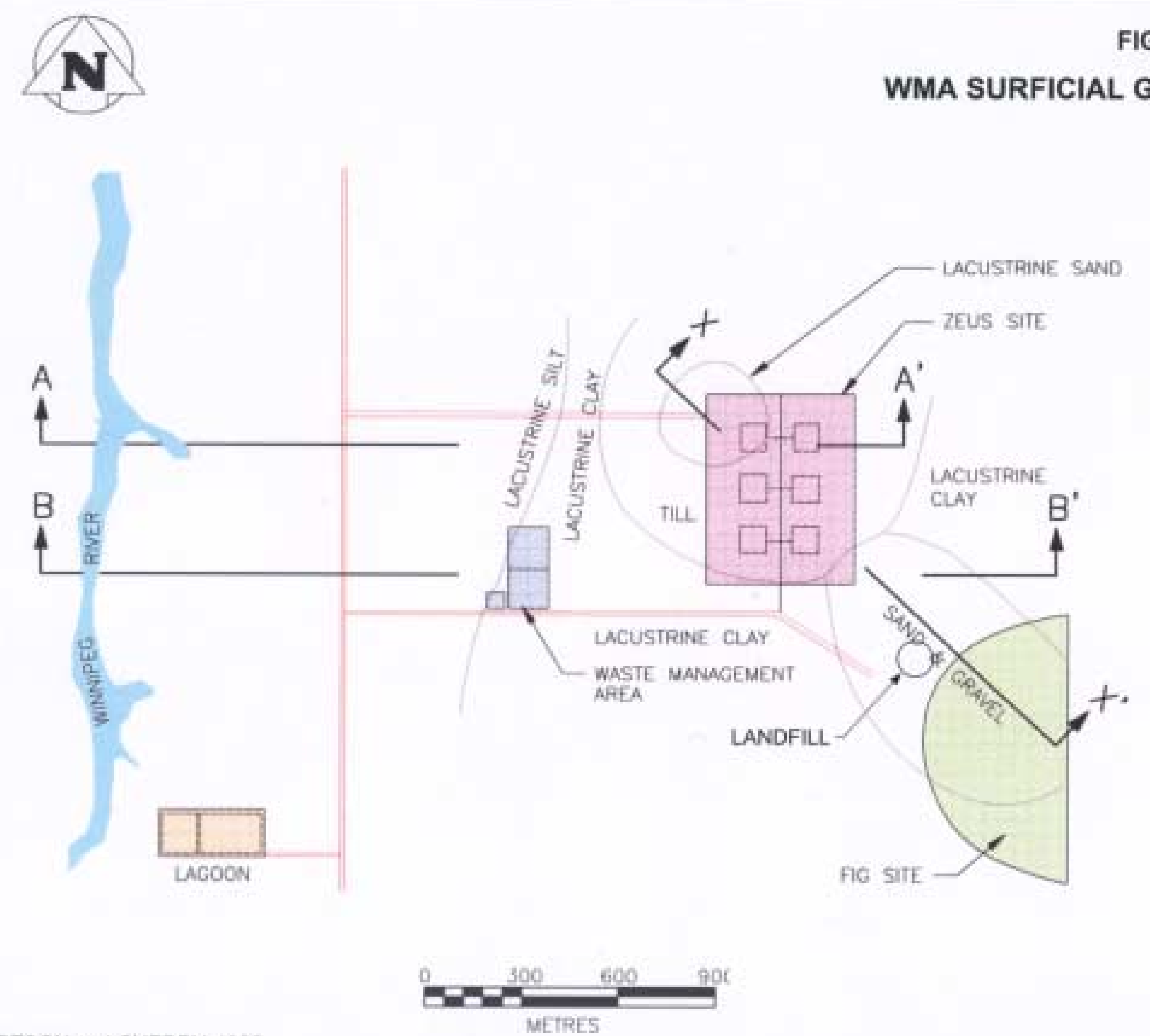
5 0 5 10km

NOTE:

Derived primarily from the maps in Guthrie and Scott, 1988

FIGURE 5.13

WMA SURFICIAL GEOLOGY



SOURCE: ROBERTSON and CHERRY, 1985

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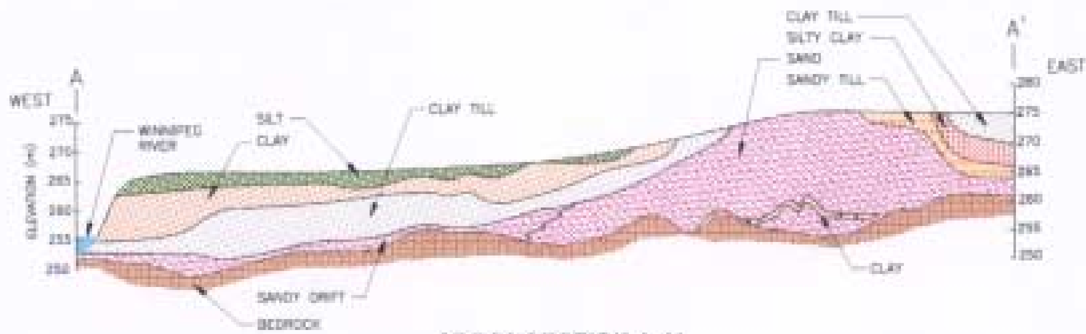
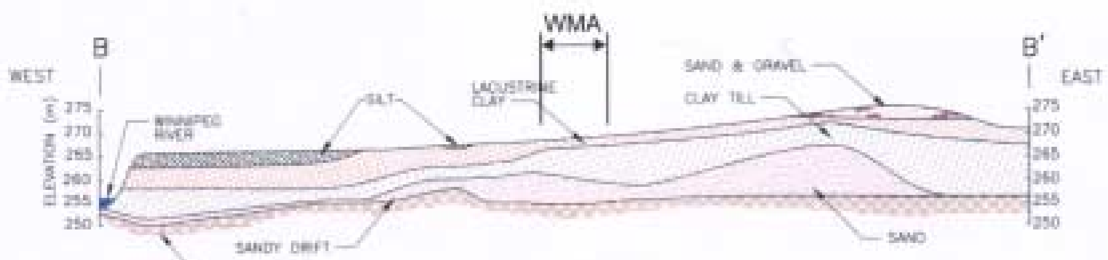
FIGURE 5.14

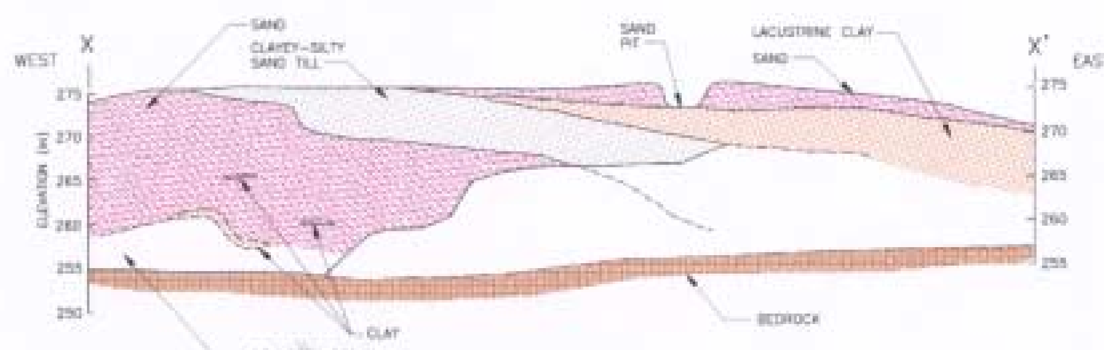
WMA SURFICIAL GEOLOGY CROSS-SECTIONS



CROSS SECTION A-A'



CROSS SECTION B-B'



CROSS SECTION X-X'

SOURCE: ROBERTSON and CHERRY, 1985

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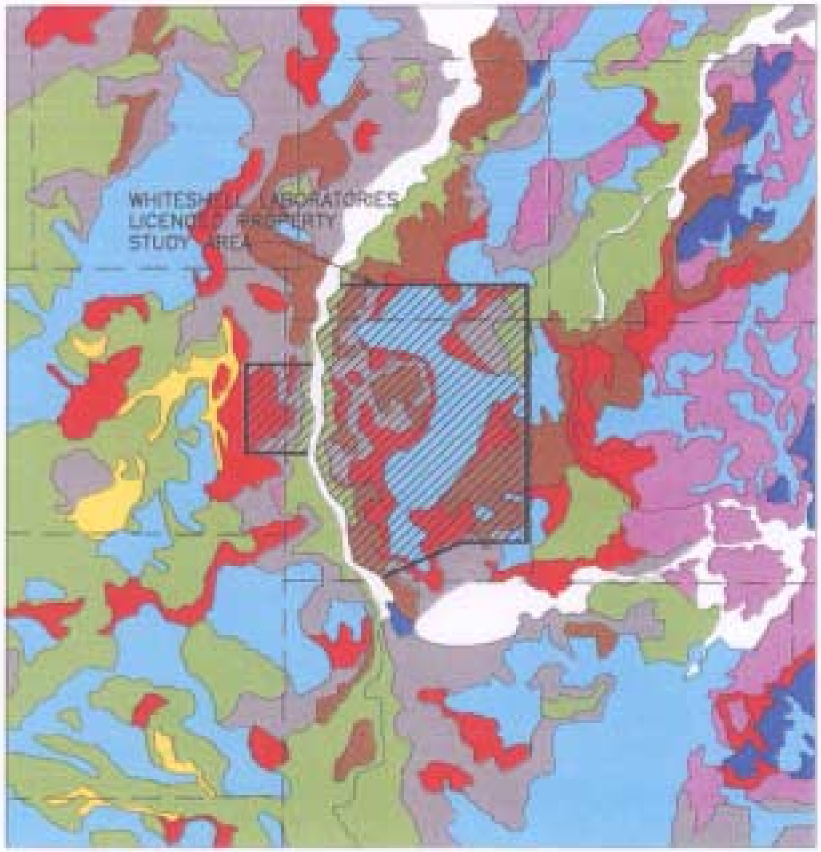
FIGURE 5.15

SURFICIAL SOILS OF LOCAL STUDY AREA



1977 TERMINOLOGY EQUIVALENT

- ROCK OUTCROPS (SOME TOPSOILS)
- GREY LUVISOLS GRLYSOLS AND TOLISOLS
- DYSTIC AND ENTRIC BRUNISOLS
- GREY LUVISOLS
- SOLONETZIC DARK GREY CHERNOZEMS
- PEATY HUMIC GLEYSOLS
- PEATY GLEYSOLS HBRISOLS AND MESISOLS
- FIBRISOLS AND MESISOLS

WHITESHELL LABORATORIES LICENCED PROPERTY STUDY AREA (APPROXIMATE LOCATION)

5 0 5 10km

NOTE:

Derived primarily from the maps in Guthrie and Scott, 1988

Whiteshell Laboratories – Project Study Area

The focus of the hydrogeological studies in the Project Study Area has been the Waste Management Area, the main storage area for the radioactive and hazardous waste at Whiteshell Laboratories. The area has been the site of intensive hydrogeological studies initiated in 1968. The area investigated is a strip of terrain 5 km by 2 km that extends from the FIG Site (Figure 5.13) to the Winnipeg River. Investigations included:

- Extensive test drilling and piezometer installation for delineation of the stratigraphy, groundwater flow conditions and hydrogeochemistry.
- Extensive monitoring of water levels (over 20,000 water level measurements were compiled).
- Estimation of hydraulic properties of the overburden deposits from several different methods including pumping tests, sediment grain size analysis, mass balance calculations and environmental tracer migration.
- 2-D and 3-D groundwater flow modelling to understand flow conditions at the site.
- Use of environmental isotope and geochemical data to investigate groundwater migration processes.

A comprehensive summary of the results from studies performed over the 17-year period 1968 to 1985 is given in Robertson and Cherry (1985). A brief summary of key results is provided here along with results from additional analysis performed in support of the CSR.

Hydraulic Parameters of the Stratigraphic Units

Groundwater flow rates and velocities are a function of the hydraulic conductivity and porosity of the stratigraphic units comprising the overburden. The stratigraphic units at the WMA from surface to bedrock as described in Section 5.4.3 comprise of approximately:

- 0.5 m of organic rich soil horizon;
- 1.5 m of lacustrine silt;
- 2.5 m of lacustrine clay;
- 5 m of clayey glacial till referred to as 'clay-till'; and
- 3-5 m of a relatively permeable sand aquifer referred to as 'basal sand' or 'basal sandy drift'.

The basal sands overlay the bedrock surface on top of the bedrock surface throughout the study area and have a maximum thickness of approximately 16 m (Figure 5.16).

The watertable in the WMA normally exists in the silt unit and fluctuates seasonally within a depth range of 0 to 3 m of ground surface. Hydraulic parameter estimation has focussed on the stratigraphic units in the saturated zone below the watertable. These are the lacustrine clay, clay-till and basal sand units. Recommended hydraulic parameter values for these units are summarized in Table 5.15. These values are best estimates and represent average values for the stratigraphic units.

Table 5.15
Hydraulic Parameters of the Stratigraphic Units

Stratigraphic Unit	Horizontal Hydraulic Conductivity K_x cm-s^{-1}	Vertical Hydraulic Conductivity K_z cm-s^{-1}	Porosity
Basal Sandy Drift in the vicinity of the WMA	[a]8E-04	[f]2E-05	[d]0.3
Basal Sand – Upland Recharge Area	[b]3E-03	[f]7.5E-05	[d]0.3
Lacustrine Clay And Clay Till	[g]<3E-07	[c]< 3E-07	[e]7E-04

a) Estimated from Pumping Tests.
b) Estimated from Mass Balance Calculations.
c) Estimated from Mass Balance Calculations and Flow Modeling.
d) Chosen Value (Robertson and Cherry 1985). Porosity of sands typically range from 0.25 to 0.5 (Freeze and Cherry 1979).
e) Estimated from average vertical fracture spacing of 6 cm and fracture aperture of 40 microns.
f) Based on ratio of horizontal to vertical conductivity of 40 (Robertson and Cherry 1985).
g) No continuous horizontal fractures were noted in the clays. Horizontal hydraulic conductivity is expected to be no greater than vertical conductivity.

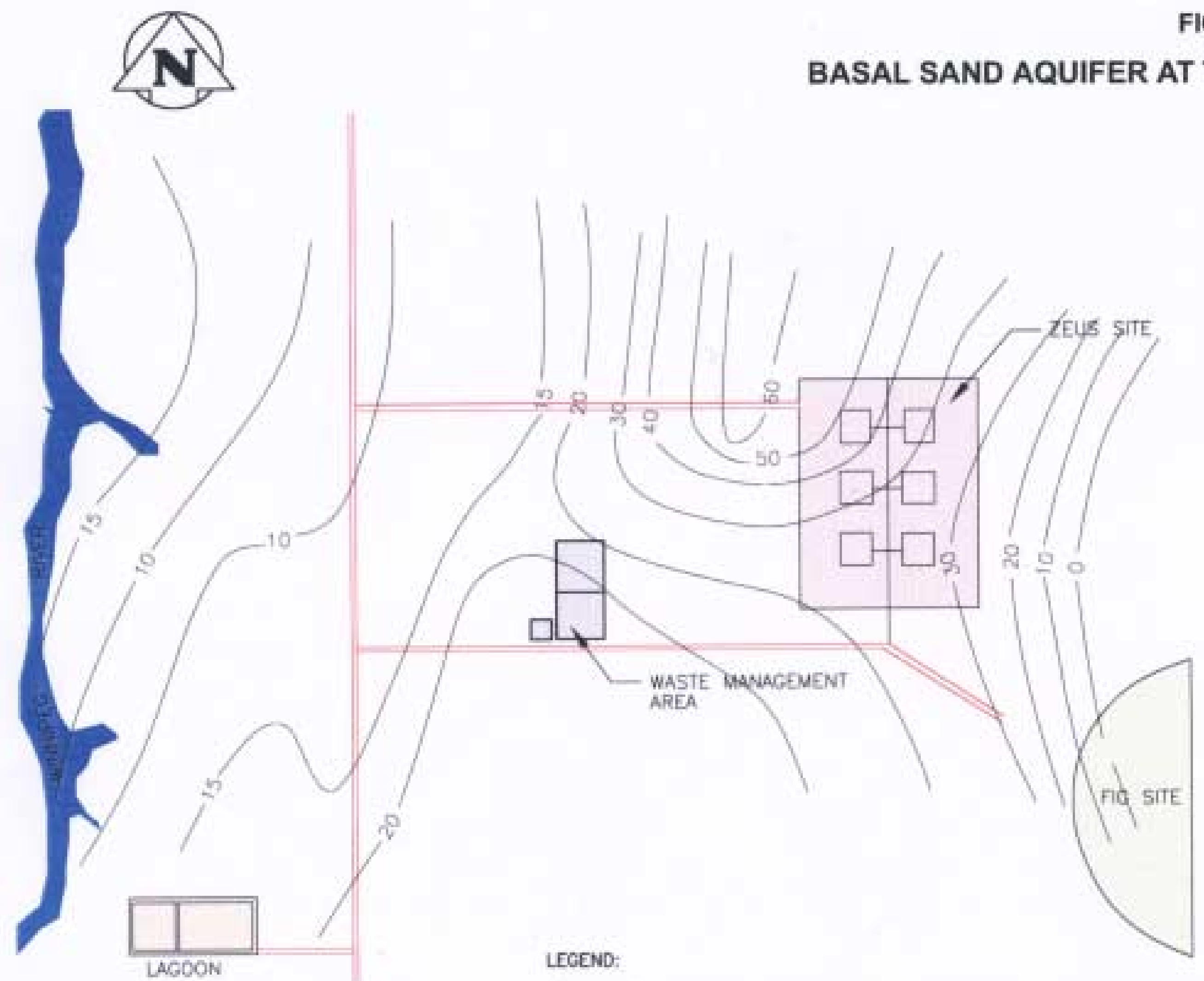
Lacustrine Clay and Clay-Till: Consolidation tests indicate that the intergranular hydraulic conductivity (K) of the lacustrine clay unit is in the range of 5E-10 cm s^{-1} to 3E-08 cm s^{-1}. Intergranular K of the clay-till is probably similarly low. However there is abundant evidence to indicate that these units are fractured and that the fractures impart a bulk permeability to this material much greater than the intergranular permeability. Because vertical fractures have been observed to cross the stratigraphic boundary between the lacustrine clay and clay-till these two materials may be considered to have similar hydraulic conductivities. The vertical hydraulic conductivity of these units is estimated to be greater than the intergranular permeability but less than 3E-07 cm-s^{-1}. The horizontal hydraulic conductivity is probably of similar magnitude.

Groundwater flow through the lacustrine clay and clay-till will occur primarily through the fractures as opposed to through the intergranular pore space. Fracture porosity is estimated from an average fracture spacing of 6 cm and fracture aperture of 40 microns and is approximately 7.0E-04.

Basal Sandy Drift: The horizontal hydraulic conductivity of the basal sands varies from approximately 1E-2 to 1E-4 cm-s^{-1}, Figure 5.17. The hydraulic conductivity in the periphery of the WMA is approximately 8E-04 cm-s^{-1} and increases to 3E-03 cm-s^{-1} as one moves eastward from the WMA to the upland recharge area located approximately 1.5 km east of the WMA. Vertical hydraulic conductivity of the basal sands is estimated to be at least a factor of 40 lower than horizontal conductivity. The porosity of the basal sands is between 0.25 and 0.5.

FIGURE 5.16

BASAL SAND AQUIFER AT THE WMA



SOURCE: ROBERTSON and CHERRY, 1985

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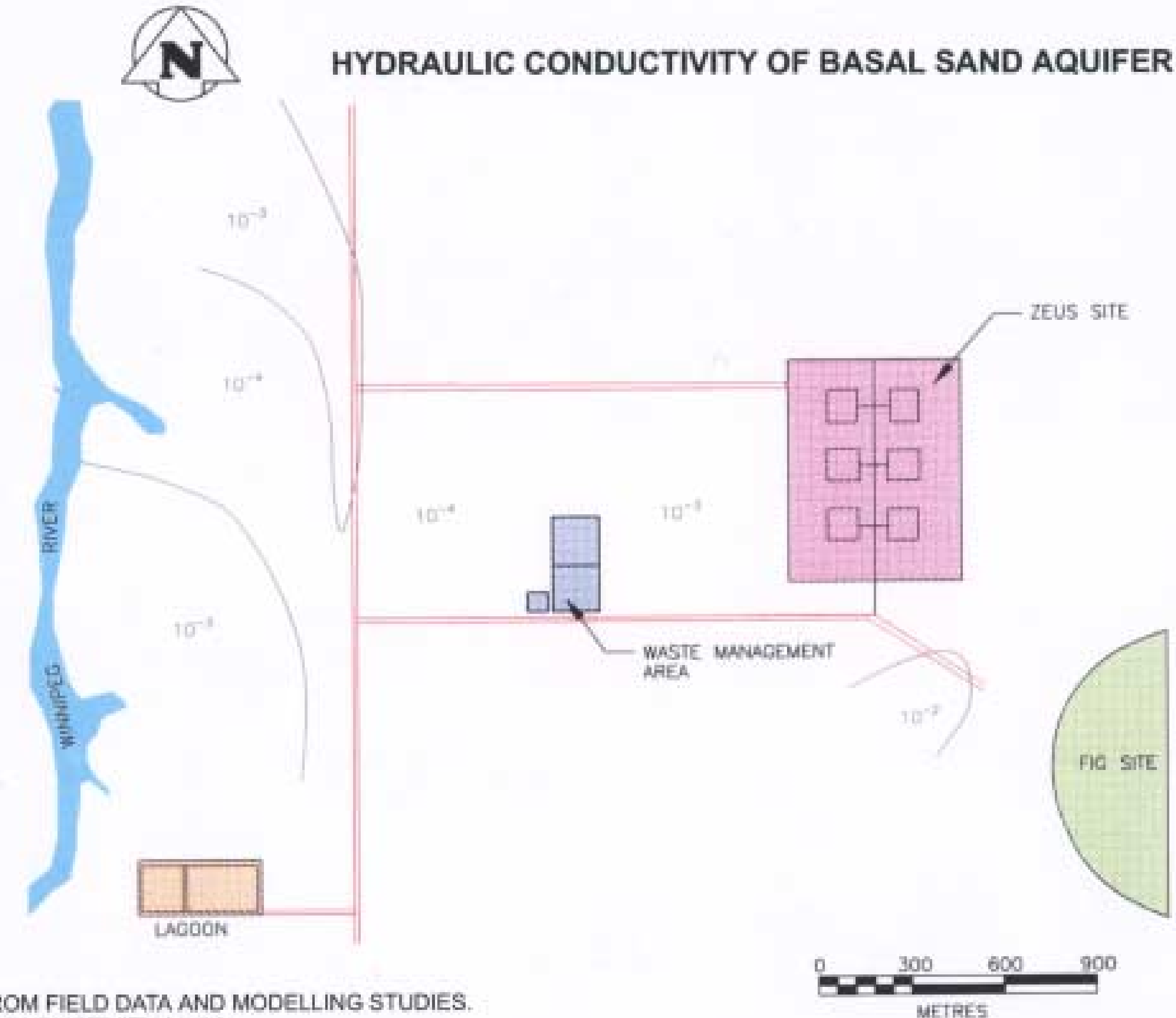
FIGURE 5.17

HYDRAULIC CONDUCTIVITY OF BASAL SAND AQUIFER AT THE WMA



NOTE:

INFERRED FROM FIELD DATA AND MODELLING STUDIES.
HYDRAULIC CONDUCTIVITY (cm/s)

SOURCE: ROBERTSON and CHERRY, 1985

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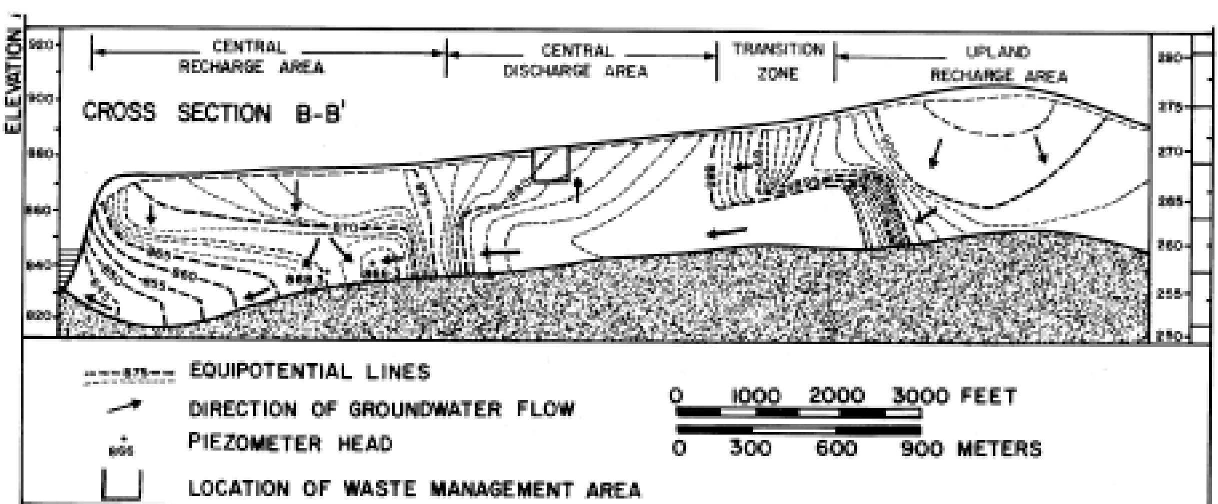
<u>Groundwater Flow, Recharge and Discharge</u>

Groundwater in the overburden is derived from rain and snow melt that infiltrates downward into the basal sands in a slight upland area of sand situated about 1 to 1.5 km east of the WMA. Recharge is estimated to be about 14% of the average annual precipitation of 57 cm (Robertson and Cherry 1985).

Water level measurements from monitoring wells in the study area provide a basis for understanding the groundwater flow patterns. Groundwater flows in the direction of decreasing water levels. Wells that are situated close to surface indicate the level of the water table. Water levels in deeper wells indicate whether there is upward or downward movement of water. If water levels in deeper wells are greater than in shallow wells there is upward movement. Conversely, if water levels in deeper wells are less than in the shallow wells, there is downward movement of water.

Figure 5.18 shows representative groundwater flow patterns along the vertical cross-section B-B'. Three distinct zones within the flow system are evident. These are from east to west an upland recharge area where groundwater moves downward from the water table into the basal sand aquifer; a central discharge area where water moves upward from the basal aquifer through the overlying clay-till and clay to the water table, and a central recharge area where groundwater migrates downward through the clay and clay-till units to the basal sandy aquifer. The boundaries between recharge and discharge zones are transient, primarily in response to water table fluctuations. Figure 5.19 shows the percentage of time recharge and discharge conditions to the basal sandy aquifer occur over the period 1968 to 1983 and the width of the transition zones between the discharge and recharge zones. To the west the width of the transition zone is approximately 300 m, to the east it is approximately 500 m.

Figure 5.18
Sketch of Hydrology and Water Flow Pattern



The WMA is located in the middle of the central discharge area. Groundwater flow in the silt, clay and clay-till units has been upward on almost all occasions during the monitoring period 1968 to 1983. These units are sufficiently fractured that flow occurs through them. The clay-till and clay units are an integral part of the flow system.

The fact that the WMA is located in a groundwater discharge zone has positive benefits. Chemical or isotopic constituents solubilized from any waste materials released at the WMA site do not move downward to the sandy zone, and thus this zone does not act as a transmission zone for contaminants from the WMA into the Winnipeg River.

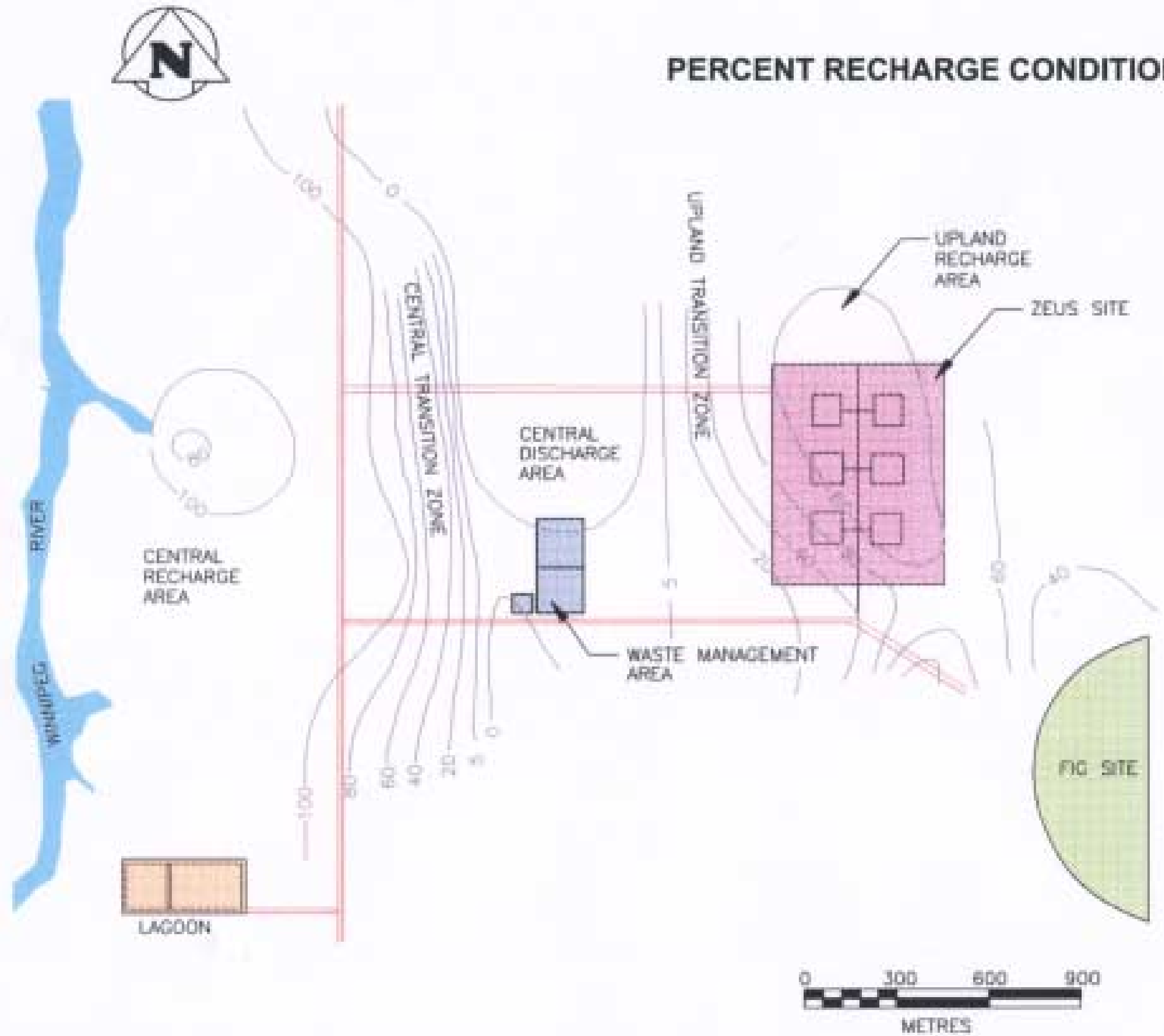
To provide more recent data on the hydrological conditions at the WMA and to confirm that hydrological conditions have not changed, groundwater monitoring data from two well nests in the WMA for the period 1984 to 2000 were analyzed; well nest RW5 located on the western boundary of the WMA and well nest RW1 located in the centre of the WMA. The analysis is reported in Appendix C.5. Records for the RW5 well nest showed a distinct upward gradient, representative of discharge conditions and in compliance with findings of earlier studies. Data for well nest RW1 were inconclusive, showing no gradient. Water elevations in the clay unit were the same as in the underlying basal sands.

The similar water level elevations in the sand and clay units for well nest RW1 is probably due to leakage between the two stratigraphic units due to poor well construction rather than to a change in hydrological conditions at the site. Both RW1 and RW5 are in a region where upward hydraulic conditions existed for more than 95% of the time over the period 1968 to 1983. The two well nests are separated by only 100 m and it is unlikely that hydrological conditions have changed such that discharge conditions exist in one well and recharge in the other. In fact, of the two well nests, RW5, for which upward hydraulic gradients were observed, is located closest to the central recharge zone.

The hydraulic head distribution and groundwater flow directions in the basal sands are shown in Figure 5.20. Groundwater flow is to the west over most of the study area and discharges to the Winnipeg River. However, a flow divide does exist in the general vicinity of the topographic high in the upland recharge area located approximately 1.5 km east of the WMA. Flow originating west of the divide migrates westward via the sand aquifer toward the Winnipeg River. Flow originating east of the divide travels eastward towards the Pinawa Channel. All nuclear facilities are located to the west of the divide. The only facilities in the immediate vicinity of the divide are the inactive landfill, the FIG site and the ZEUS site.

FIGURE 5.19

PERCENT RECHARGE CONDITION, 1968 - 1983



SOURCE: ROBERTSON and CHERRY, 1985

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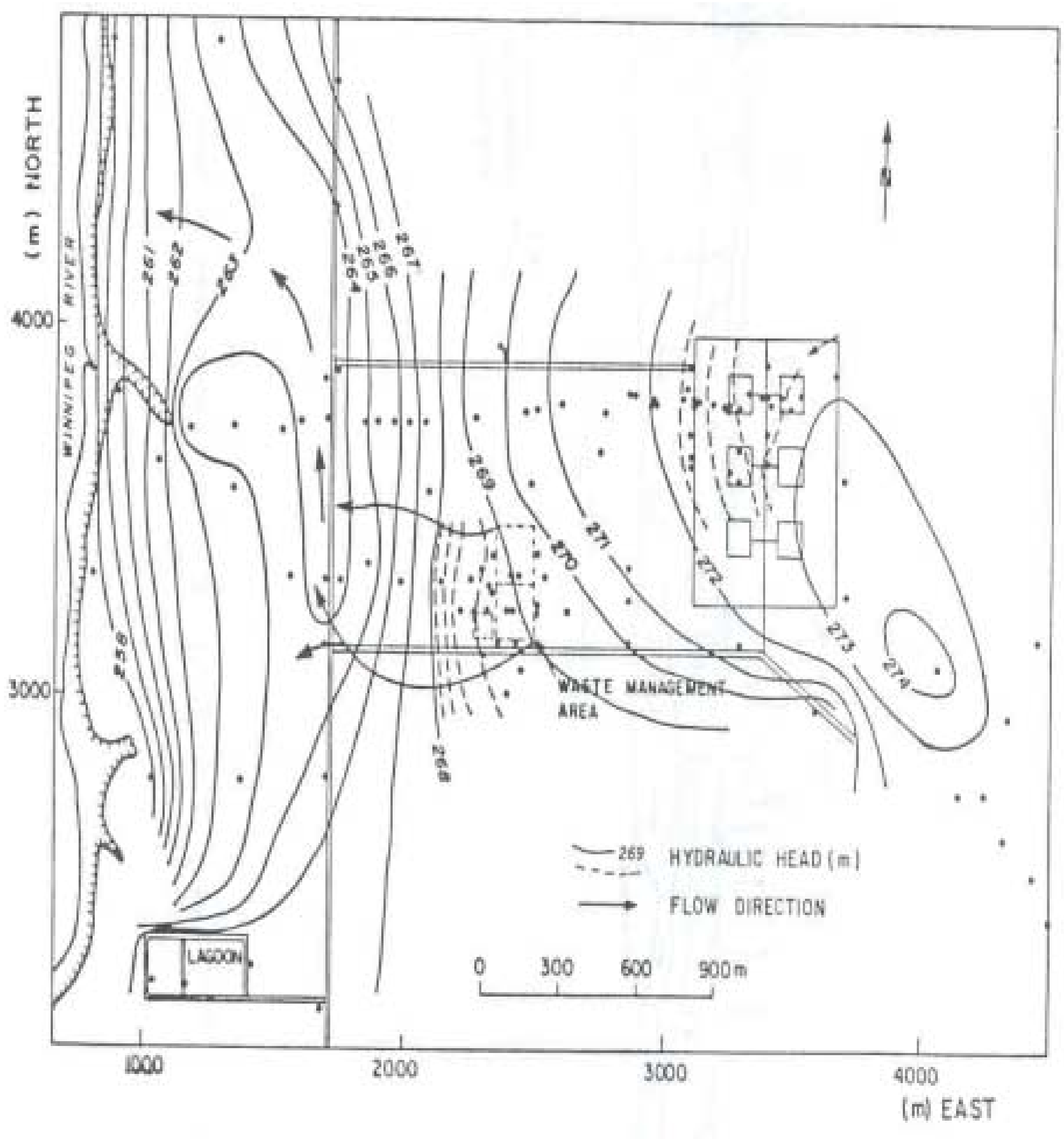
Figure 5.20
Potentiometric Surface and Approximate Groundwater Flow Directions in the Sandy Zone



There is the potential for lateral flow in the vicinity silt, clay and clay-till units. Lateral flow in the vicinity of the WMA is influenced by permeability of the soil zone, drainage ditches, and local scale effects from waste trenches. As a result, there may be significant lateral components to flow in the clay, clay till and silt zones in the vicinity of the WMA.

Groundwater Velocities, Flow Rates and Transit Times

Groundwater velocities represent the rate at which non-reactive contaminants move through the flow system. The estimates are derived from application of Darcy's Law and make use of the representative hydraulic conductivity and porosity values and measured hydraulic gradients. Flow rates represent the volume of water discharge per unit aquifer area.

Average horizontal groundwater velocities in the basal sand in the WMA are estimated to be 1.6 m a^{-1}. These are derived from an average horizontal hydraulic gradient of approximately 0.002, an effective porosity of 0.3 and hydraulic conductivity of 8.0E-04 cm s^{-1}. Velocities in the basal sands are highly variable due to the heterogeneous nature of the unit. Velocities to the east of the WMA where sands are more permeable are probably an order of magnitude greater than at the WMA. The flow rate through the basal sand aquifer in the vicinity of the WMA is estimated to range from 3000 to 50,000 L per year per meter of aquifer width. The groundwater transit time for water recharging in the upland recharge area to the WMA is of the order of 100 to 1000 years.

Groundwater flow in the clay and clay-till unit is predominantly through the fractures in these units. The average vertical hydraulic gradient across the clay and clay till unit is 0.2 which occurs commonly in discharge and recharge areas. Assuming vertical hydraulic conductivity of 3E-07 cm s^{-1}, and porosity of 7E-04 gives vertical groundwater velocities of several meters per year. The groundwater flow rate through the clay and clay till units are very low owing to the low hydraulic conductivity of these units. The vertical flow rate is in the range of a few cm per year (few hundred m^3-ha^{-1} per year). Water seeping to surface is lost by evaporation from the soil and transpiration from plants. The transit time for upward flow from the base of the clay till unit to surface is of the order of a few months to a few years.

Groundwater Quality

Local Study Area

The groundwater quality in the Local Study Area varies considerably, but in general is considered potable (Rutulis 1982). This includes groundwater from both overburden and bedrock aquifers. The quality of groundwater appears to be slightly better, with respect to hardness and total dissolved solids, in or near the main recharge areas of the western portion of the Local Study Area, namely the Milner Ridge area. With respect to domestic purposes, groundwater quality generally degrades east of the Winnipeg River.

Several groundwater sampling and laboratory analyses programs have been initiated by AECL prior to, and since facility start-up. In general, the laboratory, engineering and statistical analyses indicates groundwater in the bedrock and overburden aquifers to be within the statistical norms for groundwater quality. Although anomalous (elevated) concentrations of uranium were detected in groundwater samples collected from primarily the Pre-Cambrian bedrock aquifer, the concentrations were comparable to other anomalous samples measured world-wide. These elevated concentrations in the bedrock aquifer are attributed to leakage from uraniferious groundwater from overlying clays (Betcher et al. 1988).

It has been determined that the potential for on-site or off-site groundwater resources to be contaminated, including those that may be tapped for livestock watering or domestic use adjacent to the site, is negligible. The location of wells off-site is not relevant to the discussion since the groundwater flow direction as determined by Cherry and Robertson (1988) precludes them from being affected.

Project Study Area - WMA

Radioactivity of deep wells and water-table wells at the Waste Management Area (WMA), is routinely monitored. Measurements are taken once a month between March and October. Results of total-beta analyses for 1999 for the water table and deep wells shown in Table 5.16.

Table 5.16
Total Beta Activity in Wells at the WMA, 1999

	Maximum	**Minimum**	**Average**
	Beta, Bq/L		
Water-Table Wells	0.7	0.13	0.34
Deep Wells	0.73	0.04	0.26

The average values for 1995 to 1999 for total beta activity in water-table wells and deep wells are shown in Table 5.17. Based on the conservative assumption that the total-beta activity is caused entirely by the most restrictive radionuclide (^{90}Sr, for which the Maximum Acceptable Concentration (MAC) in drinking water is 5 Bq/L), the data presented shows that the average concentrations were below MAC in all wells. Table 5.17 confirms for the low average concentration for the period 1995 to 1999.

Table 5.17
Average Total Beta Activity in Waters at the WMA

	1995	**1996**	**1997**	**1998**	**1999**
	Beta, Bq/L				
Water-Table Wells	0.5	0.43	0.35	0.41	0.34
Deep Wells	0.28	0.24	0.38	0.2	0.26

Inactive Landfill

Operating protocols for the landfill site exclude the disposal of radioactive wastes and all wastes are monitored prior to emplacement. There was one recorded incident of an inadvertent placement of low-level radioactive waste in the landfill. The material was subsequently removed

and the area surveyed to ensure there was no residual contamination remaining. The area is routinely monitored for gamma radiation to ensure that storage practices are effective in ensuring that only non-radioactive wastes are emplaced.
A groundwater monitoring program at the landfill has been in operation since 1993. Annually, groundwater is collected from several points at the landfill and a control point 300 m to the north. The groundwater is analyzed for gross alpha and gross beta activity. The analysis results for 1999, which are representative of other years, are presented in the following table.

Table 5.18
Gross Alpha & Beta Activity for Landfill Groundwater

ILS Pond Sample Location	Sample Date	Gross Alpha Bq/L		(2s)	Gross Beta Bq/L		(2s)
5	04-May-99	0.03	+/-	0.03	0.11	+/-	0.02
11	04-May-99	0.21	+/-	0.07	0.41	+/-	0.03
14	04-May-99		< 0.08		0.35	+/-	0.04
15	04-May-99	0.07	+/-	0.06	0.29	+/-	0.04
21	04-May-99	0.14	+/-	0.07	0.30	+/-	0.04
22	04-May-99		< 0.11		0.22	+/-	0.04

For comparison, the Maximum Acceptable Concentration (MAC) for gross beta (assumed to be due to ^{90}Sr) in drinking water is 5 Bq/L.

<u>Sewage Lagoons</u>

Radioactive contamination is present in the lagoon sludge with a higher concentration in the primary pond than in the secondary pond. The activity appears to increase with depth at the inlet to the secondary lagoon, while it is level or decreases with depth in the surrounding areas.

Lagoon sediment sampling indicates very low levels of contamination, less than 3 Bq/g for ^{137}Cs and trace quantities of ^{60}Co, and shows no evidence of migration into the underlying clays.

5.4.5 Hydrology

Drainage Patterns

<u>Regional Study Area</u>

The regional hydrology or surface water drainage regime is primarily determined by the slope, thickness and texture of surficial deposits, and the proximity and permeability of bedrock (Guthrie and Scott 1988). Three regional drainage categories include: (i) thick glacial ridge-depression areas to the west of the Winnipeg River, (ii) bedrock outcrops and thin glacial deposits over impervious Precambrian bedrock to the east, and (iii) low-lying but drainable lacustrine deposits along the Whitemouth and Winnipeg Rivers and along parts of the Pinawa

Channel. Drainage and surface water flow patterns have been extensively modified within southern Manitoba over the past hundred years through the development of hydroelectric dams on the Winnipeg River as well as the draining of marshes and swamps to improve or develop agricultural land.

The Regional Study Area comprises 5% of the Lake Winnipeg Drainage basin, and 50% of the Winnipeg River Drainage basin. These basins drain areas 1,000,000 km^2 and 150,000 km^2, respectively (Betcher et al. 1995).

Winnipeg River

The Winnipeg River is classified as a medium-sized lowland river. The total drainage basin of the Winnipeg River is approximately 150,000 km^2, although only about 4,000 km^2 are below the junction of the English River in the Province of Manitoba proper. A descent in ground elevation of 83 m from the Manitoba-Ontario border to Lake Winnipeg through a series of falls and rapids has resulted in extensive hydroelectric exploitation of this river. Six electric generating stations are present on the Winnipeg River, whose discharge rate is now largely controlled by these hydroelectric dams, which precludes any short-term correlation between precipitation and river flow.

At the Whiteshell Laboratories site, the river is approximately 0.3 km wide, 7 m deep and flows in a northerly direction at a velocity of approximately 0.3 m/s. Flow rates as high as 2,000 m^3/s have been measured during flood conditions (Guthrie 1964). At the Whiteshell Laboratories site, flow velocities measured in the Winnipeg River were noted to be greater on the west bank, with no backwater noted. Additional data on currents and flow volume at the Whiteshell Laboratories outfall are found in Ireland et al. (1973).

Lake Winnipeg

Lake Winnipeg is one of the largest freshwater lakes in the world, with a direct drainage basin that includes much of the central-eastern portion of the province. Indirectly, drainage into Lake Winnipeg includes the Lake Manitoba and Saskatchewan River basin to the west, the Assiniboine and Red River Basin drainage basins to the south and southwest, and the Winnipeg River basin to the southeast. Drainage from Lake Winnipeg is into the Nelson River system, which discharges into Hudson Bay and ultimately the Arctic Ocean.

Local Study Area

In the western portion of the Local Study Area, surface drainage is discouraged in the Milner Ridge area due to rapid entry through coarse-textured ridge materials, and/or slowly through finer sediments in local depressions. Therefore, few streams are found in this area. Except for bogs in low-lying areas, there are few lakes (Guthrie and Scott 1988). To the east, surface drainage is encouraged due to Precambrian outcrops with their thinner glacial deposits. Here, drainage is primarily by surface streams, which flow into the Pinawa Channel and the Winnipeg River. To the south, the Whitemouth river basin drains into the Winnipeg River at Seven Sisters Falls/Natalie Lake. The Whitemouth and Winnipeg Rivers flow through the glaciolacustrine deposits in the centre of the region. Although these fine-textured deposits exhibit little variation in relief, they are of sufficient thickness that postglacial incision by these major rivers encourages east-west drainage towards them.

Project Study Area

Surface water run-off at the Whiteshell Laboratories site drains into the Winnipeg River (Figure 5.21). Water quality is discussed in the next section.

5.4.6 Water Quality

Sampling and laboratory analyses of water from the Winnipeg River near the Whiteshell Laboratories has been undertaken by AECL. In general, the studies conclude no significant anomalous concentrations of various parameters analyzed, including radionuclides. The primary source of liquid radioactive effluents at the Whiteshell site is the process water outfall. Discharges include storm run-off, miscellaneous cooling water, and holding tank discharges from the Active Liquid Waste Treatment Centre. These discharges are designed to remain within regulatory guidelines and the DRLs, however there has been some accumulation of radionuclides in sediments near the outfall that is discussed later in this section.

The on-site sewage lagoon also discharges into the Winnipeg River. Studies conducted by Manitoba Environment to assess water quality in the vicinity of Lac du Bonnet from 1997 to 1998, did not indicate any water quality problems in terms of nutrient loading from upstream sources. Thus it is believed that the lagoon discharges have not had a negative impact on the river water quality in terms of nutrient loading. (Ralley 1999).[1]

The Winnipeg River Task Force (1995) looked at potential sources of Winnipeg River water quality degradation near the community of Sagkeeng. The Task Force found that Whiteshell Laboratories has not had an adverse effect on water quality in the Winnipeg River for downstream communities.

Similar sampling and analyses has been undertaken for water samples collected from Lake Winnipeg. In general, the laboratory analyses and interpretation indicates no anomalous concentrations of routine water quality parameters.

[1] Sampling locations include three sites near the town of Lac du Bonnet on the Winnipeg River, roughly 10km downstream of AECL's Whiteshell Laboratories, and a number in the lake of Lac du Bonnet. Locations were sampled for ammonia, nitrate/nitrite, nitrogen, phosphorus, fecal coliform and chlorophyll. Concentration of nutrients in the Winnipeg River were found to be within normal ranges for waterbodies in eastern Manitoba and generally below water quality guidelines.

FIGURE 5.21

TOPOGRAPHY AND DRAINAGE IN LOCAL STUDY AREA

SOURCE: GUTHRIE AND SCOTT, 1988

AECL EACL

WHITESHELL LABORATORIES DECOMMISSIONING
ENVIRONMENTAL ASSESSMENT

Radioactivity in the Winnipeg River

As outlined in Niemi and Soonawala (1999b), five radiological parameters (including three radionuclides) are currently monitored in the Winnipeg River at the Whiteshell Laboratories site by AECL. Monthly composite samples of Winnipeg River water are collected from four locations: about 17 km upstream of the process outfall (at Pinawa); 2 km downstream at the Whiteshell Laboratories boundary; 10 km downstream at the Lac du Bonnet water intake; and, 28 km downstream at the Great Falls generating station. Monitoring of downstream concentrations to date have not been found to vary significantly from upstream sampling. For example, between 1962 and 1972 the average annual concentrations of ^{137}Cs in river water downstream (28 km) were similar to upstream concentrations. It is believed that the major contributor of ^{137}Cs was atmospheric nuclear weapons testing occurring during that time. After 1972, nuclide concentrations found in the river were thought to be most affected by Whiteshell Laboratories (Dunford et al. 1983). Recent (1994-1998) concentrations of nuclides found in the Winnipeg River are given in Table 5.19. Concentrations in 1998 were comparable to those in previous years. The measured concentrations were very small fractions of the Maximum Acceptable Concentrations (MACs) for radioactivity in drinking water in Canada, specified by Health Canada. The 1998 concentrations at the sampling points downstream of Whiteshell Laboratories were not much different from the concentrations at the upstream sampling point.

Table 5.19
Radioactivity in Winnipeg River Water

Location	**Mean Concentration (Bq/L)**				
	1994	**1995**	**1996**	**1997**	**1998**
Pinawa (upstream from Whiteshell Laboratories)					
^{137}Cs	0.002	0.002	0.002	0.002	0.003
^{40}K	NA	NA	NA	NA	0.046
^{90}Sr	0.015	0.016	0.016	0.011	0.014
Location K11 (2km downstream)					
^{137}Cs	0.014	0.003	0.004	0.003	0.004
^{40}K	NA	NA	NA	NA	0.068
^{90}Sr	0.022	* 0.021	0.018	0.011	0.015
Lac du Bonnet (10km downstream)					
^{137}Cs	0.004	0.001	0.001	0.001	0.002
^{40}K	NA	NA	NA	NA	0.045
^{90}Sr	0.017	0.017	0.015	0.011	0.012
Great Falls (28 km downstream)					
^{137}Cs	0.003	0.002	0.002	0.001	0.003
^{40}K	NA	NA	NA	NA	0.039
^{90}Sr	0.017	0.017	0.015	0.014	0.013

MAC Values: ^{137}Cs: 10 Bq/L
^{40}K: no standard
^{90}Sr: 5Bq/L

* Mean excluding two results considered to be outliers.

Source: Niemi and Soonawala 1999b.

Within the Whiteshell Laboratories Site

Radioactivity was monitored in surface waters of two ditches (one flowing west to the Winnipeg River and the other flowing north) located near the Waste Management Area (WMA). Water from the recharge area east of the WMA is diverted around the WMA to the west-flowing ditch and into the Winnipeg River. The other ditch, running north to the Whiteshell Laboratories boundary, drains the land north of the WMA up to the site boundary.

The results for both ditches, for years 1994 to 1998, are shown in Table 5.20 and in Figures 5.22 and 5.23. Data show a slight increase in the gross beta activity in the north ditch, otherwise, the activity is stable over the five-year period.

The radioactivity results from an accidental spill in the late 1980s and is not indicative of routine releases from the area. Very low levels of contamination can be detected in the ditch system (about 0.13 GBq of radioactivity was estimated to be deposited in the drainage system in the public domain) and analysis of the condition following initial remediation indicated negligible effect of leaving the contamination in place.

Table 5.20

Annual Mean Gross Beta and Gross Alpha Radioactivity in Ditches Near WMA, 1998

LOCATION	**Activity (Bq/L)**				
	1994	**1995**	**1996**	**1997**	**1998**
9 – Ditch From Waste Management Area					
West to Winnipeg River					
Gross Beta	0.27	0.20	0.16	0.25	0.33
Gross Alpha	0.03	0.03	0.02	0.04	0.03
8 – Ditch From Waste Management Area					
North to Whiteshell Laboratories boundary					
Gross Beta	0.62	0.55	0.33	0.43	0.83
Gross Alpha	0.07	0.10	0.01	0.04	0.03

Figure 5.22

Gross Alpha Activity in Surface Water from Streams Flowing from the Whiteshell Laboratories WMA, 1994-1998

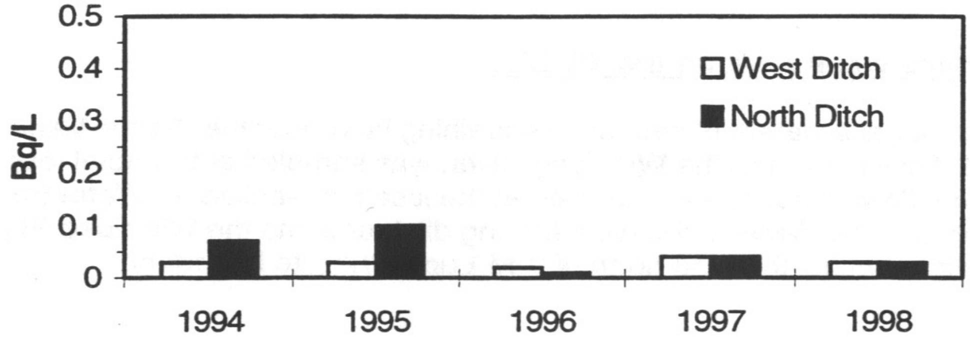
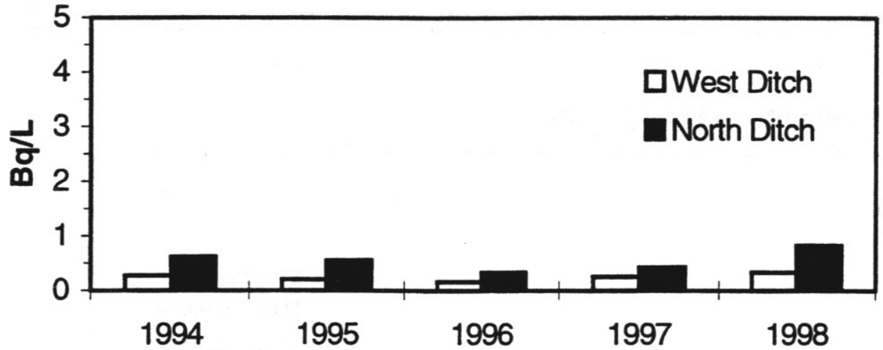


Figure 5.23
Gross Beta Activity in Surface Water from Streams Flowing from the Whiteshell Laboratories WMA, 1994-1998



5.4.7 Sediment Quality

Lacustrine clay is the predominant component of both water-borne and deposited sediments in the Winnipeg River and Lake Winnipeg. Coarser-grain materials are present in the Winnipeg River bed sediments, including gravel, sand and silt, although less gravel was observed upstream than downstream of the Whiteshell Laboratories site (Guthrie and Scott 1988).

Sampling and laboratory analyses of riverbed sediments along the Winnipeg River near the Whiteshell Laboratories have been undertaken. Similar sampling and analyses has been undertaken for the lakebed sediments of Lake Winnipeg, including Traverse Bay, the location of the Winnipeg River discharge into the lake. In general, the data indicate that the chemical history of the lakebed sediments correlates well with parameter maxima in other North American lakebed sediments since European settlement (Lockhart et al. 1994).

Radioactivity in Sediments

Sediment contamination has been examined through several studies from the early 1960s until more recently. It extends from the Whiteshell Laboratories outfall to Lake Winnipeg. Peak activity for ^{137}Cs occurred during the 1960s and was accredited to peak nuclear bomb testing activity during the time. The source of elevated levels in the 1970s and 80s is less clear. A study of deeper sediment samples (Soonawala 2000) concluded that Whiteshell Laboratories could not have contributed to the ^{137}Cs deeper in the sediment column. These elevated levels are, in fact, attributed to the residual effect of global fallout. Regardless, evidence exists through monitoring that ^{137}Cs concentrations in the Winnipeg River surface sediments are elevated downstream of Whiteshell Laboratories, compared to upstream values. This radionuclide is present as a result of the accumulation of solids which could settle from the ALWTC discharges (and possibly leaks from WR-1). The International Atomic Energy Agency (IAEA) clearance levels for unconditional clearance levels of mildly contaminated solids to the public domain is 300 Bq/kg for ^{137}Cs. Table 5.21 shows radioactivity found in the first centimetre of Winnipeg River sediment at various locations up and downstream from Whiteshell Laboratories.

Table 5.21

Radioactivity in Sediment Samples from the Winnipeg River

Distance from Outfall (km)	Year	^{137}Cs (Bq/kg)
0.76 Upstream	1994	10.1
	1995	7
	1996	3
	1997	13
	1998	16
0.37 Upstream	1994	4.37
	1995	8
	1996	3
	1997	8
	1998	8
0 (At Outfall)	1994	75500
	1995	2285
	1996	20604
	1997	499
	1998	206
0.15 Downstream	1994	206
	1995	94
	1996	59
	1997	114
	1998	41
0.52 Downstream	1994	440
	1995	508
	1996	111
	1997	139
	1998	157
0.79 Downstream	1994	49.2
	1995	25
	1996	73
	1997	142
	1998	79
2.56 Downstream	1994	93.6
	1995	95
	1996	96
	1997	82
	1998	76
3.48 Downstream	1994	116
	1995	44
	1996	42

Distance from Outfall (km)	Year	^{137}Cs (Bq/kg)
	1997	36
	1998	38
4.78 Downstream	1994	123
	1995	124
	1996	123
	1997	230
	1998	63
13.06 Downstream	1994	110
	1995	79
	1996	26
	1997	54
	1998	28

(Adapted from Niemi and Soonawala 1999b)

River-bottom sediments were collected from 12 locations along the Winnipeg River, ranging from 0.76 km upstream to 13.06 km downstream of the process outfall.

Table 5.22 shows the gross beta and gross alpha activities (in Bq/kg dry weight) of the river-bottom sediments from the 12 locations along the Winnipeg River for the years 1994 to 1998.

Table 5.22
Radioactivity in River-Bottom Sediments, 1995 – 1998

LOCATION		ACTIVITY (Bq/kg Dry Weight)									
		1994		1995		1996		1997		1998	
Name	Downstream, Distance & Outfall	Gross Beta	Gross Alpha	Gross Beta	Gross Alpha	Gross Beta	Gross Alpha	Gross Beta	Gross Alpha	Gross Beta	Gross Alpha(1)
J04	-0.76	662	11.2	334	33	377	150	659	135	506	< LLD(2)
J02	-0.37	519	1.05	500	41	410	169	609	112	503	< LLD
OFL	0	5740	27.9	1168	105	1628	230	20751	717	663	< LLD
K01	+0.15	694	18.9	659	152	712	155	684	164	736	< LLD
K03	+0.52	1210	11.2	1518	157	637	216	667	204	721	< LLD
K05	+0.79	549	13.1	551	186	542	197	678	192	699	495
K14	+2.56	838	12.0	675	209	480	181	498	185	550	583
K19	+3.48	754	11.2	291	200	381	124	386	242	393	< LLD
K22	+4.63									694	< LLD
K23	+4.78	881	19.9	874	211	790	188	860	198	802	538
K24	+4.93									510	503
K30	+13.06	778	21.2	772	183	832	219	673	161	686	< LLD

(1) The gross alpha data for 1998 are based on a revised efficiency factor. Previous years values would have been higher if the revised efficiency factor had been applied two those years.
(2) Less than Lower Limit of Detection.

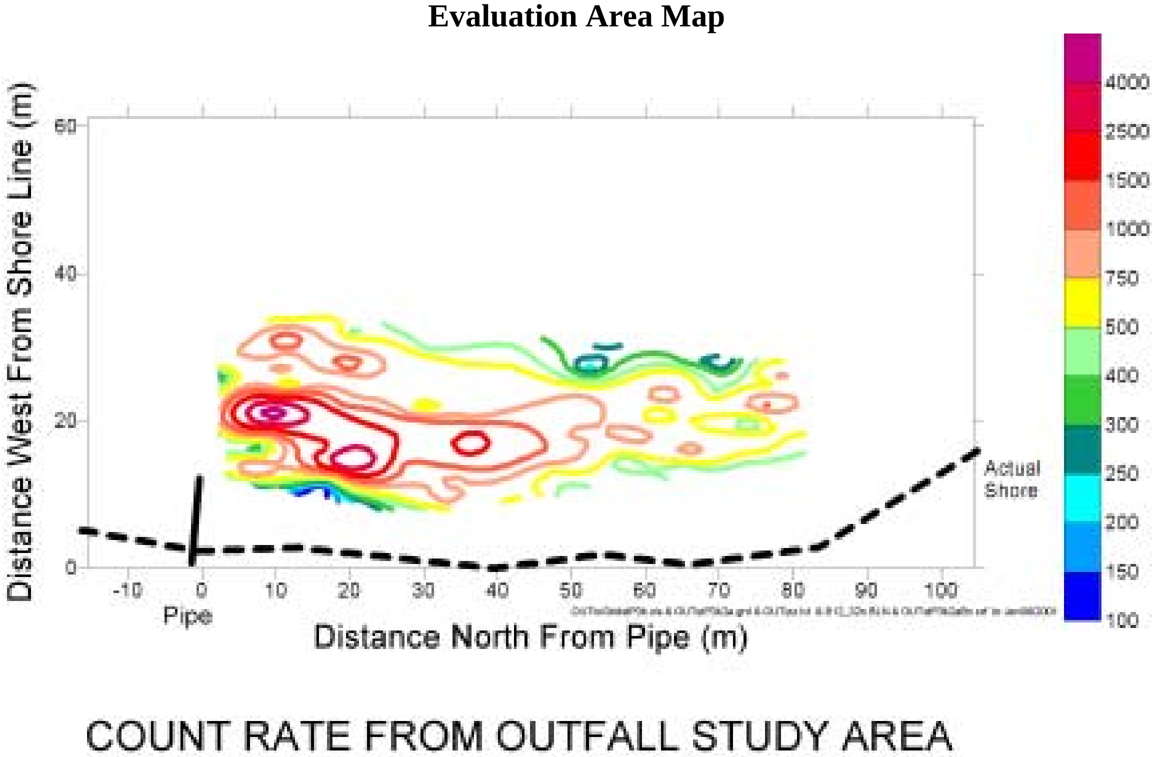
Sediment Contaminant Levels at the Outfall

To evaluate the impact of contaminated sediments at the outfall, a detailed assessment of the contaminated inventory was taken to support in-situ abandonment of the contaminated outfall area. A detailed field study to assess the potential impact of the sediment contamination on aquatic biota and humans was completed in the summer of 2000 and is documented in Appendix B. The study included:

- A detailed gamma survey of the riverbed in the contaminated area having sediment activities 5-fold above background.
- Measurement of contaminant levels in sediment cores and grab samples collected from the riverbed.

A 2-D contour plot of the gamma activity is shown in Figure 5.24. The gamma survey showed a region of elevated activity (10 times greater than background) extending a distance 80 m downstream of the outfall and 20 m in width.

Figure 5.24
Evaluation Area Map



The gamma survey results were plotted with software that allows definition of isopleths. These were used to compute an inventory of contaminant in the sediment of the evaluation area (Table 5.23). The observed activity at the isopleth line (counts per second or cps) was corrected for background, converted to dose rate (nGy/h) using the calibration developed for the sediment survey, and converted to concentration of ^{137}Cs Bq/g. Assuming a sediment density of 1500 kg/m^3, consistent with the dense clay observed, and a contamination depth of 5 cm, the contamination per unit area was computed. This multiplied by the corresponding area between this isopleth and the next gives an amount as Bq (Further details are given in Appendix B.1).

These values were summed for all the isopleths, resulting in an estimate of total inventory of 1.3 GBq. It is relevant to note that this is substantially less than the annual releases of ^{137}Cs prior to 1985 when the reactor was operating.

Table 5.23
Estimate of the Inventory of Cs-137 in Sediments in the Study Area Just Downstream of the Outfall
Areas are Computed From Measured Count Rate (Cps) Isopleths.

Isopleth (cps)	**Net Count Rate (ncps)**	**Isopleth Equivalent Area (m^2)**	**Net Area (m^2)**	**Isopleth Dose Rate (nGy/hr)**	**Activity Concentration (Bq/g)**	**Total Activity (GBq)**	**Bkg (cps)**
100	0	1598.71	6.8	8	0.27	0.000	100
150	50	1591.90	3.9	23	0.81	0.000	
200	100	1587.99	15.6	38	1.34	0.002	
250	150	1572.39	44.3	54	1.88	0.006	
300	200	1528.14	50.1	76	2.69	0.010	
400	300	1478.03	193.6	107	3.76	0.055	
500	400	1284.44	244.9	161	5.65	0.104	
750	650	1039.54	556.1	237	8.34	0.348	
1000	900	483.45	204.2	352	12.37	0.189	
1500	1400	279.21	159.3	581	20.44	0.244	
2500	2400	119.92	89.1	963	33.88	0.226	
4000	3900	30.81	28.7	1346	47.33	0.102	
5000	4900	2.15	2.1	1560	54.86	0.009	
		Total=	1598.706		Total =	1.295	

5.4.8 Aquatic Habitat and Biota

Local Study Area

The primary aquatic habitat found in the Local Study Area is the Winnipeg River, which passes directly through the licensed property area. In addition to this, there are several small isolated ponds on the Whiteshell Laboratories' site that are fed by local runoff and intermittent streams that run primarily during the spring. The streams are associated with gullies that dissect the clay plains along the banks of the Winnipeg River. They provide ideal beaver habitat, and as a result, beaver ponds are a common feature on the site. Ponds formed by beaver dams are seldom more than a few years old before they are drained and thus are not considered good aquatic habitat. There are also two sewage lagoons that are over 20 years old and that harbour a number of aquatic plants and animals. Man-made ditches carry water during spring runoff, but are generally dry in summer. Some become saline seeps in summer, as groundwater discharges into the dry ditches and the salts accumulate.

Fish

Of the 177 endemic fish species present in Canada, 94 species are found in the Hudson Bay Drainage System, which includes the Winnipeg River, and 79 species are present in Manitoba (Scott and Crossman 1973). Most of these species are forage fish such as carp and other minnow species. Predator fish in the area include walleye, northern pike, smallmouth bass, mooneye and lake trout. Populations of the fish, with the exception of sturgeon are considered stable.

Lake Sturgeon considered a species at risk due, in part, to over fishing during the first half of the century, is also found in the Winnipeg River. It is being studied because of concerns that the population may be declining as a result of the extensive hydroelectric developments on the river. The sturgeon is known for living upwards of 70 years, attaining weights of over 100 kg and reaching maturity at 20 years of age. Sturgeon feed on insect larvae, molluscs and crayfish. It has been suggested by locals that an area favoured by sturgeon is located at the outfall of the Whiteshell Laboratories.

Radioactivity in the Winnipeg River Fish

Fish consumption is the dominant exposure pathway of ^{137}Cs for people in the local area. Within the Winnipeg River, dominant fish species are walleye, pike, red sucker, white sucker and whitefish. In the past, variations in ^{137}Cs in fish flesh was not statistically significant between the fish downstream and upstream during the decade from 1962 to 1972; however marked increases of ^{137}Cs were observed in fish downstream between 1976 and 1982. These levels decreased to those observed between 1962 to 1972 after construction of the ALWTC in 1982 (Dunford et al. 1983). Table 5.24 to 5.26 gives a summary of the ^{137}Cs, potassium-40 and gross beta activity found in fish flesh at three locations on the Winnipeg River, from 1992 to 1998.

It is evident from data collected between 1992 to 1998 that fish in the downstream locations generally have higher concentrations of ^{137}Cs. Pickerel, common sucker and pike showed elevated concentrations in 1996 at 0.5 km downstream of the outfall. Otherwise, concentrations are uniform over the seven years except for a slight decline in 1997 and 1998 (Niemi and Soonawala 1999b).

Table 5.24
Average Radioactivity in Winnipeg River Fish Flesh Upstream of Whiteshell Laboratories (Pinawa)

Year	Cs-137 (Bq/kg, wet weight)	K-40 (Bq/kg, wet weight)	Gross Beta (Bq/kg, wet weight)
		White Sucker	
1992	0.56	125	92
1993	0.42	116	91
1994	0.45	110	97
1995	0.33	100	92
1996	0.4	124	98
1997	0.37	126	100
1998	0.57	162	97
		Pickerel (Walleye)	
1992	1.11	105	87
1993	1.32	121	96
1994	1.22	113	94
1995	0.76	112	93
1996	0.99	132	97
1997	1.03	141	102
1998	1.44	119	89
		Whitefish	
1992	1.29	118	99

1993			
1994	0.17	118	95
1995	0.28	108	105
1996	0.58	134	105
1997	0.26	135	105
1998	0.24	159	100
	Pike		
1992	2.26	122	98
1993	0.16	115	90
1994	0.69	114	98
1995	0.63	98	91
1996	0.66	116	90
1997	0.76	135	98
1998	1.74	132	89

(Adapted from Graham et al. 1998)

Table 5.25

Average Radioactivity in Winnipeg River Fish Flesh 0.5 km Downstream of Whiteshell Laboratories

Year	**Cs-137 (Bq/kg, wet weight)**	**K-40 (Bq/kg, wet weight)**	**Gross Beta (Bq/kg, wet weight)**
	White Sucker		
1992	1.65	115	87
1993	1.84	122	96
1994	1.81	112	104
1995	2.18	99	93
1996	2.87	120	92
1997	1.31	130	96
1998	1.03	109	87
	Pickerel (Walleye)		
1992	3.66	110	90
1993	2.04	117	90
1994	2.35	116	101
1995	2.21	112	99
1996	3.26	136	103
1997	1.88	133	98
1998	1.96	150	108
	Whitefish		
1992	4.28	127	87
1993	0.53	112	96
1994	0.55	111	102
1995	1.96	95	97
1996	1.56	121	90
1997	0.38	122	96
1998	0.45	140	115
	Pike		
1992	2.54	115	90
1993	2.53	118	94
1994	2.62	103	100
1995	1.72	99	99
1996	4.63	114	99
1997	1.42	125	103
1998	1.94	118	98

(Adapted from Graham et al., 1998)

Table 5.26

Average Radioactivity in Winnipeg River Fish Flesh 5 km Downstream of Whiteshell Laboratories

Year	**Cs-137 (Bq/kg, wet weight)**	**K-40 (Bq/kg, wet weight)**	**Gross Beta (Bq/kg, wet weight)**
	White Sucker		
1992	1.22	117	88
1993	1.56	120	96
1994	0.93	108	90
1995	1.41	102	93
1996	1.56	121	90
1998	1.36	154	117
	Pickerel (Walleye)		
1992	2.69	118	92
1993	2.46	122	100
1994	1.80	114	96
1995	1.90	109	97
1996	1.30	130	104
1998	1.73	131	106
	Whitefish		
1992	0.79	120	90
1993	0.66	120	100
1994	0.6	111	105

1995	0.51	91	91
1996	0.72	120	92
1998	0.35	116	91
Pike			
1992	2.07	112	86
1993	1.32	62	91
1994	2.08	99	86
1995	1.53	99	95
1996	1.62	118	101
1998	1.10	116	88

(Adapted from Graham et al., 1998)

Invertebrates

Studies on benthic species have been undertaken on the Winnipeg River by Guthrie and Iverson (1970) and Ireland et al. (1973). More recent studies have been undertaken by Wong et al. (1996) downstream near Pine Falls and in Whiteshell Provincial Park (McKillop 1996).

Among the many species of zooplankton in Winnipeg River, rotifers, cladocera and copepoda are usually dominant. The benthic fauna include protozoa, ostracods, nematodes, oligochaetes, leeches, mysids (the opossum shrimp), crayfish, amphipods, mollusks (snails), bivalve clams (e.g. mussels) and aquatic insects. The latter include Diptera larvae such as Chironomid and Chaoborus larvae, dragonflies, mayflies (e.g. Hexagenia) caddisflies, true bugs and aquatic beetles (Guthrie and Iverson 1970).

Diversity and production of the benthos is generally greater in the littoral (shallow) area than in the profundal (deep water) area. However, production in profundal areas may be high as attested by the large emergence of mayflies from Lac du Bonnet each summer. Blackfly larvae are present in fast water reaches of connecting channels. Chironomidae and tubificids were particularly numerous in the early operational survey carried out by Ireland et al. (1973). These authors provide benthic abundance data for the Winnipeg River upstream and downstream of the Whiteshell Laboratories liquid effluent outfall. The benthic fauna has been investigated in more detail downstream in the Winnipeg River near Pine Falls (Wong et al. 1996). The distribution of aquatic snails and their association with aquatic plants in nearby Whiteshell Provincial Park has been documented (Pip 1978; Pip 1979; McKillop 1996).

In the summer 2000 study, ^{137}Cs levels in clamshells and tissue were found to be slightly elevated. There was considerable variation in levels with slight trends to higher tissue concentrations close to the outfall and higher concentrations in larger (older) clams. Additional details are provided in Appendix B.1.

Macrophytes (Aquatic Vegetation) and Phytoplanton (Algae)

Emergent macrophytes such as bullrushes, cattails and wild rice are found to a depth of about 1 m along the shores of the Winnipeg River. Phytoplankton of the Winnipeg River consists of a diverse assemblage of nearly all major algal taxonomic groups. Wild rice is harvested in the region, with harvesters reporting individual takes in the order of 5,000 kg. Almost all of this is concentrated on smaller water bodies than the Winnipeg River, including some seeded lakes. There are no water bodies suitable for wild rice on the Whiteshell Laboratories site.

5.4.9 Terrestrial Biota and Habitat

Regional Study Area

The Regional Study Area falls almost entirely within the Boreal Shield Ecozone, existing in Ecoregion 90 and Ecoregion 91, specifically the Lac Seul Upland and Lake of the Woods area, respectively. A very small portion of the Boreal Plains Ecozone, represented by a portion of Ecoregion 155 or the Interlake Plain, is also within the Regional Study Area (Environment Canada 1999). Lac Seul Upland makes up approximately 38% of the Regional Study Area, Lake of the Woods makes up approximately 56% of the area, and the Interlake Plain makes up approximately 6% (Manitoba Conservation Data Centre 1998).

The Regional Study Area is on the interface between aspen parkland and boreal forest. The local relative dominance of tree species depends largely on the underlying soils. The calcareous poorly drained clay soils, if not covered by organic deposits, support aspen parkland, whereas sandy soils and organic soils tend to support species typical of boreal forest (e.g. black spruce, white spruce, tamarack, jack pine, balsam fir). The confluence of these two major habitat types results in complex local associations. The region is also the eastern boundary of the range of many western species, and the western boundary of the range of many eastern species. The river has an additional influence on this combination of habitats. The riparian zones along the shore of the Winnipeg River are first footholds for species not normally found in the area. For example, the ironwood tree is at the northern boundary of its range, and occurs in the region almost exclusively along the riverbanks.

Of the listed species of concern outlined by the Manitoba Conservation Data Centre, the Lake of the Woods ecoregion maintains vegetation that is widespread throughout North America; however, 20% of species are ranked as being very rare within Manitoba. In Lac Seul Upland, 19% of the species of vegetation listed are very rare throughout their range in the province, but are common elsewhere. In the Interlake Plain, 30% of the listed vegetation is rare within the province. Within this ecoregion, the Western Prairie Fringed Orchid and the Western Silvery Aster are listed as endangered and threatened, respectively (Manitoba Conservation Data Centre 1998).

Local Study Area

Figure 5.25 shows vegetation cover in the local area. The aspen and balsam poplar forest on the clay plains has associations of willow, rose, alder, currant and dogwood. The mixed deciduous forest and the river forest include ash, aspen, birch, oak and fir, with associations of cranberry, willow, rose and strawberry. The black spruce in the bogs to the east is associated with Labrador tea, moss, tamarack, horsetail, blueberry and willow. The upland mixed conifers on the sandy soils include jack pine and poplar stands, with spruce, fir and birch and associations of Labrador tea, hazelnut, plum and blueberry. The wetlands contain manna-grass, cattail, sedge, and bullrush. The old-field areas and other areas where vegetation is controlled contain types of grass, bluegrass, sedge, strawberry, clover and aster.

Project Study Area

The terrestrial habitat in the Project Study Area is diverse over short distances. Large tracts of wetland cover the easterly portions of the site, with black spruce common. Within this area is a ridge of well-drained sandy soils with jack pine as the notable species. Further to the west are poorly drained clay plains, some forested with species such as ash and poplar, and some as abandoned farm fields vegetated with grasses and shrubs. Near the FIG (Field Irradiator Gamma) site are upland mixed conifers including jack pine and poplar stands, with spruce, fir and birch and associations of Labrador tea, hazelnut, plum and blueberry. This is shown in Figure 5.26. Close to the Winnipeg River are gullies or ravines where beaver dams are common. The gullies and the riparian environments along the Winnipeg River occasionally harbour species not common to the region.

Mammals

Over 50 species of mammals can be expected to occur around the Whiteshell Laboratories site (Banfield and Brooks 1974). More detailed regional data are available from Manitoba Natural Resources through hunting and trapping statistics. Many of the mammals, such as the snowshoe hare, American red squirrel, meadow vole, red fox and white-tailed deer, are common and widespread. Others, such as the American water shrew, Franklin's ground squirrel, southern bog lemming, fisher and moose are only locally common where suitable habitat is available. Still others, such as the grey fox, wolverine and mountain lion are rare.

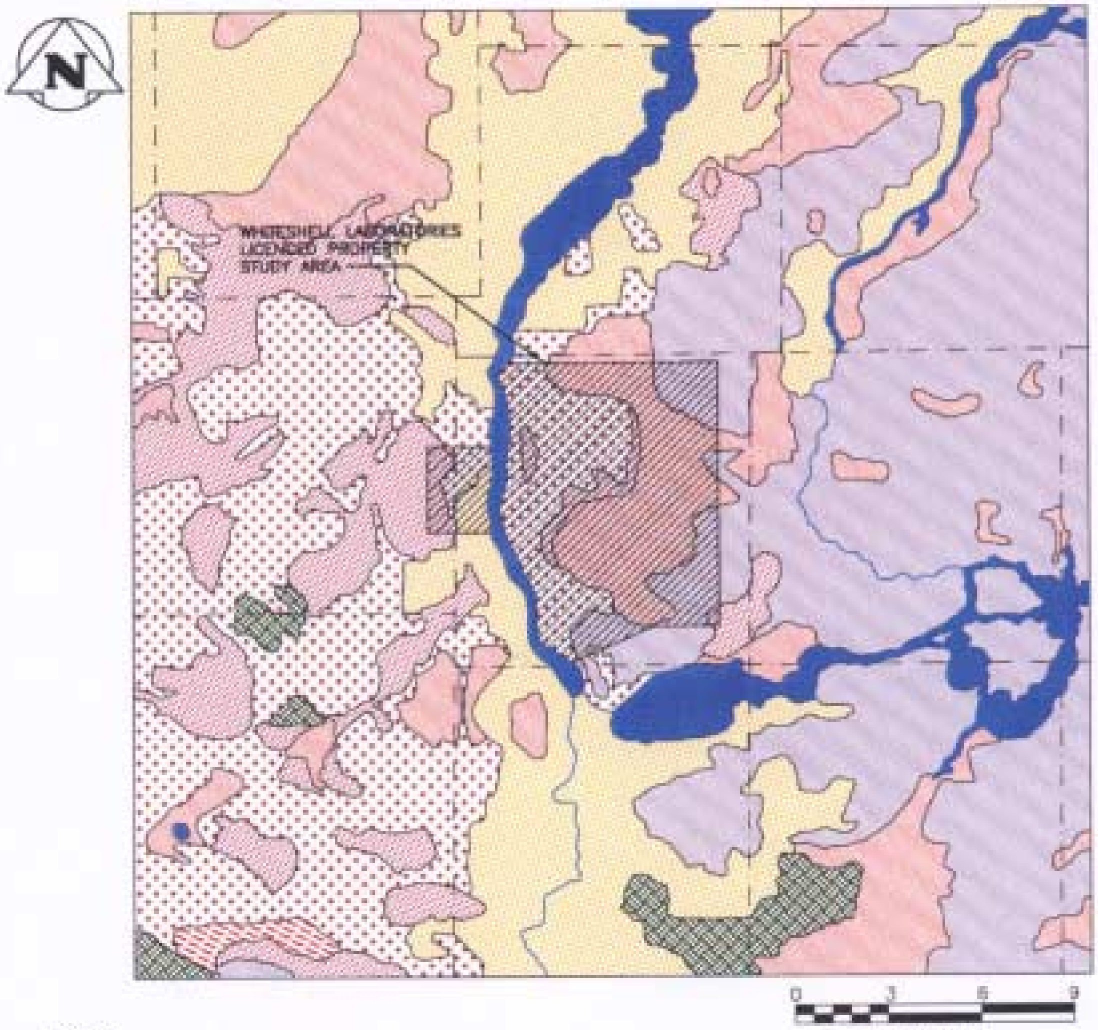
The Committee on the Status of Endangered Wildlife in Canada produced an annual Canada wide list of species designated at risk (e.g. extinct, extirpated, endangered, threatened and vulnerable) for 1997. No mammals species in the area were listed as endangered while the grey fox and the wolverine were listed as vulnerable.

White-tailed deer successfully colonized Manitoba at the turn of the century with the settlement of the province. These deer have become an important ecological component and are considered important for aboriginal peoples, as well as a game species. Deer inhabit the Whiteshell Laboratories site and have established wintering areas on the site. A capability map for ungulates (which include deer) is provided in Figure 5.27.

Mammals common to the Whiteshell Laboratories area, generally have a range that extends well beyond the facility. This range is of similar habitat to the Whiteshell Laboratories site.

FIGURE 5.25

VEGETATION COVER IN LOCAL STUDY AREA



LEGEND:

- AGRICULTURAL, GRAZING AND MODIFIED COVER
- HARDWOODS (PRIMARILY ASPEN)
- MIXED FOREST (HARDWOODS & CONIFERS)
- JACK PINE
- CONIFERS (PRIMARILY WHITE & BLACK SPRUCE)
- CONIFERS (PRIMARILY BLACK SPRUCE, SOME TAMARACK)
- MARSHLAND (OPEN TO THINLY TREED)
- WHITESHELL LABORATORIES LICENCED PROPERTY STUDY AREA (APPROXIMATE LOCATION)

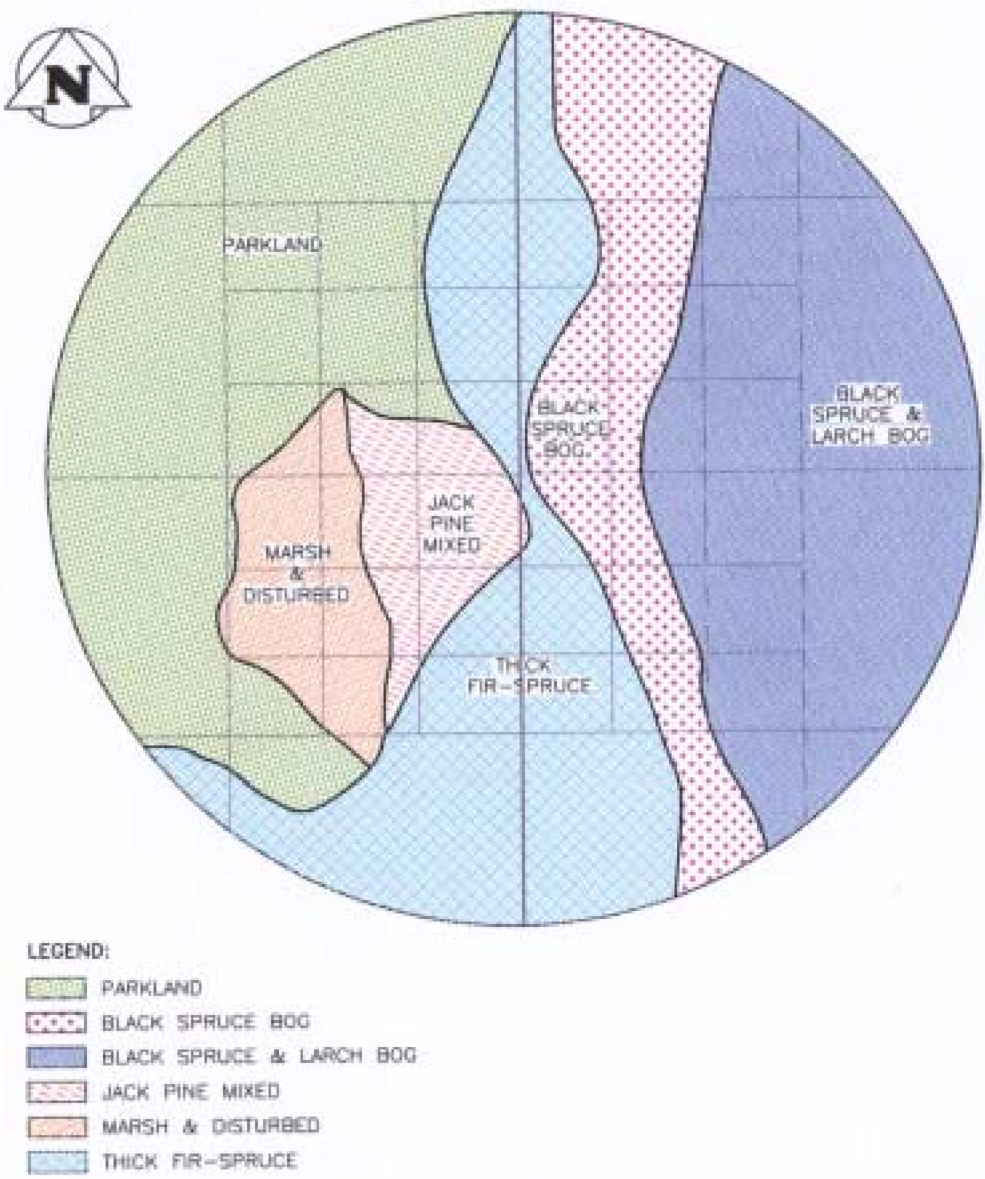
NOTE:

VEGETATION COVER INCLUDING THE WHITESHELL SITE (CENTRE OF THE MAP) AND PARTS OF THE LOCAL STUDY AREA. THE VARIETY OF HABITAT NEAR THE SITE IS EVIDENT, AND THIS DIVERSITY OVER A SMALL AREA DESIGNATED AS A TERRESTRIAL VALUED ECOSYSTEM COMPONENT (VEC).

SOURCE: GUTHRIE AND SCOTT, 1988

FIGURE 5.26

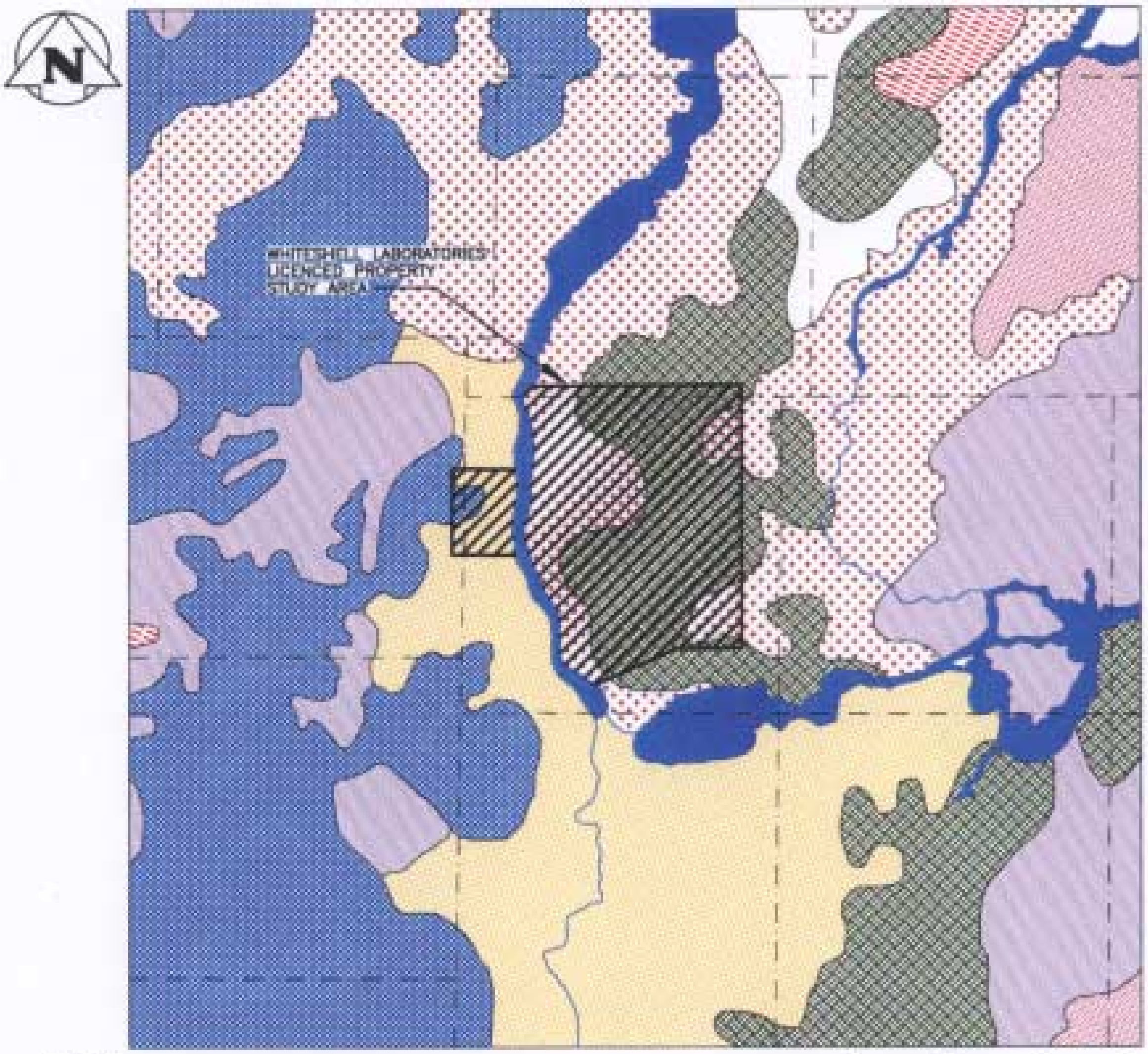
VEGETATION MAP FOR THE FIELD IRRADIATOR GAMMA (FIG) SITE



SOURCE: GUTHRIE AND SCOTT, 1988

FIGURE 5.27

LAND CAPABILITY FOR UNGULATES



LEGEND:

- NO SIGNIFICANT LIMITATIONS
- VERY SLIGHT LIMITATIONS
- SLIGHT LIMITATIONS
- MODERATE LIMITATIONS
- MODERATELY SEVERE LIMITATIONS
- SEVERE LIMITATIONS
- ALMOST NO PRODUCTION
- MODERATE/MODERATELY SEVERE/SEVERE LIMITATIONS
- WHITESHELL LABORATORIES LICENCED PROPERTY STUDY AREA (APPROXIMATE LOCATION)

0 3 6 9
KILOMETRES

NOTE:

LAND CAPABILITY FOR UNGULATES AT THE WHITESHELL SITE (CENTRE OF THE MAP) AND PARTS OF THE LOCAL STUDY AREA. THERE IS, IN CERTAIN YEARS, A LARGE POPULATION OF DEER AND SOME MOOSE IN THE AREA, AND THOSE WERE DESIGNATED AS A VALUED ECOSYSTEM COMPONENT (VEC).

SOURCE: GUTHRIE AND SCOTT, 1988

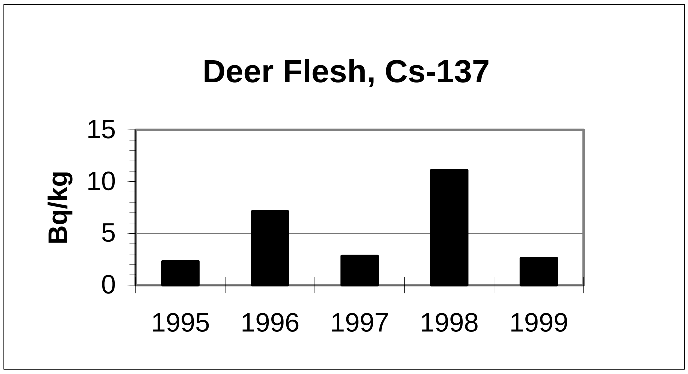
Radioactivity in the Flesh of Wildlife

Niemi et al. 2000 presents data on radioactivity in flesh of roadkills from the vicinity of Whiteshell Laboratories and trapped animals from Crowduck Lake, about 60 km northeast of Whiteshell Laboratories on the Winnipeg River system. The data are presented in Table 5.27. The trend for years 1995 to 1999 for ^{137}Cs concentration in deer flesh from the vicinity of Whiteshell Laboratories is shown in Figure 5.28.

Table 5.27
Radioactivity in Flesh of Roadkills

Month	Species	Approx Age (Year)	Gross Beta			Gross Alpha			Cs-137			K-40		
Crowduck Lake (60 km northeast of WL)														
99 March	Fox	1 to 2	104.7	+/-	7.3	9.0	+/-	7.0	13.7	+/-	0.4	122.4	+/-	5.4
99 March	Fox	< 1	105.5	+/-	7.2	7.0	+/-	5.0	39.0	+/-	1.3	107.6	+/-	12.8
99 March	Fox	1 to 2	71.7	+/-	4.9	7.0	+/-	5.0	8.9	+/-	0.7	84.2	+/-	8.5
99 March	Otter	1 to 2	80.6	+/-	5.5	16.0	+/-	6.0	9.4	+/-	0.5	93.5	+/-	6.5
99 March	Otter	1 to 2	294.2	+/-	20.0	78.0	+/-	24.0	1.9	+/-	0.5	380.5	+/-	11.6
99 March	Otter	1 to 2	78.4	+/-	5.5	22.0	+/-	8.0	1.2	+/-	0.4	99.2	+/-	7.3
99 March	Otter	1 to 2	90.2	+/-	6.2	13.0	+/-	7.0	20.7	+/-	0.7	122.4	+/-	8.3
99 March	Otter	1 to 2	64.5	+/-	4.5	7.0	+/-	5.0	0.9	+/-	0.3	80.4	+/-	4.8
Whiteshell Labs (Licensed property and vicinity)														
99 Feb	Deer	3	94.3	+/-	6.5	<7			2.4	+/-	0.2	125.0	+/-	5.7
99 Feb	Deer	3	27.8	+/-	1.9	<2.4			2.9	+/-	0.1	38.2	+/-	2.5

Figure 5.28
Radioactivity in Flesh of Deer
(Bq/kg, fresh weight)



Radioactivity in Vegetation

Radioactivity in native vegetation, in units of Bq/kg fresh weight, is reported from 6 locations at Whiteshell Laboratories in Table 5.28.

Table 5.28
Radioactivity in Native Vegetation at
Whiteshell Laboratories – 1998
(Bq/kg Fresh Weight)

Location	Gross Beta[(1)] (Bq/kg)
ARMS 1, North	87
ARMS 3, South-southeast	209
ARMS 4 West	150
ARMS 5, Northwest	152
West of WMA (standpipe 83 spill area)	450[(2)]
North of Canisters	234[(2)]

(1) ARMS locations are yearly averages.
(2) Stations sampled once (during spring) known to yield elevated results.

Birds

A large variety of bird species can be expected to occur in the vicinity of the Whiteshell Laboratories site based on general distribution data (Godfrey 1986). The birds of the region have been studied in detail by Taylor (1983) and Seabloom (1975). Taylor's surveys continue and data for the area includes breeding bird and owl surveys as well as Christmas bird counts. Zach (1982) has studied the breeding biology of house wrens and tree swallows on the site itself, so

data exists on parameters such as brood size, hatching success and growth rates (Zach 1982; Zach and Mayoh 1982a, 1982b, 1986).
There are important bird migration staging areas on or near the site. The most important physical feature related to migration routes of birds is the Winnipeg River. It represents a migratory corridor for several species that move into central Manitoba and beyond from the Great Lakes and/or the Mississippi River in spring and back in the fall. The most important species include the common loon, red-necked grebe, horned grebe, double-crested cormorant, American white pelican, Bonaparte's gull, common tern, Caspian tern, lesser scaup, greater scaup and bald eagle. The Winnipeg River can become an important staging area for a variety of waterbirds each spring (e.g. common loon and red-necked grebe).

The Committee on the Status of Endangered Wildlife in Canada annual Canada-wide list of species designated at risk for 1997 indicates that the area may support several endangered species including: peregrine falcon, burrowing owl, piping plover and loggerhead shrike. Vulnerable species in the area may include the least bittern, short-eared Owl, Caspian tern and red-headed Woodpecker.

Amphibians and Reptiles

A wide diversity of amphibians is present in the vicinity of the Whiteshell Laboratories site, despite the generally harsh winter conditions. About 10 species of amphibians can be found (Froom 1982; Cook 1984). Most are frogs such as the spring peeper, grey tree frog, striped chorus frog, wood frog and northern leopard frog are common and widespread. However, some species, such as the green frog and the mink frog are less common and widespread (Taylor 1990).

Only four reptile species can be found on-site; two turtle and two snake species (Preston 1982; Cook 1984). Both are common and widespread. The common garter snake is widely distributed and prevalent in the region, but little is known about the exact status of the redbelly snake found in the area. All the reptile species hibernate to survive the harsh winters and hibernacula are a potentially important ecological feature in the Whiteshell region. None are known to exist on the Whiteshell Laboratories site. In spring, the reptiles become active and enter their breeding cycle, which may involve special areas for egg-laying; none are known to be located in the Whiteshell Laboratories' controlled area.

5.4.10 Regional Land and Resource Use

Agriculture

In the regional area, some of the best farmland is along waterways and on upland lighter-textured soils (Canada Land Inventory 1968, 1975). Consistent with the regional area, in the local area better farm land is found along the Winnipeg River. The land capability map (Figure 5.29) identifies classes of crop land for the local area. Agricultural operations in the region include cereal production, hay, flax, canola and alfalfa crops, and dairy and livestock production. Alfalfa seed production and the attendant leaf-cutter bees is a specialty in the area. Early data for comparison to present-day production, cultivation and harvest is available for cereal, flax, alfalfa and hay (Guthrie and Scott 1988). These data are broken out by township and farm size. The early census data show that less than half of the cattle in the area are dairy animals. Poultry, eggs and swine are also produced. Specialty operations in the area include goat herding, emu and ostrich farming, and leaf cutter bee operations. Farmers lease land from AECL on the west side of the Winnipeg River, in the area catagorized as unaffected.

Forestry

Forestry is a strong industry in the regional area, although little if any forestry has occurred in the local area. Aspen, black spruce and jack pine are the dominating natural stands of timber in the region (Dugle et al. 1974; Canada Land Inventory 1974). There are extensive and potentially productive softwood and hardwood forests close to Whiteshell Laboratories (Guthrie and Scott 1988). The Province's Agassiz Forest Reserve is just to the west of the Whiteshell site. Considerable softwood stands (black and white spruce, balsam fir and jack pine) in the region have been and are presently being logged to supply pulp to Pine Falls Pulp and Paper Co. newsprint operation at Pine Falls. Guthrie and Scott (1988) give regional commercial forestry harvest statistics for the 1960s. However, maps from Canada Land Inventory (1974) indicate that the area in the immediate proximity of the Whiteshell Laboratories site shows moderate to moderately severe limitations to commercial forestry and the land due east of the plant site (primarily bog) has either severe limitations or commercial forest growth is completely precluded. The site is within the Manitoba Model Forest boundary presenting some restrictions or oversight to large-scale forestry operations at present.

Recreation

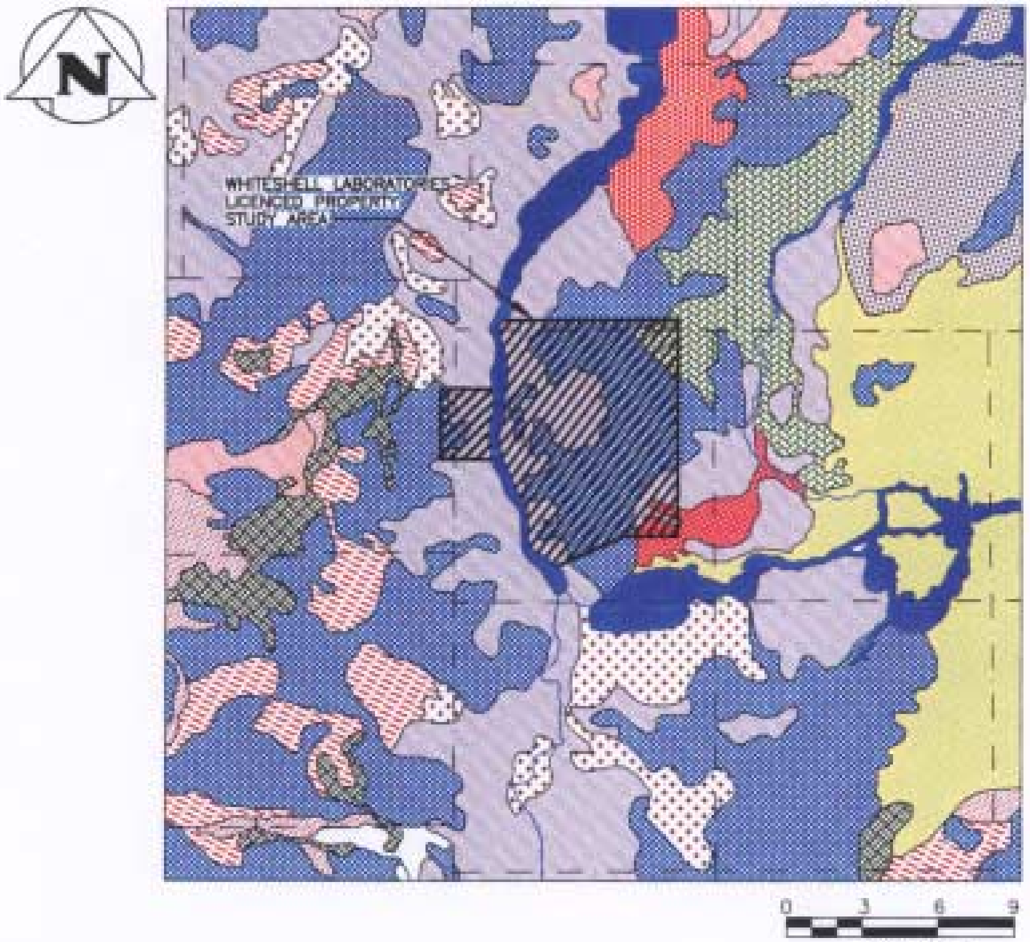
Recreation is a major land and water use. The Whiteshell Laboratories' site is located just a few kilometres northwest of the Whiteshell Provincial Park boundary and southwest of the Nopiming Provincial Park, both of which are prime outdoor recreation areas in eastern Manitoba. The Trans-Canada Trail follows the dyke along Natalie Lake just south of Highway 211 and the Whiteshell Laboratories' controlled area. Home and cottage development along the west side of the Winnipeg River indicates that waterways, scenery, trails and wildlife of the region are attracting vacationers and weekend campers. The area to the north affords great vistas and interesting hiking terrain as well as heritage and cultural points of interest (such as the Bannock Point petroforms, the Old Pinawa Dam, voyageur routes along the Winnipeg River). Explore Magazine and Going Places, the magazine of the Canadian Automobile Association (CAA), recently featured Pinawa as one of the birding meccas of Manitoba, with some 20 km of maintained hiking trails in summer. This area also has considerable recreational resource use in winter with 30 km of groomed cross-country ski trails and access to hundreds of kilometres of snowmobile trails (directly linked to the U.S.).

Hunting and Trapping

Hunting and trapping is popular in the region (Canada Land Inventory 1971, 1972a, 1972b). The principle game animals are deer and moose, although bear hunting is becoming more popular. Wolf, coyote, fox, beaver, muskrat, mink, weasel, otter, fisher, martin and squirrel are the most commonly trapped species on the twenty to thirty traplines in the Whiteshell game hunting area. Both open areas and registered traplines exist and Manitoba Natural Resources maintain records of game and fur-bearing species harvested. No registered traplines are within the controlled area of the Whiteshell Laboratories site (it is designated restricted). However, trapline number 23 is located along the southern and eastern boundary of the controlled area (Lac du Bonnet Natural Resources Officer 1999).

FIGURE 5.29

LAND CAPABILITY FOR AGRICULTURE



LEGEND:

- MODERATE LIMITATIONS FOR CROPS
- MODERATE TO SEVERE LIMITATIONS FOR CROPS
- SEVERE LIMITATIONS FOR CROPS
- VERY SEVERE LIMITATIONS FOR CROPS
- PERENNIAL FORAGE CROPS ONLY
- NO CAPABILITY FOR AGRICULTURE
- ORGANIC SOILS; NOT RELATED
- MODERATE/MODERATE TO SEVERE/NO CAPABILITY
- MODERATE TO SEVERE/SEVERE/NO CAPABILITY
- MODERATE TO SEVERE/ORGANIC SOILS
- NO CAPABILITY/ORGANIC SOILS
- NO CAPABILITY/MODERATE TO SEVERE/ORGANIC SOILS
- WHITESHELL LABORATORIES LICENCED PROPERTY STUDY AREA (APPROXIMATE LOCATION)

NOTE:
LAND USE (LAND CAPABILITY FOR AGRICULTURE) AT THE WHITESHELL SITE (CENTRE OF THE MAP) AND PARTS OF THE LOCAL STUDY AREA.

SOURCE: GUTHRIE AND SCOTT, 1988

Water Use

The primary use of water from the Winnipeg River is for domestic purposes. The Winnipeg River serves as the drinking water source for the downstream towns of Lac du Bonnet, Great Falls, St. George and Pine Falls. Water treatment varies for each municipality and includes a range from chlorination only, to chlorination, filtration, sedimentation and coagulation (Pine Falls).

Some irrigation water is also taken and the province keeps records of irrigation permits. The entire length of the Winnipeg River is used for boating and water skiing. Owners of private property with river frontage have docks and use the river for swimming. The closest beach for public swimming is on the west shore of Lac du Bonnet in the town's centre.

Fishing

No commercial fishing is carried out on the Winnipeg River. Commercial fishing takes place at the mouth of the river in Traverse Bay at the south end of Lake Winnipeg. The major species are northern pike, walleye, lake sturgeon, smallmouth bass, burbot and yellow perch.

Sport fishing, however, is very popular in the Winnipeg River. In this respect, the Whiteshell Laboratories site is in management area No.3 (Guthrie and Scott 1988). Major sports fish in the area are walleye, northern pike, smallmouth bass, mooneye, and lake trout. Mooneye is a relatively small fish prized for consumption when pickled and smoked. The aforementioned species are common in the region and although they are thought to have stable populations, capture limits have been designated by Manitoba Conservation. Local knowledge suggests an area favoured by sturgeon is located near the outfall of the Whiteshell Laboratories. Sturgeon is a protected species that must be released if caught.

5.5 BASELINE CONDITIONS: SOCIO-ECONOMIC

5.5.1 Population

Whiteshell Laboratories is part of the Pinawa LGD. In 1996, the population of the communities around Whiteshell Laboratories was approximately 18,700, up about 400 from 1991 (Table 5.29). According to the Community/Provincial Leaders Committee on the Closure of Whiteshell Laboratories, approximately half of the workforce at Whiteshell Laboratories has tended to live in the Pinawa-Whitemouth Region. In 1996, the two communities (Pinawa LGD and Whitemouth RM) had a combined population of 3,311, down from 3,520 in 1991 and 3,847 in 1981. The population of Pinawa where the Whiteshell facility is located was down from 2011 in 1981 to 1672 in 1996.

Table 5.29
Population Data for Communities Around Whiteshell Laboratories

Community	1981	1986	1991	1996
Alexander	N.A.	N.A.	2399	2555
Town of Beausejour	2465	2535	2636	2712
R.M. of Brokenhead	3021	3175	3325	3495
Fort Alexander	N.A.	N.A.	1579	1690
Village of Lac du Bonnet	1030	1021	1088	1070
R.M. of Lac du Bonnet	2194	2189	2219	2280
L.G.D. of Pinawa	2011	2078	1806	1672
R.M. of Whitemouth	1836	1820	1714	1639
Pine Falls	N.A.	N.A.	800	794
Powerview	N.A.	N.A.	736	759
Total			**18302**	**18666**

Source: The Whiteshell Laboratories Community/Provincial Leaders Committee April 30, 1999.

5.5.2 Employment and Economic Base

General

Employers such as government, schools, shops and some new services and industries have evolved since downsizing of the Whiteshell Laboratories began. Historically, however, the Whiteshell facility has been the dominant employer in the area (Table 5.30). Estimates prepared for the Community/Provincial Leaders Committee's report indicate that the workforce at Whiteshell Laboratories peaked at about 1168 in the fall of 1984, and was fairly constant at around 1100 until June 1992. Thereafter, employment fell off to 802 in February 1998 and, following the layoffs of March 1998, has fallen to 349. The decommissioning workforce will be about 150. Ultimately, once the first phase of decommissioning is complete, total employment at the site will be approximately 30 people. The number of staff in addition to those involved in the decommissioning is not clear. AECL records indicate that at present, approximately 50% of the employees who have been laid off from Whiteshell continue to live in Pinawa.

Table 5.30
Employment by Sector

Sector	Manitoba	Lac du Bonnet (Rural Municipality)	Alexander	Pine Falls	Pinawa	Lac du Bonnet (Village)	Powerview	Fort Alexander
Total Population 15 yrs & over	855880	1850	1960	625	1300	840	600	1125
Participation Rate	66.3%	62.7%	56.6%	64.8%	69.6%	53%	67.5%	43.1%
Unemployment rate	7.9%	6.3%	6.8%	2.5%	3.9%	13.5%	4.9%	38.1%
All industry divisions	553875	1130	1095	405	905	415	395	380
Agricultural and related service industries	39660	125	75	0	0	10	0	0
Fishing and trapping industries	1015	0	0	0	0	0	0	10
Logging and forestry industries	1940	15	10	0	0	0	0	20
Mining/manufacturing	67095	165	185	160	10	65	115	15
Construction	27310	90	55	0	20	15	0	20
Transportation and Storage	30490	85	80	10	15	20	0	10
Communication & other utilities	19755	100	75	0	20	20	10	10
Education Service	42470	30	100	30	120	30	75	60
Health and Social Service	65015	55	130	60	55	45	65	100
Retail/wholesale trade & hospitality	129385	315	215	75	95	105	55	20
Personal & financial & other	90030	100	100	40	525	35	45	20

Sources: Statistics Canada, 1996 census.
Interviews with Manitoba Industry, 1997 data.

In the past, this employment brought significant amounts of income into Pinawa and the area. AECL's 1991 Whiteshell Laboratories' payroll was approximately $54 million. Half of that amount went to employees living in Pinawa. Downsizing has reduced AECL's income contribution. The current (early 1999) payroll is about $18 million and the average annual salary is now $51,576 down from the 1991 level of $53,138, (not counting inflation).

Other Activities

Mining

Mining activity in the eastern region includes tantalum mining in the Lac du Bonnet area. The Tanco mine produces high grade spodumene for ceramic and specialty glass industries. Mining operations restarted in 1995. There are also quarry leases for granite in the area. In addition, silicon sand leases are pending in the area.

Forestry

Forestry is an important industry in the area. There are extensive and potentially productive softwood and hardwood forests close to Whiteshell Laboratories. Several of the softwood stands in the region are logged to supply pulp to Pine Falls Pulp and Paper Co. newsprint operation at Pine Falls.

A Federal/Provincial Program designed to create a sustainable forest environment is now underway in the area. The model forest is a large-scale working model of sustainable forest management. The Manitoba Model Forest covers a large area, which extends just south of Pinawa northward, including the southern portion of Atikaki Provincial Wilderness Park, east to the Manitoba-Ontario border and west to Lake Winnipeg.

Agriculture

As discussed in Section 5.4.10, cereal, flax, alfalfa and hay are grown in the Whiteshell area. Specialty operations in the area include goat herding; emu and ostrich farming; and alfalfa seed production and leaf cutter bee operations.

Gross farm receipts by municipality in the regional area are provided in Table 5.31.

Table 5.31
Agriculture Gross Farm Receipts

Rural Municipality	# of Farms	Total Gross Farm Receipts	Receipts per Farm	$50,000+ Reportin g	Under $50,000 Reporting
Lac du Bonnet	126	$9,537,662	$75,696	49	94
Whitemouth	155	18,161,139	117,169	126	87
Alexander	83	2,554,093	30,772	17	71
Brokenhead	362	19,760,520	54,587	187	245
Manitoba Total	**24,383**	**2,970,070,722**	**121,809**	**20204**	**12205**

Note: These figures do not include expenses, but are strictly gross receipts for farm operations in these rural municipalities. They are given as indication of the economic activity associated with farming in the area.
Source: Statistics Canada, 1996 Census.

Tourism

Tourism in the south east area of Manitoba is a significant industry (Table 5.32). According to a 1998 survey, 12% of American visitors to Manitoba visited the south east area of the province. This area extends north to just past Victoria Beach, east to the Manitoba – Ontario border and south to the American border and includes approximately the eastside of the Red River. Expenditures by American tourists average $188 per visit for the province and for the south east region the expenditures are over $200 per visit.

Table 5.32
Tourism Activity in South East Manitoba

Visits	Manitoba	South East Region	Percent of Manitoba Total
Total American Visits	824500	96500	12%
Total Domestic Visits	6306	1097	17%
American Visitors' Expenditures			

Average Reported Spending per Visit	$187.77	$86.97	
Average Reported Spending per Night	$132.84	$138.46	

Housing (Cottages)

Home and cottage development along the west side of the Winnipeg River indicates that waterways, scenery, trails and wildlife of the region are attracting vacationers and weekend campers.

Cottages and cottage lots have shown a steady demand over the last few years. The current price for river lots ranges from $35,000 to $50,000 depending on the location. Cottage lots on the Winnipeg River are in demand with the increase of retirees in southern Manitoba.

Sport Fishing

As discussed in Section 5.4.10, there is no commercial fishing in the Winnipeg River. However, sport fishing is popular.

The Whiteshell/Nopiming area represents about 20% of the total sport fishing activity in Manitoba, based on figures from sport surveys undertaken by Fisheries Branch, Province of Manitoba.

Table 5.33 is a summary of some indicators that establish the relative importance of sport fishing in Manitoba. Twenty percent of the sport fishing activity of the province takes place in the Whiteshell/Nopiming area. On a provincial basis, expenditures directly attributable to sport fishing totalled $28,755,591 for non-residents and $49,191,732 for Manitoba residents in 1995. This indicates the substantial impact sport fishing has the general area which includes the study area.

Table 5.33
Sport Fishing in Manitoba

Sport Fishing Indicator		1985	1990	1995
Whiteshell/Nopiming				
Percentage of Provincial Angler Days Expended by Anglers		18.7%	19.8%	20.4%
Non-resident		7.2%	8.8%	6.4%
Resident		20.0%	21.1%	22.4%
Total Province				
Non-residents	Average days per angler		7	7
	Trips – all reasons	159,880	176,212	180,997
	Fishing trips	64,759	96,748	105,031
	Days spent fishing	291,193	251,536	267,493
Non-residents (Continued)	Expenditures directly attributed to sport fishing- Manitoba		$23,503,144	$28,755,591
	Expenditures relating in hole or to sport fishing- Manitoba		$1,377,433	$3,661,591
Residents	Average days per angler		16	16
	Expenditures directly attributed to sport fishing –Manitoba		$68,046,453	$49,191,732

Sport Fishing Indicator		1985	1990	1995
	Expenditure relating in whole or part to sport fishing – Manitoba		$115,883,175	$123,907,154
Daily Average – Resident and Non-Resident Licence				
Expenditure directly attributed to sport fishing per day			$38.60	$35.48

Notes: * Includes food, lodging, travel cost, fishing supplies, household-owned boat costs, other costs and packages.

** Includes fishing equipment, boats and related equipment, camping equipment, special vehicles, land/buildings, and other expenditures.

Trapping and Hunting

The value of the traplines in the local area is unknown, but a general trend across Canada has been a reduction in the economic value of trapping in recent years, due to the falling price of furs. Hunting remains a popular activity in the area, but the economic impact is unknown.

5.5.3 Infrastructure

Roads

The primary access to Whiteshell Laboratories from Winnipeg is via Highway 44 east, Highway 11 north, and Highway 211 east. The road between Winnipeg and Beausejour (46 km) is a four lane divided highway. Highway 11 connects the area to Lake Winnipeg to the north and the Trans-Canada Highway to the south. The remaining 90 kilometres are two lane, paved roads. There are several unpaved through roads – Highway 520 between Pinawa and Lac de Bonnet via Highway 307 and Highway 406 south of Seven Sisters connecting to Highway 11. Municipal roads in towns are paved. There are numerous unpaved interior access roads. Within the Whiteshell Laboratories' site, the main access roads to the facility are paved, although roads accessing facilities outside of the main complex, for example the waste management facility, are generally unpaved.

During most of the year, there are no load restrictions on any of the paved roads in the area. There are some load restrictions in the spring, particularly on unpaved roads. The bridge over the Winnipeg River at Highway 211 just of Highway 11, has no load restrictions.

In addition to serving the area's local permanent population, the roads to the Whiteshell area serve a large number of cottagers in and around Whiteshell Provincial Park.

Water Supply and Sewers

The Winnipeg River is the source of water for most of the people living in the area. The Town of Lac de Bonnet and the LGD of Pinawa draw water from the river and treat it at their water treatment plants. Water co-ops (there are five in the RM of Lac de Bonnet alone) also draw water from the river and provide it directly through local piped systems or haul it to individual homes or systems away from the river.

Sewer systems exist in several communities, including the Town of Lac de Bonnet and the LGD of Pinawa, and include treatment at lagoons. The RM of Lac de Bonnet has no sewerage system but has a lagoon in which local septic tank maintenance contractors as well as travellers using RV's can dispose of their wastes.

5.5.4 Community Services

Apart from the availability of a considerable variety of outdoor recreational opportunities (see Section 5.4.10), most notably the Winnipeg River and the Nopiming and Whiteshell Provincial Parks, the area is well served with recreation and community services, Pinawa is particularly well serviced. It has both a high school and a public school. It has a 17-bed hospital, a community hall, and numerous other facilities including baseball and soccer fields, tennis courts, artificial ice arena as well as a popular golf course. These facilities are in part an outcome of the relatively high per capita expenditures on recreation. The Community/Provincial Leaders Committee on the Closure of Whiteshell Laboratories noted that, on a per capita basis, recreation and cultural expenditures were twice the Manitoba average even excluding the $250 annual costs of cable television.

5.5.5 Municipal Finance

Notwithstanding the high level of services available to residents of Pinawa, taxes on a standard bungalow (defined as 102 m^2, built around 1975) are on a par with communities elsewhere in the area but substantially lower than in Winnipeg (Table 5.34).

Table 5.34
Property Taxes in Manitoba Communities

Community	1997	1999
Pinawa	$1922	$1779
Beausejour	$1718	$1680
Lac du Bonnet	$1791	$1690
Winnipeg St. James	$2523	$2783

Note: Data adjusted to reflect different charges (cable TV, water and sewer).

Source: The Whiteshell Laboratories, Community/ Provincial Leaders Committee (April 30, 1999).

The provision of a high level of community services in conjunction with relatively low property taxes was planned by AECL for Pinawa. The grant-in-lieu of taxes paid by AECL to Pinawa was designed to ensure that the Town had services at least comparable to those elsewhere, if not better. The grant-in-lieu has recently been in excess of $1.9 million and has effectively amounted to half the revenue spent on schools and municipal services. Without the grant, the Leaders Committee estimated that the owner of a typical bungalow would have to pay $4,569 in property taxes, assuming that the Provincial policy of not providing the same educational funding assistance that it provides to other municipalities in Manitoba continues.

5.5.6 Historical and Archaeological Features

A comprehensive archaeological and historical record for the Licensed Property Study Area is not available. The lack of archaeological data for this area is not an indication of low potential for archaeological site, but rather is due to the fact that no formal archaeological field investigations have occurred within this study area. Only two archaeological sites within the area are presently recorded in the Provincial Archaeological Site Inventory: EaLa-6, the Sweet Creek Petroform Site, and EaLa-7, the Boat Launch Site (Figure 5.30). The first site was an ancient ceremonial site, which was destroyed during agricultural activities. The second is a pre-European-contact campsite. The present condition of this site is not known.

Two archaeological studies were conducted during the 1970s, one on each side of the reach of river where AECL property is located. These studies revealed high concentrations of pre-European-contact and fur trade sites. Of particular importance were the sites at the confluence of the Whitemouth and Winnipeg Rivers, where large settlements and burial mounds were recorded. These sites occur several kilometres south of the Licensed Property Study Area.

Archaeological Sites

Throughout history, rivers have played a vital role in the lives of people around the world. Aside from being a source of food and water, rivers are also important in transportation, communication, commerce and religion. The Winnipeg River is no exception, and has been used as an artery in east-west movements from as early as 5000 BC (Steinbring 1980).

The Winnipeg River has a rich and varied history ranging from the earliest Transitional (Shield-Archaic) populations to the Laurel peoples and the Blackduck, Selkirk and other pre-European-contact cultural groups terminating with the introduction of European fur traders and, eventually, white settlers. Evidence of early human occupation along the Winnipeg River has been found in a large number of archaeological sites located along the length of the waterway. Many of these sites were identified during the Winnipeg River Archaeological Project (1980-1982). This project was undertaken when Manitoba Hydro announced in 1979 that repairs to the Great Falls and Seven Sisters Dams would lead to the lowering of water levels in their forebays for three years. This project focused on two areas: from Great Falls to McArthur Falls and from Seven Sisters Falls to Sturgeon Falls (Buchner 1982).

The Regional Study Area is characterized by a concentration of archaeological sites along the banks of the Winnipeg, Whitemouth and Brokenhead Rivers. No sites are registered for the Project Study Area. However, because no sites are currently registered does not mean that there are no sites present in this area.

The Regional Study Area contains 638 known archaeological sites, and encompasses a vast area. The Local Study area contains 97 of the above numbered sites, and most are located between Otter Falls and Seven Sisters Falls. The locations of the two sites, which are found within the Project Study Area, are not precise due to poor data.

FIGURE 5.30

POTENTIAL ARCHAEOLOGICAL SITES IN THE AECL STUDY AREA

Local Study Area

While the section of the river represented as the Local Study Area was left out of the early assessment, some sites are known, including some of the most prolific sites in Manitoba. The Whitemouth Falls (EaLa-1) and Bjorklund (EaLa-3) sites located at the confluence of the Whitemouth and Winnipeg Rivers, for example, show evidence of occupation spanning several millennia. In addition to the large number of artifacts found, the sites in this area are also notable for their rare finds of considerable cultural significance.

Petroform sites are abundant in the Winnipeg River area, compared to the rest of Canada and may represent a localized cultural phenomenon. These sites consist of boulders that have been aligned in a particular fashion to produce various figures. Ranging from lines and ellipses to easily recognizable zoomorphic figures, these sites are considered very important by both archaeologists and the descendants of their creators. The Anishinabe inhabitants of the area consider "*the teachings inherent in the petroforms. … necessary for [their] present and future physical, emotional, and spiritual well-being*" (Pettipas 1990). One such site has been located in the Local Study Area, on the east-side of the Winnipeg River. The Sweet Creek Petroform site consisted of a linear feature, a circle and a snake before plowing destroyed the alignments.

Another significant find in the Local Study Area consists of a large burial mound located near the Bjorklund site. Such large mounds are characteristic of the Laurel Culture whose people may have immigrated into the Winnipeg River area from the east nearly two thousand years ago (Steinbring 1980). The mound cult developed in large centres in Ontario and the midwestern United States and terminated, with this exception near Seven Sisters, on the Rainy River (Steinbring 1980). This lone mound on the Winnipeg River, known as the Porth Mound, measures approximately 10 m long, 5 m wide and 3.5 m high (Steinbring 1980).

Historical Sites

Within the Regional Study Area, only one provincially recognized site, the Pinawa Dam Provincial Heritage Park, is found. This park is under the management of Manitoba Conservation (former Natural Resources). During the construction of the amphitheatre Historic Resources Branch staff conducted some archaeological investigations, and a cultural component related to the dam construction was identified. The site was assigned an archaeological Borden Number EbKx-5.

5.5.7 First Nation and Aboriginal Interests

The Regional Study Area includes lands covered by the terms of both Treaty 1 and Treaty 3. The Treaty 1 Ojibway communities of Sagkeeng First Nation (also known as Fort Alexander, Manitoba) and Brokenhead Ojibway Nation (also known as Scanterbury, Manitoba) are located within the Regional Study Area.

Lands within the Regional Study Area are part of the historic traditional territories of both Sagkeeng Fist Nation and Brokenhead Ojibway Nation. The Regional Study Area is also located within the historic traditional territory of the Wabaseemoong Independent Nation which is a Treaty 3 First

Nation whose Reserve is located in Ontario.

Consultations with the First Nations have confirmed that First Nations participate in traditional activities within the Regional Study Area. The Sagkeeng First Nation participates in traditional activities of wild rice harvesting, sturgeon fishing, berry picking and gathering of plants and medicines. The Brokenhead First Nation has not identified specific activities. However, it has a Treaty Land Entitlement and is in discussions with the Province regarding a petroform site in Whiteshell Provincial Park located east and south of Pinawa. Contact with 7 Treaty 3 First Nations confirmed that the Wabaseemoong Independent Nation has interests in the Regional Study Area and cultural activity occurs frequently and regularly. Two of the First Nations contacted indicated that they had no concerns with the decommissioning program and did not have traditional lands or aboriginal interests in the Regional Study Area. Four First Nations contacted did not provide confirmation of their interests.

The Sagkeeng First Nation also uses the Winnipeg River as its water supply and considers the river to be a valued social component.

5.6 SUMMARY OF VECS AND VSCS

5.6.1 Definition

Valued ecosystem components (VECs) are features of the environment selected to be a focus of an environmental assessment because of their ecological value and their potential vulnerability to the effects of the project. Project components are assessed with respect to their interaction with the natural and social environment and based on this assessment, a determination is made of residual environmental effects and the impact on the VECs. VECs are considered to be valuable because they are:

- legally recognized and afforded specific protection by law, policy or regulation; and/or
- recognized by the scientific or professional communities as important due to their abundance, scarcity, endangered status or role in the ecosystem.

Attributes that may be selected as VECs include: habitats, species, populations, communities, organisms, significant sites etc.

Valued social components VSCs are a subset of VECs and generally refer to those items recognized by the public as being important because of their social importance, commercial or economic value, or their role in maintaining quality of life within the community. They are generally environmental components, such as a river or a sport fishery but they may also be cultural or heritage components such as archaeological or traditional First Nations sites.

5.6.2 Assessment of VECs

VECs were selected by various means:

- expert professional opinion (e.g. ecologists, biologists, naturalists, etc.);

- interviews with knowledgeable lay persons (e.g. trappers, bird watchers, hikers, local residents);
- consultation with appropriate government staff (e.g. Manitoba Natural Resources);
- input from public consultation program; and
- lists of endangered, threatened and vulnerable species (e.g. Committee on the Status of Endangered Wildlife in Canada).

Using information collected from the sources above, the VECs and VSCs were assessed according to their ecological and social importance, spatial extent and species abundance. None of the wildlife species selected as VECs were considered to be endangered. While all VECs and VSCs were weighted equally, the assessment concluded that the Winnipeg River and the aquatic features of the waterway were the area's most important VEC and VSC.

The Winnipeg River and its Shoreline

The Winnipeg River provides drinking water to the area either through municipal systems or co-ops. Its waters are the basis of a sports fishery, which in turn is a major component of the tourist industry as well as the growing retirement home and cottage communities. It is highly valued, and is susceptible to effects related to contamination, sediment loading and sediment and shoreline disturbance. It also serves as a migratory route for many birds and as such, is susceptible to disturbance, due to human presence on the water and along the shores. Because the river is large and flows throughout the region, effects on the river have regional implications.

The shorelines of the Winnipeg River have provided locations for the homes or cottages of aboriginal and European peoples for centuries. The shorelines are traditional first nations lands and may contain important archaeological sites and artefacts. Their location next to the water make them desirable locations for year-around homes, cottages and tourism facilities. The access to water also makes the lands of the Winnipeg River desirable locations for industries requiring large amounts of water (e.g. Pine Falls). Finally, the shorelines are adjacent to some of the best farmland in the region.

Other VECs and VSCs considered during the project include:

Sturgeon, Walleye, Northern Pike and Mooneye

Sturgeon, walleye, pike and mooneye are valued fish species in the Winnipeg River. Sturgeon, a protected species, must be released if caught. As an illustration of their valued status, they are used in advertising campaigns for the downstream community of Lac du Bonnet. As a very long-lived bottom feeder, they are particularly susceptible to contaminated sediments and bone-seeking radionuclides such as ^{90}Sr. Anecdotal evidence suggests sturgeon continue to be common near the Whiteshell Laboratories' outfall. They were netted in the area prior to the start-up of the Whiteshell site, and two small ones were captured in the fall 1999 AECL fish monitoring campaign. Walleye, northern pike and mooneye are preferred sportfishing species; walleye and northern pike are top predators and mooneye feed heavily on invertebrates. They are common in the region and although they are thought to have stable populations, capture limits are applied to the sport fishery.

Whitetail Deer and Moose

Whitetail deer and moose are valued by both subsistence hunters and sport hunters and by the general public as interesting and visible signs of the natural environment. Whitetail deer are very common throughout the region, supporting a large hunting effort and populations of wolves and perhaps mountain lions. They aggressively invade and feed in disturbed areas, and will graze contaminated vegetation even where access is physically restricted. They also consume soil in the saline-seep ditches common near the site, which makes them susceptible to groundwater discharges of contamination. Moose are present but not common. They require large tracts of undisturbed lands with a predominance of wetlands and small water bodies.

Gullies and Ravines

The gullies and ravines along the river offer a unique habitat. They provide habitat to locally rare species such as the woodland jumping mouse. As riparian features with specific microclimates, the gullies provide habitat for species not endemic to the region. Beavers frequently build dams in the gullies, and this introduces new habitat for other organisms. Beaver activity on the site is restricted to the gullies. The gullies are susceptible to contamination because any overland runoff or groundwater flows from inland areas travel through the gullies toward the Winnipeg River.

Coniferous Forest

The coniferous forest on the site includes both wetland areas dominated by black spruce, and well-drained areas populated by jack pine. Both types of trees are found in the FIG (Field Irradiator Gamma) research area (Figure 5.26). Black spruce in particular is very slow growing, and stands on the site may be over 100 years old. The conifers provide cover for a large number of undergrowth plant species as well as for birds and mammals listed as potential VECs. The FIG area was intensively studied for over 10 years, and has the potential to serve as a benchmark site for conifers and boreal environments in Canada.

Habitat Diversity

The diversity of habitats is an important attribute of the site. Upland sandy soils, clay plains, peat-filled wetlands, beaver ponds and a major river contribute to the diversity on the site. The confluence of aspen parkland and boreal forest ecosystem types and the overlap of the ranges of eastern and western species result in interesting combinations in the region. Agricultural and forestry practices also merge with large undisturbed areas in the region.

The Sport Fishery

The Sport Fishery is a major component of the local economy. Nopiming and Whiteshell Provincial Parks provide 20% of the total annual sport fishing days in Manitoba.

Provincial Park and Natural Forest Areas

Natural recreational areas include the Nopiming and Whiteshell Provincial Parks and the Agassiz, Whiteshell and Sandilands Provincial Forests. These areas attract both local residents and tourists and include a full range of recreational potential and activities such as cottaging, canoeing, hiking, hunting, fishing, and snowmobiling.

The Model Forest

Forestry is a major industry to the north of the area. A Federal/Provincial Program designed to create a sustainable forest environment is now underway in the area.

The FIG

There is an area within the Whiteshell boundaries known as the Field Irradiated Gamma (FIG). This facility, intentionally irradiated over an approximately fifteen-year period, represents a historical research area that has attracted researchers worldwide.

6.0 ASSESSMENT OF ENVIRONMENTAL EFFECTS

6.1 OVERVIEW AND APPROACH

6.1.1 Overview

This section discusses potential effects on the environment from activities associated with the decommissioning of the Whiteshell Laboratories. The objective of this section is to identify residual effects (after mitigation) as a basis for the later determination of the *CEAA* environmental assessment requirement of whether or not the project has any significant adverse effects on the environment (Section 7.0). The baseline condition is that of autumn 2000, a point in time in which substantial portions of the facility have already been placed in operational shutdown state.

The analysis addresses the effects of decommissioning activities on the environment throughout the decommissioning project. It only incidentally considers the overall effect of decommissioning itself, which will in all likelihood generate substantial positive benefits. Thus:

- Decommissioning will lead to improvements to the environment as the overall risk posed by the facilities is progressively reduced.
- The achievement of operational shutdown will dramatically reduce any current discharges.
- Natural radioactive decay will reduce radioactivity on site.
- There will be no new sources of contamination.
- As the decommissioning of each facility is completed, the land on which it is located will be restored to a more "natural" condition, that is, the land will be seeded with natural grasses and left to develop as nature allows.

6.1.2 Approach

The analysis of effects is organized into an analysis of the effects of:

- Air Quality.
- Noise.
- Surface Water.
- Groundwater and Soils.
- Terrestrial Biota.
- Aquatic Biota including biota living or feeding in sediments.
- Worker Health and Safety.
- Public Health.
- Socio-Economic Effects:
  - Cultural and Physical Heritage;
  - Archaeological Features;
  - Land and Resource Use; and
  - Aboriginal Interests.

- Accidents and Malfunctions.
- How the Environment itself might affect Decommissioning.
- Sustainable Use of Renewable Resources.
- VECs and VSCs.

The effects were determined by:

1. reviewing decommissioning activities on a facility by facility basis and assessing the sources and amounts of emissions;
2. indicating the primary pathways for these emissions (air, soils, biota, surface water and groundwater);
3. identifying the receptors (especially VECs and VSCs) that could be affected along the pathways;
4. assessing whether there could be any environmental effects;
5. determining whether or not mitigation is required;
6. applying appropriate mitigative measures; and
7. assessing the possibility of residual effects.

The actual analysis involved the following steps.

Consultation with Experts and the Public

There were two types of consultation to obtain information relevant to the decommissioning project. The first was a formal and on-going program of consultation with the community. The second part was an interchange of ideas between the consultants and expert and interested groups and individuals on a less formal basis. This involved discussions on particular issues, such as the identification of VECs. A full discussion of the public consultation program is given in Section 10.0.

Effects Workshop and Initial Screening

A technical workshop attended by the consulting team and the AECL decommissioning team was held to identify potential effects from decommissioning activities associated with particular facilities that warranted further review and analysis. At the workshop, environmental screening tables were developed to show how different activities associated with the project might affect environmental components such as air, surface water, etc. All facilities were discussed at the workshop although tables were not prepared for all of them. The screening tables were used as the starting point, not the end point, of the analysis. Appendix E presents the initial screening tables prepared for each facility.

Review of Literature and Data

The literature and data were reviewed to determine if there was adequate support for the analysis.

Data Supplements

Because Whiteshell Laboratories is a highly regulated facility, there is substantial data for baseline conditions for most environmental components. In some areas, however, specifically, with respect to the river sediments and the low-level waste trenches, more data was collected.

Environmental Interaction Analysis

Interactions with environmental components were determined and environmental effects estimated using various analytical tools, models, and professional judgement.

Application of Mitigation Measures

Mitigation measures were applied to reduce the level of environmental effect as appropriate. Many of these measures are applied during the normal course of operation to meet licensing requirements. Other measures, not necessarily related to AECL's current policies are applied in accordance with good environmental practice.

Estimation of Residual Environmental Effects -VECs

Once mitigation has been applied the residual effects on the VECs and VSCs outlined in Section 5.0 could be estimated. These effects form the basis for the analysis of significance (Section 7.0) and cumulative effects (Section 8.0).

6.1.3 Organization of Section 6

The remainder of this chapter is organized into six main sections:

1. Environmental Mitigation Measures currently applied at Whiteshell.
2. The assessment of Potential Environmental Effects by Environmental Component.
3. Effects of Accidents and Malfunctions.
4. Effects of the environment on Decommissioning.
5. Effects on the Sustainable Use of Renewable Resources.
6. Summary of Effects on VECs and VSCs.

6.2 Mitigation Measures

6.2.1 Compliance Programs

A number of compliance programs are in place that translate legal and related requirements into processes or program requirements appropriate for AECL. The compliance programs establish a common set of work practices and procedures to ensure work is performed consistently across all AECL sites. At Whiteshell Laboratories, these programs were initially designed for an operating nuclear facility with control systems to handle a much larger (several orders of magnitude) radioactive inventory than are expected from the decommissioning program. Equivalent programs and control systems will remain during the entire decommissioning project and will be augmented as necessary according to the Detailed Decommissioning Plans (DDPs) to ensure that any effects from decommissioning activities would be handled in a controlled and effective manner.

6.2.1.1 Radiation Protection

The AECL Radiation Protection Requirements Implementation Plan outlines the requirements for radiation protection. These requirements are implemented through the Radiation Protection Manual. Alternate protocols are provided where a specific procedure has not been outlined in the manual.

All decommissioning work will be conducted in accordance with requirements of the AECL Radiation Protection Program using approved procedures and work plans, ALARA reviews and pre-job briefings to minimize the exposure to personnel and ensure that regulatory and site limits are not exceeded. If a specific job presents hazard potential, an ALARA review that includes a dose assessment will be performed and engineering controls will be implemented to minimize the dose to personnel (e.g. incorporate shielding, limit exposure time, rotate personnel).

6.2.1.2 Occupational Health and Safety

AECL's Occupational Safety and Health Program is defined by the requirements contained in AECL's Occupational Safety and Health Program Manual and AECL's Work Permit System.

The decommissioning work will be conducted in accordance with the manual's requirements using approved procedures and work plans and/or implementation of AECL's Work Permit System. The primary safeguard against industrial hazards is the use of qualified staff following approved procedures. This includes the Work Permit System, which provides a systematic approach to identifying hazards and ensures that staff are properly qualified and equipped for the workplace.

6.2.1.3 Environmental Protection

The Environmental Protection Program at Whiteshell Laboratories is designed to ensure protection of the environment and the public with respect to environmental aspects that result from operation of AECL's facilities. Requirements are outlined in AECL's Environmental Protection Program Manual.

Decommissioning work will be conducted in accordance with the requirements of AECL's Environmental Protection Program. The Whiteshell Laboratories Monitoring Program will be maintained throughout the decommissioning project to monitor the effect of decommissioning activities and verify that the requirements and objectives of the Environmental Protection Program are met.

6.2.1.4 Emergency Preparedness

Whiteshell Laboratories site and facility-specific emergency plans are a contingency measure designed to address an accident or malfunction scenario. The requirements are contained in an Emergency Preparedness Program Requirements Manual and Whiteshell Laboratories Emergency Plan.
Decommissioning work will be carried out in accordance with these plans and the plans will remain in effect until the hazards associated with each activity are removed or mitigated. These plans deal with accidents, malfunctions or other non-routine events, such as a spill of a hazardous substance.

6.2.1.5 Security Program

A company-wide Security Program is described in the Physical Security Program Manual. A site- specific plan is also in place at the Whiteshell Laboratories.

The Security Force provides access control, visual monitoring and patrolling, and operates an extensive surveillance system to detect and deter unauthorized entry to the Laboratories and/or any diversion of materials and equipment. A progressive system of zones is used to provide increasing levels of security to specified areas of the Laboratories, in accordance with the *Nuclear Security Regulations* issued pursuant to the *Nuclear Safety and Control Act*.

The security program will continue to apply throughout the decommissioning program.

6.2.1.6 Quality Assurance

The Quality Assurance (QA) programs at AECL apply to all staff and external contractors who participate in, or support, projects and activities at AECL sites.

The AECL Management Manual (AECL 1999) describes how AECL manages its business and how it attains quality. It provides employees with direction on the business and management systems. Quality programs and procedures within AECL must meet the requirements, principles and practices described in the Management Manual.

For nuclear safety-related activities, the QA programs and supporting procedures meet the requirements and practices described in the Canadian Standards Association CAN/CSA-N286 series of standards. All activities defined as nuclear safety-related are carried out under quality assurance programs meeting the requirements of the standards.

6.2.1.7 Other Applicable Compliance Programs

In addition to the programs described in the preceding sections, other compliance programs applicable to the decommissioning activities include:

- Operational Experience.
- Nuclear Materials Management.
- Transportation of Radioactive Materials.
- Nuclear Operations.

Internal assessments and audits are conducted to assess the adequacy and effectiveness of the compliance programs. Independent reviews of proposed activities at AECL sites are also carried out by the Safety Review Committee on behalf of the President and CEO of AECL.

6.2.2 Application of Policies and Guidelines

As noted in Section 6.2.1, since Whiteshell Laboratories is an existing licensed facility, there are many key support programs in place to deal with radiation protection, occupational health and safety, environmental protection and emergency preparedness. There are also numerous policies, and guidelines that are adhered to at the facility (examples are given in Table 6.1). All of these programs and policies help to ensure that effects on health, safety and the environment are controlled at source and thus effectively mitigate against environmental effects. In addition, Detailed Decommissioning Plans (DDPs) are being developed for each facility and will provide detailed measures to mitigate environmental effects. These mitigative measures will be consistent with AECL policies, procedures and programs. The DDPs will be subject to review and approval by the CNSC. An important part of the mitigation program is the maintenance of detailed records on the progress of the decommissioning. Such records support later analysis and the identification of required follow-up procedures.

Table 6.1

Policies or Guidelines Related to Mitigation

Policy or Guideline	Title/Topic	Comment
AECB-R-85	Radiation Protection Requisites for the Exemption of Certain Radioactive Material from Further Licencing Upon Transferral for Disposal.	Provides guidance to determine which material can be exempted from regulatory control based on a deminimis risk.
CNSC R-104	Long-Term Radioactive Waste Disposal	Regulatory basis for judging the acceptability of waste disposal facilities.
CNSC G-219	Decommissioning Planning Guideline for Licensed Activities	Provides guidance for the preparation of decommissioning plans.
CNSC 1049, Rev. 2	Accountability Procedures	Accountability records necessary for the Non-Proliferation Treaty and the NSCA.
CNSC Licence NRTEOL-2.00-2002	Whiteshell Laboratories Site Licence	
CAN/CSA-N286	Quality Assurance	Standard for the nuclear life cycle. Quality assurance of work done for decommissioning.
CAN-Z299	Procurement Standards	Non-nuclear standard covering manufacturing, procurement and supply of services.
IAEA Tech Doc 716	Decontamination and decommissioning of nuclear facilities	
IAEA Safety Standard Series WS-G-2.2	Decontamination of medical, industrial and research facilities	
RC-2000-633-0	AECL Research's Radiation Protection Requirements and Implementation Plan	Radiation protection methodology within AECL.
W-SPP-#1.1 to 11.1	AECL Policies and Procedures	Basic structure for management of AECL activities and personnel, including: safety, dosimetry, radioactive waste management and security.
AECL 40101	Corporate Management Policy Manual:	Elements of the health, safety and

Policy or Guideline	Title/Topic	Comment
	Health Safety and Environmental Review	environmental review program, including Safety Review Committee.
AECL 40501	Corporate Management Policy Manual: Protection of Environment	Key elements of the environmental protection policy.
RC-2000-060-500	Whiteshell Laboratories Emergency Plan	Emergency response plan which provides a mechanism to minimize the effect of an emergency on AECL employees, the public, the site and the environment.
RC-2000-060-000	Emergency Preparedness Program Requirements	
RC-2000-633-1	AECL Radiation Protection Manual (Draft)	
SRC-R-4/00-832	AECL Requirements for Independent Review of the Decommissioning of Buildings Facilities and Sites	
RC-2000-021-0	Environmental Protection Program Manual	Provides in-depth description of the key elements of AECL's environmental protection program.
RC-2000-101-01-0810	Working Draft AECL's Work Permit System Procedure	A work permit is a mechanism for controlling and co-ordinating work to protect workers. A work permit informs a person of hazards and safety measures, so the work can be done safely.
Emergency Procedures	Emergency Procedures Whiteshell Laboratories	An on-line document covering basics of Whiteshell Laboratories emergency signals and the required sections by staff.
Policy 00-003 Rev 0	Security	Policy covering personnel security, protection of information systems and data, and physical security.
WNRE-659	Radiation Protection Manual	

All decommissioning work will be conducted in accordance with AECL's approved policies, programs and procedures to ensure the safety of workers, the public and the environment. For this reason, it is expected that most of the possible environmental effects from the decommissioning project can be mitigated through adherence to the AECL's programs. Few additional mitigative measures will be required.

Due to the fact that the decommissioning program is essentially a process of managing waste streams, a comprehensive program for the management of wastes arising from decommissioning work at the site is being developed by AECL. As detailed in Section 4.5, existing waste facilities will be modified and new facilities will be constructed to process and manage wastes which cannot remain in existing storage structures until waste disposal becomes available. This enables the decommissioning process to handle all waste streams on site, thereby providing a key mitigative measure. These facilities will remain operational until no longer required and will then be decommissioned.

The Whiteshell Laboratories was originally designed with protection systems to handle a much larger (several orders of magnitude) radioactive inventory than exists now. These protection systems will remain in effect entirely during the first phase of decommissioning, and similar measures will routinely be applied to subsequent phases to ensure that any process streams or malfunctions from decommissioning activities would be handled in a controlled and effective manner.

Where measures outlined above were not deemed adequate to mitigate potential environmental effects, additional measures were proposed. Following the application of these measures, an assessment was made to determine whether or not an effect would remain. If an effect could not be fully mitigated, it was considered a residual effect. Note that the classification of an effect as "residual" is not a statement of the significance of the effect. That analysis is carried out in Section 7.0.

6.3 ASSESSMENT OF POTENTIAL ENVIRONMENTAL EFFECTS

6.3.1 Air Quality

Air quality refers to the quality of atmospheric air. It is typically assessed at a site's property boundary. For the Whiteshell Laboratories site, this would normally be the licensed property area. However, to accommodate the potential for the early release of certain lands within the licensed property area, air quality effects are evaluated at the boundary of the Project Study Area.

Air quality effects have been categorized as:

(a) airborne radioactive emissions - particulate bound emissions which are distinct from conventional airborne emissions;
(b) airborne non-radioactive emissions - particulate emissions which are not radioactive (e.g. solvents, mercury, lead and asbestos);
(c) nuisance dust - this is typically represented by TSP (total suspended particulate) and is an indicator of soiling, visibility, and in high enough concentrations, health effects; and
(d) fine particulate - this is typically represented by PM_{10} (particulate matter less than 10 microns in diameter) and is an indicator of health effects associated with respirable particulates (e.g. asthma).

In a typical air quality assessment, concentrations at a particular point (usually the property boundary or a sensitive receptor) are either measured or estimated and compared against existing provincial or federal air quality guidelines or standards. These standards are usually reflective of the most stringent effect whether it be on human, terrestrial or aquatic species.

Although it is theoretically possible to develop predictive models for concentrations of emissions at the boundary, the episodic nature of the activities that would generate the emissions as well as the distance of the activity from the boundary make modelling highly speculative. As a result, there is reliance on professional judgement. Note that in Section 9.0, a monitoring program calling for studies of air emissions from various activities which are expected to confirm our professional judgement, has been outlined. The approach considers:

- the potential for emissions to enter the atmosphere;
- the type of emissions (as defined above);
- the potential magnitude (concentration) of emissions;
- the potential lareal extent of the emissions;
- the frequency and duration of emissions; and
- the predominant meteorological conditions (particularly wind direction).

6.3.1.1 Potential Project/Environment Interactions

Physical works/activities resulting in 1) the release of airborne radioactive emissions 2) airborne non-radioactive emissions and 3) nuisance dust, are summarized below.

Physical works/activities leading to the release of airborne radioactive emissions:

- operation of the WMA, including operation of the baler during compaction of wastes, constructing new storage space, retrieval and repackaging of waste from existing storage facilities and decontamination activities and site restoration;
- operation of building ventilation systems for nuclear facilities (B300, Decontamination Centre, ALWTC, B100);
- retrieval and recovery of fuels from the CCSF and exterior decontamination of the canisters. The risk is associated with the possible release of airborne radioactive particles during canister demolition;
- decontamination of nuclear/radioisotope facilities (Shielded Facilities, Active Liquid Waste Treatment Centre, WR-1, B300, Decontamination Centre);
- disconnecting of nuclear facility services; and
- remediation of contaminated soils/sediments (buried services, affected lands and sewage lagoons).

Physical works/activities leading to the release of airborne non-radioactive emissions include:

- disconnecting of nuclear facility services and maintenance of buildings;
- removal of hazardous materials from facilities; and
- methane pollution from organic material that may be in the inactive landfill.

Physical works/activities leading to nuisance dust and fine particulates include:

- retrieval and repackaging of waste from existing storage facilities and construction of new storage area;
- demolition of facilities and disposal of rubble as clean fill; and
- site restoration.

6.3.1.2 Likely Environmental Effects

Air quality effects range from the release of very small amounts of radioactive airborne particulates to nuisance dust. Several observations may be made about likely environmental effects from the project:

1. The nature of the decommissioning process means air emissions are likely to be limited to intermittent releases. Thus, air quality standards could be exceeded over short averaging periods such as twenty-four hours, but are very unlikely to exceed weekly DRLs.

2. Airborne radioactive emissions are controlled to be below DRL's and are kept As Low As Reasonably Achievable (ALARA) through the use of mitigation measures.

3. The area affected by nuisance dust is expected to be small. Recent work (Watson and Chow 1999) suggests that most fugitive PM_{10} dust (for example, dust generated by construction-type activities) will remain in the lowest 2 m of the atmosphere and that the local deposition losses and impaction losses (trees) will reduce the amount transported beyond a few hundred metres by over 50%.

4. The bi-directional character of the prevailing wind pattern in a south-southeast north-northwest direction and predominantly low wind speeds (on average less than 14 km/hour over the year), would normally limit the geographical extent of any air quality effects to within the boundaries of the Project Study Area. Only on particularly windy days, would air quality effects be observed beyond the Study Area.

5. Deposition of radioactive particulates to ground surface could occur in areas identified as VECs (gullies, ravines and coniferous forest). However, since emissions are expected to be well below applicable limits, no effect on these areas is expected.

6.3.1.3 Identified Mitigation Measures

Mitigation measures to minimize air quality effects from the project fall into the following categories:

- Use of enclosures and HEPA filters to control airborne radioactive emissions. HEPA filters used during decontamination will remove a high level of radioactively contaminated dust (99.7%).
- Use of dust control measures (e.g. containment and suppression) to control generation of non-radioactive airborne emissions and nuisance dust.
- Curtailment of activities during periods of adverse meteorological conditions (e.g. during periods of very high winds).
- Maintenance of on site access routes.

Special enclosures to cover large areas may be required to contain airborne emissions from decommissioning activities in some cases (for example decommissioning of the WMA, Buried services and larger buildings on site). Enclosures covering large areas are available. Portable enclosures can and are being used to control dust in road repair and removal and cover areas of up to 800 square feet. The need for such enclosures will be identified in the DDPs.

6.3.1.4 Residual Effects

The expected residual effects are:

- Release of airborne radioactive particulates from the following project activities:
    - disconnecting services;
    - decontamination of facilities;
    - retrieval and repackaging of materials; and
    - remediation of WMA's, buried services and affected lands.
- Nuisance dust and fine particulates from building demolition and site restoration and rehabilitation.
- Production of methane gas from the inactive landfill.

The spatial extent of residual effects is expected to be limited to the Project Study Area.

6.3.2 Noise and Vibration Assessment

In a typical noise vibration assessment, sound levels from the source are either measured or estimated and compared against the existing sound levels at the closest residence or other sensitive receptor (e.g. campground, school or church). In this assessment, specific recent and relevant noise level data at the closest residence or sensitive receptor is not available. Excessive noise has been documented to have a negative influence on wildlife breeding, migration and feeding patterns (Canter 1996). During decommissioning activities, noise is expected to be short-term and sporadic and will be confined to daytime activities. Those wildlife species identified as VECs (deer and moose) have a range that extends beyond the site and can temporarily relocate to other suitable habitats nearby if the noise is too disruptive.

Potential noise effects prior to mitigation are evaluated based on professional judgement. This approach considers, as a minimum, for each activity:

- the origin and type of noise emissions and vibrations;
- the potential magnitude of noise and vibration emissions;
- the potential areal extent of the noise emissions;
- the frequency, duration, and time-of-day of the noise emissions;
- the distance to the nearest residence and/or sensitive receptor; and
- the presence of existing (e.g. building envelope) and/or natural (e.g. trees) sound barriers.

6.3.2.1 Project/Environment Interactions

Project physical works and activities likely to generate noise and vibrations are building demolition, site remediation and restoration activities. Decommissioning activities will include little or no blasting.

6.3.2.2 Likely Environmental Effects

The noise generated may have significant magnitude, but is expected to be short-term and sporadic and will be confined to daytime activities. The preservation of the dense tree coverage across the site will provide a natural noise barrier between site activities and potential noise receptors within the Project Study Area. Furthermore, because of the natural dissipation of noise energy with distance, the impact of noise on offsite residences will be limited. Vibration effects would likely only be of concern within the Project Study Area to adjacent buildings and structures.

Wildlife living near the site boundaries may be exposed to the noise generated by decommissioning. However, due to the nature of the decommissioning generated noises (dismantling, using little if any blasting) none of the wildlife species affected will experience habitat loss as a result.

No residual effects from noise and vibration are expected.

6.3.2.3 Identified Mitigation Measures

No mitigation measures for noise and vibration will be required.

6.3.3 Hydrology

Surface water flows include all surface water flow on site (streams, surface water runoff and flow through storm sewers) and the Winnipeg River – the ultimate destination of surface water discharges from the site and the most important surface water body in the area.

Surface water quality effects have been categorized as:

a) Effluent discharges to the Winnipeg River.
b) Effluent discharges to ground-surface which have the potential to migrate via surface runoff to the Winnipeg River.
c) Contaminated groundwater discharges to the Winnipeg River.

Surface water quality is generally assessed at locations where surface water leaves the site's boundary and in water-bodies affected by discharges. Concentrations of radiological and non-radiological parameters are measured and compared against existing provincial or federal surface water quality guidelines or standards. These standards are usually reflective of the most stringent effect, whether it be on human, terrestrial or aquatic species.

The potential for surface water quality effects prior to mitigation is evaluated using existing data, data collected specifically for the CSR (See Appendix B and C) and professional judgement. The approach considers:

- The potential for effluent discharges.
- The receptors potentially affected by the discharges.

6.3.3.1 Likely Project/Environment Interactions

Physical works/activities with the potential to affect surface water quality are listed according to each effect category.

Physical works/activities resulting in discharges to the Winnipeg River are:

- Operation of the Active Liquid Waste Treatment Centre (ALWTC). Effluents from the ALWTC are discharged to the process sewer which in turn discharges to the Winnipeg River via the outfall. Releases will continue to be controlled within compliance guidelines through Phases 1 to 3.
- Bi-annual operational releases are expected to continue through Phases 1 to 3 from the sewage lagoons.
- Surface water runoff from the site collected by storm sewers and drained via the Process Sewer.
- Intermittent discharges from ditches draining the WMA (Phase 1 to 3 and beyond).

Physical works/activities with the potential for discharges to ground-surface and migration via surface runoff to the Winnipeg River are:

- Operation and Passive Operation of the WMA (Phase 1 to 3) and In-situ Disposal of LLW at the WMA (Phase 3 and beyond).
- Remediation of buried services and affected lands (Phase 1 and 3).

Physical works/activities with the potential for leachate migration to groundwater and discharge to the Winnipeg River are:

- Operation and passive operation of WMA in-situ trenches (Phase 1 to 3).
- In-situ disposal of LLW in WMA (Phase 3 and beyond).
- Operation of the inactive landfill and sewage lagoon (Phase 1 to 3).

6.3.3.2 Likely Environmental Effects

General comments about likely effects from decommissioning on water quality of the Winnipeg River, the ultimate discharge location for all effluent from the site are listed below:

- The water quality of the Winnipeg River has met drinking water standards throughout the operation of Whiteshell Laboratories. Effluent emissions during decommissioning will decline from operational levels and no adverse effect on water quality is expected.

- Residual contamination on river sediments from past operations is not expected to affect water quality. The radionuclide inventory in the most contaminated region of the sediments is 1.3 GBq, a small fraction of total releases to the Winnipeg River (See Appendix B). Even if the complete sediment radionuclide inventory was released to water by de-sorption and re-suspension in a short period of time (for example, one year) the increase in concentrations would only be 6.5 E-05 Bq/L. This value is derived from the estimated sediment inventory of 1.3 GBq divided by the average annual flow rate of 19.9 E+09 m^3/a. The increase in the radionuclide concentration is a small fraction of the maximum acceptable concentration (10 Bq/L) for ^{137}Cs (the most abundant radionuclide in the sediments) in drinking water (Canadian Council of Ministers of the Environment 1999a).

- Discharges to the Winnipeg River from the ALWTC and sewage lagoon will be intermittent and controlled. The discharges are currently well below accepted standards (Niemi, Soonawala and Ross 2000) and will gradually diminish to zero by the time decommissioning is complete;

- Radioactivity levels in ALWTC effluent discharges are monitored to ensure compliance with release criteria. Liquid waste above release criteria is processed to a solid form for storage at the WMA's. The sewage lagoon water is monitored during release periods (Niemi, Soonawala and Ross 2000);

- Non-radiological contaminants are monitored at the Process Sewer outfall and sewage lagoon outlets and documented in AECL MISC-390 series. AECL guidelines have not been exceeded at the outfall or sewage lagoon outlets. Current operational control levels will be maintained throughout the decommissioning program and because operations will decline, even lower emissions will result;

- The largest potential source for groundwater leachate is the WMA. The WMA is situated in a groundwater discharge zone which effectively limits contaminant migration from the WMA to the river (Section 5.4.4 and 6.3.4); and

- The travel time from the WMA to the Winnipeg River through the most permeable hydrogeologic unit for the most hazardous radionuclides, ^{90}Sr and ^{137}Cs, is probably several hundred years (Cherry, Grisak and Clister 1973). This is sufficient time for the ^{90}Sr and ^{137}Cs to decay to background. Therefore, even if leachate from the WMA's entered the permeable sands, the impact on the Winnipeg River would be small.

6.3.3.3 Identified Mitigation Measures

Mitigation measures to minimize water quality effects from the project fall into the following categories:

- Continued compliance with release limits at the ALWTC and sewage lagoon.

- Groundwater monitoring at the WMA, sewage lagoons and inactive landfill to indicate potential contaminant migration from these facilities to the river.
- Construction of containment barriers where necessary to ensure collection, control of and treatment of contaminated water (for example at the WMA).
- Use of effluent containment procedures including use of rain barriers (berms and coverings) to minimize surface water runoff during remediation of buried services and affected lands.

6.3.3.4 Residual Effects

Effluent emissions from decommissioning are not expected to result in an increase in conventional or radionuclide concentrations in the Winnipeg River as effluent emissions during decommissioning are expected to decrease from current operational levels. However, as noted above, some discharges to the River will occur. Residual effects on the Winnipeg River and surface water from decommissioning include:

- Discharges of treated flows to the Winnipeg River from the ALWTC and the sewage lagoon.
- Surface water contamination in the Project Study Area and potential migration to the Winnipeg River from the WMA, buried services and affected lands.
- Potential for groundwater contaminant migration to the Winnipeg River from the WMA, sewage lagoons and the inactive landfill.

Effects on surface water are expected to be limited to the Project Study Area and the Winnipeg River. Selected fish species in the river and Sport Fishing have been identified as VECs/VSCs (Section 5.6).

6.3.4 Geology and Hydrogeology

The analysis of the potential for soil and groundwater contamination was based on an understanding of the site geological and hydrogeological conditions described in Section 5.0. The nature and amount of possible contamination was considered. Containment methods were reviewed and special note taken of any previous incidents and the experience gained from them. The effect of project activities on the groundwater flow regime was also assessed.

Groundwater quality is assessed by collecting groundwater samples from monitoring wells and measuring concentrations of radiological and non-radiological parameters. The measured concentrations are compared against existing provincial or federal water quality guidelines or standards.

6.3.4.1 Project/Environment Interactions

Physical works/activities with the potential to cause groundwater contamination are:

- Continued operation and passive operation of the WMA (Phases 1 through 3).
- In-situ disposal of LLW waste at WMA (Phase 3 and beyond).

- Operation of the inactive landfill (Phase 1 through 3).
- Operation of the sewage lagoons (Phase 1 through 3).
- Buried services and affected lands (Phases 1 to 3).

Physical works/activities with the potential to affect the groundwater flow regime are:

- Stabilization and closure of the inactive landfill and sewage lagoon: reduced infiltration of surface water as a result of covering, capping these facilities and site re-establishment including grading and ditching around the facilities has the potential to affect groundwater flow (Phase 3).

6.3.4.2 Likely Environmental Effects

Groundwater contamination effects are related to the operation and decommissioning of five facilities/areas:

1. WMA;
2. inactive landfill;
3. sewage lagoons;
4. buried services; and
5. affected lands.

The WMA is the main waste management facility on site and contains low, intermediate and high level waste (Section 4.5). Contaminant migration from this facility is the main hydrogeological issue and is the focus of this section.

The alteration of groundwater flow regimes from the decommissioning activities is not expected to be significant and will not affect the VECs. No mitigation measures are required. Alteration of groundwater flow regimes will not be discussed further.

WMA

There is the potential for groundwater contamination during operation of the WMA and from in-situ disposal of LLW at the site. The potential impact of the WMA on groundwater during continued operation of the WMA is limited by:

- Existing engineered barriers.
- Short half-life of active waste in WMA trenches.
- Groundwater flow regime at the WMA.

These are discussed followed by comments on likely effects from in-situ disposal of LLW at the WMA.

WMA - Engineered Barriers

All high and intermediate level waste, with the exception of high-level waste in trench 6 is stored in engineered structures (concrete standpipes, concrete bunkers, storage tanks). These structures provide a barrier between the waste and the natural environment until these wastes are transferred to disposal facilities in Phase 3.

Other waste which cannot stay in existing storage structures, for example, irradiated fuel waste in standpipes, will be moved to new interim engineered storage facilities in Phase 2.

WMA – In-Situ Disposal of Trench Waste

Low-level radioactive waste and some conventional waste will be managed in-situ. The final safety case for the in-situ end state will be made near the end of Phase 3. For the project period (60 years), the WMA remains under regulatory control. This provides a mechanism to respond to any changes detected in the storage environment that could affect contaminant migration. Also, this period will be utilized to develop fully the safety case leading to a confirmation and approval of in-situ disposal as a final end state. The opportunity for additional environmental assessment is also retained.

The nature of groundwater flow in the area around the WMA limits contaminant migration away from the WMA. The WMA is located in a groundwater discharge zone. Groundwater flow is upward through the sands and continues upward through fractures in the overlying silts and clays. The groundwater then exits the groundwater zone by evaporation and evapotranspiration. There is no downward movement of groundwater flow from the WMA to the underlying permeable sandy zone which has the potential to act as a transmission zone to the Winnipeg River (Cherry and Robertson 1988).

The waste contained in trenches, is located to a depth of 4 m below ground-surface and 1 to 2 m below the watertable. The upward groundwater flow will cause some upward migration of constituents toward the biosphere. It is expected that many of the solubilized constituents will be rendered relatively immobile due to sorption on clay minerals and organic materials (Cherry and Robertson 1988). However, there is the potential for some contaminant migration through the clay fractures because there is a long-term accumulation of sulfate salts on the fractures that may reduce sorption tendencies. Once the water table zone is reached the constituents could migrate laterally towards the periphery of the WMA and ultimately to the Winnipeg River (Cherry and Robertson 1988).

A review of hydrological data collected over the past 20 years has confirmed our understanding of the groundwater flow regime at the WMA (See Appendix C.5).

A detailed evaluation to support the in-situ disposal approach was conducted in the autumn of 2000 and is detailed in Appendix C.1. The evaluation was based on:

- a review of the trench inventory;
- existing environmental monitoring and ground water well data;
- sampling of trench cover material and soil adjacent to the trenches;
- confirmation of the ground water flow model; and
- modelling of contaminant transport mechanisms.

The evaluation found that:

- The WMA remains a water discharge zone consistent with the original hydrogeological model.
- The clay soils around the trenches provide a natural attenuation (retards contaminant transport).
- The upper bound of the radionuclide inventory is 40 TBq of initial radioactivity. The majority of radionuclides in the inventory have relatively short half-lives. There are non-radiological contaminants of concern which will likely require selective remediation.
- There is no indication of significant upward or lateral migration in the near trench zone.
- Migration of radioactive contaminants occurs at a rate slower than radioactive decay.
- Trenches 1, 6, 10 and 16 were determined to be unsuitable for in-situ disposal.
- Institutional control will be required beyond the project period to confirm the performance of the disposal environment.

In-situ disposal of LLW is subject to regulatory review and approval and must address all the basic requirements applicable to the long-term aspects of radioactive waste disposal. Those aspects are currently documented in CNSC Regulatory Policy R-104. The basic requirements emphasize minimizing the burden on future generations and protecting the environment and human health. The maximum acceptable risk is 10^{-6} fatal cancers and serious genetic effects in a year over a period of up to 200 years (the period required for ^{90}Sr and ^{137}Cs to decay to background). AECL will develop a safety case to demonstrate compliance with those requirements to confirm in-situ disposal of LLW as a final end state.

Inactive Landfill

There is the potential for contaminant migration to groundwater from the landfill (Phases 1 to 3). Operating procedures for the landfill have been in place to ensure only non-radiological and non-hazardous waste were placed in the landfill (Barnard et al. 1985). Therefore contaminant levels in leachate from the landfill are expected to be low. This will be verified through the implementation of an enhanced monitoring program (See Section 9.5.3).

Sewage Lagoon

There is a potential for contaminant migration to groundwater during operation of the lagoon. The lagoons are constructed of low permeability clay embankments placed on a prepared clay surface, with no additional lining (Section 4.3.3). The clay embankments and underlying clay are barriers to groundwater flow and it is unlikely that there has been any release of contaminants to groundwater. This will be verified through the implementation of an enhanced monitoring program (See Section 9.5.4).

Buried Services

Ultimately, the effects of shutdown and decommissioning of the buried services is minimized by first flushing the pipes and by removing the internal contaminated piping before removal of external piping. Removing and remediating the lines will reduce the contaminating potential of the drain lines and consequently soil and groundwater composition is improved.

There is the potential of soil contamination from past leaks and from migration of contaminants to groundwater. The extent of any groundwater contamination is expected to be limited to the Project Study Area.

Affected Lands

There is a potential for groundwater contamination from contaminated soils within the affected lands project component. Ultimately, remediating affected land will reduce the contamination potential of the area and consequently soil and groundwater composition is improved. The only areas with the potential for ground water contamination are the cesium ponds and laboratory site contaminated areas (ALWTC).

6.3.4.3 Mitigation Measures

Remediation plans and mitigation measures will be developed for the affected land areas discussed in this section. Mitigation measures which will be used to control groundwater contamination are:

- Ground-surface radiation surveys to monitor potential surface contamination for cesium ponds and active area soil contamination.
- Effluent containment procedures including the use of rain barriers (berms and coverings) to minimize the spread of contamination during remediation of cesium ponds and active area contaminated soils.
- Continued control of wastes deposited in the inactive landfill.

6.3.4.4 Residual Effects

Groundwater flow in the Project Study Area is towards the Winnipeg River. Potential groundwater contamination from the affected lands is therefore expected to be limited to the Project Study Area.

VECs which may be effected by contaminated groundwater discharges to surface and soil contamination are:

- Winnipeg River and selected fish species (Sturgeon, Walleye, Pike and Mooneye).
- Winnipeg River Shoreline and Gullies and Ravines on site.
- Deer and moose – the risk is that these may graze in areas affected by groundwater contamination.
- Coniferous Forest on site.

6.3.5 Terrestrial Biota

The following discussion provides a qualitative assessment of likely effects on vegetation and mammals in the Project Study Area.

6.3.5.1 Likely Project/Environment Interactions

Physical works/activities affecting air, soils, groundwater and surface water have the potential to affect terrestrial biota. These physical works/activities were discussed in the preceding sections (6.3.1, 6.3.3 and 6.3.4).

6.3.5.2 Likely Effects on the Environment

Vegetation

Vegetation in the area includes forested areas and fields vegetated with shrubs and grasslands. Coniferous forest in the area has been identified as a VEC. No vegetation species in the Project Study Area is identified as a rare or protected species.

Contaminant exposure pathways for vegetation are by contaminants in air, contaminated soil, groundwater and surface water. Airborne emissions from decommissioning activities are likely to be less than in the past and no effect from this exposure pathway is expected.

There is the potential for exposure from contaminated soils, contaminated groundwater and surface water within the Project Study Area, in particular near WMA. However, any effects are expected to be limited to the Project Study Area.

It is expected that the natural vegetation will re-establish itself in released areas.

Mammals

Over 50 species of mammals can be expected to occur around the Whiteshell Laboratories site. These include squirrels, the meadow vole, fox and larger mammals such as deer and moose. No mammal species in the area is an endangered species however the grey fox and wolverine are listed as vulnerable. Mammals selected as VECs are deer and moose. It should be noted that they are valued because of their value to subsistence and sport hunters and the general public. They are neither endangered nor vulnerable species.

Contaminant exposure pathways for mammals are by contaminants in air, soil, surface water and vegetation. Airborne emissions from decommissioning activities are likely to be less than in the past and no effect from this exposure pathway is expected. There is the potential for exposure from contaminated soils and surface water, in particular near WMA. No effect on the population of mammals is expected because:

- The geographical extent of areas affected by residual contamination is expected to be limited to the Project Study Area.

- Mammals are mobile and will also feed and graze outside contaminated areas.

No effects from noise on wildlife are expected (Section 6.3.2).

6.3.5.3 Identified Mitigation Measures

No mitigation measures are warranted to protect terrestrial biota.

6.3.5.4 Residual Effects

No residual effects on terrestrial biota are expected.

6.3.6 Aquatic Biota

Aquatic biota considered include fish and benthic organisms in the Winnipeg River. This section provides a discussion on the maximum dose aquatic biota might receive from decommissioning activities and contaminated river sediments. The discussion is based on the detailed evaluation on contaminated river sediment impacts is presented in Appendix B.1.

6.3.6.1 Likely Project/Environment Interactions

Physical works/activities affecting aquatic biota are effluent emissions to the Winnipeg River, potential contaminated surface runoff and groundwater discharges to the river and contaminated river sediments. These emissions were discussed in detail in Section 6.3.3.

6.3.6.2 Likely Effects on the Environment

Exposure pathways to aquatic biota include radiation from nuclides in the water and sediment and from radionuclides accumulated in the body. Decommissioning activities have the potential to affect radionuclide levels in water and sediment and the discussion is limited to these exposure pathways. The radio-sensitivity of aquatic organisms was reviewed by the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR 1996). UNSCEAR concluded that the reproductive viability of aquatic populations would not affected at dose rates below 10 mGy/d.

Exposure from nuclides in water is not expected to affect aquatic biota. No decrease in water quality is expected from the project as effluent emissions to the river are expected to decline from present levels (Section 6.3.3). Re-suspension of contamination in sediments was discussed in Section 6.3.3.2 and is also not expected to lead to a decrease in water quality.

The effect of exposure from radionuclides in sediments on aquatic biota was estimated by Sheppard (See Appendix B.1) and is briefly summarized here. Many organisms may interact with the contaminated sediments, despite the fact they are in a 3 to 4m depth of water. Clams are an obvious endpoint for the calculation of likely effects from the sediments because they are present, long-lived and relatively sessile, and they dwell in or on the sediment. Benthic invertebrates may be important, but are short-lived and emergent species and are only seasonally present.

Exposures to predators of the clams were not estimated because:

- the possible predictors are quite mobile and will feed outside the contaminated area, thus diluting their ingestion of contamination by some unknown amount; and
- most radionuclides do not biomagnify, and are at their highest concentration in biota most closely associated with the contaminated media.

The scenarios to assess the dose to clams from sediments assume the clams are located in an area where concentrations are greater than 99th and 99.9th percentile values of the sediment concentrations one might observe in the most contaminated region. It should be noted that these concentrations were not observed in the sediment survey.

The doses for the 99th and 99.9th percentile scenarios were 1.06E-04mGy/d and 4.65E-02 mGy/d, a small fraction of the UNSCEAR limit of 10 mGy/d and the limit at which no effect on aquatic populations is expected.

In conclusion, no effect on aquatic species is expected from decommissioning activities or the contaminated sediments. Therefore, likely radiation effects on aquatic biota do not warrant further attention.

6.3.6.3 Identified Mitigation Measures

No mitigation measures are required.

6.3.6.4 Residual Effects

No residual effects on aquatic biota are expected.

6.3.7 Worker Health and Safety

As operator of the facility, AECL is responsible for ensuring the health and safety of its employees. AECL's health objective is that no worker shall be subjected to exposure to ionizing radiation beyond the prescribed limits and exposures shall be kept As Low As Reasonably Achievable (ALARA) within the restrictions of social and economic factors. This is to be achieved through the operation of the facility and decommissioning activities in compliance with the regulations set out by the CNSC and the AECL Radiation Protection Program.

The current annual dose limit to atomic radiation workers is 20 mSv per year averaged over 5 years (CNSC 2000b).

6.3.7.1 Likely Project/Environment Interactions

The potential for exposure to radiation and hazardous materials from Physical activities/works will be evaluated and documented in Detailed Decommissioning Plans. These will be prepared for each facility.

The following is a list of generic activities expected to result in radiation exposure to workers during decommissioning:

- Decontamination of facilities.
- Dismantling and demolition of facilities.
- Processing, handling and transporting radioactive and hazardous materials on-site.
- Facility maintenance.

6.3.7.2 Likely Environmental Effects

Preliminary radiological dose estimates for Phase 1 of the Whiteshell Laboratories Decommissioning Project have been prepared. The estimates were provided as an initial project hazard assessment to assist with the further development and refinement of facility decommissioning plans.

The estimates do not address Phase 2 and 3 of the project because detailed evaluation, engineering and design of specific project components for these phases has not been completed. Dose estimates for these phases will be done in accordance with AECL's Radiation Protection Protocols and all regulatory requirements and will be documented in the Detailed Decommissioning Plan for each facility.

The Phase 1 radiological dose estimate is for the following facilities:

- Active Liquid Waste Treatment Centre.
- Shielded Facilities.
- Building 300.
- Building 411.
- Site General.
- Waste Management Area.
- Concrete Canister Storage Facilities.

The total estimated dose for Phase 1 is 0.27 person-Sv (27.37 person-rem). Approximately 90% of the dose is expected from the Shielded Facility and Active Liquid Waste Treatment Centre.

The radiation dose to workers will be kept within regulatory limits. This is to be achieved through the operation of the facility and decommissioning activities in compliance with the regulations set out by the CNSC and the AECL Radiation Protection Program.

6.3.7.3 Identified Mitigation Measures

No additional mitigation measures are warranted or recommended.

6.3.7.4 Residual Effects

No residual effects on worker health are expected.

6.3.8 Public Health

For an effect on public health to occur, there must first be a significant effect on one or more of the environmental components linked directly or indirectly to a human receptor. Public health effects were reviewed to determine if it was possible for contaminants to reach offsite human receptors via the air, water, or food chain. If such a process was possible, further analysis, such as estimation of radiation dose and other measures of exposure, was carried out to determine the nature of the effect. Of interest to this assessment are:

- air quality;
- drinking water quality (groundwater and surface water);
- water quality of the Winnipeg River for recreational activities; and
- the dose from exposure to radiation.

As operator of the facility, AECL is responsible for ensuring the health and safety of its employees and the public, and for the protection of the environment. AECL's health objective is that no member of the public or the environment shall be subjected to exposure to ionizing radiation beyond the prescribed limits and exposures shall be kept As Low As Reasonably Achievable (ALARA) within the restrictions of social and economic factors. This is to be achieved through the operation of the facility and decommissioning activities in compliance with the regulations set out by the CNSC and the AECL Radiation Protection Program.

6.3.8.1 Likely Project/Environment Interactions

The physical works/activities with the potential to affect human health are the physical works/activities affecting environmental compartments linked indirectly or directly to a human receptor. These compartments include air, surface water, groundwater and aquatic and terrestrial biota. Physical works/activities affecting these compartments were discussed in the respective sections on environmental effects.

6.3.8.2 Likely Environmental Effects

Potential effects on the public can be assessed by estimating the expected annual dose to members of the critical group in the vicinity of the Project Study Area. A critical group is considered to be the group of individuals who would be expected to receive the highest doses due to their location, age, diet and other characteristics. The current regulatory limit for the public is 1000 µSv/a (CNSC 2000b).

Decommissioning activities are not expected to lead to increased emissions to air and surface water (Section 6.3.1 and 6.3.3). In fact, emissions are expected to decrease. There is the potential for groundwater contamination from the project but any contamination is expected to remain within the Project Study Area. For these reasons, decommissioning activities are not expected to affect public health. No decline in the quality of the air, offsite surface water (Winnipeg River) or offsite groundwater is expected.

Because emissions are expected to decrease, the incremental dose from the project on the public is expected to be less than the incremental dose estimated from current operations reported in Section 5.2.3. Total incremental dose to adults and infants in 1999 were 4.35 E-04 and 2.43 E-04 mSv/a, respectively. These values are significantly less than typical radiation doses to adults from major natural sources and medical diagnostic procedures (3.2 mSv/a). The estimate takes into account water, fish and vegetable ingestion and beach exposure. Immersion in air and ingestion of wildlife (game) are not considered because of the very low radioactivity associated with those two source terms.

A review was also made of the effects of radiation from contaminated river sediments on human health (See Appendix B.1). The hypothesis was that somehow the flow of water in the Winnipeg River was blocked allowing a person to stand on an area of active sediments. This was in itself considered a highly unlikely scenario. This produced a dose from beach exposure of 4.0 E-02 mSv/a for an adult; a value higher than the exposure dose of 2.42 E-05 mSv/a reported by Niemi et al. (2000). Thus the incremental dose remains 2 orders of magnitude lower than the typical dose received by an adult.

6.3.8.3 Identified Mitigation Measures

No further mitigation measures are required to protect the public.

6.3.8.4 Residual Effects

No residual effects on public health are expected.

6.3.9 Socio-Economic Impacts

The *Canadian Environmental Assessment Act* considers socio-economic impacts only when a biophysical effect is identified. In general, few biophysical effects have been indicated and therefore, no socio-economic impacts are anticipated.

6.3.9.1 Impact of Cultural Heritage and Archeological Features

A society's cultural heritage is composed of many elements including history, traditions, arts, architecture, religious beliefs, sciences, education and other distinct traits. Archeological features are particularly important because they are non-renewable. Cultural heritage and archaeological features include:

- Architectural sites.
- Sites or objects formally recognized at the international, national, provincial or municipal level.
- Sites or objects whose cultural value may be greater than the site's physical components.
- Sites or objects of unique cultural value to aboriginal peoples.

Of particular interest are archaeological features that may be present in the study areas.

A review of historical and archaeological information relating to the area was undertaken to determine if there were any particular aspects of the study areas that required attention. The findings are summarized in Section 5.5.6.

Project/Environment Interactions

Any restoration activities undertaken along the Winnipeg River may impact on archaeological features along the shoreline and vicinity.

Likely Environment Effect

The shorelines of the Winnipeg River have been utilized for many centuries. As mentioned in Section 5.5.6, no archaeological studies were carried out on the licensed Property Study Area, however, the abundance of sites in the regional study area would indicate that sites might exist on the property.

Restoration and remediation activities conducted along the Winnipeg River and sewage lagoons have the potential for disturbing or destroying historical or archaeological artifacts.

Identified Mitigation Measures

An archaeologist will be available to assess the significance of any finds during excavation of restoration work conducted along the Winnipeg River area.

Residual Effect/Comment

Other archaeological sites in the region are notable for their rare finds of considerable cultural importance. It is therefore important to have experts on hand to prevent or minimize the loss of artifacts.

6.3.9.2 Impact on Land and Resource Use

The CSR addressed the question of how sustainability of a resource could be potentially affected by the project. For a resource to be affected adversely, a residual environmental effect must decrease the ability of a resource to be used at least at its current level. This could occur, for example, if contamination affected the ability of fish, such as the Winnipeg River sturgeon, to reproduce.

Project/Environment Interaction

Activities that can impact on the land and resource use during and after the decommissioning project include:

- low-level waste in trenches in the Waste Management Area;
- closure of the inactive landfill; and
- closure of the sewage lagoons.

Likely Environment Effect

During decommissioning and the institutional control period, the use of some lands will be restricted.

Identified Mitigation Measures

- Limit areas of restricted use as much as possible.
- Monitor the river sediments, shorelines and river water quality as part of the follow-up program.
- Monitor the inactive landfill and sewage lagoons to provide input for the development of suitable closure plans. The *Manitoba Environment Act* (Regulation 163/88 and Regulation 150/91 for the sewage lagoon and landfill site, respectively) will also be considered in developing the closure plans. This will minimize restrictions for the use of the landfill and sewage lagoons areas.

Residual Effect /Comment

AECL has already taken steps to release a large portion of its property that has remained unaffected by its operations. The unaffected land represents approximately 3,000 hectares of the 4,375 hectares of the licensed site. As the facilities are decommissioned, additional areas will likely be released. Thus, the 'footprint' of AECL property will diminish with time. Towards the end of the decommissioning project, it is expected that the licensed activities will be centred on the Waste Management Area. For the period of institutional control, only a few tens of hectares may be restricted.

6.3.9.3 Economic Impact

As mentioned above, the economic impacts to be assessed in the context of the federal environmental assessment regime are limited to impacts resulting from a change in the bio-physical conditions. Therefore, the socio-economic effects resulting from the closure of Whiteshell Laboratories are not considered here.

Potential Project/Environment Interactions

Project activities that may have an economic impact include:

- Any remediation or restoration activities in or along the Winnipeg River.
- Release of contaminants to surface waters as a result of decommissioning activities.
- Release of contaminants into the groundwater as a result of in-situ management of low-level waste or other sources of contaminants on-site.

Likely Environment Effects

The users of the Winnipeg River and/or the landowners along the river could feel the effects of the aforementioned activities. Those effects, real or perceived, may include:

- Reduction of the Sport Fishery if fish caught are believed to be unsafe for human consumption.
- Reduction in value of cottage properties due to water believed to be of inadequate quality.
- Alternate sources of drinking water if groundwater contamination occurs. This would result in additional costs to property owners.

Identified Mitigation Measures

The mitigation measures that will be implemented are essentially the same as those used to minimize or prevent the deterioration of surface water and groundwater quality (Sections 6.3.3 and 6.3.4). The results of the monitoring activities will be communicated to the public.

AECL also supports the establishment of a Public Advisory Committee that would make recommendations on the monitoring activities. The Committee may also make recommendations on additional mitigation or compensation measures based on the follow-up activities, if and where necessary.

Residual Effects/Comment

Because effects on the bio-physical environment are highly unlikely, any residual economic effects emanating from the project are also unlikely.

6.3.9.4 Impact on Aboriginal Interests

A comprehensive public consultation program was set up which included specific consultation with aboriginal communities. Feedback from these communities was used to determine effects from decommissioning activities as they relate to aboriginal interests. A summary of those interests is presented in Section 5.5.7.

Potential Project/Environment Interactions

The interactions that may impact on Aboriginal interests are as follows:

- Any remediation or restoration activities in or along the Winnipeg River or in the vicinity of the sewage lagoons.
- Release of contaminants to surface waters as a result of decommissioning activities.

Likely Environment Effects

Aboriginal people have acquired an ecological knowledge based on experience and teachings passed from generation to generation. That knowledge brings a holistic view where the environment cannot be separated from the people that live in it. Aboriginal people understand the complexity of ecosystems and can foresee long-term and cumulative impacts resulting from individual activities. The following effects are believed to have some importance:

- Reduction of the Sport Fishery if fish caught are believed to be unsafe for human consumption.
- Land use restrictions particularly along the shores of the Winnipeg River may impact on the traditional use of the land for fishing, hunting, wild rice harvesting and the gathering of medicinal plants.
- Loss of cultural features such as burial sites/mounds, historic campsites, spiritual and ceremonial sites.
- Deterioration of water quality or other environmental features.

Identified Mitigation Measures

Mitigation measures proposed for surface waters (Section 6.3.3.3) will be implemented. Also, the results of the monitoring activities will be communicated to Sagkeeng and other Aboriginal communities potentially affected by the decommissioning.

AECL supports the establishment of a Public Advisory Committee on which representatives from the communities can sit. The Committee would have the ability to make recommendations on the monitoring activities. The Committee may also make recommendations on additional mitigation or compensation measures based on the follow-up activities, if and where necessary.

As mentioned above, an archaeologist will be available to assess the significance of any finds during excavation or restoration work conducted along the Winnipeg River area. Although no cultural features have been identified in the Project Study Area, particular care will be taken during any restoration work performed along the riverbanks to prevent the loss of valuable artifacts if any are identified.

6.3.9.5 Residual Effects/Comment

No land use restrictions are anticipated for the river shoreline; therefore, no effects are anticipated on the traditional use of the shoreline aboriginal people. Potential residual effects include reduction of the sport fishery as a result the contamination of the river water or fish and the possible loss of cultural features during restoration work.

6.4 EFFECTS OF ACCIDENTS AND MALFUNCTIONS

Accidents and Malfunction Events

This section addresses accidents and malfunctions related to on-site events and offsite transportation of radioactive materials which are not part of normal operations, and which may result in potential emergency situations. These events include equipment failure, fire, explosion, spills and leaks loss of services and off-site transportation accidents. These events are briefly described below.

Equipment Failure

Equipment failure may result from equipment malfunction, power loss, fire, explosion, extreme environmental conditions and human intrusion (vandalism) or error. Examples include:

- failure or malfunction of the aqueous waste collection and associated drainage systems;
- failure or malfunction of air emission control equipment associated with decontaminating, repackaging and containment systems;
- failure or malfunction of surface water containment systems;
- failure of product containment systems (storage buildings and tanks);
- failure or malfunction of alarm and monitoring systems; and
- failure of shielding systems.

Fire

Fire may result from equipment malfunction, electrical faults, extreme environmental conditions, and human intrusion (vandalism) or error. Fire hazards include solvents, fuels, and flammable building materials.

Explosion

Explosion may result from equipment malfunction, fire (particularly related to fine particulates, solvents and fuels), building demolition, and human intrusion (vandalism) or error.

Spills and Leaks

Spills and leaks may result from breaks or cracks in piping, storage tanks, holding tanks, drums, transformers and sumps; dripping valves; repackaging operations; loading, transfer and unloading operations; pumping operations; decommissioning and transport equipment; extreme environmental conditions; power loss; fire; explosion; and human intrusion (vandalism) or error (overfilling or improper storage).

Loss of Service to Buildings

Loss of service pertains primarily to power failure which can lead to all of the above accident and malfunction scenarios.

Off-site Transportation Accidents

The movement of hazardous and radioactive materials off-site is governed by the *Packaging and Transport of Nuclear Substances Regulations* (CNSC 2000c). The containers are designed to prevent the release of contaminants in the event of a severe accident and must be approved by the CNSC. In the event of an accident, AECL has procedures for corrective action.

Effects and Mitigation of Accident and Malfunction Events

The effects and mitigation measures of each of the aforementioned events are presented in Table 6.2. As indicated in Section 6.2.1.4., Whiteshell Laboratories already has site wide and facility-specific emergency preparedness plans to address accident and malfunction events. Hazard analyses have been performed on all the major facilities at the Whiteshell Laboratories site and are documented in the Safety Analysis Reports which identify the potential worst-case hazards for each facility. The main focus is on potential radiological hazards but non-radiological hazards are addressed where appropriate. Procedures to respond to the potential hazards are identified in the Safety Analysis Reports or in the facility-specific plan. The decommissioning work will be carried out in accordance with these plans and the plans will remain in effect until the hazards associated with each facility and/or activity are removed or mitigated.

Important aspects of these plans include:

(a) Fire and Explosion:

An incident such as a fire or explosion that could result in a high radiation field or the release of hazardous quantities of radioactive or other toxic substances would initiate a Stay-in or Evacuation. The actions to be taken on discovering such an emergency are:

- ensure no one is in immediate danger;
- pull the nearest fire alarm, if there is a fire;
- call Protective Services and report the location and nature of the emergency;
- request a Stay-in, if warranted; and
- close all doors, windows and fumehoods before vacating the area.

The initiation of a Stay-in will result in the formation of the Emergency Operations Centre (EOC). All information from the scene of the incident will be transmitted to the EOC which will then deploy the required personnel to deal with the incident.

(b) Spills:

For a radiological spill requiring a Stay-in, the same procedures as described for fire and explosion will be followed. If it is a spill of radiological or hazardous material not requiring a Stay-in, the Safety Supervisor will assign a Health Surveyor to the area to determine the extent of the contamination and the remedial measures that are required.

In addition, a number of buildings and infrastructure facilities (e.g. ALWTC; the aqueous waste collection system associated with B300; the Decontamination Centre; WM storage; and processing facilities) will not be shutdown until the latter stages of decommissioning and events associated with equipment failure could occur over the entire period of the decommissioning program.

The movement of hazardous and radioactive materials off-site is governed by the *Packaging and Transport of Nuclear Substances Regulations* (CNSC 2000c). The containers are designed to prevent the release of contaminants in the event of a severe accident and must be approved by the CNSC. In the event of an accident, AECL has procedures for corrective action.

Table 6.2
Summary of Potential Effects of Accidents and Malfunctions on Decommissioning Activities

Accident and Malfunctions	**Potential Effects/Mitigation Measures**
Equipment Failure	<u>Effects</u> • Release of airborne emissions to the atmosphere where they may be subsequently transported and deposited at various distances from the source • Release of liquid contaminants which could contaminate soil, groundwater, surface water and air • Worker health and safety issues <u>Mitigation</u> • Where possible equipment will be designed and operated in a fail-safe mode • Secondary containment is already provided for most existing equipment and systems; new equipment and systems will provide for secondary containment where necessary • Contingency plans and emergency preparedness plans already exist for the Whiteshell facility. In the unlikely event of significant contaminant release, any migration will be curtailed and immediate clean-up will be implemented
Fire	<u>Effects</u> • Release of airborne emissions (existing contaminants and those generated from the fire) to the atmosphere where they may be subsequently transported and deposited at various distances from the source • Release of liquid contaminants which could contaminate soil, groundwater, surface water and air • Explosion and propagation to off-site (creation of a large-scale forest fire with wider reaching environmental effects) • Worker health and safety issues <u>Mitigation</u> • Whiteshell has fire fighting procedures for dealing with fires

Accident and Malfunctions	Potential Effects/Mitigation Measures
	• Whiteshell expects to enter into an agreement with local communities with respect to fire protection • In the unlikely event of any contaminant release as a result of fire, any migration will be curtailed and immediate clean-up will be implemented
Explosion	*Effects* • Release of airborne emissions to the atmosphere where they may be subsequently transported and deposited at various distances from the source • Release of liquid contaminants which could contaminate soil, groundwater, surface water and air • Fire and associated effects • Worker health and safety issues • Expulsion of projectiles resulting in widespread debris *Mitigation* • Whiteshell has fire fighting procedures for dealing with fires caused by explosions • In the unlikely event of any contaminant release as a result from explosion, any migration will be curtailed and immediate clean-up will be implemented
Spills and Leaks	*Effects* • Release of volatile contaminants to the atmosphere where they may be subsequently transported and deposited at various distances from the origin. • Release of liquid contaminants which could contaminate soil, groundwater, surface water and air • Fire and associated effects • Worker health and safety issues *Mitigation* • Secondary containment is already provided for most existing equipment and systems; new equipment and systems will provide for secondary containment where necessary • Contingency plans and emergency preparedness plans already exist for the Whiteshell facility. In the unlikely event of significant contaminant release, any migration will be curtailed and immediate clean-up will be implemented
Loss of service (power)	• Failure of lighting, air and water systems (including fans and pumps) which may result in worker health and safety effects • Failure of alarm and monitoring systems which could result in the release of airborne and liquid effluents to the environment and worker health and safety issues *Mitigation* • Where possible equipment and systems will be designed to shutdown in a fail-

Accident and Malfunctions	Potential Effects/Mitigation Measures
	safe mode in the event of a power loss • Secondary containment is already provided for most existing equipment and systems; new equipment and systems will provide for secondary containment where necessary • Contingency plans and emergency preparedness plans already exist for the Whiteshell facility. In the unlikely event of significant contaminant release, any migration will be curtailed and immediate clean-up will be implemented
Off-Site Transportation Accidents	*Effects* • A transportation accident releasing contaminants to the environment exposing workers and the public to radiation fields and radioactive contamination *Mitigation* • The movement of radioactive materials is governed by the *Packaging and Transport of Nuclear Substances Regulations* (CNSC 2000c) • The containers are designed to prevent the release of contaminants in the event of a severe accident and must be approved by the CNSC. Contingency plans and emergency preparedness plans already exist for Whiteshell Laboratories • In the unlikely event of significant contaminant release, any migration will be curtailed and immediate clean-up will be implemented

Conclusions

The accidents and malfunctions listed in Table 6.2, have avoidance and contingency plans applicable to each, in order to mitigate the potential environmental effects. Mitigation measures to reduce the potential hazards during decommissioning will be developed in individual decommissioning plans for individual facilities. Accident mitigation is based on prevention, early detection, remediation and accommodation.

6.5 THE EFFECT OF THE ENVIRONMENT ON DECOMMISSIONING ACTIVITIES (NON-ROUTINE EVENTS)

Non-routine environmental events are defined as naturally occurring events that can produce extreme conditions affecting the performance of decommissioning activities. These events include extreme rainfall and flooding, earthquakes, tornadoes, and forest/grass fires. Plans exist for handling such events on-site. They have been submitted and approved by the regulatory authorities and their risks are assessed in the Safety Reports.

These non-routine events are described below and potential effects from them are presented in Table 6.5.

Extreme Rainfall and Flooding

Extreme rainfall statistics are presented in Table 6.3. These statistics integrate return periods and the length of the rainfall event with the amount of rainfall.

Table 6.3
Extreme Rainfall Statistics for Winnipeg, Manitoba

Return Period (Years)	Rainfall in mm								
	5min	10min	15min	30min	1-hr	2-hr	6-hr	12-hr	24-hr
2	8.34	13.18	15.85	22.36	28.36	32.70	37.38	47.21	52.38
5	11.88	17.60	22.03	31.19	37.19	45.07	51.50	62.22	66.50
10	14.22	20.53	26.14	37.05	43.05	53.27	60.88	72.19	75.88
15	15.54	22.18	28.45	40.35	46.35	57.89	66.16	77.80	81.16
20	16.46	23.33	30.06	42.66	48.66	61.12	69.86	81.72	84.86
25	17.18	24.22	31.31	44.44	50.44	63.62	72.70	84.75	87.70
50	19.37	26.96	35.14	49.92	55.92	71.29	81.47	94.06	96.47
100	21.55	29.69	38.96	55.37	61.37	78.92	90.19	103.33	105.19

Source: W.D. Hogg and D.A. Carr, 1985.

No rainfall event has affected the operation of Whiteshell Laboratories. Therefore, the only potential effect on the decommissioning project will be to curtail activities during a rainfall event.

Overflow of the Winnipeg River

Flooding of the Winnipeg River may result from extreme rainfall conditions and/or as a result of failure of the Seven Sisters Dam which is located southeast of the Whiteshell Laboratories area.

With particular regard to the Seven Sisters Dam, literature indicates that there has never been a failure of any hydroelectric dam in Canada. Further, Manitoba Hydro has contingency plans for comprehensive notification, warning, and response systems in case an emergency condition is detected. It is estimated that it would take 1.5 hours to reach a peak flood level of 7 m above normal conditions 7.8 km downstream of the breach, on AECL property. Table 6.4 provides an estimate of the propagation of flood wave characteristics.

A dam break may affect the shoreline but will not flood the site. The only effects therefore would be on the outfall. Any rupture would not affect the amount of flow into the river. An overflow of the river is deemed highly unlikely and the effects on the decommissioning project would be negligible.

Table 6.4
Propagation of Flood Wave Resulting from Dam Breach at Seven Sisters

Location	Distance Downstream of Breach (km)	Time from Start of Flow Through Breach (hours)		Estimated Duration of Flooding (hours)	Estimated Increase in River Level from Normal Condition	
		First Arrival of Flood Water	Peak Flood Level		(ft)	(m)
AECL Property	7.8	0.7	1.5	6.3	23	7
AECL Property	10.0	0.7	1.6	6.5	23	7

Earthquake

The province of Manitoba is the least earthquake-prone area in Canada. Seismic activity in the prairie region south of 60°N is predominantly confined to southern Saskatchewan in a zone that continues into Montana (Anglin et al. 1990).

The Canadian nuclear fuel waste management program studying seismic stability in Northwest Ontario and Eastern Manitoba has found, based on a detection level of 2.5 on the Richter scale, that the Whiteshell Laboratories area and the southern two-thirds of Manitoba are aseismic (Wetmiller et al. 1996).

Tornado

Between 1868 and 1990 at least 75 tornadoes or tornado groups have occurred in Manitoba with two of these tornadoes passing near Whiteshell Laboratories in 1978. It has been estimated that the probability of a tornado strike in a given 1 km^2 area within the most southerly 190 km of Manitoba is about 4.8 x 10^{-4}/year; that is, there is a moderate probability of a tornado affecting the Whiteshell Laboratories' site. If a tornado did strike, it would affect many site buildings. It would not, however, affect the reactor or the concrete canisters which are designed to withstand very high winds.

Forest/Grass Fires External to the Facility

Natural grasslands and hardwood forests are located close to the Whiteshell Laboratories site (Guthrie and Scott 1988). Forest/grass fires may result from extremely dry conditions or lightning strikes. Whiteshell Laboratories has procedures for dealing with fires. Fire fighting capability will be supplemented with arrangements with surrounding communities.

Table 6.5
Summary of Effects of Environment (Non-Routine Events) on Decommissioning Activities

Environmental Event	Potential Effects/Mitigation Measures
Extreme Rainfall and Flooding	*Effects* • Increased soil erosion • Significant increase in surface water run-off • Increased worker safety issues (slippery surfaces for both workers and equipment, reduced visibility; increased electrical hazards, etc.) • Delays in the decommissioning schedule *Mitigation* • The suspension of outdoor decommissioning/remediation activities that could lead to contamination of run-off • WR-1 and the concrete canisters, in particular, have been designed to withstand extreme environmental events; new storage facilities constructed during decommissioning will also be designed to withstand extreme environmental events • Maintain adequate storm drainage facilities • In the unlikely event of significant contaminant release, clean-up will be implemented
Overflow of the River	*Effects* • No effect *Mitigation* • No mitigation required *Comments* • A breach of the Seven Sisters Dam is highly unlikely to occur • In the unlikely event of a breach of the dam, flooding would be expected to occur south of Whiteshell Laboratories and further north by Lac Du Bonnet • Notwithstanding, such extreme conditions could affect the AECL Bridge which could result in delays in decommissioning activities involving off-site transportation
Earthquake	*Effects* • Damage to decommissioning containment enclosures • Damage to active drains and stormwater drains • Destabilization of excavation slopes and stockpiles • Worker health and safety effects • Delays in the decommissioning schedule *Mitigation* • WR-1 and the concrete canisters, in particular, have been designed to withstand extreme environmental events; new storage facilities constructed during decommissioning will also be designed to withstand extreme environmental events

Environmental Event	Potential Effects/Mitigation Measures
	• Contingency plans and emergency preparedness plans already exist for the Whiteshell facility. In the unlikely event of significant contaminant release, any migration will be curtailed and immediate clean-up will be implemented *Comments* • Low probability • Area is aseismic
Tornadoes	*Effects* • Damage to existing above-ground facilities • Damage to decommissioning containment enclosures • Destabilization of excavation slopes and stockpiles • Worker health and safety effects • Delays in the decommissioning schedule *Mitigation* • WR-1 and the concrete canisters, in particular, have been designed to withstand extreme environmental events; new storage facilities constructed during decommissioning will also be designed to withstand extreme environmental events • Contingency plans and emergency preparedness plans already exist for the Whiteshell facility. In the unlikely event of significant contaminant release, any migration will be curtailed and immediate clean-up will be implemented *Comments* • Effects likely very localized within Whiteshell Laboratories • Moderate probability
Forest/Grass Fires	*Effects* • Temporary cessation of decommissioning activities • Evacuation due to fire and smoke *Mitigation* • The area around the facility will remain cleared to reduce the potential for the spread of fire onto the facility • In the unlikely event of a contaminant release resulting from fire, clean-up will be implemented *Comments* • Fire fighting capability will be supplemented with arrangements with surrounding communities

Conclusions

If a non-routine event were to occur, AECL's existing contingency plans and emergency preparedness plans would be implemented. If required, remediation of any new contamination would be undertaken.

6.6 EFFECTS ON SUSTAINABLE USE OF RENEWABLE RESOURCES

The *Canadian Environmental Assessment Act* requires that a Comprehensive Study Report consider the capacity of renewable resources that may be affected by the project. The capacity of sustainable use is based on a range of ecological considerations such as integrity of the ecosystem, productive capacity of the resource, carrying capacity of the ecosystem, and assimilative capacity of the ecosystem.

Renewable resources are those resources that can be naturally regenerated, such as forests or fisheries. The sustainable use of renewable resources refers to the ability to utilize these resources today without adversely affecting prospects for their use by future generations.

The decommissioning of Whiteshell Laboratories will have a positive effect on renewable resources in the biophysical environment both directly or indirectly. For example, the remediation and reestablishment of habitat for wildlife within the area is proposed after decommissioning and demolition. The decommissioning of facilities such as the ALWTC should also result in positive effects to the Winnipeg River. The release of new contaminants will be curtailed and eventually stopped. Subsequently, a review will be made of the contamination in the river sediments to confirm in-situ abandonment as the final end state.

In the case of Whiteshell Laboratories decommissioning, water quality is a renewable resource that will be improved as a result of the project. Other resource improvements would include fisheries, aquatic and terrestrial biota and terrestrial vegetation and wildlife.

Within the Project Study Area, it is expected that the effects of decommissioning on renewable resources should be mostly positive in nature. It is estimated that all but 1,415 ha of the site would be available for new business ventures by 2001. Release of maintained land would result in a larger area for hunting and other recreational activities. Table 6.6 summarizes the effects on renewable resources.

Table 6.6
Renewable Resources

	EFFECT
Forest	Positive – forested area may increase
Winnipeg River	Positive – flow of contaminants is already reduced and will eventually cease
Wildlife	Positive – habitat area will increase
Fisheries	Positive – water quality (which is currently high) will continue improve. This is conducive to the maintenance of fish habitats.

6.7 SUMMARY OF RESIDUAL EFFECTS ON VECs / VSCs

VECs and VSCs were identified in Section 5.6. The Winnipeg River and the aquatic features of the waterway are the area's most important VECs. Additional VECs/VSCs include wildlife in the area, the Sport Fishery and provincial parks and natural forests areas which are valued for their recreational uses.

This section provides an assessment of effects of the project on VECs/VSCs. Examples of possible adverse effects are a reduction in the water quality of a lake or river, a reduction in the population of fish or wildlife, loss of habitat and changes in breeding patterns.

6.7.1 Project / Environment Interactions (VECs / VSCs)

The VECs/VSCs are primarily related to the aquatic and terrestrial environmental components. Physical works/activities affecting air, surface water, soil and groundwater quality have the potential to affect the VECs/VSCs. Those interactions were assessed in Sections 6.3.1, 6.3.3 and 6.3.4.

6.7.1.1 Likely Environmental Effects

Likely effects on VECs / VSCs are as follows:

Winnipeg River and its Shoreline

Environmental effects of the project on the Winnipeg River were discussed in Section 6.3.3 (Hydrology). No adverse effects on the river are expected. Effluent emissions from decommissioning activities are expected to decline from current levels and no effect from contaminated sediments is anticipated (Appendix B.1).

There is the potential for contamination of the shoreline from contaminated surface water runoff and groundwater discharges. The geographical extent of any contamination would be limited to the shoreline on the Whiteshell Laboratories site.

Contaminated river sediments are not expected to affect the shoreline. The contamination levels of the sediments are low and do not represent a risk to public health or aquatic biota (Appendix B.1).

Gullies and Ravines along the Winnipeg River

Gullies and Ravines along the river were chosen as a VEC because they offer a unique habitat to wildlife. There is the potential for contamination from contaminated surface water runoff and contaminated groundwater discharges. The geographical extent of contamination is expected to be limited to the Project Study Area.

Fish Species in the Winnipeg River (Sturgeon, Walleye, Northern Pike and Mooneye) and the Sport Fishery

Effects on aquatic biota including fish species were discussed in Section 6.3.6. No effects on the population of fish species or the Sport Fishery are expected. Sport fishermen have been known to fish in the vicinity of Whiteshell Laboratories and it is expected that they will continue to do so.

Whitetail Deer and Moose

The effect of the project on White Tail Deer and Moose was addressed in the discussion of effects on terrestrial biota (Section 6.3.5). There is the potential for exposure from contaminated soils and surface water, in particular near Waste Management Area. However, no effect on the population of mammals is expected because the:

- contamination is extremely low and vegetation uptake is limited;
- geographical extent of areas affected by residual contamination is expected to be limited to the Project Study Area; and
- deer and moose are mobile and will also feed and graze outside contaminated areas, diluting any uptake.

Habitat Diversity, Coniferous Forest at Whiteshell and the FIG

There is the potential for localized soil, groundwater and surface-water contamination within the Whiteshell Laboratories site, particularly at the WMA (Sections 6.3.3 and 6.3.4). Any effects such as contamination of vegetation are expected to be localized and will not effect habitat diversity, the coniferous forest or other vegetation on the site as a whole.

FIG, the Field Irradiated Gamma research area, is not likely to be affected by decommissioning. It is located approximately 1.5 km from the WMA and 3 km from the laboratory facilities. Surface water and groundwater contamination from the WMA and Laboratories are not expected to reach this area.

Provincial Park, Natural Forest Areas, the Model Forest

These VSCs lie outside of the Whiteshell Laboratories site. No likely environmental effects are expected outside the Whiteshell Laboratories site and therefore no effects on these VSCs are expected.

6.7.1.2 Identified Mitigation Measures

No mitigation measures are warranted or recommended.

6.7.1.3 Residual Effects

There is the potential for contamination of Gullies and Ravines and the Winnipeg River shoreline by contaminated surface runoff and contaminated groundwater discharges.

7.0 EVALUATION OF SIGNIFICANCE

7.1 RESIDUAL EFFECTS

Section 6.0 identified residual effects emanating from the Whiteshell Laboratories Decommissioning Project. Residual effects are defined as any effect, no matter how small, arising from the project after mitigation. *CEAA* requires that an assessment be carried out to determine if any of the residual effects can cause a significant adverse environmental effect. The assessment of significance begins with residual effects. These are summarized in Table 7.1. The column, spatial effect, indicates if it is anticipated that the effect will go beyond the property boundary, that is, offsite.

Table 7.1
Summary of Residual Effects

Category	Description of Residual Effect	Potential Spatial Effect	Facility/Source
Air Quality and Noise	Release of airborne radioactive particulates during disconnecting of services, decontamination retrieval and repackaging of materials and remediation	On-site	ALWTC, WR-1, B300, Decontamination Centre, B402, WMA, Buried Services, Affected Lands, North Ditch, River Sediments
	Release of airborne radioactive particulates during demolition of canisters	On-site	Concrete canisters
	Nuisance dust and fine particulates from building demolition, and site restoration and rehabilitation	On-site	All except Van de Graaff Accelerator and Neutron Generator
	Production of methane gases from landfill	On-site	Inactive landfill
	Noise during demolition and site restoration	On-site	All facilities
Surface water (hydrology)	Surface water contamination associated with migration of decontamination process water, the removal of drains and other buried services and remediation	Off-site Winnipeg River	Buried Services, WMA, Affected Lands, North Ditch
	Discharge of treated water flows into Winnipeg River (active and inactive)	Off-site Winnipeg River	ALWTC, Sewage Lagoons
	Leaks into surface water from in-situ trenches	Off-site Winnipeg River	WMA
Soil and groundwater (geology and hydrology)	Soil and Groundwater contamination during operations	Off-site Winnipeg River	WMA, Sewage Lagoons
	Contamination from leaks around existing facilities or contamination during remediation	Off-site Winnipeg River	Off-site Contaminated Lands, Sewage Lagoons, Buried Services, Affected Lands, North Ditch
	Leachate from in-situ trenches	Off-site Winnipeg River	WMA
	Leachate from remediated facilities	Off-site Winnipeg River	Inactive landfill
Terrestrial Biota	No effects identified		
Aquatic Biota	No effects identified		

Category	Description of Residual Effect	Potential Spatial Effect	Facility/Source
Worker Health and Safety	No effects identified		
Socio-economics	No effects identified		
Public Health	No effects identified		
Physical and Cultural Heritage	Potential to disrupt traditional uses of the Winnipeg River	Off-site Winnipeg River shoreline	Shoreline
Land and Resource Use	Land-use restriction associated with in-situ disposal of radioactive waste	On-site	WMA
	Land-use restrictions associated with in-situ disposal of non-radioactive waste	On-site	Inactive landfill
Archaeology	Artifact loss during excavations near shores of the Winnipeg River	On-site Shoreline	Sewage lagoon, shoreline
Aboriginal Interests	General interest in the project especially as it affects the Winnipeg River. Artifact loss during excavations near shores of the Winnipeg River	On-site Shoreline	Sewage lagoon, shoreline

There are four overall comments that should be made with respect to all releases:

- Releases during decommissioning will not be continuous. The decommissioning process is spread over many years and activities will occur sporadically.
- Radioactive releases are controlled. For example, discharges from the ALWTC are regulated and releases above prescribed limits are not permitted.
- A Detailed Decommissioning Plan (DDP) will be prepared for every nuclear facility to be decommissioned. The DDPs will address environmental control issues, describe control procedures and form the basis for regulatory approval of individual decommissioning projects.
- Monitoring will be continuous. It will not be possible for an emission which exceed regulatory limits to go undetected. In most cases, the detection is less than a day.

The following is a brief description of the residual environmental effects for each of the categories in Table 7.1.

Air Quality and Noise

Air quality issues were related to most decommissioning activities including decontamination, building demolition and site remediation. Air quality effects ranged from the release of very small amounts of radioactive air borne particulates to nuisance dust and noise. Several observations may be made:

- airborne radioactive emissions are controlled to be below the DRL and kept as low as reasonably achievable (ALARA). The target for total emissions is a small fraction of the DRL. HEPA filters effectively control radioactive particulates. Where greater control is required, additional HEPA filters can be added. The result is that the release of radioactive particulates is negligible;

- radioactive materials will be removed from all structures through a decontamination process. HEPA filters used during decontamination will remove a high level of radioactively contaminated dust (99.97%). As a result virtually no radioactivity will be released during the demolition process;
- experience at other sites suggests that from time to time nuisance dust will be generated. Recent work (Watson and Chow 1999) suggests that the fine fraction (PM_{10}) of fugitive dust, generated by construction-type activities, will tend to remain in the lowest 2 m of the atmosphere and that the local deposition losses and impaction losses (vegetation and especially trees) will reduce the amount transported beyond 50 metres by over 90%;
- under extremely windy conditions, when there is a possibility that emissions may leave the site, activities will be curtailed; and
- the nature of the decommissioning activities will limit the generation of noise. The preservation of the dense tree coverage across the site will provide a natural noise barrier between site activities and potential noise receptors within the Project Study Area. Vibration effects would likely only be of concern within the Project Study Area to adjacent buildings and structures.

Soil and Groundwater

Small amounts of active contamination may remain in the soils where leaks have occurred around buried services and where active buildings or facilities, such as Shielded Facilities, have been removed. A small amount of leachate from these contaminated soils and from the inactive landfill may migrate into the groundwater. The evaluation of contaminant migration from the WMA trenches (Appendix C) concluded that there is no contaminant migration beyond the WMA boundaries. These amounts will be extremely small and below release limits. The approaches to their treatment will be addressed in the DDPs.

Surface Water

Residual effects on surface water, particularly the Winnipeg River, were identified from ALWTC discharges and the sewage lagoon. These discharges are currently lower than accepted release levels and will gradually diminish to virtually zero by the time the decommissioning is complete. Contaminated river sediments will not affect surface water quality (Section 6.3.3).

Terrestrial Biota

No effects were identified on terrestrial biota. The only potential effect of the project on terrestrial wildlife might be intermittent noise. However deer and moose have ranges much larger than the property and, if disturbed by noise, can go to other areas.

Aquatic Biota

The only effect on aquatic biota is related to the Winnipeg River. The river will only be affected if there is a substantial leak. Contaminated river sediments will not affect aquatic biota (Section 6.3.6).

Socio-Economic

Socio-economic effects were related to contamination of the Winnipeg River in amounts sufficient to affect aquatic life, drinking water quality and in general the economic activities associated with the river. No such contamination levels were identified and no effects are anticipated.

Worker Health and Safety

Workers will be exposed to radiation in many of the decommissioning activities. Adherence to AECL's radiation protection and occupational health and safety programs will ensure that doses are controlled and incorporate ALARA principals. Decommissioning activities will build upon past experience with nuclear facility decommissioning. Other worker health and safety risks are limited to the kinds of risk associated with normal building demolition.

Physical and Cultural Heritage

Physical and cultural heritage refers to the use of the land by First Nations and others over time. In particular, First Nations groups have used the area and especially the Winnipeg River for hunting, fishing and many other traditional activities. Other archaeological sites in the region are notable for their rare finds of considerable cultural importance.

Land and Resource Use

A potential residual effect identified is long-term restriction on land use. The use of certain areas (the WMA) will be restricted during the institutional control period. There may also be some restrictions on use of the area around the inactive landfill site. The amount of land associated with all of these areas is very small relative to the 4375 ha area of the Whiteshell Laboratories site.

Public Health

Currently there are no public health threats from the Whiteshell Laboratories Decommissioning Project. Releases are well within limits. Regular monitoring ensures that any aberrations are detected immediately. There is the possibility of an accident associated with the transport of radioactive wastes offsite. Approaches to ensuring the safety of radioactive materials transport have been developed and include contingency plans for accidental spills.

Archaeology

Residual effects in this area may be associated with the decommissioning of the sewage lagoon and any remediation activities along the Winnipeg River. Small areas adjacent to the Winnipeg River have been previously excavated to create the existing facilities. An archaeologist will be available during excavations to ensure that no artifacts are lost. The end state of the project will return the area to a “natural” state.

Aboriginal Interests

Activities of specific interest to aboriginal communities are associated with historical and current uses of the Winnipeg River, the disturbance of sacred lands and artifacts as well as other aspects of interest to other groups. No particular valuable historical site has been identified and First Nations will kept apprised of any findings during excavations as well as being kept abreast of the progress of the project in general. The quality of the Winnipeg River will be maintained as described in previous sections.

7.2 APPROACH TO ASSESSING SIGNIFICANCE

A two-step procedure was used to determine the significance of these effects. The first step was to identify effects that were considered significant based on existing legal and social standards that would be applied to any project or activity. A residual environmental effect was automatically determined to be significant if it:

- contravenes an applicable federal, provincial or municipal standard such as water quality or CNSC regulations;
- displaces or endangers a designated or protected environmental feature or population;
- adversely affects established treaty and/or aboriginal rights;
- displaces a human community; or
- causes a proven chronic effect on human health.

The second step, which was applied to those effects that did not contravene the Step 1 criteria, involved evaluating significance within a framework developed specifically for this project. The object was to determine the degree to which VECs or VSCs were affected. The framework was developed following a review of procedures described in Natural Resources Canada (1996), Canadian Environmental Assessment Agency (1997) and Canadian Standards Association (in preparation).

Significance was determined by the degree of change from existing conditions and the value of the environmental components being affected. The measures of significance used include:

- the anticipated magnitude of disturbance in relation to existing conditions;
- the duration of the effect, is the time period over which the event will last;
- the occurrence of the effect, percent of entire decommissioning period when effects occur;
- the geographical area covered, specifically whether it went beyond the Project Study Area; and
- the reversibility of the environment affected, specifically whether the environment affected can be reversed within a reasonable time period.

The specific evaluation criteria used are presented in Table 7.2. Definitions of the terms are also provided in the glossary.

Table 7.2
Evaluation Criteria Used to Assess Significance of Residual Environmental Effects

Criteria	Rating*	Definition
Magnitude: extent of predicted disturbance compared to existing conditions	L M H	No measurable disturbance Measurable disturbance but no loss of function Measurable disturbance but with some loss of function
Duration: the time period over which the event will last	L M H	Short-term (less than a week) Moderate (less than a month) Long-term (continuous over at least a one year period)
Occurrence: percent of entire decommissioning period when effects occur	L M H	Less than 1% of the time Less than 30% of the time Greater than 30% of the time
Geographic extent: area over which the effect will occur	L M H	Project Study Area Local Study Area Regional Study Area
Reversibility: the ability of the environment affected to return to the state before the effect occurred	L M H	Effect naturally reversible within one year Effect reversible within one year but only with human intervention Effect not reversible within one year

* L = Low; M = Medium; H = High.

Note: These are generally qualitative judgements. In some cases, especially for duration and occurrence, different definitions related to human health and ecological risks would apply.

In carrying out the assessment, it became apparent that the most important criteria affecting the significance of the effect was magnitude. The nature of the project calls for sporadic activities carried out over a long period of time, with more intense level of activities at the beginning and at the end of the decommissioning project. Thus, the temporal aspect would not appear to be a dominant factor. Likewise, it was shown that, for most of the effects identified, the area affected would be relatively small in the regional context. Finally, the ability of an environmental component to recover from a stress – the reversibility of an effect – is largely linked to the severity or magnitude of an effect. Accordingly, the following rules were set:

Magnitude Rating	Requirements for Effect to be Significant
"H"	One additional criterion rated "H" and two other criteria that rated either "H" or "M"
"M"	Two additional criteria rated "H" and two other criteria that rated either "H" or "M"
"L"	Four additional criteria rated "H"

Note: These rankings when applied individually do not imply that there is a significant effect.

7.3 SIGNIFICANCE ANALYSIS

Step 1

All activities met the criteria outlined in Step 1 and no violations were found.

Step 2

Application of the criteria outlined in Table 7.2 led to the results shown in Table 7.3.

Table 7.3
Significance Analysis

Component	Description of Residual Effect	*M*	*D*	*O*	*G*	*R*	Comment/Conclusion
Air Quality and Noise	Release of airborne radioactive particulates during operating and maintenance of the facility	L	M	L	L	L	***Not significant:*** *Radioactive emissions are regulated and controlled in accordance with derived release limits. The target for total emissions is a small percentage of the DRL. HEPA filters effectively control radioactive dust and where greater filtration is required, more filters can be added. The result is that the release of radioactive emissions is negligible.*
	Release of airborne radioactive particulates during disconnecting of services, decontamination retrieval and repackaging of materials and remediation	L	L	M	L	L	
	Release of airborne radioactive particulates during break-up of concrete canisters	L	L	L	L	L	
	Nuisance Dust and fine particulates from building demolition, and site restoration and rehabilitation	L	M	L	L	L	***Not significant:*** *A number of factors will limit the transport of nuisance dust to the licensed property area.*
	Production of methane gases from Landfill	L	H	H	L	L	***Not significant:*** *Effect is easily mitigated as venting is widely used technology for controlling methane gas build-up.*
	Noise during demolition and site restoration	L	L	L	L	L	***Not significant:*** *The preservation of the dense tree cover across the site will provide a natural noise barrier between site activities and potential noise receptors within the Project Study Area. Vibration effects would likely only be of concern within the Project Study Area to adjacent buildings and structures.*

Table 7.3 (continued)
Significance Analysis

Component	Description of Residual Effect	*M*	*D*	*O*	*G*	*R*	Comment/Conclusion
Surface Water Quality (hydrology)	Surface water contamination associated with migration of decontamination process water, the remediation of affected lands and buried services	**L**	**M**	**M**	**L**	**M**	***Not significant:*** *Decontamination process water will be sent to the ALWTC for treatment. Decontamination is normally done indoors and there is no opportunity for water to go anywhere except to the ALWTC drains.*
	Discharge of treated water flows into Winnipeg River (active and inactive)	**L**	**L**	**L**	**M**	**L**	***Not significant:*** *Releases controlled so that effluents remain below acceptable standards.*
	Leaks into surface water from in-situ trenches	**L**	**M**	**L**	**M**	**L**	***Not significant:*** *No migration of radioactive contaminants to surface water.*
Soil and Groundwater Contaminatio n (geology and hydrogeology)	Contamination from leaks around existing facilities	**L**	**M**	**L**	**L**	**M**	***Not significant:*** *Contamination will be removed and only small amounts at levels to allow unrestricted use will remain. Amounts too small affect groundwater.*
	Soil and Groundwater contamination during operations	**L**	**M**	**L**	**L**	**M**	***Not significant:*** *Routine monitoring to ensure integrity of facility.*
	Soil and Groundwater contamination during remediation	**L**	**L**	**L**	**L**	**M**	***Not significant:*** *Use of rain barriers, berms, to keep water from flowing away from site being remediated containment barriers to direct water to drains.*
	Leachate from WMA trenches	**L**	**M**	**M**	**L**	**M**	***Not significant:*** *The hydrogeological conditions at the WMA are favourable for in-situ management of the waste. There is no evidence of upward or lateral migration to date and scooping calculations suggest no significant migration from the WMA will occur (Appendix C). Monitoring performed as part of the follow-up will ensure no undetected migration from the WMA.*
	Leachate from remediated facilities	**L**	**M**	**M**	**L**	**M**	***Not significant:*** *Remediation plan measures will limit leachate to below acceptable standards.*
Terrestrial Biota	No effects identified						
Aquatic Biota	No effects identified						

Worker Health and Safety	No effects identified						
Public Health	No effects identified						
Socio-Economic	No effects identified						

Table 7.3 (continued)
Significance Analysis

Component	Description of Residual Effect	*M*	*D*	*O*	*G*	*R*	Comment/Conclusion
Physical and Cultural Heritage	Loss of resource use of Winnipeg River associated with sediment removal option	**L**	**L**	**L**	**M**	**L**	***Not significant:*** *Remediation will only be undertaken if there are no significant environmental effects.*
Land and Resource Use	Land-use restriction associated with in-situ disposal of radioactive waste	**L**	**H**	**L**	**L**	**H**	***Not significant:*** *Areas involved very small; especially relative to the total amount of land being released on site.*
	Land-use restrictions associated with in-situ disposal of non-radioactive waste	**L**	**H**	**L**	**L**	**H**	***Not significant:*** *Areas involved very small; land still useable for many purposes.*
Archaeology	Artifact loss during excavations near shores of Winnipeg River	**L**	**L**	**L**	**M**	**H**	***Not significant:*** *The Presence of an Archaeologist during excavations will ensure that artifacts are not destroyed or lost.*
Aboriginal Interests	General interest in the project especially as it affects the Winnipeg River. Special interest in artifact loss during excavations near shores of Winnipeg River	**L**	**L**	**L**	**M**	**H**	***Not Significant*** *Concerns about specific artifacts have been addressed under physical heritage and archaeological aspects. There will no significant effects on the wider concerns of First Nations' people with respect to the protection of the Winnipeg River.*

* L = Low; M = Medium; H = High.

7.4 CONCLUSION

It is concluded that the Whiteshell Laboratories Decommissioning Project, taking into account the appropriate mitigation measures, is not likely to cause significant adverse environmental effects.

8.0 CUMULATIVE EFFECTS

Section 16(1) of the *Canadian Environmental Assessment Act* requires that the environmental assessment include a consideration of cumulative environmental effects. Cumulative environmental effects are defined in the Agency's Practitioner's Guide (1999) as "changes in the environment that are caused by an action in combination with other past, present and future human actions". The following steps are used in determining the cumulative effects of the Whiteshell Laboratories Decommissioning Project:

- the identification of actions or works that in some way might interact with the project;
- the characterization of those actions or works in terms of the effects that might interact with those effects from the decommissioning project;
- the assessment of the interactions;
- the identification of any additional mitigation measures;
- the assessing of the significances; and
- follow-up measures.

8.1 IDENTIFICATION OF ACTIONS/PHYSICAL WORKS

A total of 30 actions/physical works were identified through consultation with people knowledgeable of the Local and Regional Study Areas and potential development. These actions/physical works are located either within the Local or Regional Study Areas defined for this assessment. The status of these actions/physical works have been determined according to three categories:

- past or ongoing;
- certain or reasonably foreseeable (i.e. are identified in an approved development plan); and
- hypothetical (i.e. no definitive information on proceeding is available).

A listing of the actions/physical works, their location with respect to the study areas and their current status is given in Table 8.1.

Table 8.1
Proposed Actions/Physical Works

Actions/Physical Works	Relevant Study Area	Current Status
Awanipark Residential Development	Local	Ongoing
Manitoba Hydro -Pointe du Bois Expansion	Regional	Ongoing
Pinawa, existing Sewage Treatment facility	Local	Ongoing
Pinawa Landfill	Local	Ongoing
Pine Falls Paper Company mill	Regional	Ongoing
Powerland Centre	Local	Ongoing
Rural Municipality of Lac du Bonnet (includes towns)	Local	Ongoing
Rural Municipality Whitemouth (includes towns)	Local	Ongoing
Technology Firms - ACSION (Whiteshell Irradiator), Channel, ECOMatters	Local	Ongoing
Underground Research Laboratory	Local	Ongoing
AECL's WM Privatization	Local	Hypothetical
Agricultural Expansion	Local	Hypothetical
Alternative Forest Products	Local	Hypothetical
Aqueduct Project	Local	Hypothetical
Call Centre	Local	Hypothetical
Education/Training Centre	Local	Hypothetical
Fish Farming, Hatcheries, etc	Local	Hypothetical
High Tech Centre	Local	Hypothetical
Market Gardening	Local	Hypothetical
National Wildlife Area	Local	Hypothetical
Natural Gas Co-operative	Local	Hypothetical
NEON project	Local	Hypothetical
Pinawa Industrial Park	Local	Hypothetical
Pinawa Residential/Commercial Expansion	Local	Hypothetical
Seven Sisters Falls Development	Local	Hypothetical
SunGro Peat Expansion	Local	Hypothetical
Tanco Expansion	Local	Hypothetical
Technology Firms - ASD opportunities B402	Local	Hypothetical
Tourism Expansion - TCT, adventure trips, river cruises	Local	Hypothetical
Wild Rice Production Increase	Local	Hypothetical

As recommended in the Agency's Practitioner's Guide, the scope of the cumulative effects assessment includes those past, ongoing and likely future actions/physical works that are certain and reasonably foreseeable. Ten actions in Table 8.1 were listed as "Ongoing". None were deemed certain.

The effect of relevant *past* projects and activities, such as the past construction and operation of the Whiteshell Laboratories, nuclear bomb testing in the 1950s and 1960s, etc. are documented in the description of the existing environment in Section 5.0 (e.g. existing residual ^{137}Cs concentrations in sediments and soils). The cumulative effects of those past activities with the effects of the decommissioning project are therefore implicitly taken into account in the assessment of the project effects in Section 6.0. To complete the assessment of cumulative effects, therefore, the cumulative effects of the project with *ongoing* and foreseeable *future* projects are considered in this section.

8.2 CHARACTERIZATION OF RELEVANT ACTIONS / PHYSICAL WORKS

On the basis of the interviews conducted and a review of the actions and physical works, ten actions/physical works selected for further review were characterized in terms of their likely environmental effects on the VECs/VSCs considered in the environmental assessment. The VECs and VSCs were summarized in Section 5.6. Table 8.2 summarizes the potential environmental effects of each action/physical work and the respective VECs/VSCs that would be affected.

Table 8.2

Review of Potential Effects of Ongoing Actions/Physical Works on VECs

Name	**Location**	**Possible *VEC* Effect**	**Comment**
Awanipark Residential Development	2.5 km Upstream of Whiteshell Laboratories	Seepage from Septic Tanks to the *Winnipeg River*	Septic tank systems are designed so that the flow from the tanks will be adequately diluted by the tile beds and that no contaminants can reach the river. This and the distance from the outfall and consequent dilution of any contaminant that may leak into the river mitigate against any combination of effects from drainage from the Whiteshell Laboratories sewage lagoon.
Manitoba Hydro Point du Bois Power Station recent Expansion	25 km Upstream of Whiteshell Laboratories	Potential for higher flows resulting from increased power production to cause greater erosion of river bottom and re-suspend sediments and contaminate the *Winnipeg River*	The sediment review (see Appendix B) has indicated that the sediment contamination in the river adjacent to the outfall is at level which, under the most conservative assumptions, presents no threat to human health or the environment. In addition the amounts of contamination are small (1.3 GBq). It would appear that even if the sediments were re-suspended, there would be no effect on water quality. The greater flows associated with any possible and unlikely displacement would augment the already substantial dilution effect.
Pinawa, Existing Sewage Treatment Facility	10 km upstream	Flows from lagoon into the *Winnipeg River*	Discharges from sewage lagoons are designed to minimize effects on the receiving water body. The result is that contamination from the lagoon is likely to be minimal and have little effect on water quality. By the time the contaminant reaches Whiteshell Laboratories, 10 km downstream, dilution is likely to render this already small amount of contamination not only negligible but essentially undetectable.
Pinawa Landfill	East of Whiteshell Laboratories	Leachate into the *Winnipeg River*	The landfill ultimately drains into the Winnipeg River via the Pinawa Channel and Lac Du Bonnet, a distance of 30 kilometres. The landfill which is subject to Provincial jurisdiction is designed to have minimal effects on surface and groundwater and, by the time it reaches the Winnipeg River, dilution is likely to render this already small amount of contamination not only negligible but essentially undetectable. Given that small amounts of contaminants are released from Whiteshell, the likelihood of any significant for interaction between those two sources is very small.
Pine Falls Paper Company Mill – waste treatment facility	At mouth of Lake Winnipeg 50 km downstream	Flow from Treatment facility into the *Winnipeg River*	Whiteshell discharges are extremely small and the dilution effect over the distance involved is such that the small amount of contamination released at Whiteshell is likely to be not only negligible but essentially undetectable by the time it reaches the paper mill outfall.
Powerland Centre - Commercial Development	Downtown Pinawa	No effect identified	Interactions with environmental components are unlikely
Rural Municipality of Lac du Bonnet (including. town of Lac du Bonnet) Sewage Treatment Facility	10 km downstream	Flows from lagoon into the *Winnipeg River*	Discharges from sewage lagoons are designed to minimize effects on the receiving water body. The result is that contamination from the lagoon is likely to be minimal and have little effect on water quality. Very little contamination is expected from Whiteshell, and by the time the contaminants reach Lac du Bonnet, 10 km downstream, dilution is likely to render this already small amount of contamination not only negligible but essentially undetectable.
Rural Municipality of Whitemouth (including town of Whitemouth)	Below Seven Sisters, 4 kms upstream	Flows from lagoon into the *Winnipeg River*	Discharges from sewage lagoons are designed to minimize effects on the receiving water body. The result is that contamination from the lagoon is likely to be minimal and have little effect on water quality. By the time any contaminants reach Whiteshell Laboratories, 4 km downstream, dilution is

Name	Location	Possible *VEC* Effect	Comment
			likely to render this already small amount of contamination not only negligible but also essentially undetectable.
Technology Firms	At Whiteshell Laboratories site	No effect identified	Interactions with environmental components are unlikely
Underground Research Laboratory		Flows from tailing ponds into the *Winnipeg River*	Liquid emissions from the mine water settling pond and mined rock storage area reach the Winnipeg River through a convoluted path (first a small surface stream, then the Lee River, Lac du Bonnet and finally, the Winnipeg River.) The surface stream is dry most of the year and no discharges from URL reach the Lee River unless the conditions are quite wet - spring and fall). Very small amounts of contaminants will be discharged from Whiteshell Laboratories. Therefore, there is little chance of any additive effects.

8.3 INTERACTIONS WITH THE DECOMMISSIONING PROJECT

This cumulative effects assessment must build upon the results of the analysis presented in previous sections of this report. Table 7.1 provides a summary of the residual effects from the project. The cumulative effect assessment focuses on the VECs and VSCs. The only VEC that the proposed actions/physical works outlined in Table 8.2 can affect is the Winnipeg River and by extension, the Sport Fishery.

The assessment also shows that the likelihood of interaction with between residual effects from the Whiteshell Laboratories Decommissioning Project and effects from the ten proposed actions/physical works is very small owing to the limited amount of contaminants released into the Winnipeg River from those actions and physical works. This is because:

- The design of the effluent control systems (septic systems are designed to produce acceptable effluents that will not adversely affect ground or surface water).
- The points of discharge or influence are so far away from the River that no significant levels of contaminants are likely to reach the river (e.g. the leachate from the Pinawa Landfill).
- Some actions/physical works affect a stretch of the Winnipeg River well downstream of the decommissioning project (e.g. URL). Others simply do not have any significant environmental effects (e.g. Powerland and Technology Firms).

8.4 CONCLUSIONS

A review of proposed and existing actions and physical works in areas surrounding the Whiteshell Laboratories site reveals that there is no measurable interactions between the effects of the ten projects and those of the Whiteshell Laboratories Decommissioning Project. It follows that there is no need for mitigation beyond the proposed decommissioning project and no significant cumulative effects are expected. As such, the only follow-up programs necessary are those related to the project as a whole. These are outlined in Section 9.0. The extent of the proposed follow-up actions including monitoring activities will allow for the identification of any unlikely cumulative effects.

9.0 FOLLOW-UP PROGRAM

In this section, the goals and description of the proposed follow-up program are provided for the operational shutdown of the facilities and the three phases of the decommissioning program. The monitoring program in effect during operations of the Whiteshell Laboratories will be used as a basis for the proposed program. However, the existing monitoring program will be subject to change as a result of discussions with regulatory agencies, information obtained, periodic review of the data, response to public concerns and actual performance of the decommissioned facilities.

9.1 GOALS AND OBJECTIVES

The purpose of follow-up is to:

- optimize the monitoring and surveillance program;
- confirm that appropriate mitigation measures are implemented;
- develop appropriate responses to unforeseen effects; and
- identify effects of the project that may not have been predicted.

Follow-up activities include monitoring, surveillance and inspection, all of which may require data collection, analysis, evaluation and reporting. Additional mitigation measures may be implemented as a result of follow-up.

9.2 DETAILED DECOMMISSIONING PLANS

Detailed Decommissioning Plans (DDP) document health, safety and environmental considerations for implementation of decommissioning work. DDPs will be prepared for each nuclear facility, outlining the proposed mitigation measures that will be in place to reduce or eliminate hazards associated with decommissioning. Individual DDPs form the basis for approval of decommissioning by the CNSC.

DDPs for activities in Phase 2 and Phase 3 will be modified as required, based on the monitoring and surveillance activities in the earlier phase(s). As such, it is not possible to present specific changes to the existing monitoring program for activities in later phases until the surveying and monitoring activities proposed for the majority of facilities have been undertaken.

9.3 ENVIRONMENTAL MONITORING PROGRAM

AECL maintains a comprehensive Site Environmental Monitoring Program for Whiteshell Laboratories to ensure that radiation doses as a result of releases of radioactive material remain well below the annual dose limits for members of the public. These annual doses are specified in the *Nuclear Safety and Control Act* and are as low as reasonably achievable (ALARA), taking into account economic and social factors. The primary objectives of the Environmental Monitoring Program are:

- to provide a quantitative record of radioactive contaminants in the environment resulting from operation of the site, which will permit assessment of actual or potential radiation doses to critical groups and populations;
- to provide data to confirm compliance with regulatory limits and other guidelines and to provide public assurance of compliance;
- to provide verification of the effectiveness of facility operation and control of emissions and the adequacy of effluent monitoring; and
- to provide data to verify or refine the assumptions and models used in DRL calculations for the site, where applicable.

The following secondary objectives are also considered in the design of the site Environmental Monitoring Program:

- to provide data for trend analysis;
- to provide baseline data and capability for monitoring and assessment in the event of emergency conditions; and
- to provide information and assurance to the public about radiological and non-radiological hazards involved in site operations.

AECL maintains a comprehensive Site Verification Monitoring Program for Whiteshell Laboratories. Monitoring locations on airborne and liquid effluent streams are representative of the final discharge to the off-site environment and may include the combined discharge from a number of facilities. Where necessary, additional monitoring points are maintained at upstream locations as an aid in identifying the specific sources of emissions. Sampling system design ensures that samples are representative of the total content of the stream at that location. An overview of environmental monitoring activities at Whiteshell Laboratories is shown in Table 9.1.

Table 9.1

Summary of Environmental Monitoring Activities at the Whiteshell Laboratories

Environmental Component	Sampling Location	Parameters	Sampling Frequency
Air	Whiteshell Laboratories perimeter, WMA, off-site	γ (TLDs)	A
Surface Water	Winnipeg River WMA Ditch	Gross α/β, γ-spec., ^{90}Sr, non-radiological Gross α/β, γ-spec., ^{90}Sr	D-W M
Groundwater	WMA FIG, Misc. (Cs ponds, landfill, B200)	Gross α/β “ “	S/A A/R A/R
Sediments	Winnipeg River	Gross α/β, ^{137}Cs	A
Fish	Winnipeg River	Gross α/β, ^{137}Cs, ^{40}K	A
Vegetation	Whiteshell Laboratories perimeter	Gross α/β, ^{137}Cs, ^{90}Sr	A
Land Surveys	On-site, off-site	γ-spec	A

D:	Daily	M:	Monthly	S/A:	Semi-annually
W:	Weekly	A:	Annually	A/R:	As required

Effluent streams are monitored for all radionuclides or groups of radionuclides that are known to be, or are likely to be, present in the effluent, and that are likely to be a significant component of emissions via the monitored effluent stream. Monitoring is conducted by direct measurement or by sampling and analysis.

An outline of the existing monitoring programs and schedules at Whiteshell Laboratories is provided below. Details of these programs may be found in specific documents issued under AECL's Environmental Protection Program.

- Radiological Environmental Program – this program provides details concerning radiological environmental monitoring of the following parameters:

- air;
- surface water;
- fish from Winnipeg River;
- sediments in the Winnipeg River;
- groundwater;
- perimeter vegetation;
- land gamma surveys of roads; and
- off-site deposition.

Details of monitoring location, frequency of sample collection and analytical methods and parameters are provided in Tables 9.2 to 9.9.

Table 9.2
Whiteshell Laboratories Environmental Monitoring - Air

Monitoring Location	Location Code	Collect/Analysis Frequency
ON-SITE STATIONS		
(a) Controlled (Active) Area Fence (4 chips/location)		
AAF South Fence (3 locations)	AAF	A
AAF East Fence (3 locations)	AAF	A
AAF North Fence (3 locations)	AAF	A
AAF West Fence (3 locations)	AAF	A
(b) Waste Management Area Perimeter Fence (4 chips/location)		
WMA West Fence (3 locations)	WMP	A
WMA North Fence (3 locations)	WMP	A
WMA East Fence (3 locations)	WMP	A
WMA South Fence (locations)	WMP	A
(c) Canister Area Perimeter Fence (4 chips/location)		
CAP North Fence (2 locations)	CAP	A
CAP East Fence (2 locations)	CAP	A
CAP South Fence (2 locations)	CAP	A
CAP West Fence (2 locations)	CAP	A
SITE BOUNDARY STATIONS		
Ambient Radiation Monitoring Stations (4 chips/location)		
Whiteshell Laboratories Perimeter, 3.2 km North, ARMS1	001	A
Whiteshell Laboratories Perimeter, 4.3 km ESE, ARMS2	002	A
Whiteshell Laboratories Perimeter, 3.4 km SSE, ARMS3	003	A
Whiteshell Laboratories Perimeter, 2.2 km W, ARMS4	004	A
Whiteshell Laboratories Perimeter, 2.4 km NW, ARMS5	005	A
OFF-SITE STATIONS		
Pinawa (8 chips/location)		
Pinawa Town Yard, ARMS6	006	A
Pinawa Hospital	007	A
Pinawa, Kelsey House	008	A

Legend: A - Annual

Table 9.3
Whiteshell Laboratories Environmental Monitoring - Surface Water

Sample Location			Sample Collection		Analytical Methods And Parameters				
Location Name	**Location Code**	**Comment**	**Freq.**	**Sample Type**	**Gross Beta**	**Gross Alpha**	**Tritium**	**Gamma Spec.**	**^{90}Sr**
WINNIPEG RIVER WATER									
Pinawa	SFD	Water Treatment Plant	D	Grab	Mcd	Mcd		Mcd	Mcd
Lac du Bonnet	LDB	Water Treatment Plant	D	Grab	Mcd	Mcd		Mcd	Mcd
Whiteshell Laboratories Downstream boundary	K11		W	Grab	Mcw	Mcw		Mcw	Mcw
Great Falls	GFD	Water Treatment Plant	D	Grab	Mcd	Mcd		Mcd	Mcd
WASTE MANAGEMENT AREA DITCH WATER									
East of WMA	WMA-1	Furthest east of WMA	Me	Grab	Me	Me		Me	A/R
East of WMA	WMA-2	Closer to WMA	Me	Grab	Me	Me		Me	A/R
SE of WMA	WMA-3	SE corner of WMA fence	Me	Grab	Me	Me		Me	A/R
SW of WMA	WMA-4	Between WMA & Canisters	Me	Grab	Me	Me		Me	A/R
SW of Canisters	WMA-5		Me	Grab	Me	Me		Me	A/R
West of Canisters	WMA-6		Me	Grab	Me	Me		Me	A/R
Road West of Canisters	WMA-7		Me	Grab	Me	Me		Me	A/R
North ditch	WMA-8	Ditch to RM of Lac Du Bonnet	Me	Grab	Me	Me		Me	A/R
West ditch	WMA-9	Ditch to Winnipeg River	Me	Grab	Me	Me		Me	A/R
Drill site road	WMA-10		Me	Grab	Me	Me		Me	A/R

Legend:
D - Daily sample.
Mcd - Monthly composite of daily samples.
Me - Monthly event, when the ditch contains water.
W - Weekly sample.
Mcw - Monthly composite of weekly samples.
A/R - As Required.

Table 9.4
Whiteshell Laboratories Environmental Monitoring – Fish

Sample Location			Analysis Method/Parameter			
Location Name	**Location Code**	**Comments**	**Gross Beta**	**Gross Alpha**	**^{137}Cs**	**^{40}K**
***FISH FROM WINNIPEG RIVER* - Walleye (pickerel) and White Sucker**						
Pinawa	Jxx	Background – Upstream of Seven Sisters Dam	A		A	A
0.5 km downstream of Whiteshell Laboratories Outfall	K03		A		A	A
5 km downstream of Whiteshell Laboratories outfall	K23		A		A	A

Legend: A – Annual.

Notes: Minimum of 6 Walleye and 6 White Sucker at each location.
Mass (kg), length (cm) and radioactivity (Bq/kg) of each species to be recorded.

Table 9.5
Whiteshell Laboratories Environmental Monitoring - Sediments

Sample Location		Analysis Method/Parameter		
Location Code	**Distance from the Site Outfall (km)**	**Gross Beta**	**Gross Alpha**	**^{137}Cs**
UPSTREAM OF THE WHITESHELL LABORATORIES OUTFALL				
J04	-0.76	A	A	A
J02	-0.37	A	A	A
DOWNSTREAM OF THE WHITESHELL LABORATORIES OUTFALL				
OFL	0.0	A	A	A
K01	0.15	A	A	A
K03	0.52	A	A	A
K05	0.79	A	A	A
K14	2.56	A	A	A
K19	3.48	A	A	A
K23	4.78	A	A	A
K30	13.06	A	A	A

Legend:
A - once per annum.

Notes:
3 samples of the top 1 cm to be taken at each location.
Results to be reported as Bq/m^2 and Bq/g.

Table 9.6

Whiteshell Laboratories Environmental Monitoring - Groundwater

Sample Location			**Sample Collection**		**Analytical Methods and Parameters**	
Location Name	**Location Code**	**Comment**	**frequenc y**	**Sample Type**	**Gross Beta**	**Gross Alpha**
WASTE MANAGEMENT AREA PIEZOMETERS						
WMA Centre North	P61-1	3 m deep	S	Grab	S	S
WMA Centre North	P61-2	6 m deep	S	Grab	S	S
WMA Centre North	P61-3	9 m deep	S	Grab	S	S
WMA West	P62-1	8.8 deep	S	Grab	S	S
WMA West	P62-2	3	S	Grab	S	S
WMA West	P62-3	6.4	S	Grab	S	S
WMA North	P63-1	6.1	S	Grab	S	S
WMA North	P63-2	8.5	S	Grab	S	S
WMA North	P63-3	3	S	Grab	S	S
WMA East	P64-1	3	S	Grab	S	S
WMA East	P64-2	6.1	S	Grab	S	S
WMA East	P64-3	9.1	S	Grab	S	S
Outside WMA	P23..	Background	S	Grab	S	S
WASTE MANAGEMENT AREA WELLS						
WMA Deep	S01		S	Grab	S	S
WMA Deep	S03		S	Grab	S	S
WMA Deep	S04		S	Grab	S	S
WMA Deep	S05		S	Grab	S	S
WMA Deep	S10		S	Grab	S	S
WMA Deep	S12		S	Grab	S	S
WMA Water Table	T01		S	Grab	S	S
WMA Water Table	T03		S	Grab	S	S
WMA Water Table	T04		S	Grab	S	S
WMA Water Table	T05		S	Grab	S	S
OTHER WATER TABLE WELLS						
FIG Area	FIG 1		S	Grab	S	S
FIG Area	FIG 2		S	Grab	S	S
FIG Area	FIG 200	Near Bog	S	Grab	S	S
FIG Area	FIG 300	Near Bog	S	Grab	S	S
SUPPLY WELLS						
Building 503	Bldg 503	Water supply to bldg 503	S	Grab	S	S
Building 423	Bldg 423	Water supply to bldg 423	S	Grab	S	S
MISCELLANEOUS						
WMA HLW tank tray	WMT	Checks for leak from high level liquid storage	M	Grab	M	M
Building 200	P	Piezometers	A/R	Grab	A/R	A/R
Cesium Pond	CSP	Experimental pond near WMA	A/R	Grab	A/R	A/R
Inactive Landfill	ILS		A/R	Grab	A/R	A/R

Legend:
S - Every 6 months.

M - Monthly.
A/R - As required.

Table 9.7

Whiteshell Laboratories Environmental Monitoring - Perimeter Vegetation

Sample Location			Analysis Method/Parameter			
Location Name	**Location Code**	**Comments**	**Gross Beta**	**Gross Alpha**	**^{90}Sr**	**^{137}Cs**
ARMS1	001		A	A	A	A
ARMS3	003		A	A	A	A
ARMS4	004		A	A	A	A

Legend:
A – Annual.

Notes:
Results to be reported in Bq/m^2, Bq/g (dry weight) and Bq/g (wet weight).

Table 9.8

Whiteshell Laboratories Environmental Monitoring
Land Gamma Surveys of Roads

Monitoring Route	Location Code	Survey Freq.
ON-SITE CONTROLLED (ACTIVE) AREA ROADS		
Building 401 into active area	A05	A
South side building 300	A06-A07	A
Approach to Hot Cells	A08-A09	A
West side of building 300	A10	A
Building 519 to building 200	A11	A
Sides of building 200 and building 411	A12 - A14	A
Building 200 to building 409	A18 - A19	A
Building 409 to East gate	A19 - A20	A
East gate to building 401	A17	A
ON-SITE SUPERVISED (FENCED) AREA ROADS:		
Building 401 to West gate	A04	A
West gate to building 408	A02	A
Building 408 to building 504	A01	A
South side of building 504	A01	A
ON-SITE UNCONTROLLED (OUTER AREA) ROADS:		
East gate to sewage lagoon road	A21- A22	A
Lagoon road	A23	A
Lagoon to site North boundary	A24	A
Drill site road		A
WMA road and landfill	A25-A35	A
OFF-SITE ROADS:		
Plant road (site to hwy. 211)		A
Highway 211		A
Pinawa		A
Highway 520 (hwy 211 to tower road)		A
Tower road		A
Riverland Road (Site to Lac du Bonnet Bridge)		A
Lac du Bonnet		A
Hwy 11 (Lac du Bonnet to Brookfield)		A
Hwy 11/Hwy307 (Brookfield to Seven Sisters)		A
Seven Sisters		A

Legend: A – Annual.

Table 9.9
Whiteshell Laboratories Environmental Monitoring - Deposition

Sample Location		Collect/Analysis Freq.				
Location Name	**Location Code**	**Gross Beta**	**Gross Alpha**	**Gamma Spec**	**^{90}Sr**	**^{137}Cs**
OFF-SITE:						
Pinawa Town Yard	006	M	M	A/R	M	A/R

Legend:
M - Monthly .
A/R - As Required.

Note:
Precipitation/deposition (total wet and dry). collected continuously in a plastic-lined open container.

- Non-Radiological Environmental Program – this program provides details concerning non-radiological monitoring for the following parameters:

  - BOD
  - fecal coliform
  - pH
  - total phosphorus
  - conductivity
  - total suspended solids
  - phenolics
  - oil/grease
  - chromium
  - copper
  - iron
  - lead
  - nickel
  - zinc
  - mercury

These parameters are monitored in the ALWTC tanks, sewage lagoon discharges and outfall effluent. The current sampling schedule for non-radiological liquid effluent sampling is provided in Table 9.10.

Table 9.10
Whiteshell Laboratories Non-Radiological Liquid Effluent Sampling Schedule

Parameter	Building 200 Laundry	(ALWTC) Decontam	Tanks R&D	WR-1	Site Outfall	Lagoon
BOD (5 day)*						Dis
Fecal Coliform*						Dis
pH	Dis	Dis	Dis	Dis	W	Dis
Phosphorus, Total	W	M	M	M	W	Dis
Conductivity	Dis	Dis	Dis	Dis	W	Dis
Tot. Susp. Solids	W	Dis	Dis	Dis	W	Dis
Phenolics (4AAP)	M	M	M	M		Dis
Oil/grease	W	Dis	Dis	Dis	W	Dis
Chromium	Mcw	Mcw	Mcw	Mcw	Mcw	Dis
Copper	Mcw	Mcw	Mcw	Mcw	Mcw	Dis
Iron	Mcw	Mcw	Mcw	Mcw	Mcw	Dis
Lead	Mcw	Mcw	Mcw	Mcw	Mcw	Dis
Nickel	Mcw	Mcw	Mcw	Mcw	Mcw	Dis
Zinc	Mcw	Mcw	Mcw	Mcw	Mcw	Dis
Mercury	Mcw	Mcw	Mcw	Mcw	Mcw	Dis

Legend:

Dis	Per discharge:	Approximately 15 times a month for laundry tanks. Approximately 2 times a month for decontam tanks. Approximately 2 times a month for R&D tanks. Approximately 2 times a month for WR-1 tanks. 2 times a year for sewage lagoon (average of 3 samples each discharge).
M	Monthly grab sample:	Normally taken 1st week of the month, or 1st discharge of the month in case of batch discharges.
Mcw	Monthly composite of weekly grab samples.	
W	Weekly grab sample:	Normally taken 1st discharge of week in case of batch discharges.
Wcd	Weekly composite of daily samples or samples taken at each discharge.	
*	Analysis of BOD and Fecal Cloakroom is by the Provincial Laboratory.	

9.4 SITE EFFLUENT VERIFICATION MONITORING PROGRAMS

AECL maintains comprehensive Site Effluent Verification Monitoring Programs for the Whiteshell Laboratories site to ensure that radiation exposures as a result of any releases of radioactive material remain well below the annual dose limits. These doses are specified in the *Nuclear Safety and Control Act*, and as low as reasonably achievable (ALARA), taking into account economic and social factors. The primary objectives of the Site Effluent Verification Monitoring Program are:

- to verify compliance with regulatory emission limits and conformance with AECL's internal emission levels and guidelines;
- to provide a quantitative record of radioactive emissions to the environment that will permit assessment of potential radiological effects on people and the environment as a result of site operations;
- to provide independent verification of site and facility operational performance with respect to radioactive emissions; and
- to provide warning of abnormal emissions that may require investigation or corrective action.

- Radiological Air Effluent Verification Monitoring – details of this program are provided in Table 9.11. For each monitored stream, routine reports provide information on:

  - the period monitored;
  - total weekly effluent volume (m^3) discharged;
  - total release (loading) in Bq of each monitored parameter for the week; and
  - a summary of any failures or unavailability of measurements or equipment.

Table 9.11
Whiteshell Laboratories Air Effluent Sampling and Analysis Schedule – Effluent Verification Monitoring

Sample Location		Sample Collection		Analytical Method &/or Parameter			
Location Name	**Location Code**	**Freq.**	**Method**	**Gross Beta**	**Gross Alpha**	**Tritium**	**Gamma Spec**
Bldg. 100 Stack	WR1	Cont	GFA Filter	W	W		W
		Cont	Charcoal Filter				W
		Cont	Bubbler			W	
Bldg. 100, SDR Exhaust Duct		Cont	GFA Filter	W	W		W
		Cont	Charcoal Filter				W
Bldg 200 V1F	AW	Cont	GFA Filter	D5	D5		D5
			Charcoal Filter				W
Bldg 200 V2F		Cont	GFA Filter	D5	D5		D5
			Charcoal Filter				W
Bldg 300 HCF	DA-1	Cont	GFA Filter	D5			D5
	DA-2	Cont	Charcoal Filter				W
	DA-3	Cont	Millipore Filter		D5		
Bldg 300 IFTF	DA-5	Cont	GFA Filter	D5			D5
		Cont	Charcoal Filter				W
	DA-4	Cont	Millipore Filter		D5		
Bldg 300 Lab 2-136	DA-7	Cont	GFA Filter	D5	D5		
WMA Compactor	WMA	A/R	GFA Filter	A/R	A/R		A/R
WMA Incinerator		A/R	GFA Filter	A/R	A/R		A/R

Legend:
Cont - The air effluent is measured by passing a continuous sample of the exhaust through a filter. The GFA filter is normally used for beta-gamma, the Millipore normally for alpha, and charcoal or silver zeolite for radioiodine, and a water bubbler for tritium.
D5 - Daily during normal workdays.
W - Weekly.
A/R - As required, continuous sample when facility is operating.

- Radiological Liquid Effluent Verification Monitoring – details of this program are provided in Tables 9.12 and 9.13. For each monitored stream, the following information is given in routine reports:

  - the period monitored;
  - total monthly (if applicable) weekly effluent volume (litres) discharged;
  - total release (loading) in Bq of each monitored parameter for the period;
  - the average concentration (Bq/L) of each monitored parameter; and
  - a summary of any failures or unavailability of measurements or equipment.

Table 9.12
Whiteshell Laboratories Liquid Effluent Monitoring Locations

Sample Location			Source Monitored	Flow Measurement		
Location Name	**Location Code**	**Location**		**Method**	**Devices**	**Frequency**
Whiteshell Laboratories Site						
Site Outfall	OFS	Bldg 422	Sewer that discharges to Winnipeg River	Continuous integrated	Weir & ultrasonic level	Continuous
Sewage Lagoon	SL2	Sewage lagoon outlet	Semi-annual discharge of domestic sewage lagoon	Depth of lagoon water	Manual depth measurement	Each discharge
Ditch north of WMA	8	Ditch north of WMA	Surface water from the Waste Management Area	not measured		
Ditch west of WMA	9	Ditch west of WMA	Surface water from the Waste Management Area	not measured	.	
Building 200						
Laundry Tank 801	TK801	Bldg 200	Laundry	Tank Volume	Level gauge	Each discharge
Laundry Tank 802	TK802	Bldg 200	Laundry	Tank Volume	Level gauge	Each discharge
Decontamination Tank 803	TK803	Bldg 200	Decontamination facility	Tank Volume	Level gauge	Each discharge
Decontamination Tank 804	TK 804	Bldg 200	Decontamination Facility	Tank Volume	Level gauge	Each discharge
R&D Tank 805	TK805	Bldg 200	Building 300 LLW	Tank Volume	Level gauge	Each discharge
R&D Tank 806	TK806	Bldg 200	Building 300 LLW	Tank Volume	Level gauge	Each discharge
WR1 Tank 808	TK808	Bldg 200	WR1 Reactor LLW drains	Tank Volume	Level gauge	Each discharge
WR1 Tank 809	TK809	Bldg 200	WR1 Reactor LLW drains	Tank Volume	Level gauge	Each discharge

Table 9.13
Whiteshell Laboratories Liquid Effluent Sampling and Analysis Schedule
Effluent Verification Monitoring

Sample Location		Sample Collection		Analytical Method &/or Parameter									
Location Name	**location Code**	**Freq.**	**Method**	**Beta Screen**	**Gross Beta**	**Gross Alpha**	**Tritium**	**Gamma Spec Liquid**	**Gamma Spec Dry**	**Sr-89**	**Sr-90**	**Pu**	**Uranium**
Whiteshell Laboratories Site													
Site Outfall	OFS	Cont	Auto	D5	Wc	Wc	Mc	Wc	Mc	Mc	Mc	Mc	Mc
Sewage Lagoon	SL2	Disch	Auto		Disch	Disch		Disch			Disch		
Ditch north of WMA	8	Me	Grab		Me	Me		A/R					
Ditch west of WMA	9	Me	Grab		Me	Me		A/R					
Building 200													
Laundry Tank 801	TK801	Disch	Grab		Disch	Mc		Mc			Mc		
Laundry Tank 802	TK802	Disch	Grab		Disch	Mc		Mc			Mc		
Decontamination Tank 803	TK803	Disch	Grab		Disch	Disch		Disch			Disch		
Decontamination Tank 804	TK804	Disch	Grab		Disch	Disch		Disch			Disch		
R&D Tank 805	TK805	Disch	Grab		Disch	Disch		Disch			Disch		
R&D Tank 806	TK806	Disch	Grab		Disch	Disch		Disch			Disch		
WR1 Tank 808	TK808	Disch	Grab		Disch	Disch		Disch			Disch		
WR1 Tank 809	TK809	Disch	Grab		Disch	Disch		Disch			Disch		

Legend:
D5 - Daily on normal weekdays.
Disch - Per discharge, twice a year for the sewage lagoon, as required for building 200.
Wc - Weekly composite, composite of samples collected during the week.
Mc - Monthly composite, composite of samples collected during the month.
Me - Monthly, when ditches have water, usually after a rain or snow melt.

- Personnel Radiation Dosimetry – this program provides data on occupational radiation doses and is part of AECL's Radiation Protection Policy #40301. The health and safety of AECL employees and the public, as a result of AECL operations, are governed by federal legislation under the *Nuclear Safety and Control Act* and Regulations. Administration of the *Act* and Regulations is performed by the CNSC.

9.5 MONITORING AND SURVEILLANCE FOR DECOMMISSIONING

Drivers

- For the decommissioning period, the monitoring program will be modified to reflect any new potential release pathways (both radioactive and non-radioactive).
- Fiscal responsibility (develop the best monitoring program possible for the resources invested).
- Environmental responsibility (monitor all parameters that are currently thought to be important).
- Temporal responsibility (the program will continue for about 60 years and knowledge will change over that period).

Environmental monitoring during the decommissioning period will be conducted in accordance with AECL's Environmental Protection Program, part of which has been outlined in Section 9.3. Monitoring and/or resurveying is built into each of the three phases of decommissioning. For monitoring requirements arising from decommissioning but not covered in the Environmental Protection Program, appropriate procedures will be developed that will meet or exceed federal and provincial regulatory requirements. Whiteshell Laboratories procedures and protocols for Emergency Preparedness will be updated to include decommissioning activities.

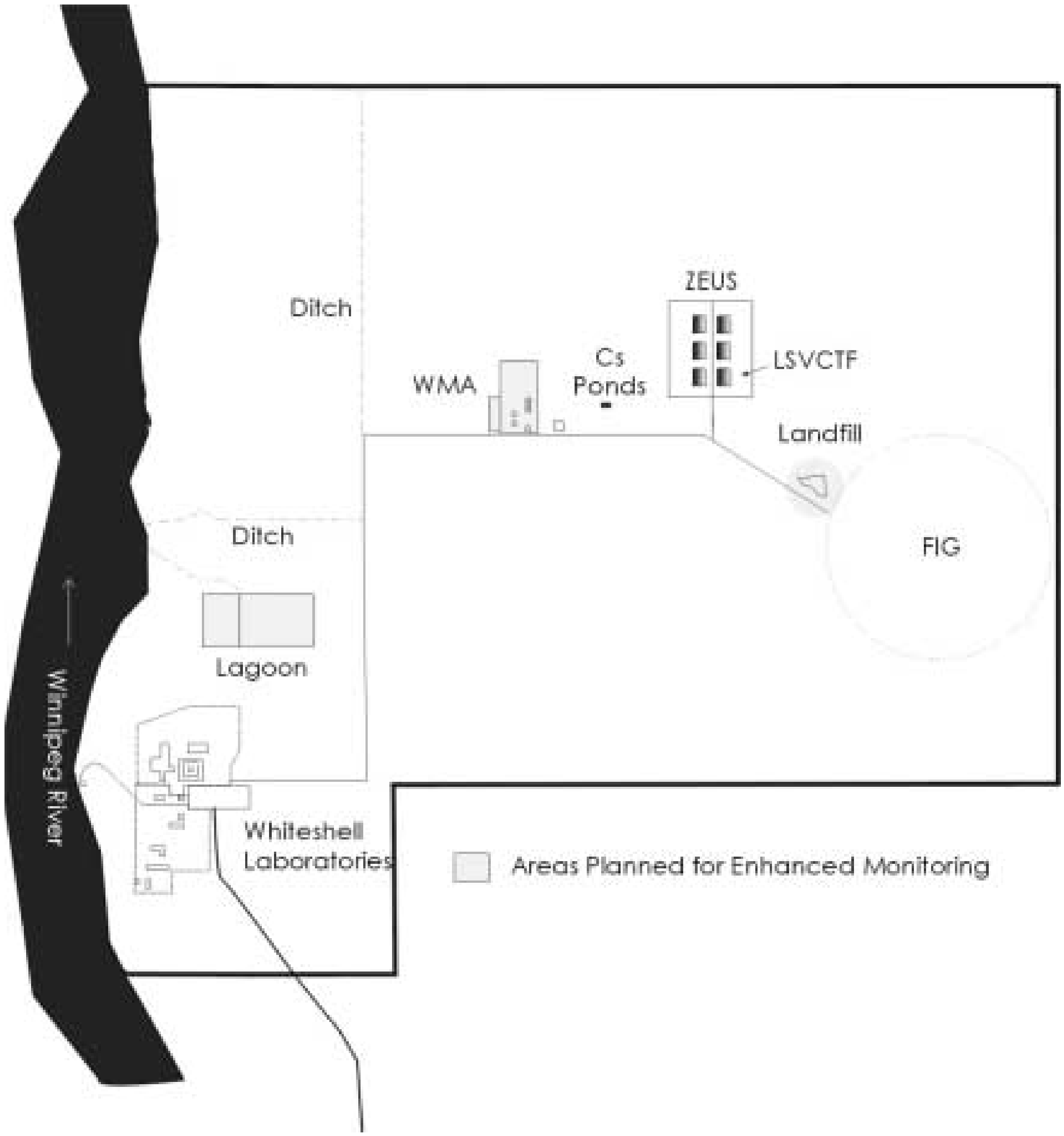
A post-decommissioning monitoring program will be established for those areas where a potential need is identified, such as in remediated sites, or in areas such as the Waste Management Area where low-level radioactive materials remain in-situ. The degree of monitoring and surveillance established for each area will be commensurate with radiological hazards or other hazards.

While baseline information is available with respect to most of the decommissioning activities to be undertaken, in some circumstances, baseline information may need to be gathered in order to define and carry out follow-up activities. One such example is the Winnipeg River, where an investigation of the river around and downstream of the outfall has been carried out as part of the CSR (See Appendix B.1).

A further area where some baseline work will be necessary during decommissioning is for air quality parameters affected by decommissioning activities. Airborne dust is the principal issue here; however, in order to properly interpret the data, meteorological data will also be needed. This aspect is discussed in the next section.

In addition, there are three further areas where additional follow-up monitoring can be envisaged at this time. The first is the waste management area where a special investigation to characterize the potential pathways for movement to the surface or laterally was carried out in the fall of 2000. (See Section 4.3.1 for a brief description of the program and the results to date) Although they are not considered to represent a hazard, for precautionary reasons, some follow-up monitoring is also proposed for the inactive landfill and the sewage lagoon. Each of these three areas is shown on Figure 9.1.

Figure 9.1
Affected Lands – Follow-Up Monitoring Program Map



The key disciplines required to carryout the Monitoring and Surveillance activities at the site are security, radiation protection, environmental monitoring and building/infrastructure maintenance staff. Fire fighting is also required but will likely be provided on a local community sharing basis. AECL will maintain adequately trained resources in each of these areas consistent with carrying out the elements of the Monitoring and Surveillance plans defined for the facility interim end states and the remaining operational support facilities.

9.5.1 Follow-Up Monitoring for Air and Meteorology

The strategy for air quality monitoring is premised on the concept that there are two monitoring states namely:

"Dormant", "Stand-by" or "Waiting" State

- This state occurs during a monitoring and surveillance period when decommissioning activities are limited.

"Active" State

- This state occurs during a period of decontamination or decommissioning. Activities likely to occur during this state include digging of soil, sandblasting buildings and demolishing buildings.

During the "dormant" state, the following is proposed:

- monitor once per season for air quality parameters of concern (dust, PM_{10}, radionuclides);
- monitor continuously for meteorological parameters (wind speed, wind direction, temperature, rainfall); and
- monitor at current locations (i.e. where there are existing state monitoring stations only).

During the "active" state, it is proposed to monitor:

- air quality parameters of concern (program to suit the activity involved);
  - dust, PM_{10}, radioactivity – 24 hour averages;
  - odour – trained nose on-site during the process;
- monitor continuously for meteorological parameters (wind speed, wind direction, temperature, rainfall); and
- monitor around the active area at upwind (one monitor) and downwind (3 monitors at various distances) locations.

It is also suggested that there be a review or audit after the first demolition projects. This audit would:

- review and analyze all monitoring data from the previous year;
- review all monitoring activity and add/subtract monitoring tasks for future monitoring as appropriate;
- review the methodology being used and adjust for future monitoring if necessary; and
- review parameters being monitored against the issues-of-the-day and adjust future monitoring requirement as necessary to address any new issues.

The reports would be prepared annually and/or after each "active" cycle, whichever comes first.

9.5.2 Follow-Up Monitoring Waste Management Area

In the fall of 2000, a program of trench cover sampling and coring adjacent to the trenches was carried out to confirm the hypothesis that there is no (significant) upward or lateral migration from the trenches. As noted earlier, a detailed description of this program and its results can be found in Appendix C.

A part of this investigation was the evaluation of hydrographs from the WMA area to confirm that the area is, for the majority of the time, a water discharge zone as originally concluded by investigators from the University of Waterloo. Part of the follow-up program will be the annual evaluation of the key hydrographs and evaluation of any potential changes to the flow pattern.

A further element of the follow-up program will be the installation of a few groundwater quality wells which will be established in key locations close to the waste trenches. The locations and monitoring details for these wells will be established following a data quality objectives protocol and discussions with the CNSC. Information from the ongoing environmental monitoring programs noted in Section 9.3 and the results of the recent investigations (Appendix C) in the trench area will be considered in developing the details of this program.

As discussed elsewhere in this document (Section 4.3.1), selective removal of certain trenches or elements of certain trenches is contemplated. In anticipation of at least some partial relocation, a plan will be developed to characterize the wastes at the time of relocation in order to strengthen the understanding of the basis for the waste inventory which has been developed from historic records. This sampling/characterization plan will be developed as part of the planning for selective trench relocation through a data quality objectives protocol and reviewed with the CNSC prior to implementation.

Confirmation of in-situ disposal of LLW as the final end state will be subject to regulatory review and approval. The safety case will be prepared to address all the basic requirements applicable to the long-term aspects of radioactive waste disposal. Those aspects are currently documented in CNSC Regulatory Policy R-104. The basic requirement is to minimize the burden on future generations and to protect the environment and human health. The maximum acceptable risk is 10^{-6} fatal cancers and serious genetic effects in a year. For the WMA trench environment a control period of up to 200 years (the period required for ^{90}Sr and ^{137}Cs to decay to background) is required. The data required to support the safety case for the final end state will be collected through the updated follow-up monitoring program. The safety case will be supported by an environmental assessment.

9.5.3 Follow-Up Monitoring for Inactive (Non-Radioactive) Landfill

The inactive (non-radioactive) landfill was placed into operation to manage non-radioactive and non-hazardous wastes, excluding food wastes. The landfill is less than 10 m in height and covers an area of less than 1 ha.

The landfill is located at a high point in the local terrain approximately 2 km east of the main site immediately north-west of the FIG (Figure 9.1). The surficial geology in this area is mainly sand

and gravel which is underlain by the following units: lacustrine clay; clayey-silty-sand till; bouldery gravel; and bedrock. The surficial geology is illustrated in Figure 5.13 and in cross-section in Figure 5.14. The landfill is located in a recharge zone and water from the landfill moves either toward the Winnipeg River (located 2.3 km to the west) or northeast towards a large black spruce and sphagnum bog.

Typical materials managed in the landfill include plastic, paper, wood, cardboard, glass and building materials. There is some possibility, however, that the landfill site may still have some radioactivity associated with instances of inadvertent placement of radioactive materials associated with industrial waste deposited in the area, although radioactive materials have been removed from the landfill and any resultant contamination has been remediated. Gross alpha and beta activity has been monitored at the periphery of the landfill for several years to ensure these actions are effective and will continue as required.

The landfill will remain fully operational for Phases 1 and 2. A plan for remediation of the landfill will be developed during Phase 2 and an environmental evaluation will be carried out to provide input to the remediation plan.

During Phase 1, monitoring of gross alpha and beta activity will continue. Monitoring will be conducted both at the periphery of the landfill and on the materials to be placed in the landfill, to ensure no further inadvertent contamination of the landfill with radioactive or hazardous materials occurs.

Due to the relatively permeable nature of the surficial sediments on which the landfill is located, and the fact that the landfill is located in a groundwater recharge area, there may be a need to monitor groundwater up and downgradient of the landfill to ensure the groundwater is not impaired such that loadings to the receiving environment are unacceptable. The details of such a plan will be developed as part of the Phase 2 remediation plan. Determination of monitoring well locations to ensure adequate monitoring and characterization of potential contamination from the site will likely involve a phased hydrogeological investigation. Any groundwater that is sampled should be analyzed for selected key radiological and non-radiological parameters similar to those being monitored in the groundwater around the WMA, in addition to standard parameters of interest with respect to a non-hazardous landfill.

9.5.4 Follow-up Monitoring for Sewage Lagoon

The sewage lagoon system consists of a primary and a secondary lagoon located 150 metres east of the Winnipeg River. The lagoons are constructed from low permeability clay embankments, which have been placed on a prepared clay surface. Underlying natural glacial deposits in the area consist of relatively low permeability silt, lacustrine clay, and clay-till deposits overlying a thin sandy layer which is itself underlain by bedrock, as illustrated in Figure 5.13 (Section 5.4.3).

Currently water is released from the facility every spring and fall to the Winnipeg River through a drainage channel from the secondary lagoon. Discharged water is monitored for the following non-radiological parameters: BOD_5, fecal coliform, pH, total phosphorus, conductivity, total suspended solids, phenolics, oil/grease, chromium, copper, iron, lead, nickel, zinc and mercury.

Discharged water is also monitored for the following radiological parameters: gross beta, gross alpha, gamma spec liquid, gamma spec dry and ^{90}Sr. The monitoring is conducted to confirm compliance with regulatory limits guidelines, to provide verification of the facility operation and to provide public assurance of compliance.

During Phase 1 and early Phase 2, the sewage lagoon will remain fully operational and the existing effluent discharge monitoring program will continue unchanged. In preparation for remediation of the lagoon system, an environmental evaluation will be conducted to determine the effects of the system, if any, on local groundwater and the Winnipeg River. This evaluation will initially require the installation of several (3 to 4) groundwater monitoring well nests, one of which will be located upgradient (to the east) of the lagoon system in order to determine groundwater quality prior to any effects from the lagoon system. The remaining monitoring well nests will likely be installed immediately downgradient of the site (to the west) between the lagoons and the Winnipeg River. Further monitoring programs for the decommissioning and post-decommissioning periods will be developed as required based on the proposed investigations and the remediation plan to be developed for the site.

9.6 FACTORS AFFECTING SCOPE OF MONITORING

Monitoring requirements will change in terms of frequency, duration and type over the course of decommissioning and following the completion of decommissioning. These changes will reflect not only changes in regulatory requirements and technological advancements but also the characteristics of the effects being monitored. Air quality monitoring, for example, will have only relatively short-term monitoring requirements because air quality generally is only affected during construction/ demolition related activities. In addition, the type of air quality monitoring will depend on the specific activity being undertaken; remediating contaminated interior spaces requires a different type and scale of air quality monitoring than that required during demolition.

The frequency and type of monitoring will continue to be evaluated over time. Monitoring will be adjusted to reflect findings from the monitoring activities. Cessation of a monitoring activity will occur once it can be shown that an effect has stabilized or has been reduced to a level where it is no longer considered significant by regulatory or other standards such as community concerns. Any modifications to the monitoring program will be communicated to the CNSC.

In the event that an unanticipated effect develops from the decommissioning activities, special surveys would be developed to assess and monitor the effect. Appropriate mitigation measures would evolve from the monitoring and surveying activities.

9.7 REPORTING

The Whiteshell Laboratories' licence requires that AECL submit to the CNSC an annual report for each calendar year summarizing the results of monitoring of radiation exposures to personnel at the site, the results of monitoring of radioactive materials in airborne and liquid effluents from the site and the results of environmental monitoring at and around the sites.

Reporting measures during decommissioning activities will follow the requirements of the regulatory bodies in addition to AECL's policy on reporting. Regular record keeping will be undertaken and include maintenance of hard copies of all monitoring reports, manuals and procedures for care and maintenance and contingency plans. A complete set of historical documents will also be maintained by AECL or other agency, as appropriate. Records may include all or some of the following:

- annual reports;
- transition monitoring-transition assessments; and/or
- background and reference studies.

9.8 AUDITING

Auditing is an independent verification of AECL's environmental monitoring programs. Auditing at Whiteshell Laboratories takes place at AECL's Safety Review Committee's discretion and/or at the CNSC's discretion. Options for auditing include:

- self auditing;
- public environmental review committee to oversee the long-term follow-up activities for the site; and
- reporting of an independent auditor to the CNSC.

Actual responsibility for ensuring that appropriate follow-up activities are undertaken will lie with the CNSC or other designated agencies.

9.9 PUBLIC ADVISORY COMMITTEE

AECL supports the idea of a Public Advisory Committee which could include members of the public, First Nations, appropriate government agencies and other stakeholders. This committee could make recommendations on the type, extent and frequency of monitoring activities on an on-going basis. It could also review monitoring results, and make recommendations on modifications to the decommissioning program and to mitigation measures, where necessary. Terms of reference for formation of the Public Advisory Committee require consultation with the local community and will be undertaken early in Phase 1.

9.10 MONITORING RESPONSIBILITY

AECL is responsible for the decommissioning activities and on-going monitoring of the project. AECL is committed to ensuring that the funding to meet the Whiteshell Laboratories decommissioning requirements is identified as a component of the segregated appropriation for decommissioning treasury board.

10.0 PUBLIC CONSULTATION

10.1 OVERVIEW

A public consultation plan was designed to fully satisfy the *Canadian Environmental Assessment Act's (CEAA)* requirements by providing opportunities for people interested in the proposed decommissioning program to learn about it and comment on it. It was also designed to establish long-term relationships with stakeholders, First Nations and interested members of the public that would endure beyond this environmental assessment phase and extend throughout the entire decommissioning program. A number of the initial communication and consultation activities were designed to communicate information about the proposed decommissioning program and environmental assessment process and to seek input into the proposed program. The consultation program was designed to meet the different informational needs of the public, stakeholders and First Nations.

The public consultation plan and program are described in detail in Sections 10.2 and 10.3. Issues raised throughout the process are presented in Section 10.4. The First Nation consultation program and issues raised in the program are described in Section 10.5. Background material is contained in Appendix E. Appendix E.1 contains a record of AECL's ongoing communications program with stakeholders. Appendix E.2 contains a record of public consultation on the Comprehensive Study Report (CSR) including a summary table of all contacts and Appendix E.3 contains copies of all public information material. Appendix E.8 contains a record of the First Nation consultation program including a table of all contacts. All issues and questions have been responded to in one of three ways: addressed in the CSR, addressed with a response from AECL or to be addressed through a follow-up program.

10.2 PUBLIC CONSULTATION PLAN

10.2.1 *CEAA* Requirements

The specific requirements of *CEAA* regarding public participation in a CSR include consideration of public comments by the Responsible Authority, public notification and consideration of public comments by the Canadian Environmental Assessment Agency and public notification concerning follow-up programs. There is no specific requirement of *CEAA* to consult with the public during an environmental assessment at the self-assessment stage; however, *CEAA* clearly supports the principle of an early and meaningful public consultation. The intent of the following public consultation plan is to comply with and where possible exceed the requirements of *CEAA*.

10.2.2 Objectives

The objectives of the public consultation plan relating to the *CEAA* component were to:

- inform stakeholders, potentially interested parties, First Nations and the public about the proposed decommissioning program and the environmental assessment process;

- introduce the decommissioning team and the environmental assessment team to stakeholders, interested parties, First Nations and the public;
- develop on-going relationships that would be important throughout the environmental assessment process, closure and decommissioning phases;
- identify issues and concerns early in the environmental assessment process and address them;
- provide input to the environmental assessment team on VECs and VSCs;
- gauge interest and level of concern; and
- assist in defining mitigation measures and follow-up programs.

10.2.3 General Strategy and Approach

The Whiteshell Laboratories operation has developed an ongoing broad communication strategy to ensure that the general public has access to information on the proposed decommissioning program. More focused consultation efforts were directed at stakeholders, First Nations and potentially interested parties. AECL recognized that relationship building was an important aspect of the consultation program and that different groups and interests would require different consultation approaches. AECL also refined its ongoing communication program.

AECL recognized that many issues surrounding the closure of Whiteshell Laboratories were of a socio-economic nature and were being addressed through other processes, whereas the CSR dealt with the decommissioning activities which result from the permanent shutdown of nuclear facilities and other associated facilities and lands. For clarity, AECL sought the Canadian Environmental Assessment Agency's comment on the exclusion of socio-economic aspects of the closure of Whiteshell Laboratories from the scope of the CSR. The Agency confirmed that these aspects could be excluded from the CSR. Communication materials were developed accordingly. Nevertheless, issues that were raised throughout the consultation process and fell outside the scope of the CSR were duly recorded.

The following discussions are related primarily to the *CEAA*-related environmental assessment public consultation plan which is an add-on and complementary to the on-going Whiteshell Laboratories' broad communication program.

10.2.4 Identification of Interests

One of the first tasks in designing the *CEAA*-related public consultation program was to identify the potential interests in the proposed project. The following interests were identified as potentially affected or interested parties:

- municipal governments
- elected federal and provincial officials
- First Nations/First Nation organizations
- aboriginal associations
- cottage associations
- tourism organizations
- environmental organizations
- nature/wilderness organizations
- conservation associations
- birders
- current AECL employees
- tenants at Whiteshell Laboratories

- area businesses
- community organizations
- community associations
- economic development organizations
- area residents
- cottagers
- regional resource industries
- land development group
- industry associations
- provincial government officials
- federal government officials
- health/education associations
- fishers, hunters, trappers, wild rice harvesters

Based on this list of interests, organizations were identified to be targeted in the communication and consultation program. The general public was recognized as a broad group with no specific interest in the proposed program but who may wish to become involved.

10.3 *CEAA*-RELATED PUBLIC CONSULTATION PROGRAM

10.3.1 Overview of Activities and Timing

Techniques that were selected for communicating information and obtaining feedback and input included newsletters, open houses, presentations, key-person interviews, meetings and information sessions. Throughout the public consultation process, identification and comments on valued ecosystem (VECs) and social components (VSCs) were also sought. An interview process was also established to identify public opinions on VECs and VSCs for input to the project team. AECL recognized that public involvement is a dynamic process and undertook an evaluation of interest and activities as the consultation program progressed.

An overview of activities carried out during the *CEAA*-related public consultation and the timing of these activities is presented in Table 10.1.

Table 10.1
Public Consultation Activities

Activities	1999	2000
Key-person Interviews	July-September	
Interviews (VECs/VSCs)	July-August	
Newsletter	October	June
Letters to Contact List	October	June
Open House	October	
Information Sessions	October	June
Follow-up Presentations	November	April

10.3.2 Presentations to Municipal Councils

AECL conducted a series of briefings for local municipal officials in winter of 1998/1999 to inform them of closure and decommissioning activities. These briefings were undertaken to advise area municipalities of AECL's notification to the Canadian Nuclear Safety Commission (CNSC) of AECL's intention to decommission the Whiteshell Laboratories site and to outline the proposed strategy and regulatory framework. An update was provided in June 1999 to the same municipalities except the L.G.D. of Pinawa which indicated that it did not require a briefing at that time. These briefings are part of AECL's routine communications and will continue throughout the decommissioning program.

10.3.3 Presentations to Interested Organizations and Individuals

Briefings for elected federal and provincial officials, Manitoba Conservation (formerly Manitoba Environment) and the media were undertaken in the winter of 1998/1999. These briefings were undertaken to advise interested parties of AECL's notification to the CNSC of AECL's intention to decommission the Whiteshell Laboratories site and to outline the proposed strategy and regulatory framework. An update was provided to Manitoba Conservation and other provincial departments in July 1999. There was also a briefing by AECL at Whiteshell Laboratories to the provincial Minister of Industry, Trade and Mines in November 1999 as part of AECL's on-going briefings. AECL will provide additional briefings at appropriate junctures in the environmental assessment process and throughout the decommissioning program.

10.3.4 Key-Person Interviews

Key-person interviews are a useful consultation tool for soliciting background information from key people about their communities and their concerns respecting a proposed undertaking. Interviews were conducted with the following people: Administrator, L.G.D. Pinawa; Mayor, L.G.D. Pinawa; President, Pinawa Community Development Corporation; Co-ordinator, Pinawa Implementation Committee; and Reeve, R.M. Lac du Bonnet.

10.3.5 Newsletter

A newsletter (No. 1 October 1999) was prepared to facilitate understanding of the proposed decommissioning program and environmental assessment process and to invite people to participate in the environmental assessment process. This newsletter was distributed on October 5 and October 6, 1999 to 7,627 post boxes in the Regional Study Area. The newsletter announced the date for an open house at Whiteshell Laboratories and provided contact information. Copies of the newsletter were also placed in Manitoba Conservation's Resource Centre in Winnipeg. A copy of the newsletter is provided in Appendix E.3.

A follow-up newsletter (No. 2 June 2000) was prepared to provide a status update on the planning of the Whiteshell Laboratories Decommissioning Project. This newsletter was distributed June 5 and June 6, 2000 to 7,627 post boxes in the region. The newsletter provided responses to issues and questions raised during the consultation process. It also invited people to discuss the project at information sessions in area communities. Copies of the newsletter were also placed in Manitoba Conservation's Resource Centre in Winnipeg. A copy of the newsletter is provided in Appendix E.3.

10.3.6 Letters to Potentially Interested Organizations/Persons

A contact list was developed based on the initial identification of potentially interested organizations and persons. The list was used to notify organizations by letter of the consultation process that was underway in 1999 and to invite them to an open house. Further, organizations that were not involved in regular briefings were asked if they would like to have a presentation made to them on the proposed decommissioning program and environmental assessment process. Copies of the newsletter were also distributed to this contact list. One organization responded with a request for a presentation. The contact list is presented in Table 10.2. A copy of the letters is provided in Appendix E.4.

Organizations were contacted in June 2000 to advise them of the status of the decommissioning project and to invite them to attend drop-in information sessions in area communities. A copy of the second newsletter was also provided. A copy of the letters is presented in Appendix E.4.

Table 10.2
Contact List

Nature and Wildlife Associations and Environmental Organizations
- Manitoba Wildlife Federation
- Manitoba Trappers Association
- Manitoba Recreational Canoeing Association
- Manitoba Naturalists Society
- Manitoba Model Forest Inc.
- Manitoba Eco-Network
- Canadian Parks and Wilderness Society
- World Wildlife Fund
- Heather Game & Fish

Whiteshell Laboratories Tenants
- ACSION Industries Incorporated

Regional Resource Industries
- Pine Falls Paper Company Inc.
- Tanco

Cottage Associations
- Lorell Cottage Owners Association
- Black Bear
- Leisureland
- Cape Coppermine
- Bonnet Oaks
- Fishers Grove
- Grosdin Point
- Lee Side Recreation Co-op
- Wendigo Association
- Arnold's Campers Co-op
- Lee River Falls Holdings

Municipal Governments
RM of Alexander
RM of Whitemouth
RM of Brokenhead
Town of Beausejour
RM of Lac du Bonnet
Town of Lac du Bonnet
LGD of Pinawa

Community and Economic Development Organizations
- Pinawa Chamber of Commerce
- Lac du Bonnet Chamber of Commerce
- Economic Development Authority of Whiteshell
- Winnipeg River Brokenhead Community Futures Development Corp.
- Pinawa Community Development Corporation
- Eastman Regional Development Corporation Inc.
- Pinawa Land Development Group
- Pinawa Implementation Committee
- Workforce Adjustment Centre

First Nations and Aboriginal Associations
- Sagkeeng First Nation
- Brokenhead Ojibway First Nation
- Treaty 3 First Nations
- Manitoba Metis Federation

Health/Education Associations
- North Eastman Health Association
- School District of Whiteshell

Community Associations
- Pinawa 50 Plus Club
- Pinawa Recycling Inc.
- Pinawa Lion's Club

Elected Federal and Provincial Officials
- MLA - La Verendrye
- MLA - Lac du Bonnet
- Senior federal Minister (Hon.Lloyd Axworthy)
- Secretary of State for Western Economic Diversification
- Member of Parliament – Provencher

Government Officials
- Chairperson –TAC, Manitoba Environment (now Conservation)
- Assistant Deputy Minister, Manitoba Environment (now Conservation)
- Director, *CEAA* Regional Office

Industry Associations
- Canadian Nuclear Association

10.3.7 Open House

The major consultation event related to *CEAA* was an open house that was hosted by AECL at Whiteshell Laboratories on Saturday, October 16 1999 from 10 a.m. to 4 p.m. This session provided an opportunity for interested persons to engage in discussions with the decommissioning team and the environmental assessment team. Tours of some of the facilities to be decommissioned including the Waste Management Area and Concrete Canister Storage Area were organized for those who wished to take them. Notification of the open house occurred via newsletters and ads in the regional newspapers.

AECL EACL

We invite you to attend the
Whiteshell Laboratories Open House
October 16, 1999
10 a.m to 4 p.m

Location: Whiteshell Laboratories off Highway 211
(accessed via Highway 11)

Atomic Energy of Canada's Whiteshell Laboratories is being shut down and will be decommissioned. The decommissioning plan is undergoing an environmental assessment. Public input is important for the environmental assessment.

Discuss the plan with the decommissioning and environmental assessment team. View displays, take tours and provide us with your feedback.

For more information, please call (204) 753-2311 ext. 2294

Storyboards were displayed on multi-screen displays in the Whiteshell Laboratories' cafeteria. The storyboards discussed the following topics:

- Purpose of the Open House.
- Whiteshell Laboratories-Historical Highlights.
- Regulatory Framework.
- Future Availability of Land.
- What is Decommissioning?
- Decommissioning Alternatives.
- Decommissioning Strategy.
- Decommissioning Scope.
- Decommissioning Activities.
- Waste Management.
- Environmental Protection.
- Health and Safety Programs.
- Regional and Local Setting.
- Valued Ecosystem and Social Components.
- Study Areas.
- Environmental Assessment Process.
- Next Steps in the Environmental Assessment Process.
- AECL's Commitments.

Members of AECL's decommissioning team and the environmental assessment consulting team were stationed at the various displays to respond to questions and assist with understanding the decommissioning program. Comment sheets were available to be completed at the open house or mailed or faxed back. A total of 10 comment sheets were returned. Questions raised at the displays or on tours were recorded.

Attendance at the open house was 121. Ten tours were conducted and 80 people took the tour. Table 10.3 shows the distribution of people who attended the open house and communities they live in.

Table 10.3
Breakdown of Attendance at Open House Whiteshell Laboratories
16 October 1999

Location	No.	Location	No.
Pinawa	57	Beausejour	6
Seven Sisters	9	Pine Falls	1
Lac du Bonnet	23	Whitemouth	2
Winnipeg	15	Elma	3
Garson	4	Sagkeeng First Nation	1

10.3.8 Information Sessions

AECL EACL

A display on the Whiteshell Laboratories decommissioning program will be set up in the following communities.

You are invited to drop in between 4p.m. and 6p.m.

Oct 21	**Beausejour**	**Town Office , 639 Park**
Oct 25	**Pinawa**	**Whiteshell Centre**
Oct 26	**Whitemouth**	**Community Hall**
Oct 28	**Lac du Bonnet**	**Community Center**

Members of the Whiteshell Decommissioning and Environmental Assessment teams will be on hand to answer your questions and obtain feedback.

For more information,
please call (204) 753-2311 ext 2294 or 1-800-665-0436

Information sessions were held in October 1999 following the open house as an opportunity for individuals who may not have been able to attend the open house. Some of the display panels were selected for display at these information sessions. They were staffed by three AECL decommissioning team members and one or two environmental assessment team members. Communities were notified with an ad in regional newspapers, posters in communities and a phone call to the municipal administrators. The information sessions were held from 4 p.m. to 6 p.m. in Beausejour, Pinawa, Whitemouth and Lac du Bonnet. In total, 19 people attended these information sessions. No comment sheets were completed.

A second round of information sessions was held in June 2000 in the same communities. These information sessions were held to provide an opportunity for people to discuss responses to issues and questions raised during the first round of consultations. New display material was developed to update the public and respond to issues raised. Communities were notified with ads placed in regional newspapers, posters sent with letters and information in the newsletter. In total, 24 people attended the information sessions. No comment sheets were completed.

10.3.9 Scoping of Valued Ecosystem and Social Components

An interview process was one of the tools used to develop a list of what members of the public considered to be valued ecosystem components. Four experts and three lay people were interviewed. In addition to the interview process, the open house, key-person interviews, information sessions and First Nation consultation process were used to obtain opinions of what individuals considered to be valued ecosystem and social components.

10.3.10 Information Availability

A handout of the display panels was made available at the open house and the October 1999 information sessions and placed on the public registry. A copy of the handout is provided in Appendix E.3. The report Whiteshell Laboratories Detailed Decommissioning Plan, Volume 1-Program Overview (Helbrecht 1999) was made available to interested persons at the open house and information sessions. A draft of the scope of assessment document written by the CNSC was made available to the public for comment in early November 1999. The reports were also made available by request through AECL. The draft CSR Revision 1 was distributed by the CNSC for technical review to federal and provincial departments and agencies in April 2000. At that time, AECL provided a copy as a courtesy to 7 municipal councils, the Whiteshell Laboratories/Provincial Leaders Committee and the Sagkeeng and Brokenhead First Nations. A copy of the transmittal letters is provided in Appendix E.4. The draft CSR will be made available to the public by the CNSC. When completed, the CSR will be released as a final report and placed on the Public Registry by the Responsible Authority for public review.

10.3.11 Web Site and Toll-Free Number

AECL's web site, e-mail address, local telephone number and toll-free number were advertised in both newsletters. A public affairs staff person at Whiteshell Laboratories managed the local information requests. As of December 2000, AECL had received nine telephone calls, four e-mails, one information pick-up and one letter. Seven of these were requests for a copy of the Decommissioning Plan.

10.3.12 Public Registry

The Canadian Environmental Assessment Agency operates a public registry and the *CEAA* requires that the Responsible Authority, in this case, the CNSC, set up a file and maintain it on the registry for all federal comprehensive study projects. The CNSC registered the Whiteshell Laboratories Decommissioning Project on the *CEAA* public registry and also made available information on its own web site. Manitoba Conservation established a public registry at the Pinawa Library, the Winnipeg Centennial Library and at its Winnipeg Regional Offices at 123 Main Street.

10.3.13 Government Contacts

A provincial Technical Advisory Committee (TAC) for the Whiteshell Laboratories Decommissioning Project was formed to undertake a technical review of the decommissioning program. The TAC is an advisory body to the Director and the Minister of Conservation and includes experts from within government as well as external agencies. The TAC is chaired by Manitoba Conservation. The regional Canadian Environmental Assessment Agency office is represented on the TAC. TAC meetings were held in June and October 1999. The CNSC made a presentation at the June and October meetings and AECL made a presentation at the October meeting. Other briefings of provincial officials occurred in July with the Chair of the TAC and the Assistant Deputy Minister of Manitoba Conservation. The TAC reviewed the draft CSR Revision 1 and forwarded comments to the CNSC.

10.3.14 Community/Provincial Leaders Committee

Another forum for addressing issues related to closure and decommissioning is the Whiteshell Laboratories Community/Provincial Leaders Committee that was established in December 1998. The purpose of the Committee is to develop a strategy for addressing the regional effects of the closure of Whiteshell Laboratories. The Committee is co-chaired by the MLA for Lac du Bonnet and the Mayor of the L.G.D. of Pinawa. The Committee membership consists of the School District of Whiteshell; the Rural Municipalities of Lac du Bonnet, Whitemouth, Brokenhead; the Towns of Lac du Bonnet and Beausejour; the Economic Development Authority of Whiteshell; the Departments of Industry Trade and Tourism, Rural Development and Conservation; and the MLA for La Verendrye.

The Committee's April 30, 1999 report identified four main issues with respect to the regional and provincial impacts of the closure of the Whiteshell Laboratories. Three of these issues fall outside AECL's mandate or the scope of the CSR and the fourth issue relates to decommissioning. The Committee also developed a set of 20 recommendations for the decommissioning program. AECL has responded to these recommendations as outlined in Table 1 in Appendix E.5. AECL contacted the Committee by letter in November 1999 to determine if it would like a briefing with the decommissioning team and environmental assessment team. A letter was sent on January 31, 2000 advising the Committee that responses to its 20 recommendations had been prepared and included in Appendix E.5. AECL offered the Committee an opportunity to discuss these responses at a meeting. A meeting was held on April 8, 2000.

10.4 RESULTS OF PUBLIC CONSULTATION

A number of issues were raised in the public consultation process. These issues were recorded from interviews, open house comments, briefings and responses to the CNSC scoping document. As well, comments were provided on the draft CSR Revision 1 by the Community/Provincial Leaders Committee. For organizational and analytic purposes, the issues have been categorized and organized into tables.

Issues that were raised that are within the scope of the CSR are discussed below and presented in Table 10.4. Other issues that fall outside the scope of the CSR have been noted and responded to in Table 1 in Appendix E.6. AECL understands these to be important community issues and notes instances where other processes are responding to them. Questions and comments that were raised at the Open House that are not otherwise recorded as issues are noted in Table 1 of

Appendix E.7. Responses to these were given by AECL and environmental assessment consultants at the Open House.

Issues that were raised that are within the scope of the CSR have been categorized in the following manner:

1. Scope of decommissioning program.
2. Time frame.
3. Environmental effects.
4. Terrestrial biota/wildlife effects.
5. Aquatic biota/fish effects.
6. Land/resource use.
7. Health and safety.
8. Environmental monitoring.
9. External events.
10. Security.
11. Future staffing requirements.
12. Site characterization.
13. Storage.
14. Long-term communications.
15. Financial assurances.
16. Planning considerations.
17. Acceptability of plan.

Table 10.4
Issues/Comments Raised in the Public Consultation within the Scope of the CSR

ISSUES/COMMENTS	STATUS
Scope of Decommissioning Program	
Why not mothball the Hot Cells and the IFTF complex and not decommission them, both as a national asset and until the question of the Canadian Neutron Facility can be debated?	**Addressed in CSR:** The business decision to discontinue research at Whiteshell Laboratories creates the requirement to decommission the nuclear facilities and the site to: Produce a safe monitoring and surveillance state until all wastes can be removed to disposal facilities; Reduce the cost of maintaining the site; and Meet all regulatory requirements for shutdown of nuclear facilities. Furthermore, mothballing of facilities to the above requirements generally precludes any further use. **Outstanding Issues:** None.
Why not consider keeping the WR-1 building and Building 300 for future use?	Same as above.
It is not acceptable to the community to not demolish the Hot Cell Facility and Building 300 until a disposal facility is available.	**Addressed in CSR:** AECL notes that conflicting community views have been expressed on the timing for demolition of these buildings. AECL plans to achieve and maintain a safe monitoring and surveillance state until disposal becomes available. The safest way to manage non-mobile hazards in these facilities is with the current facility and building structures until disposal options become available. All potentially mobile hazards will be addressed prior to placing the facilities in a safe monitoring and surveillance condition. **Outstanding Issues:** None.

ISSUES/COMMENTS	STATUS
We insist that the hot cells should remain serviceable until after all of the repackaging and storage of high and intermediate-level decommissioning wastes is complete.	**Addressed in CSR:** Hot cells will be in service until no longer needed. Packaging/handling of high level wastes may require local shielded equipment in the WMA. AECL's analysis of the decommissioning requirements indicate that the SF is required only to process active liquid wastes currently stored in the WMA and the SF. The facility will be decommissioned after that need has been met and local shielded structures will be used for repackaging WMA wastes where required. Transfer of wastes to the Shielded Facility is not economic nor an efficient processing option. **Outstanding Issues:** None.
There is a concern about future uses of the site being outside the scope of the environmental assessment.	**Addressed in CSR:** Any new site business uses or activities are expected to be subject to the environmental assessment requirements for the proposed activity. Section 8.0 of the CSR which deals with cumulative effects, addresses this issue. **Outstanding Issues:** None.
Time Frame	
The Whiteshell site must be fully decommissioned in less than 20 years and not defer costs to future generations.	**Addressed in CSR:** AECL believes the preferred alternative of a final end-state by 2060 is advantageous for a variety of reasons. Although there is a national policy for disposal of nuclear waste, permanent disposal space for Whiteshell Laboratories waste is not expected to be available until 2025 for LLW and 2050 for HLW. The proposed plan optimizes the use of existing engineered structures and building envelopes to control nuclear liabilities. The plan takes advantage of the reduction in activity of key radionuclides. This minimizes the exposure to workers/the environment, and the cost for protection of workers/the environment. The issue of double handling is avoided. For example, if a waste storage facility were currently available for HLW, it would have to be handled twice. First, it needs to be handled at Whiteshell Laboratories when being sent to the storage location. Then, it would need to be handled for a second time, when a permanent disposal location becomes available. The cost efficiency of this approach will be assessed and compared to other alternatives. **Outstanding Issues:** None.
The 60-year timeframe for decommissioning is unacceptable to communities.	**Addressed in CSR:** AECL understands the concern of communities and acknowledges different points of view. The proposed phased approach optimizes the timeframe relative to the existing life of buildings and storage structures, radioactivity decay and the availability of disposal facilities. **Outstanding Issues:** None.
The average person doesn't understand why a long time frame is contemplated and the argument needs to be made in terms that they understand.	**Addressed in CSR:** AECL acknowledges that the rationale for the long time frame may not be understandable to the average person and it will endeavour to communicate this in lay terms. **Outstanding Issues:** None.
There are a number of outstanding public issues, the principal one being AECL's intention to close up the site and not do any real decommissioning and decontamination until decades in the future.	**Addressed in CSR:** The amount of decommissioning that will occur during the first 10 years is substantial. While it is true that WR-1 will not be decommissioned for 50 years to allow for radioactive decay and to enhance safety, the decommissioning of other facilities will begin as soon as approval is given. Figure 4.4 summarizes plans for the management of liquid and solid waste and indicates that decommissioning including decontamination will begin as early as 2002. **Outstanding Issues:** None.
Long-term storage is unacceptable to communities.	**Addressed in CSR:** Groundwater monitoring around the WMA indicates no movement of radionuclides during the 35 years of operation. A safety assessment has been conducted to determine the long-term environmental acceptability of in-situ management of low-level waste. (Appendix C) **Outstanding Issues:** None.
Very little needs to be postponed for safety reasons.	**Addressed in CSR:** It is true that only WR-1 and some intermediate-level waste in the WMA benefit from radioactive decay over a deferment period. However, other safety considerations include minimizing overall radiation doses to decontamination staff by avoiding double handling of material. Whiteshell Laboratories' waste is currently in safe storage and will only be moved when national disposal facilities are available. **Outstanding Issues:** None.

ISSUES/COMMENTS	STATUS
AECL has also ignored the additional risks of leaving the radioactive materials in their present location for long periods.	**Addressed in CSR:** Additional information on the waste inventory, the trenches and the river sediments etc. and the associated risks has been provided in Section 5 and 6. In the case of WR-1, early decommissioning such as a 20-year time frame increases safety risks and is extremely costly especially given the unavailability of a national waste disposal facility. The risks of early decommissioning of WR-1 are outlined in Section 3.0. Regardless of how long the project takes, the site will remain under CNSC licence control and will be subject to appropriate monitoring to ensure people and the environment are adequately protected. **Outstanding Issues:** None.
We expect AECL to fully decommission the site in a continuous process in less than twenty years. A project with a sixty-year completion date can never be guaranteed.	**Addressed in CSR:** The CNSC will maintain full licensed control of the decommissioning project for as long as is necessary to ensure there are no unreasonable risks to people and the environment. The assessment has determined that a phased decommissioning approach over several decades will pose the least risk to people and the environment. **Outstanding Issues:** None.
AECL's strategy of deferring decommissioning is out of step with practices and safety considerations applied in other OECD countries.	**Addressed in CSR:** The policies for national waste disposal are set at the national level in all countries. Canadian policies and laws are being followed. Deferred decommissioning is practiced in virtually every OECD country. Even where waste disposal is already available, health, safety and environment priorities and funding priorities determine the immediate or early decommissioning requirements. When public and environmental safety is not a critical issue, deferment is routinely applied as an interim decommissioning step. **Outstanding Issues:** None.
The morality of deferring the immense costs of decommissioning the Whiteshell site to our grandchildren who had no benefit of AECL's existence is reprehensible.	**Addressed in CSR:** Many of the costs are being borne by this generation. Note also, that the benefits of the Whiteshell Laboratories research projects apply to more than one generation. **Outstanding Issues:** None.
The integrity of concrete canisters over the long term is questioned as is potential for radioactivity leaking out of the canisters.	**Addressed in CSR:** The life of the concrete canisters is expected to be at least 50 to 100 years. Twenty-five years of experience indicates no deterioration and AECL expects the actual life to be adequate until final disposal is available. The integrity of the canisters will be routinely assessed during the decommissioning program. Deterioration prior to fuel transfer would require construction of replacement canisters. **Outstanding Issues:** None.
Environmental Effects	
There is concern about potential contamination of the environment in general during decommissioning and over the longer term.	**Addressed in CSR:** The purpose of decommissioning is to mitigate, remove or reduce hazards. All work is conducted according to this principle. The general approach to assessing potential environmental effects is to investigate them through the site characterization activities, which are a component of the decommissioning program. Decommissioning activities related to all project tasks are evaluated in the CSR and where necessary, mitigation plans are developed or proposed. AECL will maintain environmental monitoring for the site for as long as wastes requiring management remain at the site. **Outstanding Issues:** None.
There is concern about downstream water quality.	**Addressed in CSR:** Residual contamination in river sediments was found to be small. In the most contaminated area, near the outfall, the inventory is a small fraction of the annual releases prior to 1985. Even if the entire inventory was released into the river, the incremental Cs-137 concentration would be negligible. **Outstanding Issues:** None.
There is concern about surface water contamination.	**Addressed in CSR:** AECL will maintain a comprehensive environmental monitoring program during the decommissioning program that will include surface water. Any indication of releases will be followed up immediately and corrective action undertaken. **Outstanding Issues:** None.
Terrestrial Biota/Wildlife Effects	

ISSUES/COMMENTS	STATUS
What are the potential impacts of decommissioning activities on wildlife?	**Addressed in CSR:** The environmental monitoring program includes analysis of road kill. Results indicate that the effect to wildlife from past operations has been negligible and no additional effects are expected from decommissioning activities. Remediation of contaminated land may disturb wildlife habitat but it would be very localized and of short duration. These areas are previously disturbed areas. Potential effects would be no different than if new development occurred on previously used site lands. **Outstanding Issues:** None.
There is potential for increased contamination during removal of waste from bunkers and tile holes in Phases 1 and 3.	**Addressed in CSR:** All work that includes the remediation of radioactive or industrial materials and hazards has the potential to spread contamination to the environment. AECL operates established and approved Radiation Protection, Occupational Safety & Health, and Environmental Protection programs that are designed to ensure the safety of workers, the public and the environment. These programs are in compliance with federal and provincial regulations, incorporate international standards and practices and are approved by the CNSC. Careful work planning is carried out using these program requirements and implemented using AECL's work permit system and pre-job briefings. During decommissioning, these programs will continue to be implemented and will be enhanced where uncommon or unique situations are addressed. This includes the use of engineering controls such as specially built enclosures to contain hazards during remediation and the use of specialized equipment designed to address these types of hazards (e.g. HEPA ventilated vacuum systems). **Outstanding Issues:** None.
There is the potential for disturbance of wildlife, increased contamination and destruction of habitat during Phases 2 and 3 remediation of contaminated lands.	Same as above.
Land/Resource Use	
There is the potential for increased contamination and sediment load during Phase 3 removal of active drain lines.	Same as above.
Aquatic Biota/Fish Effects	
There is the potential for increased contamination and sediment load during Phase 3 removal of active drain lines.	**Addressed in CSR:** All work that includes the remediation of radioactive or industrial materials and hazards has the potential to spread contamination to the environment. AECL operates established and approved Radiation Protection, Occupational Safety & Health, and Environmental Protection programs that are designed to ensure the safety of workers, the public and the environment. These programs are in compliance with federal and provincial regulations, incorporate international standards and practices and are approved by the CNSC. Careful work planning is carried out using these program requirements and implemented using AECL's work permit system and pre-job briefings. During decommissioning, these programs will continue to be implemented and will be enhanced where uncommon or unique situations are addressed. This includes the use of engineering controls such as specially built enclosures to contain hazards during remediation and the use of specialized equipment designed to address these types of hazards (e.g. HEPA ventilated vacuum systems). **Outstanding Issues:** None.
There is the potential for increased contamination, sediment load and habitat destruction during Phases 1 and 3 removal of river sediment.	**Addressed in CSR:** Residual contamination in river sediments was found to be small. In the most contaminated area, near the outfall, the inventory is a small fraction of the annual releases prior to 1985. Even if the entire inventory was released into the river, the incremental Cs-137 concentration would be negligible. **Outstanding Issues:** None.

ISSUES/COMMENTS	STATUS
Land/Resource Use	
There is the potential for increased contamination and sediment load during Phase 3 removal of active drain lines.	**Addressed in CSR:** All work that includes the remediation of radioactive or industrial materials and hazards has the potential to spread contamination to the environment. AECL operates established and approved Radiation Protection, Occupational Safety & Health, and Environmental Protection programs that are designed to ensure the safety of workers, the public and the environment. These programs are in compliance with federal and provincial regulations, incorporate international standards and practices and are approved by the CNSC. Careful work planning is carried out using these program requirements and implemented using AECL's work permit system and pre-job briefings. During decommissioning, these programs will continue to be implemented and will be enhanced where uncommon or unique situations are addressed. This includes the use of engineering controls such as specially built enclosures to contain hazards during remediation and the use of specialized equipment designed to address these types of hazards (e.g. HEPA ventilated vacuum systems). **Outstanding Issues:** None.
Health and Safety	
Some members of community lack confidence in future safety measures.	**Addressed in CSR:** AECL's health and safety programs are reviewed by the CNSC and will continue to be implemented during the decommissioning project. AECL will retain the responsibility for maintenance of the licence. AECL is committed to an ongoing communication program with area communities and stakeholders and will report on its health and safety program. **Outstanding Issues:** None.
There is a concern that a loss of hands-on knowledge is a risk to future worker and community safety.	**Addressed in CSR:** AECL has retained key individuals to develop and initiate its decommissioning program. AECL is committed to maintaining key people in its decommissioning team. Currently, AECL is recalling some former staff on a contract basis. There are standards and procedures that will be followed and future staff will be required to adhere to these standards and procedures. **Outstanding Issues:** None.
Will there be adequate fire fighting services?	**Addressed in CSR:** Yes. AECL's fire fighting capability is reviewed annually by the AECB and is subject to the Federal Fire Regulations and the National Fire and Building Code. Fire fighting capability at Whiteshell Laboratories will be maintained consistent with these regulations. **Outstanding Issues:** None.
What are the potential health effects from decommissioning?	**Addressed in CSR:** Decommissioning involves less activity than the operations phase of Whiteshell Laboratories. During operations, the estimated annual doses to the public have been, and continue to be, well within regulatory limits established by the CNSC. All releases and doses to the public will continue to be reported annually. **Outstanding Issues:** None.
How can people be assured that health and safety are protected?	**Addressed in CSR:** AECL is committed to an ongoing communication program with area residents to ensure they are informed of site activities and to respond to concerns that residents may have. **Outstanding Issues:** None.
Plan is clearly at odds with basic safety principles applied in other countries.	**Addressed in CSR:** The CNSC will not authorize the project to proceed until it is satisfied that it meets all of the relevant regulatory requirements. **Outstanding Issues:** None.
Environmental Monitoring	
There should be local input to the design of monitoring program.	**Addressed in CSR:** AECL supports the idea of a Public Advisory Committee. Local input into the design of the monitoring program could be accommodated through this mechanism. **Outstanding Issues:** A Public Advisory Committee will be considered in parallel with implementation of the decommissioning program.
Regular reporting of information to neighbouring communities would help alleviate concerns.	**Addressed in CSR:** AECL is committed to an ongoing communication program with neighbouring communities. **Outstanding Issues:** None.
The fact that there is off-site monitoring would imply that there are releases of concern to the environment.	**Addressed in CSR:** Off-site monitoring is undertaken to confirm that there are no releases above regulatory limits and to measure any effect of site operations. **Outstanding Issues:** None.

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Independent monitoring would give people more confidence.	**Addressed in CSR:** Independent monitoring has been done in the past (e.g. Fisheries and Oceans Canada and Health Canada). Health Canada continues to monitor at stations downstream of Whiteshell Laboratories. **Outstanding Issues:** None.
External Events	
Significant external events like forest fires could impact on security.	**Addressed in CSR:** External events have been considered in the Safety Analysis Reports for the various nuclear facilities at Whiteshell Laboratories. **Outstanding Issues:** None.
There is a need to undertake a probabilistic risk assessment of external events.	**Addressed in CSR:** Safety Analysis Reports have considered external events. Future safety analysis to support interim end-state and monitoring and surveillance plans will also consider external events. **Outstanding Issues:** None.
Has the effect of flooding of the Winnipeg River on stored waste materials been considered?	**Addressed in CSR:** Flooding was assessed by Manitoba Hydro on the basis of a dam failure at Seven Sisters. The assessment determined the Whiteshell Laboratories site including the WMA would be unaffected. **Outstanding Issues:** None.
Security	
24-hour monitoring of Waste Management Area should be considered.	**Addressed in CSR:** There will be 24-hour camera surveillance of the WMA during decommissioning. Any incidents can be responded to within a reasonable timeframe (approximately one-half hour). This represents an enhancement in routine monitoring and surveillance from the level in place throughout the site operating period. **Outstanding Issues:** None.
There is the perception that AECL is abandoning the site and leaving it to a security company with low-paid employees.	**Addressed in CSR:** AECL is committed to maintaining fully trained and qualified staff on site to carry out the site monitoring and surveillance activities As well, AECL's management system clearly identifies responsibilities for radiation protection, environmental protection and monitoring, and health and safety. **Outstanding Issues:** None.
Future Staffing Requirements	
The loss of technical resources in region will impact on future availability of qualified staff.	**Addressed in CSR:** Key people have been retained and will be retained to maintain all site management requirements. **Outstanding Issues:** None.
Loss of corporate memory is reducing peoples' confidence in ability of future staff to manage problems.	**Addressed in CSR:** There are a variety of methods AECL uses to protect against the loss of corporate memory. These include: A management system that defines responsibilities, sets goals and uses standards for operating the Company and its staff; Internal and external training programs (e.g. radiation protection training); Maintaining a complement of key staff; Contracting back former staff to help address operational or decommissioning issues; Operating procedures for the various buildings and systems; Centralized records and reports systems; On-line information available through the Intranet; Retention of internal and external consultants to assist in the identification and assessment of historical information and data. **Outstanding Issues:** None.
There is a concern about whether training will be adequate for staff and what their qualification requirements will be.	**Addressed in CSR:** A training program will be maintained as required by the CNSC to meet all site monitoring and surveillance requirements. AECL can also call on its resources at Chalk River to provide support for training if it is not available at Whiteshell Laboratories. The program is audited by the CNSC. **Outstanding Issues:** None.

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When decommissioning, using personnel familiar with the operations of a facility and the location and nature of the contamination poses less risk to the employees.	**Addressed in CSR: It** is desirable to take advantage of the knowledge of people who are on the site. The DDP's will be developed using information from all available sources. Generally, these plans will be completed during the next five years. However it should be pointed out that virtually all of the people who have worked on Whiteshell will have reached retirement age within the next ten years. They simply won't be available to participate in the actual decommissioning process regardless of the alternative selected. That said, the DDP's will provide a detailed disciplined step-by-step description of the decommissioning process in accordance with CNSC Regulatory Document G-219. This will ensure that the process is not dependent on human memory alone. It should also be noted that "corporate memory" is most important in the achievement of facility shutdown. Once shutdown is complete, there is a transition to a team expert in monitoring, dismantling, demolishing, and remediating. **Outstanding Issues:** None.
To leave a site virtually unattended without the necessary staff to provide full protection is unprecedented. The CSR does not even give an indication of the structure and competence of the caretaker operation.	**Addressed in CSR:** AECL has clearly committed to maintaining the resources required to carry out the monitoring and surveillance activities to the end of the decommissioning program including security, fire fighting, environmental monitoring, radiation protection and buildings maintenance. A new Section (9.5.1) describing the disciplines required has been added. The site will remain under CNSC licence as appropriate to ensure there will be no unreasonable risk to people or the environment. **Outstanding Issues:** None.
AECL has been putting pressure on the L.G.D. of Pinawa to agree to provide fire protection to the active area of the site. AECL must maintain their own fully trained fire protection staff as long as there are contaminated facilities on the site.	**Addressed in CSR:** As noted in the above response, AECL commits to meeting fire protection requirements for the licensed site and facilities. The provision of such services can include the use of shared community resources. The CNSC will also ensure, through its licensing and compliance process, that adequate emergency response is in place. **Outstanding Issues:** None.
Start immediately to fully decommission the Whiteshell site in a continuous way according to the twenty-year time frame. This would allow full advantage to be taken of local knowledge and provide continuous employment for a decommissioning team and a level of economic activity that would go some way to alleviating the impact of the withdrawal of AECL's R&D activities.	**Addressed in CSR:** See response to 4th comment above. Note also that, with respect to economic effects, the scope of the assessment includes only those effects that are directly the result of changes that the project is likely to cause to the biophysical environment. **Outstanding Issues:** None.
An intermittent decommissioning process will have huge problems in assembling the human resources each time there is an incremental activity.	**Addressed in CSR:** With the exception of the WMA and WR-1, a large portion of the decommissioning will occur during the first 20 years. The safety and environmental rationales for the proposed phasing of the decommissioning program are set out in the draft CSR. A summary table and figures outlining the scheduling of key decommissioning activities is included in Section 4.0. Given the lead times available for the detailed planning and preparation of the various decommissioning phases, and the anticipated requirements for the provision of financial guarantees, the assembly of the necessary resources to carry out the decommissioning stages is not anticipated to be a problem. **Outstanding Issues:** None.
Site Characterization	
Does AECL know everything about the site?	**Addressed in CSR:** AECL has adequate knowledge about the site to ensure maintenance of health and safety and environmental protection. Decommissioning involves activities to characterize the hazards and minimize potential effects on workers, the public and environment. **Outstanding Issues:** None.

ISSUES/COMMENTS	STATUS
There is the perception that records on where materials are stored at the WMA are not good.	**Addressed in CSR:** This is a false perception. Records are good and the locations of where waste is stored at the WMA are well documented. As well, records will be maintained in a secure, centralized location. **Outstanding Issues:** None.
There is a lack of detail as to the nature of the contamination in the facilities and the quantities and location of the various waste forms.	**Addressed in CSR:** Full information on the waste streams involved for each site awaits the completion of the DDP's. Additional information on the characterization of the river sediments and the Waste Management Area is provided in the appropriate sections of Section 4.0. AECL believes that the amount of information necessary to demonstrate that the decommissioning can be carried out without significant effects on the environment, as required under *CEAA*, has been provided. **Outstanding Issues:** None.
Much more detail on the condition of the facilities (nature, location and amounts of contamination) is required before AECL can be allowed to proceed with decommissioning.	**Addressed in CSR:** The responsible authority(ies) will consider in the CSR the information necessary to decide if the project is likely to cause significant adverse environmental effects, taking into account the appropriate mitigation measures. This will require a certain amount of detail on the conditions and characteristics of the facilities and the ranges of contamination present. It is normally not necessary to have all of the detailed information to make an EA decision on the overall likelihood and significance of effects. The revised CSR now contains the information appropriate for arriving at environmental assessment-level decisions with a reasonable level of certainty. Further detailed information will be required for licensing purposes, such as prior to the authorization of specific decommissioning tasks to be specified in Detailed Decommissioning Plans for each facility. Furthermore, the proposed follow-up and monitoring program will be designed to gather more specific information during the actual decommissioning process. That information will be used to verify the predicted effects and ensure effectiveness of the mitigation measures. **Outstanding Issues:** None.
There is no analysis in the report to support the conclusions. AECL is controlling the access to information about the condition of the facilities and the quantities, types and disposition of the radionuclides, making it impossible to undertake independent safety assessments.	**Addressed in CSR:** All of the information necessary to support the conclusions of the environmental assessment has now been added to the CSR. If the project proceeds from the environmental assessment stage, further detailed information will be included at the time that the Detailed Decommissioning Plans for each component of the facility will be prepared under the CNSC licensing process. All information used in the environmental assessment is available to the public in either the CSR itself, or from the related documents listed in the Public Registry. Information related to the licensing will also be available to the public from the CNSC. **Outstanding Issues:** None.
Storage	
Waste currently stored in trenches or below ground should be moved to above ground storage bunkers or series of bunkers.	**Addressed in CSR:** Current environmental monitoring demonstrates that waste is safely stored. Except for one trench with fuel channels and some standpipe waste, waste will continue to be stored in this manner. Current safety assessments show there is no risk to human health. **Outstanding Issues:** None.
The decommissioning plan should not anticipate the availability of a repository but should focus on getting all of the high-level waste into safe storage now.	**Addressed in CSR:** All waste will be stored in CNSC-approved storage facilities throughout the decommissioning process. As buildings approach the limits of their useable and safe life they will be decommissioned. WR-1 currently meets all safety requirements and it is safer to manage components of WR-1 in the facilities until a national waste disposal site becomes available than to move it. The alternative would require the construction of an interim storage facility with shielding equal to that currently provided by WR-1. **Outstanding Issues:** None.
They must not use the lack of a repository as an excuse for not building engineered storage facilities now.	**Addressed in CSR:** Any storage of existing wastes, or those that may arise from the decommissioning project, will remain in waste management facilities, licensed by the CNSC until such time as other alternative, licensed facilities are made available. **Outstanding Issues:** None.
Long-Term Communications	

ISSUES/COMMENTS	STATUS
There is a need for ongoing communications to provide information on decommissioning program.	**Addressed in CSR:** AECL is committed to an ongoing communication program with area communities and stakeholders. **Outstanding Issues:** None.
There is a need to inform and involve the community in a communications plan during the decommissioning years (i.e. role in monitoring, notification protocol for work in progress, accidental releases into the environment, etc.)	**Addressed in CSR:** AECL supports the idea of a Public Advisory Committee. These are the kinds of activities that the local community could be involved with through a Public Advisory Committee. **Outstanding Issues:** A Public Advisory Committee will be considered in parallel with implementation of the decommissioning program.
Financial Assurances	
Will AECL be able to acquire the necessary resources for decommissioning particularly when it is looking for new money for Chalk River?	**Addressed in CSR:** AECL's decommissioning budget is a separate appropriation from Treasury Board. This money is separate from any operations/refurbishment budget needed for Chalk River. **Outstanding Issues:** None.
What guarantees are there that resources will be available for long-term monitoring?	**Addressed in CSR:** Decommissioning is covered under a direct appropriation from the Treasury Board to ensure that adequate funding is available to meet commitments. AECL has a responsibility to maintain compliance for a licensed site which includes long-term monitoring. **Outstanding Issues:** None.
What assurances does the public have that AECL won't take shortcuts?	**Addressed in CSR:** AECL has a historical track record of responsibly managing nuclear sites and operations. AECL prides itself on that reputation and intends to maintain it. The CNSC also provides a routine check on the ongoing performance of AECL and the administration of nuclear sites. As well, AECL will be required to operate within guidelines laid down by other federal and provincial agencies. **Outstanding Issues:** None.
Whatever decommissioning plan is finally accepted, there must be guaranteed funding in place to carry it out.	**Addressed in CSR:** The CNSC will require that financial guarantees are in place to ensure successful completion of the decommissioning project. **Outstanding Issues:** None.
AECL and the federal government must stop passing the buck on the financial liability and all future commitments for decommissioning should be presented and guaranteed jointly. We understand that the new CNSC regulations require that financial provisions be made before decommissioning plans can be implemented.	**Addressed in CSR:** The CNSC will require that financial guarantees are in place to ensure successful completion of the decommissioning project. **Outstanding Issues:** None.
Once a decommissioning plan is accepted and approved, firm financial guarantees from the federal government must be put in place, with penalties for missing major targets.	**Addressed in CSR:** The CNSC will require that financial guarantees are in place to ensure successful completion of the decommissioning project. **Outstanding Issues:** None.
Planning Considerations	
Table 3.2, in which the rationale for choosing the 60-year plan is presented, contains many unsupported conclusions.	**Addressed in CSR:** In general, conservative estimates have been used for costs and radioactivity. These estimates are entirely suitable for planning purposes. **Outstanding Issues:** None.
This decommissioning plan is clearly driven by fiscal considerations and not by considerations of safety, economics or public morality. Some references in the report to economic choices are not supported by analysis.	**Addressed in CSR:** The major factors controlling the timing of the decommissioning are the availability of an off-site disposal facility and the safety of the workers. That said, a costly solution such as early decommissioning of WR-1 that achieves no safety goals is not prudent. Maintaining facilities over the proposed long decommissioning time frame is also costly. **Outstanding Issues:** None.

ISSUES/COMMENTS	STATUS
We expect AECL to contract immediately for the necessary decommissioning facilities so that the project can move forward.	**Addressed in CSR:** The decommissioning project may not proceed until the environmental assessment requirements are complete and a decommissioning licence has been issued by the CNSC. **Outstanding Issues:** None.
Remediation of the tile hole situation should proceed with the highest priority and not wait 10 years to proceed.	**Addressed in CSR:** Addressing fuel waste stored in standpipes at Whiteshell Laboratories will capitalize on remediation planning for similar materials at Chalk River Laboratories. Engineering specifications are currently being developed for retrieval, processing and re-packaging facilities at Chalk River to safely handle the wastes. This project is aggressively in progress at Chalk River Laboratories and the realistic timeframe for implementation is 10 years. **Outstanding Issues:** None.
There is concern that attention will soon become focussed on decommissioning liabilities at Chalk River and that the Whiteshell liabilities will drop in priority.	**Addressed in CSR:** The priority of the Whiteshell Laboratories Decommissioning Project is adequately recognized to proceed with activities outlined in the reference document. Initiation of the decommissioning planning process with the regulator has begun and AECL is committed to this process.
Acceptability of Plan	
The CSR ignores the concerns of the Community Leaders and falsely concludes that there are no concerns in the community about the decommissioning plan.	**Addressed in CSR:** All relevant concerns expressed by the public will be carefully documented and considered in the completion of the environmental assessment. The CSR addresses recommendations made by the Community Leaders Committee in Appendix E.5. Also, a meeting was held with the Committee April 8, 2000 to respond to its recommendations. Other concerns that the Committee has that are of an economic nature are outside the scope of the CSR and are being addressed through other processes. **Outstanding Issues:** None.
Urge that the CNSC reject this decommissioning plan and instruct AECL to seek the necessary resources to properly decommission the Whiteshell Laboratories in accordance with the expectations of the communities in Eastern Manitoba and the Government of Manitoba.	**Addressed in CSR:** The CNSC will not authorise the decommissioning project until it is satisfied that it will meet all of the applicable regulatory requirements, including those for the protection of people and the environment, and for ensuring that the exposure of workers and the public to radiation is as low as reasonably achievable, social and economic factors taken into account. **Outstanding Issues:** None.
The decommissioning plan as outlined is totally unacceptable to the L.G.D. of Pinawa, also to the Mayors and Reeves of the surrounding communities, an important fact that the report neglects to mention.	**Addressed in CSR:** A draft CSR, including a description of the proposed decommissioning project, will be circulated for public review and comment before it is finalized and submitted to the Canadian Environmental Assessment Agency for a further public review. That future draft and final CSR will contain the views expressed by the public on the project and how they were considered in the environmental assessment. **Outstanding Issues:** None.
AECL's concept of community consultation is to ignore them and move on with their plan as originally conceived.	**Addressed in CSR: The** scope of the assessment offers several opportunities for public input. All relevant comments received from stakeholders will be carefully considered in the completion of the assessment. **Outstanding Issues:** None.

In general terms, the time frame to decommission is not viewed favourably by the public. However, the associated issue of availability of national disposal facilities is recognized as a constraint to the Whiteshell Laboratories decommissioning program. The CNSC has indicated that these matters fall outside the scope of the Whiteshell Laboratories decommissioning program and environmental assessment process. The long-term in-situ waste management of low-level radioactive wastes is also a concern. The environmental monitoring program confirms that these wastes are being safely managed. A risk assessment has been conducted to evaluate the feasibility of in-situ waste disposal. Results are documented in Appendix C.

The main concerns revolve around the time frame to decommission and the associated issues related to overall site management, staffing and security requirements; health and safety;

environmental protection; containment of waste; long-term involvement of local communities; and financial assurances.

The public is seeking assurances from AECL that appropriate levels of financial and human resources are committed to the Whiteshell Laboratories decommissioning program. The public is seeking assurances that AECL will put in place appropriate procedures and staffing requirements to ensure that public safety and security are protected. There is concern that a loss of corporate technical knowledge through staff reductions at Whiteshell Laboratories could have an impact on the ability of AECL to adequately characterize hazards and minimize effects. Potential environmental effects are also a concern. Much of the public has not been aware of the routine releases to the environment during Whiteshell Laboratories operations and of the comprehensive environmental monitoring program in place. A heightened awareness has occurred through the public consultation program and the public is seeking opportunities to become informed about the environmental monitoring program and to provide their input. The public is also concerned about the integrity of the concrete canisters over the long term and wants assurances that radioactivity will not leak out.

The public has consistently noted the need for a long-term communications and consultation program. AECL also notes that conflicting points of view on the proposed decommissioning plan have been raised during the consultation process. AECL acknowledges these points of view and encourages ongoing participation during the decommissioning program.

10.5 First Nation Consultation

10.5.1 Overview

As part of the *CEAA*-related consultation program, a process was designed to consider the informational needs and consultation preferences of First Nations whose communities and/or traditional territories are within the Regional Study Area. Areas considered in the CSR include lands covered by the terms of Treaty 1 and Treaty 3. The Treaty 1 Ojibway communities of Sagkeeng First Nation (also known as Fort Alexander, Manitoba) and Brokenhead Ojibway Nation (also known as Scanterbury, Manitoba) are located within the Regional Study Area. Lands within the Regional Study Area and Local Study Area are part of the traditional territories of Sagkeeng First Nation and Treaty 3 First Nations located in Ontario. Finally, Brokenhead Ojibway Nation has recently identified lands approximately 25 km east and south of Pinawa as part of its Treaty Land Entitlement.

Given the different contexts of each First Nation community and its potential interest in the Whiteshell Laboratories' decommissioning program, AECL developed a different initial consultation strategy with the two First Nations located in the Regional Study Area and the Treaty 3 communities located outside the study area. A description of the approach follows in Sections 10.5.2 to 10.5.4. Copies of correspondence, project description, communication protocol with Sagkeeng First Nation and a summary of contacts is provided in Appendix E.8.

10.5.2 Sagkeeng First Nation

AECL has had some previous interaction with the Sagkeeng First Nation through its participation on the Winnipeg River Roundtable on Environment and Economy. The Round Table has taken an interest in the Winnipeg River and has a number of objectives including providing recommendations on environmental sustainability with respect to specific issues and encouraging a bioregional perspective.

The initial consultation with Sagkeeng First Nation on the proposed Whiteshell Laboratories' decommissioning program involved a meeting with staff of Sagkeeng's Environment Department and AECL's consultant in August 1999. This provided an initial understanding of potential interest in the Whiteshell Laboratories' decommissioning program. A follow-up letter was sent to Chief and Council outlining the proposed decommissioning program and environmental assessment process and providing a project description with maps of the Local and Regional Study Areas. AECL also suggested that a meeting be held at Whiteshell Laboratories. A meeting was held at Whiteshell Laboratories in October 1999, that also included a tour of the facilities. Newsletters were forwarded to the Band office and staff and Chief and Council were notified of the Open House. A meeting was held in November 1999 with the Elders Council at Sagkeeng.

Sagkeeng First Nation secured external resources to retain a consultant to assist with the development and implementation of a communication protocol. A meeting was held with Sagkeeng and its consultants in November 1999 to discuss a joint communication process. The *Consultation and Communication Process for the Participation of the Sagkeeng First Nation* was jointly developed by AECL and Sagkeeng First Nation in November 1999 and set out the process for AECL and Sagkeeng First Nation to follow in reviewing and discussing issues of concern to Sagkeeng First Nation (Appendix E.8). A Core Group has been established to undertake this process.

At the request of Sagkeeng First Nation, AECL provided copies of reports for review for its assessment of potential issues of concern. Two copies of the environmental monitoring display panels indicating environmental monitoring locations were also provided.

10.5.3 Brokenhead Ojibway Nation

Initial contact was made with Brokenhead Ojibway Nation in September 1999 by AECL's consultant to notify it of the proposed decommissioning program and to determine if Brokenhead was interested in participating in the process. A follow-up letter with the attached project description and Regional and Local Study Area maps was forwarded with a suggestion that a meeting be held. A meeting was held at the Brokenhead Ojibway Nation's offices in November 1999, with Chief and Council and AECL. Copies of the newsletter were provided at an earlier date. As a follow-up to the meeting, copies of 15 years of environmental monitoring reports were forwarded for their review.

10.5.4 Treaty 3 First Nations

Initial contact was made with seven First Nations in the Treaty 3 region of Ontario in September 1999, by AECL's consultant to advise them of the proposed decommissioning program and to determine if they had an interest in the project. A follow-up letter in September 1999 provided a project description and Regional and Local Study Area maps. AECL indicated that it was interested in knowing if the First Nations currently use the local area as identified in the local area map for traditional activities. The First Nations that were contacted included: Shoal Lake 40 First Nation, Iskatewizaagegan #39 Independent Nation, Anishinabe of Wauzhushk Onigum, Ochiichagwe'babigo'ining First Nation, Lac Seul First Nation, Wabaseemoong Independent

Nations and Grassy Narrows First Nation. A letter was sent in November 1999 to the Grand Chief of Treaty 3 to advise him of the contacts that had been made with the individual First Nations.

10.6 RESULTS OF CONSULTATION

10.6.1 Sagkeeng First Nation

The Sagkeeng First Nation forwarded its issues of concern in February 2000 in a document entitled "*Identified Issues for Atomic Energy of Canada for the Preparation of a Comprehensive Study Report for the Whiteshell Laboratories Decommissioning Program.*" This document is provided in Appendix E. A summary of the issues raised along with responses is presented in Table 10.5. A meeting to discuss issues and responses with representatives of the Sagkeeng First Nation was held on April 11, 2000. Further to that meeting, AECL forwarded a copy of "Whiteshell Laboratories Emergency Plan" and a copy of the draft CSR Revision 1 in April 2000. Sagkeeng was advised of the information sessions in area municipalities and were forwarded copies of the June 2000 newsletter. Copies of transmittal letters are provided in Appendix E.8. Further communication with Sagkeeng occurred at a meeting held on August 28, 2000 to provide a status update of the CSR technical review and to discuss Sagkeeng's potential involvement in the environmental monitoring program and its training requirements. As a result of discussions in November 2000, it was agreed that further meetings would be held on completion of the technical review of the draft CSR.

Table 10.5
Issues Raised by Sagkeeng First Nation

ISSUES/COMMENTS	STATUS
Impacts to Flora and Fauna	
CSR should address possible impacts on flora and fauna from historical activities as well as proposed decommissioning activities. Study should also address impacts to migratory species.	**Addressed in CSR:** Results of the environmental monitoring program indicate that the effects on flora and fauna, including migratory species, from past operations have been negligible. Proposed remediation of contaminated land may disturb wildlife habitat but it would be very localized and of short duration.
Specific concern about impacts to wildlife as they move in and out of Waste Management Area.	Since the WMA is fenced, large animals cannot enter the area. Although smaller species and birds enter and leave the site, monitoring data which includes animal carcasses identified no previous impacts. **Outstanding issues:** None.
Risks Associated with the Waste Management Area	
Concern about how accidental releases will be mitigated and monitored and what sort of institutional controls will be provided.	**Addressed in CSR:** The fact that the WMA is situated in clay soils and in a ground water discharge zone has positive benefits. Contaminants stored within the WMA will not move downward to the sandy zone, and this zone will not act as a transmission zone for contaminants from the WMA into the Winnipeg River. Contaminants will be rendered relatively immobile due to sorption on clay soils. Mitigation measures that will be put in place include construction of containment barriers where necessary to ensure collection and control of decontamination process water and routine site inspections to ensure the integrity of the facility. Table 6.12.2 describes the proposed mitigation measures for the continued operation and decommissioning of the WMA. Monitoring locations in the vicinity of the WMA will be maintained for as long as wastes requiring management remain at the WMA. Monitoring results will be reported annually to the regulator and will be publicly available.
Clarification sought on how	

ISSUES/COMMENTS	STATUS
intentional intrusion into the WMA will be mitigated. Request that a risk assessment report be prepared for the WMA that quantifies risks to the environment and human health from material stored in the WMA and material ultimately slated for disposal in the WMA that currently lies in the trench facility.	Site security will be maintained as a component of monitoring and surveillance. A risk assessment for the in-situ disposal of low-level wastes at the WMA has been prepared. (see Appendix C). **Outstanding Issues:** None.
Impacts to Sediment and Water Quality	
AECL asked to describe background conditions prior to Whiteshell Laboratories operations and nature and extent of impacts from releases. Concern about contaminated sediment and water downstream of Whiteshell Laboratories and impacts on fish species from AECL activities and potential for impacts from decommissioning.	**Addressed in CSR:** Background conditions for the site are documented in Guthrie and Scott 1988 "Pre-operational Environmental Survey Report of the Whiteshell Nuclear Research establishment Area" WNRE-756. AECL has an extensive program for monitoring the environment the site including the Winnipeg River. Results are documented in annual environmental monitoring reports. The 1995 Winnipeg River Task Force report concluded that it is unlikely that Whiteshell Laboratories has ever posed a significant threat to the health of downstream residents. With respect to fishery impacts, radioactivity levels in fish in the Winnipeg River are typical of values obtained across Canada, including regions very remote from nuclear facilities. These levels are well below Health Canada's guidelines. The Winnipeg River and associated fishery will only be affected if there is a substantial leak. AECL records show that routine discharges are currently maintained within acceptable standards and discharges will gradually diminish to virtually zero by the time decommissioning is complete. The likelihood of a major leak is low because all site and facilities protection systems and work controls are maintained during the decommissioning project. The decision on the in-situ abandonment of river sediments was dependent on completion of the assessment outlined in Appendix B. The study carried out in the fall of 2000 revealed a small inventory of contaminants immediately downstream of the outfall. It was determined that if the entire inventory was resuspended in the river, the increase in Cs-137 concentration in the river would be negligible. An assessment indicated that the dose to human or non-human biota would be well below applicable limits. No remediation is contemplated in light of those results. **Outstanding Issues:** None.
Accidents	
Concern about potential accidents during the decommissioning process and potential impacts to human health and land and water resources. AECL asked to describe safeguards that will be implemented and contingency plan in case of an accident. Sagkeeng request a communication program to notify Sagkeeng in the event of an incident.	**Addressed in CSR:** Potential accidents and malfunctions have avoidance and contingency plans applicable to each in order to mitigate potential environmental effects. Table 6.26 describes safeguards that will be put in place. Contingency plans and emergency preparedness plans already exist for the Whiteshell Laboratories facility. In the unlikely event of significant contaminant release, any migration will be curtailed and immediate clean-up will be implemented. Consistent with the November 1999 communications protocol between AECL and the Sagkeeng First Nation, AECL will ensure that the Sagkeeng First Nation is notified of any accident that has the potential to impact the resources within its Traditional Land Use Area. **Outstanding Issues**: None.
Reporting	
Sagkeeng request that decommissioning status reports be prepared for each phase and that reports be placed in a public registry.	**AECL Response:** AECL will prepare publicly available decommissioning status reports for submission to the CNSC. Such reports are available to any interested party. Status reporting will also be maintained as part of the ongoing communications program with the Sagkeeng.

ISSUES/COMMENTS	STATUS
	Outstanding Issues: A formal mechanism for public registries during decommissioning project implementation has not been established**.**
Involvement in Monitoring	
Sagkeeng request that they be involved in the development of a long-term monitoring program and that the people of Sagkeeng be trained and employed in the collection of monitoring data. Sagkeeng would like to partner with AECL in the monitoring of resources within the regional study area.	**AECL Response:** AECL is committed to the involvement of the Sagkeeng First Nation in the development of the long-term monitoring program. AECL is prepared to provide training and some employment in the collection of monitoring data. Discussions on Sagkeeng's involvement were initiated in August 2000 with representatives of AECL and Sagkeeng First Nation. Involvement could begin when the project commences. **Outstanding Issues:** None.

10.6.2 Brokenhead Ojibway Nation

At the initial consultation meeting with Chief and Council of the Brokenhead Ojibway Nation, AECL provided an overview of the decommissioning program and made the offer to host a tour at Whiteshell Laboratories. A number of questions were raised. In summary, concerns were expressed on the following issues:

- impacts to surface water, ground water and any effects on the Brokenhead River;
- airborne effects;
- assessment of potential contamination of lands that may be turned into a wildlife management area;
- potential impacts to wildlife; and
- potential impacts to bison herd at Brokenhead.

AECL explained that the environmental monitoring program has demonstrated that there have been no adverse environmental effects off-site. Also, the Brokenhead River is not within the same watershed.

The Brokenhead Ojibway Nation advised AECL in a letter in January 2000 that the Chief and Council wished to remain informed about the decommissioning project and further reiterated its concerns. AECL advised Brokenhead in a follow-up letter that its concerns were being addressed in the CSR and that AECL would continue to keep Chief and Council informed. Further communications included a copy of the draft CSR Revision 1 in April 2000 and copies of the June 2000 newsletter. Copies of correspondence are presented in Appendix E.8.

10.6.3 Treaty 3 First Nations

Based on information reviewed by Chief and Council, the Iskatewizaagenean Independent Nation and Shoal Lake #40 First Nation have both confirmed that they have no immediate concerns regarding the proposed decommissioning program. However, if anything new were to come up, both First Nations requested that they be contacted again. The Anishinabe of Wauzhushk Onigum confirmed receipt of AECL's letter and information. However, they have indicated that other matters were more pressing in their community and they have not yet had the opportunity to respond.

The Wabaseemoong Independent Nations indicated that they have extensive interest in the Regional Study Area, but have not responded with an identification of interests or concerns. No response was received from the Grassy Narrows First Nation, the Ochchagwe'babigo'ining First Nation or the Lac Seul First Nation.

The Treaty 3 First Nations and the Grand Chief of the Grand Council Treaty #3 were advised by letter in January 2000 that under the *CEAA* guidelines there were further opportunities for them to submit their interests during the review process. They were forwarded copies of the June 2000 newsletter to update them on the status of the CSR. Copies of correspondence is in Appendix E.8.

10.7 ONGOING CONSULTATION

AECL is committed to an ongoing communication and consultation program after the environmental assessment process is complete. Ongoing communications with area municipalities and elected officials will be undertaken. AECL supports the idea of a Public Advisory Committee and will give this consideration in parallel with implementation of the decommissioning program.
A process for a long-term relationship between AECL and Sagkeeng First Nation that ensures Sagkeeng's ongoing involvement in its areas of interest in the decommissioning program (e.g. environmental monitoring) will be established. In the spirit of partnership and capacity-building, AECL will endeavour to provide opportunities for the Sagkeeng First Nation to build on skills at the community level.

10.8 SUMMARY OF PUBLIC AND FIRST NATION CONSULTATION

The consultation program that has been undertaken by AECL has included a number of different mechanisms for providing information and receiving input on the proposed decommissioning program. These mechanisms included:

- Presentations
- Open Houses
- Information sessions
- Interviews
- Newsletters
- Reports and documents
- Meetings with stakeholders
- Public tours
- Public notices
- On-going communication via telephone, e-mail, letters.

The questions and concerns raised through the consultation process were responded to in a number of different ways:

- Verbal response at a meeting, presentation, or open house;
- Written response by letter;
- Development of a communications protocol;
- Incorporation of input into appropriate sections of the Comprehensive Study Report;
- Responses in issues tables in the Comprehensive Study Report and its appendices; and
- Follow-up programs.

AECL's commitments to an ongoing communication and consultation program will ensure that information on the decommissioning program will be made available during the implementation phases and opportunities will be available for further input. Further, AECL supports the establishment of a Public Liaison Committee in parallel with the implementation of the decommissioning program.

10.9 CONCLUSIONS

Through its consultation program, AECL is confident that it has provided appropriate opportunities for interested parties, First Nations and members of the public to become informed about the proposed decommissioning program and to raise issues of concern. These issues have been addressed in the Comprehensive Study Report. AECL is committed to an ongoing communication and consultation program to provide opportunities for public involvement during the implementation phases. It appears that the public has had and will continue to have adequate information to assess the effects of the project. No outstanding concerns associated with the decommissioning activities have been indicated.

11.0 CONCLUSIONS OF THE ASSESSMENT

This report describes the Whiteshell Laboratories Decommissioning Project and provides the results of an assessment of the likely effects of the project including an assessment of the cumulative effects of the project with other existing and proposed projects. Where appropriate, it describes mitigation measures and identifies any adverse environmental effects. The report provides the results of an assessment, which used standard and accepted methodologies, of the significance of all residual effects. Finally, the report describes the extensive and ongoing public consultation program associated with this assessment. This program includes a process developed in consultation with First Nations to keep them informed of the progress of the decommissioning program and to allow them to participate in the project in a meaningful way.

The Decommissioning Project covers a very long time frame – estimated at 60 years for the reference alternative, Alternative 3. To address the inevitable uncertainties associated with a time frame of this length, the report proposes an ongoing follow-up and monitoring program designed to keep track of environmental indicators and to allow for any necessary changes to be made. Two parts of that program are of particular interest. One is the preparation of DDPs for each nuclear facility; the other is support for a Public Advisory Committee that could assist AECL in issues related to the decommissioning.

The following conclusions may be drawn from the Comprehensive Study Report:

- the Whiteshell Laboratories Decommissioning Project is not likely to cause significant adverse environmental effects taking into account the mitigation measures recommended in the report;
- the cumulative effects analysis indicates that there are not likely to be any cumulative effects associated with the Project; and
- the public has had appropriate opportunities to become informed and to raise issues of concern. Responses have been provided for all concerns related to the proposed Decommissioning Project.

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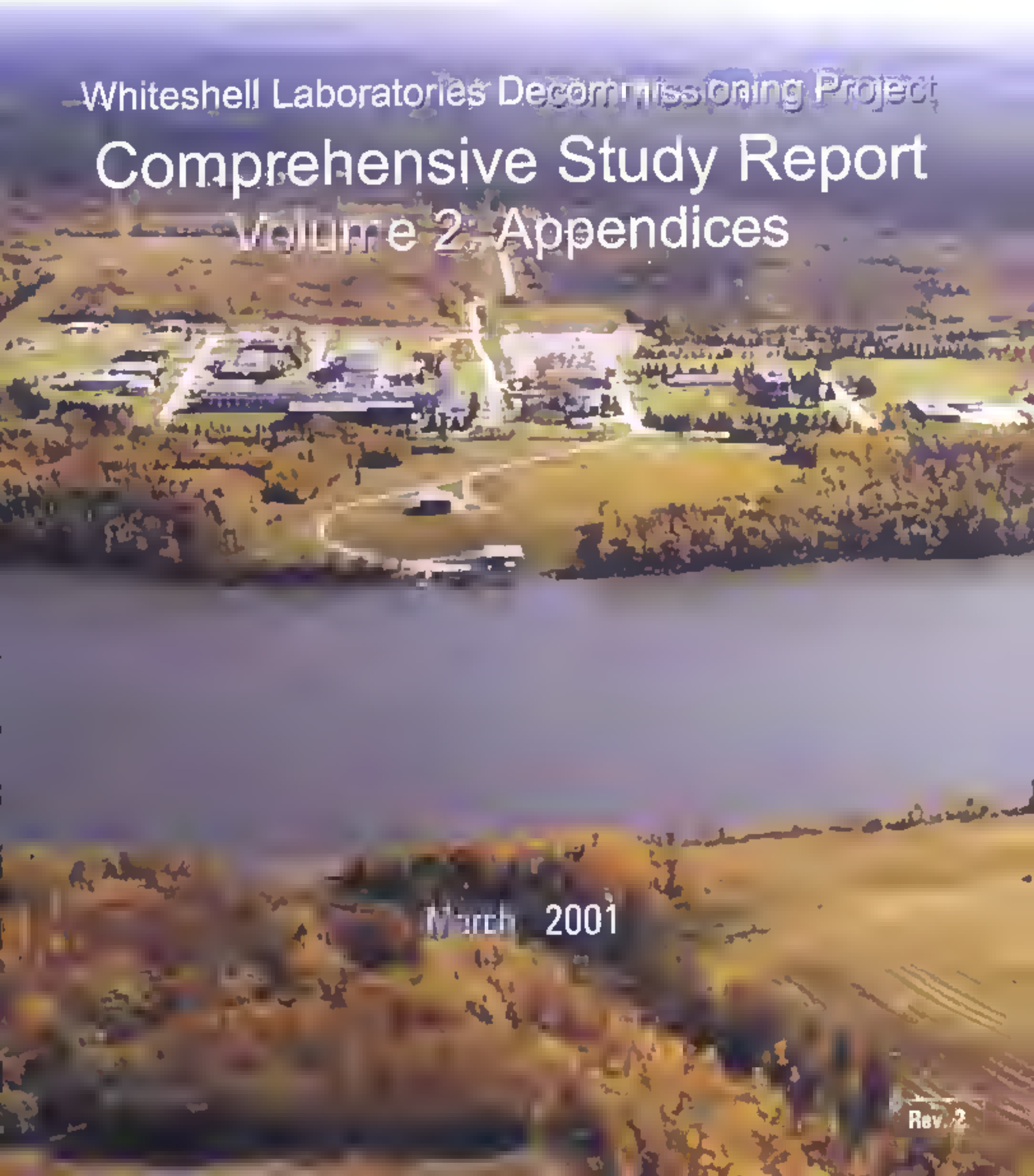
Whiteshell Laboratories Decommissioning Project

Comprehensive Study Report

Volume 2: Appendices



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APPENDIX A

DECOMMISSIONING OF THE WHITESHELL LABORATORIES: SCOPE OF PROJECT AND ASSESSMENT FOR AN ENVIRONMENTAL ASSESSMENT PURSUANT TO THE *CANADIAN ENVIRONMENTAL ASSESSMENT ACT*

APPENDIX A: DECOMMISSIONING OF THE WHITESHELL LABORATORIES: SCOPE OF PROJECT AND ASSESSMENT FOR AN ENVIRONMENTAL ASSESSMENT PURSUANT TO THE *CANADIAN ENVIRONMENTAL ASSESSMENT ACT*

Notice:

Atomic Energy of Canada Limited (AECL) has notified the Canadian Nuclear Safety Commission (CNSC) of its intention to apply for regulatory approval to decommission its Whiteshell Laboratories near Pinawa, Manitoba. The CNSC has determined that a comprehensive study environmental assessment must be completed in accordance with the Canadian Environmental Assessment Act (CEAA) before a regulatory decision on this licensing request can be made. There are several steps to the CEAA process, including an initial one to establish the scope of the project and the factors to be considered in the assessment.

This document, prepared in consultation with the public and other federal and provincial government departments and agencies, is intended to provide AECL with guidance for conduct of the environmental assessment, including several aspects of the public consultation program, which the CNSC has formally delegated to AECL.

The scope of the assessment includes a summary of the process steps, including a further period for public review of the draft Comprehensive Study Report when available. In the meantime, all interested parties are encouraged to participate in the variety of consultation activities being offered by AECL, or to submit comments at any time directly to AECL or the CNSC (see CNSC contact information at the end of this document).

A.1 PURPOSE

This document provides Atomic Energy of Canada Limited (AECL) with guidance and direction from the Canadian Nuclear Safety Commission (CNSC) on the scope of the Environmental Assessment (EA) that must be completed to satisfy the requirements of the *Canadian Environmental Assessment Act* (CEAA), as it applies to the proposal from AECL to decommission the Whiteshell Laboratories. The scope of the assessment describes the basis for the conduct of the environmental assessment, and focuses the assessment on relevant issues and concerns. This document also establishes the assessment process and schedule and provides direction to AECL on how to structure the environmental assessment report. When complete, the environmental assessment report will be submitted by the CNSC staff to the Canadian Environmental Assessment Agency (the Agency) and the federal Minister of the Environment.

While the guidelines provide the basis for conducting the environmental assessment and preparing the assessment report, it is the responsibility of the proponent to provide sufficient information and analyses to allow evaluation of the potential adverse environmental effects of the proposal.

The scope of assessment has been drafted by the CNSC pursuant to Sections 15 and 16 of the *CEAA*.

In addition to this scope of assessment document, AECL is directed to the Agency's document entitled, "*Guide to the Preparation of a Comprehensive Study for Proponents and Responsible Authorities*" (1997).

A.2 BACKGROUND

The Whiteshell Laboratories were established in the early 1960s to carry out AECL research and development activities for higher temperature versions of the CANDU reactor. Significant programs carried out at Whiteshell Laboratories included the operation of the organic cooled WR-1 Reactor, the Nuclear Fuel Waste Management Program, the SLOWPOKE Demonstration Reactor Project and various accelerator activities.

As a consequence of the federal government's program review process, AECL has decided to discontinue research programs and operations at Whiteshell Laboratories. After attempts to find a private-sector sponsor that would assume the financial responsibility for the site operations, AECL received government concurrence to proceed with actions to achieve the closure of Whiteshell Laboratories.

Whiteshell Laboratories is currently regulated under CNSC licence NRTE 2/98. The decommissioning of Whiteshell Laboratories will involve a licensing strategy that includes a future revocation of the site licence and the issuance of new licences that allow the various decommissioning and operating activities to proceed. In the short-term, the decommissioning activities will be licensed under subsection 7(1) and Section 9 of the *Atomic Energy Control* (AEC) Regulations, following an amendment of the existing licence pursuant to subsection 27(1) of the AEC Regulations.

A.3 APPLICATION OF THE CANADIAN ENVIRONMENTAL ASSESSMENT ACT

CNSC staff have received a notification letter and project description from AECL for the decommissioning of Whiteshell Laboratories.

The decommissioning of Whiteshell Laboratories has been determined by the CNSC to be a project as defined in subsection 2(1) of the *CEAA*. According to paragraph 5(1)(d) of the CEAA, an environmental assessment is required before a federal authority exercises a regulatory duty listed in the *Law List Regulations* of the *CEAA* that enables a project to be carried out.

The anticipated amendment of the Whiteshell Laboratories licence to allow the decommissioning of the various facilities at Whiteshell Laboratories will be made under a provision (subsection 27(1) of the *AEC Regulations*) prescribed in the *Law List Regulations*, and thus constitutes a “trigger” for the application of the *CEAA* to this proposal. The CNSC is the Responsible Authority (RA) under the *CEAA* in relation to the project. There are no other RAs for this project.

The project does not appear in the *Exclusion List Regulations* of the *CEAA* and thus there is no exclusion from the need to conduct an assessment by these regulations. No other exemptions under the *CEAA* are considered applicable to this project. Part of the project is described in Part VI subsection 19(d) of the *Comprehensive Study List Regulations* of the *CEAA* and, in accordance with Section 21 of the *CEAA*, the CNSC has a responsibility to ensure that a comprehensive study of the project is conducted and that a comprehensive study report (CSR) is prepared.

AECL has been notified of this determination by the CNSC. The CNSC has delegated to AECL the conduct of the environmental assessment and the preparation of the draft CSR, pursuant to subsection 17(1) of the *CEAA*.

A Public Registry for the project assessment has been established. This includes identification of the project assessment in the Federal Environmental Assessment Index (FEAI) which can be accessed on the Internet Web site of the Agency (www.ceaa.gc.ca). The FEAI reference number is “18737".

The CNSC, as the RA for the project, must ensure that the environmental assessment is conducted in accordance with the provisions of the *CEAA*. This includes determining the scope of the project and the factors to be considered in the assessment, reviewing the assessment report and forwarding it to the Agency and the federal Minister of the Environment. Following a public review period, the Minister must make a decision, pursuant to Section 23 of the *CEAA*, concerning a course of action in respect of the project. The CNSC cannot take any action that would allow the project to proceed until the *CEAA* process is complete.

Pursuant to the *Federal Co-ordination Regulations* under the *CEAA*, the following federal departments/agencies that are likely to have an interest in the review of this project have been notified: Department of Fisheries and Oceans; Health Canada, Natural Resources Canada, Environment Canada, and Western Economic Diversification.

The Manitoba Conservation Department has been notified of the federal environmental assessment to be conducted for this project. It has been confirmed that there are no provincial environmental assessment requirements that are applicable to the proposal. In addition, provincial technical staff have been invited to participate in the technical review of the assessment. To facilitate this input, the province of Manitoba has established the AECL Technical Advisory Committee.

The CNSC considers that the environmental assessment issues and concerns that are relevant to the decommissioning project can be addressed effectively and appropriately in the comprehensive study that is required pursuant to *CEAA*. The environmental assessment process that has been established for this project includes opportunities for the input and participation of the public and other stakeholders that will provide for effective consideration of public issues and concerns.

A.4 ASSESSMENT PROCESS

A summary of the key process steps in the environmental assessment of the Whiteshell Laboratories Decommissioning Project is provided in Section A.9.

An initial step was to finalize the Scope of Project and Assessment document in consultation with the public and other stakeholders.

After AECL submits a draft CSR and preliminary comments from CNSC staff and other federal authorities have been incorporated, the draft CSR will be released for a four-week public review period.

After the public comments have been considered and the draft CSR has been amended to the satisfaction of CNSC staff and the other federal authorities, the final CSR will be submitted to the Agency and federal Minister of the Environment. The Agency will then sponsor an additional public review of the final report.

It is currently anticipated that the Minister of the Environment will take a course of action concerning the assessment by the late fall of 2000.

The CNSC may not act upon the licence application until the *CEAA* process is complete and the project has been referred back to the CNSC by the Minister without prohibition.

A.5 SCOPE OF THE PROJECT

The scope of the project refers to the various components of the proposed undertaking that will be considered as the project for the purposes of the environmental assessment. The project must include the principal undertaking and any accessory activities or works that are directly linked to, or interconnected with, the principal project.

The principal project is the decommissioning of the following nuclear facilities (listed in Appendices A and D of the site licence NRTE 2/98):

- Shielded Facility
- Concrete Canister Storage Facility
- Waste Management Area
- Active Liquid Waste Treatment Centre
- Van de Graaff Accelerator
- Neutron Generator
- Whiteshell Reactor (WR-1)

The buildings and other structures connected or associated with the above listed facilities and which also form part of the project, include all buildings within the project area as well as the Large Scale Vented Combustion Test Facility, Building 503 environmental laboratory, the inactive landfill, the sewage lagoons and all related subsurface structures, piping and services.

The land under CNSC licence, identified as being "affected or potentially affected" by nuclear development and/or operations is also included in the project scope. Land which is presently not connected or associated with any nuclear development or operations and which is not linked to the decommissioning project, is not within the scope of the project. This includes a large portion of land currently under the CNSC licence. The approximately 10,800 acres currently under CNSC licence, was originally selected to provide an appropriate exclusion zone when the WR-1 reactor and site facilities were in full operation. The use of this area for that purpose is no longer required. The Project Study Area map, Figure 2.1, defines the boundaries between the decommissioning project and the assessment study areas.

A preliminary site investigation and review of historic documents and other information indicates that the licensed lands that fall outside the Project Study Area were neither used during the facility operations, nor indirectly contaminated by those activities. Should the results of detailed investigations undertaken during the environmental assessment, or for other purposes, indicate a connection to the decommissioning project, adjustments to the Project Study Area may be necessary. The CNSC believes that including all of the unaffected land in the decommissioning project would place unnecessary restrictions on the potential disposition and future use of that land. Although not part of the project, the land that does not form part of the project is within the study areas identified for assessing potential effects from the decommissioning activities.

The decommissioning activities consist of the dismantling and/or decontamination and refurbishment of all structures, infrastructure and services and the remediation of all lands in the Project Study Area, except for an eight hectare area where continued management of radioactive waste under CNSC licence is proposed to continue in the future.

The decommissioning is intended to render those facilities, buildings and lands to a condition acceptable for release from CNSC licensed control and unrestricted future use. Acceptability in terms of both radiological and non-radiological hazards will be assured. The project also includes the on-site sorting, segregation, decontamination and interim storage of all radiological and non-radiological materials either currently in storage or arising from the decommissioning activities. Areas where waste management activities are proposed to continue, will remain under an CNSC licence and thus will not be available for unrestricted public use at the end of the decommissioning project. Although not part of the current project, the future decommissioning of the remaining waste management areas will be accounted for in the cumulative effects assessment part of the comprehensive study.

For clarity, the project does not include the Underground Research Laboratory (URL). The CNSC does not licence the URL except to permit the use of prescribed substances at that location in accordance with the Nuclear Security Regulations. AECL is not proposing to decommission the URL in which case related CNSC licences will remain in effect. The project also does not include the Whiteshell Irradiator (which is under an CNSC licence held by ACSION). The remaining waste management areas will be addressed in the context of the cumulative effects assessment.

Under the terms of the current CNSC licence, AECL is permitted to do maintenance and continue other activities necessary to maintain security, safety and protection of the environment on the site. The current licence also does not constrain AECL from undertaking any of the investigations necessary to identify, delineate or evaluate existing site conditions or undertake other investigations necessary for the conduct of the environmental assessment.

The long-term management of nuclear wastes is contingent upon finding a nationally acceptable solution consistent with federal policy on waste management. No options or sites have been defined or approved that will provide such a solution. Consequently, it is not possible to examine long-term waste management alternatives as part of the scope of the Whiteshell Laboratories Decommissioning Project.

A.6 SCOPE OF ASSESSMENT

A.6.1 General

The terms "environment" and "environmental effect", for the purposes of this environmental assessment, are explained in Section 2 of *CEAA*.

> ***"environment"*** *means the components of the Earth, and includes a) land, water and air, including all layers of the atmosphere, b) all organic and inorganic matter and living organisms, and c) the interacting natural systems that include components referred to in a) and b) above.*
>
> ***"environmental effect"*** *means, in respect of a project, a) any change that the project may cause in the environment, including any effect of any such change on health and socio-economic conditions, on physical and cultural heritage, on the current use of lands and resources for traditional purposes by aboriginal persons, or on any structure, site or thing that is of historical, archaeological, paleontological or architectural significance, and b) any change to the project that may be caused by the environment, whether any such change occurs within or outside Canada.*

The term "cumulative environmental effect" means cumulative environmental effects that are likely to result from the project in combination with other projects or activities that have been or will be carried out. An "environmental assessment" means an assessment of the environmental effects of the project that is conducted in accordance with the provisions of the *CEAA* and with this Scope of Assessment document. The results of the environmental assessment will be documented in a Comprehensive Study Report (CSR), in accordance with the provisions of the *CEAA* and with the Scope of Project and Assessment document.

The environmental assessment of the proposed project will include a consideration of the following factors identified in paragraphs 16(1)(a) to (d) and 16(2)(a) to (d) of *CEAA*:

- the purpose of the project;
- the alternative means of carrying out the project that are technically and economically feasible and the environmental effects of any such alternatives;
- the environmental effects of the project, including the environmental effects of malfunctions or accidents that may occur in connection with the project and any cumulative environmental effects that are likely to result from the project in combination with other projects or activities that have been or will be carried out;
- the significance of the effects referred to in the foregoing point;
- comments from the public that are received in accordance with the CEAA and its regulations, during the scoping, conduct and review of the environmental assessment;
- measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the project;
- the requirements of a follow-up program in respect of the project; and
- sustainability of renewable resources, including effects on the capacity of renewable resources that are likely to be affected by the project.

In accordance with subsection 16(1)(e) of the *CEAA*, the assessment will also include a consideration of the following matters considered relevant by the CNSC:

- a description of the decommissioning project;
- a description of the existing environment which may reasonably be expected to be affected by the project; and
- the program for consultation with the community and other stakeholders on the project, and for addressing issues raised by the public that are within the scope of this assessment.

A.6.2 Scope of the Factors

Description of the Project

The purpose of the project must be clearly identified.

The description of the project will refer to the items identified in the Scope of the Project (Section A.5 of this document), supported with appropriate maps and diagrams. Emphasis will be placed on describing those aspects of the project, including accidents and malfunctions that have a reasonable probability of occurrence, waste management practices, and radioactive and non-radioactive emissions that could reasonably be expected to affect the environment. The descriptions will be supported with sufficient information to enable an analysis of the potential interactions of the project with the environment. An identification of how potential environmental and man-made hazards have influenced the design and operation of the project will also be provided.

Given that Whiteshell Laboratories is an existing, licensed facility, a description can be provided of the current radiation protection, occupational health and safety, environmental protection and emergency preparedness programs for the facility. Changes to those programs that are needed as a result of the decommissioning project can be identified in the "Mitigation Measures" section of the CSR. If the proposed project proceeds, those programs will be subject to further evaluation under the CNSC licensing review process.

Relevant information on the history and current status of the Whiteshell Laboratories facility must also be provided.

Description of the Existing Environment

The information used to describe the existing environment will be in sufficient detail to support the identification, assessment and determination of the significance of potentially adverse environmental effects that may result from the project. Emphasis will be placed on describing those aspects of the environment that could reasonably be expected to be affected by the project. The description of the baseline environmental conditions will present sufficient data and information to establish norms, trends and extremes, to the extent that such information is available.

An ecosystem approach can be used in the description of the biophysical environment. The description will include those valued ecosystem components (VECs), processes and interactions that are considered likely to be affected by the project. Components of the biophysical environment that may be described include: meteorology, climate and air quality; geology and hydrogeology; soil and groundwater quality; surface hydrology and water quality; aquatic ecology and quality; terrestrial ecology and quality; and the radiation environment.

The description of the socio-economic environment will include information on the functioning and structure of the socio-economic environment of the people and communities in the study area; existing and planned land uses; heritage, cultural or archaeological sites; and recreational sites. The description can be limited to those aspects that could reasonably be expected to be affected by the project.

Spatial and Temporal Boundaries to the Assessment

AECL will conduct the assessment on the basis of four geographic study areas, as follows:

1. Project Study Area:

   This area encompasses all facilities, buildings and infrastructure, including lands, that are directly connected or associated with the Whiteshell Laboratories Decommissioning Project, as described in Section A.5 of this document (Figure 2.1).

2. AECL Licensed Property Study Area:

This is the area contained within the Whiteshell Laboratories property boundaries. The area is located north of Highway 211 and includes lands on the west side of the Winnipeg River (Figure 2.2).

3. Local Study Area:

   This area includes the Rural Municipality of Lac du Bonnet, the Local Government District of Pinawa and the north part of the Rural Municipality of Whitemouth. The area includes the communities of Pinawa, Seven Sister Falls and Lac du Bonnet. It includes a north-south reach of the Winnipeg River, the Pinawa Channel and the Underground Research Laboratory (Figure 2.2).

4. Regional Study Area:

   This is the area approximately bounded by the east-west extension of Highway 15 in the south, Township 20 in the north, Highway 12 in the west and north-south boundary of Whiteshell Provincial Park at Nutimik Lake. The area includes the Local Study Area communities, as well as Beausejour, Pine Falls, Great Falls and Whitemouth. It includes parts of Whiteshell and Nopiming Provincial Parks, Grand Beach Provincial Park, part of the Winnipeg River, Broken Head Reserve and the Sagkeeng First Nation (Figure 2.3).

Characterization of the study areas in this manner will allow for a systematic evaluation of the potential environmental effects, beginning with the more immediate direct effects and leading to the more indirect effects.

The study areas should not be considered rigid and should allow for the full geographic range of a particular effect to be evaluated.

The time frame for the assessment will be the duration of the decommissioning program and the subsequent period of control over the wastes and facilities proposed to remain on-site prior to transfer to a permanent disposal facility or other nationally acceptable long-term solution to the management of radioactive wastes. Depending on which of the three alternative approaches to decommissioning is examined, the time frame for the project will range from between 20 years to 100 years.

Assessment of Alternatives

The following three alternative means of carrying out the Whiteshell Laboratories Decommissioning Project will be evaluated in the environmental assessment:

- Alternative 1: End State in a Short Time Period

  This alternative would see decommissioning of the Whiteshell Laboratories occur over a relatively short time period (approximately 20 years). The approach assumes that a radioactive waste disposal repository will be available within 10 years. The Whiteshell Laboratories facilities would initially be decommissioned to a safe maintenance and surveillance state. Once waste disposal facilities are available, the final decommissioning phase would be completed. The waste would be removed to disposal throughout the subsequent 10-year time period.

- Alternative 2: End State in a Long Time Period

  Under this alternative, decommissioning of the Whiteshell Laboratories would occur over a longer time period (assumed maximum time frame of 100 years). As in Alternative 1, the initial work would be completed to place the Whiteshell Laboratories' facilities in a safe maintenance and surveillance state for a lengthy deferment period. Re-qualification and/or rebuilding of infrastructure would be implemented as required to ensure the long term safety and the protection of the environment.

- Alternative 3: End State in a Moderate Time Period

  This alternative proposes that the Whiteshell Laboratories would be decommissioned over an intermediate time frame (approximately 60 years). This alternative is based on the current best estimate of availability of a waste disposal facility.

  All of the alternatives include a period of waste storage on site with transfer to an off-site waste disposal facility when it becomes available. The establishment of an off-site waste disposal facility is not in the scope of this project.

  The three alternatives capture a broad range of strategic approaches for the decommissioning project. It is these strategic alternatives that have the greatest relevance to the overall potential effects of the project on the environment and hence are the most appropriate type of alternatives for consideration in this environmental assessment.

  Alternative methods of decontaminating or dismantling the specific parts of the facility will not be compared in the environmental assessment. A wide range of tools and technologies will need to be employed on a component-specific basis. Because this level of detailed work-package planning will be done later under the CNSC licensing process, including during the decommissioning project, a comparison of alternative methods at this level of detail is neither possible nor appropriate for the environmental assessment. The environmental assessment, however, will take into account how the types of reasonably available decontamination and dismantling technologies could lead to effects in the surrounding environment.

Assessment of Potential Environmental Effects

The environmental assessment must present a systematic evaluation of how the project is likely to cause changes in the environment within the various study areas, and how those changes to the environment could affect the identified VECs, health and socio-economic conditions, physical and cultural heritage, current use of lands and resources for traditional purposes by aboriginal persons, or items of historical, archaeological, paleontological or architectural significance. In doing so, the assessment should:

- identify the changes expected to occur as a result of the project;
- assess these effects and their significance;
- describe and justify mitigation measures and the plans for their implementation; and
- identify any residual effects of the project, i.e., those effects following mitigation, and assess the significance of those residual effects.

The methodology used to conduct the assessment of effects must be described and justified. There will be a clear explanation of how scientific, engineering and other knowledge has been used to reach the conclusions of the study. Any assumptions made must be clearly identified and justified. All significant gaps of knowledge and understanding will be identified where they are relevant to the principal conclusions of the assessment; any steps being taken by AECL to address these gaps will also be identified.

The relative environmental effects of the three alternative strategies will be first evaluated and compared, followed by a more detailed examination of the preferred alternative. For all evaluations, project-environment interactions, including those that may arise from possible accidents and malfunctions, will be summarized. The process used to identify such interactions and the likely adverse effects on the environment that may arise, must be identified.

The document must also include a description of the process, factors and criteria used to characterize likely environmental effects, and to determine their significance following application of mitigation measures. Factors used in the characterization of the effects and their significance, may include magnitude, duration, probability of occurrence, geographic extent and the degree to which the effects may be reversible. Criteria for assessing the significance of the potential environmental effects may also include relevant federal and provincial standards, guidelines and objectives for environmental quality criteria (air, water, biota) and for protection of human health (discharge limits, radiation dose limits).

The criteria and level of analysis used to choose from among the alternative strategies must be appropriate for ensuring that all alternatives are compared equally and that a clear environmental preference for one alternative is demonstrated. If a clear preference can be shown, it is possible that the comparison of alternatives can be done at a generally lower level of detail than the subsequent assessment of the preferred method.

AECL must also identify, characterize and assess the likely adverse cumulative environmental effects of the project with other activities or projects in the study area that have been or will be carried out. The other activities or projects considered and the approach and methodology used in the cumulative effects assessment must be documented.

The likely effects of the environment on the project must also be evaluated. Information must be presented on how these potential effects have been addressed in the planning of the project. Such effects may include those associated with in-situ or man-made hazards, such as flooding and severe weather.

AECL must also assess the potential adverse environmental effects on the sustainability of renewable resources that are likely to be affected by the project.

Mitigation Measures

AECL must describe the general and specific measures that it proposes to implement to mitigate the potentially adverse environmental effects of the project. This should include a description of contingency measures that have been designed to address potential accidents and malfunctions that could result in spills or unplanned releases of contaminants to the environment.

Some mitigation measures can be introduced in the “Project Description” section of the CSR (e.g. as standard operating procedures), with other more specific measures identified in the assessment of potential effects. For clarity, all general and specific mitigation measures which have been proposed for the project can be summarized in one section of the Report.

Mitigation measures will be described in terms of their purpose, timing and duration, economic feasibility, anticipated effectiveness, previously demonstrated performance and potential risk of failure.

Community and Stakeholder Consultation - AECL Program

Although public consultation during the preparation of the environmental assessment studies is not mandatory under *CEAA*, the CNSC considers this to be an essential component of this environmental assessment.

AECL must establish a public consultation program that keeps the community and stakeholders fully informed of the proposed project and provides reasonable opportunities for the issues, concerns and comments of the public to be identified and considered in the environmental assessment. This program should make use of existing public communication and participation activities of AECL, but should not necessarily be limited to those. The participation of individuals and groups from outside the geographic study areas identified for the assessment of effects will also be welcomed. The consultation program should extend throughout the entire environmental assessment process. Plans for continued community and public consultation activities after the assessment process should be identified.

AECL must describe the objectives and methods of their public consultation program in the assessment report. AECL must also identify and evaluate the results of their public consultation program and indicate in the CSR how public issues and concerns were addressed.

Under AECL’s planned consultation program for this project, interested parties will be identified and consulted early in the assessment process so that they are informed of the proposal and their comments and concerns are identified and properly addressed in the assessment study. The public consultation program may include the following:

- newsletters;
- an Open House;
- “Meet and Greet” meetings;
- opportunities for individuals to meet individually with team members;
- First Nations consultations; and

- regularly updated website information.

At this early scoping stage, it is not possible to identify all the individuals and groups that may have an interest in the assessment. Part of the purpose of the environmental assessment is to identify those stakeholders as early as possible. AECL must maintain a list of participants and take reasonable steps to keep each informed during the course of the assessment process.

Public Participation - CNSC Program

The environmental assessment process established by the CNSC, as the Responsible Authority for the assessment under the *CEAA*, includes opportunities for the public to participate in the process. These include: establishment of a *Public Registry* for the project, pursuant to the requirements of the *CEAA*; provision of information on the status of the assessment of the project via the CNSC Internet web-site (http://www.cnsc-ccsn.gc.ca); a three-week period for public review and comment on the draft “Scope of Assessment” document; and a planned four-week period for public review and comment on the draft CSR which will document the results of the environmental assessment.

The public review periods for the draft scope of assessment and draft CSR are in addition to the public consultation process to be conducted by AECL, and that which the Agency will conduct on the final version of the CSR.

These opportunities for public involvement are identified further in the “Assessment Process” section of this document.

Monitoring and Follow-up Programs

AECL must describe their proposal for monitoring and follow-up programs for the project, including their objectives, content, implementation and reporting of results.

AECL must identify any proposed changes or modifications to the existing monitoring programs for the Whiteshell Laboratories site. An overview of the content of the programs (parameters, locations, frequency, methods) will be provided; the details of the programs would be subject to further regulatory review during the licensing process that would follow this environmental assessment process. AECL will describe how the results of the monitoring programs are to be used in the management and operation of the decommissioning program.

In addition to confirming compliance with the terms and conditions of the CNSC licence, the proposed follow-up program will address the need to verify the predictions of environmental effects, and to determine the effectiveness of mitigation measures.

All monitoring and follow-up programs are to be designed to be integrated into the existing compliance monitoring and licensing programs of the CNSC.

A.7 DRAFT COMPREHENSIVE STUDY REPORT

Documentation of the results of the environmental assessment will be submitted by AECL to the CNSC in the form of a draft CSR. Following a public review of that draft, the CNSC will finalize the CSR and submit it to the Agency and the Minister of Environment for review and ministerial decision.

The CSR must provide the CNSC, and ultimately the Minister of Environment, with the information necessary to decide whether or not the potential adverse environmental effects assessed for the proposed project are significant. The report must demonstrate how both the potential environmental effects and related public concerns have been addressed, so that a decision concerning the acceptability of the residual effects may be rendered.

The CSR should be written in the clearest language possible. Where the complexity of the issues addressed requires the use of technical language, a glossary defining technical words and acronyms should be included. Maps, diagrams and charts should be provided wherever useful to clarify the text.

The CSR should be kept concise and well organized. It should only contain information directly relevant to environmental assessment decisions. Background and supplementary information, as far as possible, should be provided in annexes to the report.

The following titles may be used as a framework for the development of the CSR:

- Executive Summary
- Introduction
- Application of the *CEAA*
- Scope of the Project
- Scope of the Environmental Assessment
- Purpose and Description of the Project
- Alternatives Means of Carrying Out the Project
- Description of the Existing Environment
- Environmental Effects and Mitigation Measures
- Significance of Residual Effects
- Public Consultation Program
- Monitoring and Follow-up Programs
- Conclusions and Recommendations

A.8 CONTACTS FOR THE ASSESSMENT

Anyone wishing to obtain information on the project and the environmental assessment, can do so through the following contacts:

Mr. Barclay Howden
Head, Operational Facilities Licensing
Protection
Research and Production Facilities Division
Canadian Nuclear Safety Commission
Commission
280 Slater Street
P.O. Box 1046
Ottawa, Ontario
K1P 5S9
Fax: (613) 995-5086
Fax: (613) 995-5086

Mr. Bernard Richard, Program Specialist
Radiation and Environmental
Division
Canadian Nuclear Safety
280 Slater Street
P.O. Box 1046
Ottawa, Ontario
K1P 5S9
Phone: (613) 996-9997

E-mail address: richard.b@cnsc-ccsn.gc.ca

A.9 PROCESS STEPS FOR THE WHITESHELL LABORATORIES DECOMMISSIONING PROJECT EA

A. Determination of Applicability of the *CEAA*

- AECL submission of project description to CNSC: *Complete*
- CNSC staff determination of applicability of *CEAA*: *Complete*
- Notification of AECL of the determination: *Complete*
- Notification of the CEA Agency of the CNSC determination: *Complete*
- Notification of Manitoba provincial authorities of federal environmental assessment determination: *Complete*

B. Initiation and Conduct of Assessment

- Establish Public Registry under *CEAA* for the project: *Complete*
- Notify other potential Federal Authorities (FA) of the CNSC determination and solicit their determination of their roles: Notification complete; Responses received CNSC staff notification of AECL of FA determinations: *Complete*
- CNSC preparation of preliminary draft Scope of Assessment: *Complete*
- FA comments on preliminary draft of Scope of Assessment: *Complete*
- CNSC preparation of draft Scope of Assessment: *Complete*
- Distribution of draft Scope of Assessment for public review: *Complete*
- Public comment period (three weeks): *Complete*
- CNSC issues final scope of assessment: *Complete*

C. Documentation and Submission of Comprehensive Study Report

- AECL submits draft CSR to CNSC staff
- CNSC staff and FA complete technical review of draft CSR
- AECL revises and resubmits draft CSR to CNSC staff
- CNSC staff distribute draft CSR for public comments
- Public review of draft CSR (four weeks)
- AECL/CNSC staff revision of draft CSR to address public review comments
- CNSC staff submission of final CSR to Agency and Minister

D. Review of the CSR and Ministerial Decision

- Agency distribution of CSR for public review and comment
- Public Review *(period to be determined by the Agency)*
- Agency/CNSC staff review comments, and Agency prepares recommendations to Minister
- Minister takes decision on course of action
- Minister notifies CNSC of decision

E. CNSC Decision and Follow-up Actions

- CNSC staff review of Minister’s decision and determination of course of action to be taken
- CNSC Staff notify AECL of CNSC’s course of action
- CNSC staff provide public notice of course of action to be taken by CNSC

APPENDIX B

WINNIPEG RIVER SEDIMENT ASSESSMENT

Appendix B consists of three documents which form part of an analysis of sediments in the Winnipeg River designed to determine the risks to human and ecological health:

- Appendix B.1 presents the main findings and analysis.
- Appendix B.2 describes the plan for sampling the sediments in the River.
- Appendix B.3 gives the results of the analysis.

Appendix B.1

Winnipeg River Sediments: Human Health and Ecological Risk Analysis

Evaluation of the Potential Ecological and Human Health Risk Effects of Sediment Contaminated by the Process Water Discharge at Whiteshell Laboratories

B1.1 INTRODUCTION

B1.1.1 Background and Objectives

The process water outfall from Whiteshell Laboratories releases radioactive and other contaminants to the Winnipeg River. The contaminants are continuously monitored and with few exceptions the releases are below the relevant standards. In routine operation, contaminated water is held in a tank (in the Active Liquid Waste Treatment Centre or ALWTC), sampled, and released only if the release will meet the regulatory criteria. There have been a few accidental releases, all duly reported.

The releases changed distinctly over the operational history of the Laboratory. Releases were highest prior to 1985, when the WR-1 reactor was operating and the radionuclide mixture was characteristic of an operating reactor (Table 1). After 1986, the releases decreased progressively to the present, and there was a shift in the mixture of radionuclides. Some of the radionuclides reported have relatively short half-lives and they all have different environmental mobilities. As a result, only a few of the radionuclides are still detectable in river sediments.

Other contaminants include HB40, the organic coolant used in the reactor, as well as heavy metals, phosphorus from the laundry and other contaminants typical of a large office/laboratory complex.

The river sediments, water and biota are sampled routinely above and below the outfall. There are contaminated[1] sediments below the outfall. Fish samples show very little difference in Cs concentration above and below the outfall. In order to evaluate the impact of the contaminated sediments, they were characterized with respect to types of contamination, concentration and spatial extent. It was observed that the contaminant concentration drops quickly downstream from the outfall. The present evaluation is not an audit of past operations, and so there is no intent to determine the absolute downstream limit of contamination. The evaluation is part of a program to determine if remediation of contaminated sediments is required, and therefore the objective is to fully delineate the contamination that may, in some present or future scenario, have a potential to cause an adverse impact.

The objective of this evaluation is to estimate the potential effects of the contaminated sediment on biota in the river and on humans. The assessment endpoints for aquatic biota are clams because:

- they are abundant in the contaminated area,
- they dwell in or on the sediment,
- they have relatively small home ranges and so are exposed to a small area of sediment,
- they live long enough to accumulate radionuclides over several years, and
- they are important prey for fish, otters and turtles.

[1] Contaminated in the sense that concentrations present are higher than background concentrations.

There are no realistic assessment scenarios leading to a notable dose for humans. The assessment scenario considers external exposure from the sediment, as could result if the sediment were dredged (very improbable), the sediment was exposed as shoreline (improbable), or selected items from the sediment were collected as keepsakes (very improbable).
The work involved the following steps:

1. developing a conceptual model of the River bottom and the general nature of the sediments;
2. adjusting the model with information obtained from a series of diver inspections of the River;
3. defining a survey area based on areas delimited by identifying criteria where they would be no effects on human or ecological health;
4. carrying out a gamma survey of the River bottom;
5. analyzing sediments;
6. analyzing clams (as an indicator of ecological risk); and
7. preparing dose estimates for clams and humans.

B1.1.2 Description of the Outfall

The outfall, or discharge pipe, is a key feature in this evaluation. The pipe drains almost all the water from the Laboratories, with the exception of sanitary sewage. The ALWTC gathers radioactive liquid discharge from the research laboratories and the discharge from the ALWTC is piped to the reactor building where the flow is augmented by the cooling water discharge from the reactor (prior to 1986). The water then proceeds underground across the site and is augmented in flow by storm water runoff. In the final descent to the Winnipeg River, the pipe is a 1.2-m (4 foot) diameter corrugated steel pipe. The pipe is buried in the floor of a natural ravine and emerges from the riverbank about 2 m below the water surface, several metres off shore (depending on water level). There were no reports of visual inspection of the outfall pipe prior to 2000.

Current flow at the outfall is in the order of tenths of metres per second, so that there is no possibility of upstream movement of contaminated water. Ice cover is not reliable in this area and stretches of the river nearby are often open much of the winter. The river shoreline, on either side of the ravine, is a steep clay till bank with frequent cobbles and some large boulders. The bank is sparsely vegetated. There is less than 1 m of level shoreline at the base of the bank.

The shoreline is frequented by deer, as evidenced by tracks. In 2000, there were no notable signs of aquatic mammal activity, although they are common in the area. Anglers use the river frequently in the area, almost entirely from boats offshore.

Monitoring results showed high levels of radioactive contamination in sediments in some years, whereas in other years sampling at those same locations showed only moderate elevation. Sample collection from a boat, as done for monitoring, was difficult because the sediment is largely impenetrable. It was reasoned that the anomalously high contamination in certain years was the result of sampling location rather than a specific event in time. The reasoning was that the River current and hard bottom produced an erosional environment where only small pockets of contamination could be retained. The higher-than-average years were attributed to occasions when the sampling probe contacted a contaminated pocket. Because the exact location of the end of the pipe could not be determined, these pockets may have been very close to the pipe outlet.

Table 1

Computation of Scaling Factors From Annual Releases Measured at the ALWTC

Scaling factors are the release of a given radionuclide divided by the release of ^{137}Cs in the same year. Also shown are the coefficients for the correlation of releases to the release of ^{137}Cs.

Recorded annual releases											**Scaling factors**								
Year	**Cs-137 (GBq)**	**Total Beta (GBq)**	**Sr-90 (GBq)**	**Cs-134 (GBq)**	**Ce-144 (GBq)**	**Ru-106 (GBq)**	**Co-60 (GBq)**	**Other (GBq)**	**Total (GBq)**	**Total Alpha (GBq)**	**Total Beta**	**Sr-90**	**Cs-134**	**Ce-144**	**Ru-106**	**Co-60**	**Other**	**Total**	**Total Alpha**
1982	51.80	163.20	21.20	5.60	25.50	35.20	0.20	3.00	142.50		4.70	0.40	0.0004	0.71	0.99	0.0005	0.09	4.11	
1983	51.80	147.30	20.70	10.40	15.90	19.60	0.20	4.40	123.00		4.15	0.39	0.0010	0.44	0.54	0.0006	0.12	3.47	
1984	40.70	170.60	40.70	3.70	9.30	6.30	0.10	5.90	106.70		5.99	0.98	0.0006	0.32	0.22	0.0004	0.21	3.74	
1985	27.40	74.00	14.80	1.40	3.70	2.80	0.05	1.24	51.39		3.77	0.53	0.0005	0.18	0.14	0.0004	0.06	2.62	
mean											4.95	0.59	0.0007	0.49	0.58	0.0005	0.14	3.77	
1986	18.70	62.50	13.30	1.00	0.70	0.03	0.03	0.37	34.30	0.18	4.57	0.70	0.0007	0.05	0.00	0.0004	0.03	2.51	0.01
1987	12.60	35.10	8.90	1.80	0.20	0.03	0.02	0.20	23.80	0.17	3.72	0.69	0.0024	0.02	0.00	0.0004	0.02	2.52	0.02
1988	9.30	19.80	4.10	0.30	0.04	0.03	0.02	0.10	13.90	0.17	2.78	0.43	0.0008	0.01	0.00	0.0006	0.01	1.95	0.02
1989	13.70	24.80	4.10	0.16	0.17	0.08	0.04	0.56	18.81	0.26	2.31	0.30	0.0004	0.02	0.01	0.0009	0.05	1.75	0.02
1990	17.00	50.20	13.70	0.23	0.00	0.01	0.11	0.54	31.58	1.79	3.69	0.80	0.0006	0.00	0.00	0.0021	0.04	2.32	0.13
1991	14.40	30.60	3.82	0.35	0.03	0.01	0.08	0.28	18.97	0.41	2.60	0.26	0.0015	0.00	0.00	0.0020	0.02	1.61	0.03
1992	6.75	16.20	2.39	0.14	0.17	0.04	0.03	0.19	7.55	0.39	2.87	0.35	0.0017	0.03	0.01	0.0017	0.03	1.34	0.07
1993	3.74	12.90	1.86	0.14	0.48	0.29	0.13	0.11	6.75	0.32	4.03	0.49	0.0041	0.15	0.09	0.0163	0.03	2.11	0.10
1994	4.19	12.30	2.00	0.09	0.32	0.17	0.03	0.26	7.05	0.31	3.36	0.47	0.0032	0.09	0.04	0.0031	0.07	1.92	0.08
1995	3.24	8.50	0.88	0.04	0.92	0.20	0.01	0.03	4.31	0.17	2.93	0.27	0.0028	0.31	0.07	0.0013	0.01	1.49	0.06
1996	2.55	6.60	0.68	0.07	0.17	0.08	0.02	0.02	3.55	0.15	2.83	0.26	0.0073	0.07	0.03	0.0046	0.01	1.52	0.06
1997	1.53	5.20	1.00	0.00	0.02	0.00	0.00	0.03	2.59	0.12	3.63	0.65	0.0008	0.02	0.00	0.0009	0.02	1.81	0.08
1998	0.45	1.13	0.13					0.57		0.05	2.65	0.28					1.35		0.13
1999	0.63	1.64	0.29					0.92		0.05	2.65	0.45					1.48		0.09
mean											3.19	0.46	0.0022	0.063	0.022	0.0028	0.23	1.90	0.07
mean all years											3.5127	0.4845	0.0018	0.1504	0.1347	0.0023	0.2034	2.2993	0.0656
half-life	30.17	1000	28.6	2.062	284.3	368.2	5.271	1000	1000	1000									
r	1	0.97	0.84	0.88	0.89	0.83	0.89	0.87	0.99	0.45									

Note:

- Scaling factors are computed from releases corrected for radioactive decay to 2000, and so represent present scaling ratios.
- Correlation coefficient are Pearson correlation coefficients.
- The mean scaling factors from the ALWTC were used if sediment scaling factors were not available.

B1.1.3 Conceptual Model of the Sediment and Contaminant Behaviour

Based on the information available and interviews with the staff who do the routine monitoring, the following assumptions were used to describe the sediment and the contaminant migration downstream of the outfall.

- The River current dominates the setting and the processes.
- The riverbed was bedrock with pockets of gravel, or very heavily armored with boulders.
- The occasional high activity samples taken during the monitoring program were by chance drawn from pockets in the bedrock, between boulders, or in a sediment drift in the lee of the pipe itself where contamination escaped flushing by the current.
- The pipe had sediment inside, because of storm water runoff.
- From the grid sampling following a spill of HB40 (organic coolant used in the reactor), it was known that there was a potential centre-of-plume within 0 to 70 m downstream of the pipe, and another area of contaminant deposition in the bay about 500 m downstream.
- Dissolved contaminants from facilities on site will have substantial time to interact with and sorb to natural particles in the storm water runoff, so that sorption onto particles may occur well before the effluent enters the river and contacts the river sediments.

B1.2 PHYSICAL INSPECTION AND SAMPLING

B1.2.1 Diver Inspection

To confirm the assumptions in the model, an inspection program using divers was undertaken in August 2000 to provide additional data on sediment contamination levels. The divers used continuous video monitoring, provided interactive interpretative comment as they explored the area, and were able to collect sediment and clam samples. Sampling points were located by a Geographic Positioning System (GPS) buoy (a shortened version of the video is available). The following observations were made:

- The pipe lay on a sloping bottom, and there was a separation of the last segment from the previous segment, just where the pipe entered the submerged riverbank. The separation was about 20 cm wide at the top, and the segments remain joined at the bottom. Inside the pipe at the separation, there was much more sediment on the bottom of the pipe, as though sediment washed in from the bank overhead.
- The diver entered the pipe and found a well-sorted pea gravel on the bottom. At the end of the pipe and under the pea gravel was a layer of black tar-like material. It was sampled using a knife.
- Large catfish were encountered in the pipe on the first visit, but not on subsequent days.
- The sediment near the pipe outlet was gravel, cobbles, and detritus such as tree branches. Nearer shore and at the separation in the pipe, there was more clay.

Further towards the center of the river there were more large boulders. There was no light sediment as expected in depositional settings. The sediment material was consistent with the above-water riverbank, from which the clay was eroded leaving the stones.

- The area within 70 m of the outfall is clearly an erosional environment, there is negligible light sediment, and the armoring is the result of erosional loss of the clay fines.
- The current accelerates as the river passes the small point of land between the study area and the downstream bay, so that there is little chance of deposition before the bay (this is supported by the isopleths drawn by Guthrie and Acres (1979) for a spill of HB40 organic coolant).
- The sediments in the study area below the boulder and gravel armoring are dense clay, with no evidence of varves or layering, and this is very likely of glacial Lake Agassiz origin.
- Clams[2] were abundant; some buried in the sediment, some on the surface.
- Inspection of the sediments in the downstream bay revealed a thin layer of light sediment, indicative of deposition. At the same time there were many large boulders, suggesting that erosion did occur in the past or in cycles. There was a current reversal, as a result of an eddy effect. Accordingly, clams were scarce.

The divers collected short-core sediment samples using the same sampling tube as used in the monitoring program. The tubes were about 2.5-cm diameter, and were pushed or hammered in by hand to about 10-cm depth. The positioning was determined by GPS. When the sample was returned to the surface, the top ~1 cm was collected as one sample, and the remainder of core as the other. Grab samples were also taken of the gravel in the pipe, the tar-like material in the pipe, coatings on the pipe and clams.

A gamma survey probe adapted for underwater use was carried by the divers. For a reading, it was pressed onto the sediment surface and counts were recorded by an operator on the surface. Readings were taken on a grid downstream of the pipe. In one case, the probe indicated high activity while the diver was moving, and follow-up inspection revealed a large boulder with higher activity immediately in the lee and in the current-ward ends, but not along the sides. This boulder was about 20 m downstream of the pipe, and there was no notably high activity between it and the pipe.

The initial diver inspection in August confirmed that contamination was not evenly spread, that the river bottom was not bedrock but was heavily armored with gravel and that erosion is a dominant process at the outfall. A grid survey indicated a rapid decrease in concentration downstream, the centre-of-plume was further from shore than the end of the pipe and the downstream bay was not very contaminated. The survey did not reach the mid-stream edge of the plume, and was not in sufficient detail to construct an inventory of contamination. Thus, another survey and sampling campaign was conducted in September 2000.

[2] Species were *Amblema plicata* (Three-ridge), *Leptodea complanata*, *Lampsilis radiata siliquoidea* (Fat Mucket), *Pyganodon grandis* (Common Floater), and Strophitus rugosus.

The second campaign differed from the first in several aspects:

- The survey grid was larger, and with improved equipment it was possible to reach the edge of the plume in all directions. All positions (except a few near-shore positions because of tree interference) were recorded by GPS.
- In addition to the gamma survey probe, a 256-channel gamma spectroscopy probe was adapted for underwater use and was used to calibrate the survey probe from counts per second (cps) to nGy/h in several locations. Analyses of the top 5 cm of sediment were used for the calibration, because that approximates the depth of sediment 'seen' by the gamma probe.
- Background measurements were repeated and refined.
- Once the centre-of-plume was defined, three long cores were collected in split barrel cylinders and a composite of ten grab samples of surface sediment were collected.
- Three deep cores were also collected upstream of the pipe in an area considered to be representative of the sediment type at the center-of-plume.
- Composite samples were also collected in the same manner upstream of the pipe and in the downstream bay.
- Clams were collected as available.

B1.2.2 Derivation of Investigation Spatial Bounds

As part of the diver inspection, it was necessary to define how large an area should be surveyed. There is evidence of very low levels of radioactive contamination several kilometers downstream of the site. There was no need to confirm this sincethe intent of the survey was to identify the area of sediment contamination that could impact the environment. The radioactive contaminants were used as a tracer to indicate the presence of all the contamination from the Laboratories. The approach was to define boundaries for the survey area beyond which the risk to aquatic biota and human health were very low. A very conservative 'technical' radiation level was identified (described in this section), an 'evaluation level' that was lower still was defined, and the actual survey was carried out to an even lower 'investigation level'. The criterion to define the edge of the contamination plume was five consecutive grid points below the investigation level outward from shore.

A number of cutoff values were developed, to form multiple lines of reasoning for selection of the investigation level.

Expected No Effect Value (ENEV)

In the process of the Canadian Environmental Protection Act (CEPA) investigation of contaminants on the Priority Substance List 2 (PSL2), staff from the Canadian Nuclear Safety Commission (CNSC) working under the direction of Environment Canada published radiation levels below which no effect is expected (expected no effect value or ENEV) (Environment Canada and Health Canada 2000 a,b). They established two Tiers: Tier 1 is hyper-conservative and is based on the most sensitive organism and environmental setting reported in the literature (within certain data quality guidelines) and typically was lowered by a factor of 10 to ensure hyper-conservatism. Tier 2 is more realistically conservative, it is based on the most sensitive study considered relevant to Canadian conditions. ENEVs for chronic exposure, taken from the PSL2 July 2000 Draft (issued for public review) are shown in Table 2. The PSL2 data remains in draft and under review.

Table 2
Summary of Conservative and Realistic ENEVs Used to Assess the Potential Toxicity of Exposure of Non-Human Biota to Radiation in the PSL2 Documents

Taxa	**ENEV ($Gy \cdot a^{-1}$)**	
	Tier 1 (Hyper-conservative)	**Tier 2 (Conservative)**
Fish	0.02	0.2
Benthic Invertebrates	0.062	0.6
Algae	0.0026	0.88
Macrophytes	0.0026	0.88
Small Mammals	0.01	0.4
Terrestrial Plants	0.088	0.88
Terrestrial Invertebrates	0.0088	0.9

Ratio of ENEV to Background

A simple and practical way to specify a technical cutoff value for a field survey is as an increment in radiation level above background. The PSL2 document suggests background radiation doses for aquatic organisms is in the range of 0.7 to 1.7 $mGy \cdot a^{-1}$ (Environment Canada and Health Canada 2000 a,b). The upper limit of this range is only 1.5-fold below the Tier 1 ENEV for aquatic macrophytes and algae. Variation in background would encompass this difference[3]. The most sensitive Tier 2 aquatic ENEV is for benthos (decreased molting in the goose barnacle), and this is 350-fold above the upper limit of the background range.

Observed gamma activity upstream of the Whiteshell Laboratories outfall (September 2000) were about 0.3 to 0.5 $mGy\ a^{-1}$, lower than the background range anticipated in the PSL2 document. The Tier 2 ENEV for benthos is 1300-fold above this value.

Effects-Based Calculations

Starting from the Tier 2 ENEV for benthos of 0.6 $Gy \cdot a^{-1}$, one can compute the sediment concentration that would give this dose, assuming much of the radiation dose is from ^{137}Cs.

The external dose conversion factor (DCFe) is 4.02 x 10^{-6} $Gy \cdot a^{-1}$ per $Bq \cdot kg^{-1}$ dry weight, assuming immersion in sediment (Amiro 1997).

[3] Because of the 10-fold conservatism adjustment in Tier 1, the actual observed effect (loss of synchrony in an algae culture in the laboratory) was at a dose 15-fold above the upper limit of the background range. Since the sediments have retained the contamination, the more relevant Tier 1 ENEV is for benthos (62 $mGy \cdot a^{-1}$), and this is 36-fold above the upper limit of the background range.

The sediment concentration is ENEV / DCFe:

$$(0.6 \text{ Gy} \cdot \text{a}^{-1}) \;/\; (4.02 \times 10^{-6} \text{ Gy} \cdot \text{a}^{-1} \text{ per Bq} \cdot \text{kg}^{-1} \text{ dry weight})$$

$$= 1.5 \times 10^{5} \text{ Bq} \cdot \text{kg}^{-1} \text{ sediment dry weight}$$

This is higher than any ^{137}Cs concentration measured in the river sediments ever.

The internal dose conversion factor (DCFi) is 4.10×10^{-6} Gy · a^{-1} per Bq · kg^{-1} wet weight of tissue (Amiro 1997). Flesh concentrations can be estimated from water concentrations, which in turn can be related to sediment concentrations. The PSL supporting document suggests benthic tissue / water concentration ratios (CR) for Cs of about 800 Bq kg^{-1} flesh wet weight per Bq L^{-1} (Environment Canada and Health Canada 2000b: 74)). Similarly, sediment / water partition coefficients (Kd) are reported as 1000 L kg^{-1}, with a range of 50 to 80000 L kg^{-1}.

The sediment concentration is (ENEV · Kd) / (DCFi · CR):

$$(0.6 \text{ Gy} \cdot \text{a}^{-1}) \cdot (1000 \text{ L kg}^{-1} \text{ dry weight}) \;/\; (4.1 \times 10^{-6} \text{ Gy} \cdot \text{a}^{-1} \text{ per Bq} \cdot \text{kg}^{-1} \text{ wet weight}) \cdot (800 \text{ Bq kg}^{-1} \text{ flesh wet weight per Bq L}^{-1})$$

$$= 1.9 \times 10^{5} \text{ Bq} \cdot \text{kg}^{-1} \text{ sediment dry weight}$$

This is higher than any ^{137}Cs concentration measured in the river sediments ever. If the lower Kd value is used, the estimated sediment concentration is:

$$(0.6 \text{ Gy} \cdot \text{a}^{-1}) \cdot (50 \text{ L kg}^{-1} \text{ dry weight}) \;/\; (4.1 \times 10^{-6} \text{ Gy} \cdot \text{a}^{-1} \text{ per Bq} \cdot \text{kg}^{-1} \text{ wet weight}) \cdot (800 \text{ Bq kg}^{-1} \text{ flesh wet weight per Bq L}^{-1})$$

$$= 9100 \text{ Bq} \cdot \text{kg}^{-1} \text{ sediment dry weight}$$

Concentrations of ^{137}Cs above this have been observed in the river sediments, but only very near the outfall pipe.

The background concentrations of ^{137}Cs in sediment upstream of the outfall are in the order of 4 Bq · kg^{-1} sediment dry weight. The computed effect concentrations are at least 2300-fold above this background.

Human Exposure Calculations

A rather hypothetical exposure scenario is that of humans directly exposed to the sediments. The dose limit (DL) of 5×10^{-5} Sv a^{-1}, based on the Atomic Energy Control Board (1987) risk limit for waste disposal, is used as a reference.

Assuming the person stood continuously on the sediment, the DCFe is 3.6×10^{-12} Sv a^{-1} per Bq kg^{-1} sediment (Holford 1988, 1989). The sediment concentration is DL / DCFe:

$$(5 \times 10^{-5} \text{ Sv a}^{-1}) \ / \ (3.6 \times 10^{-12} \text{ Sv a}^{-1} \text{ per Bq kg}^{-1})$$

$$= 1.4 \times 10^{7} \text{ Bq kg}^{-1}$$

Clearly human external exposure is not a limiting criteria.

Summary

Expressed as an increase above background, the arguments presented indicate a technical cutoff of at the least 36-fold, and more realistically 350-fold. These are derived from the Environment Canada and Health Canada (2000 a,b) ENEV values for Tier 1 and Tier 2. Based on the known distribution of contamination in the sediment, an evaluation cutoff of 10-fold above the measured background was used, and the investigation cutoff was 5-fold above background. Although these are very conservative cutoffs, the area defined by these criteria was small enough that a thorough survey was possible. Based on this analysis, the edge of the plume was defined at concentrations well below where any effects would be expected.

B1.2.3 Results and Interpretation of Gamma Survey

The positions of the gamma survey points are shown in Figure 1. The survey lines are not straight because wind and current made it difficult to direct the divers to walk in straight lines. The points are colour coded to show the level of activity observed. These are also shown in the 3-D plot of Figure 2. The plane at the top of Figure 2 is 350-fold above background, the Tier 2 level derived in B1.2.2 of this Appendix. Clearly, none of the observations approach this level. Figure 3 shows the activity in counts per second (cps) as observed in the survey along the centre line of the plume downstream from the end of the pipe. The rapid decrease in concentration with distance is evident.

The two peaks of activity just downstream of the pipe outlet were taken as the centre-of-plume. The fact that there are two peaks instead of one may reflect features of the bottom topography or sediment (that were not apparent to the divers) or may reflect the discharge history. When discharges occurred at times of high flow, such as spring melt or when the reactor was drawing large volumes of water, the increased exit velocity of the effluent would propel contaminants further towards the centre of the river. In low flow, the contaminants would move more directly downstream from the end of the pipe.

There was a slight increase above background in the sediment immediately downstream of the separation in the pipe. This is only barely visible in Figure 2. Contaminated water would exit the separation when, because of temperature differential, it was more buoyant than the river water. The reactor cooling water would have been warmer and more buoyant at least some of the year. The relatively small amount of contamination near the separation may be because the bulk of the water exited the end of the pipe, or the sediment near the separation undergoes more turbation because of shoreline effects. More turbation would cause particulate contaminants and contaminated water to mix with the bulk flow of the river, and may limit localized contamination.

Figure 1

Positioning of Grid Points for Gamma Survey of Sediments

Each point shown by a coloured symbol. The points are superimposed on a low-resolution aerial photograph. The colour of the points is indexed to the activity level observed. The straight line out from the inlet is the outfall pipe.

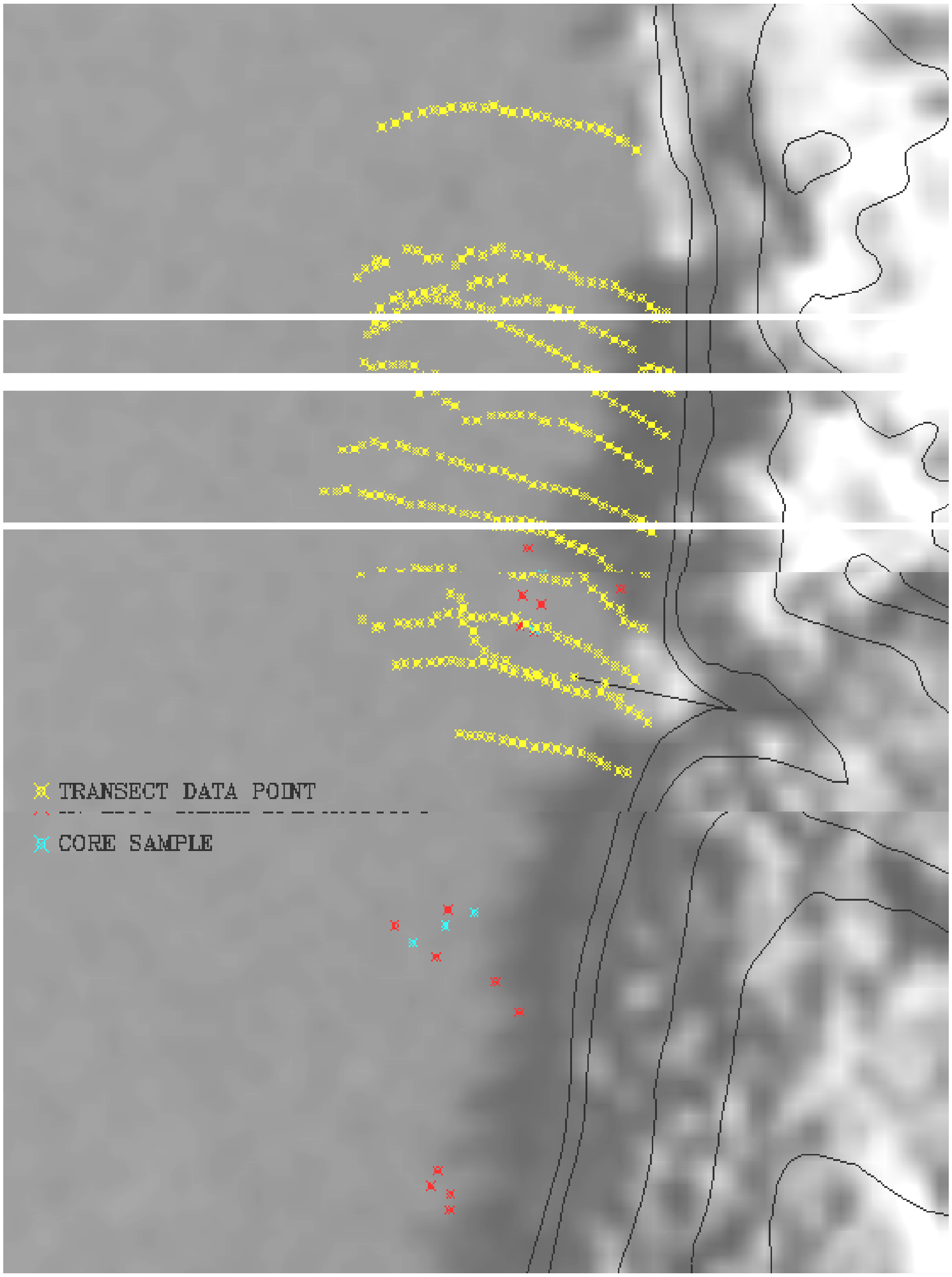


Figure 2

Three-Dimensional Rendition of the Gamma Survey Results

The observed level of activity is indicated on the vertical (z) axis and by colour coding. The plateau at the top of the graph is the Tier 2 expected no effect level for effects on benthos, clearly well above any observed activity levels.

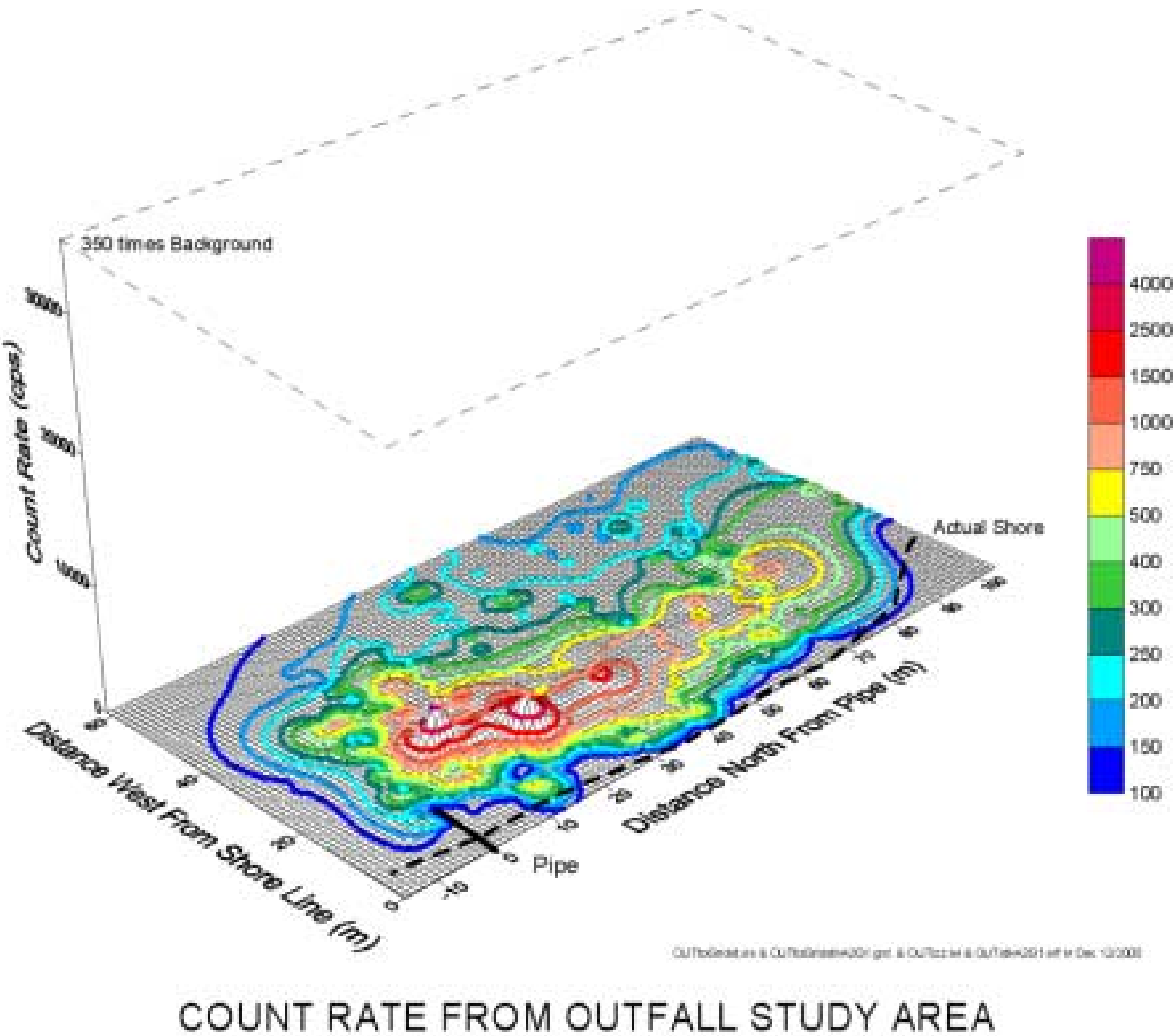
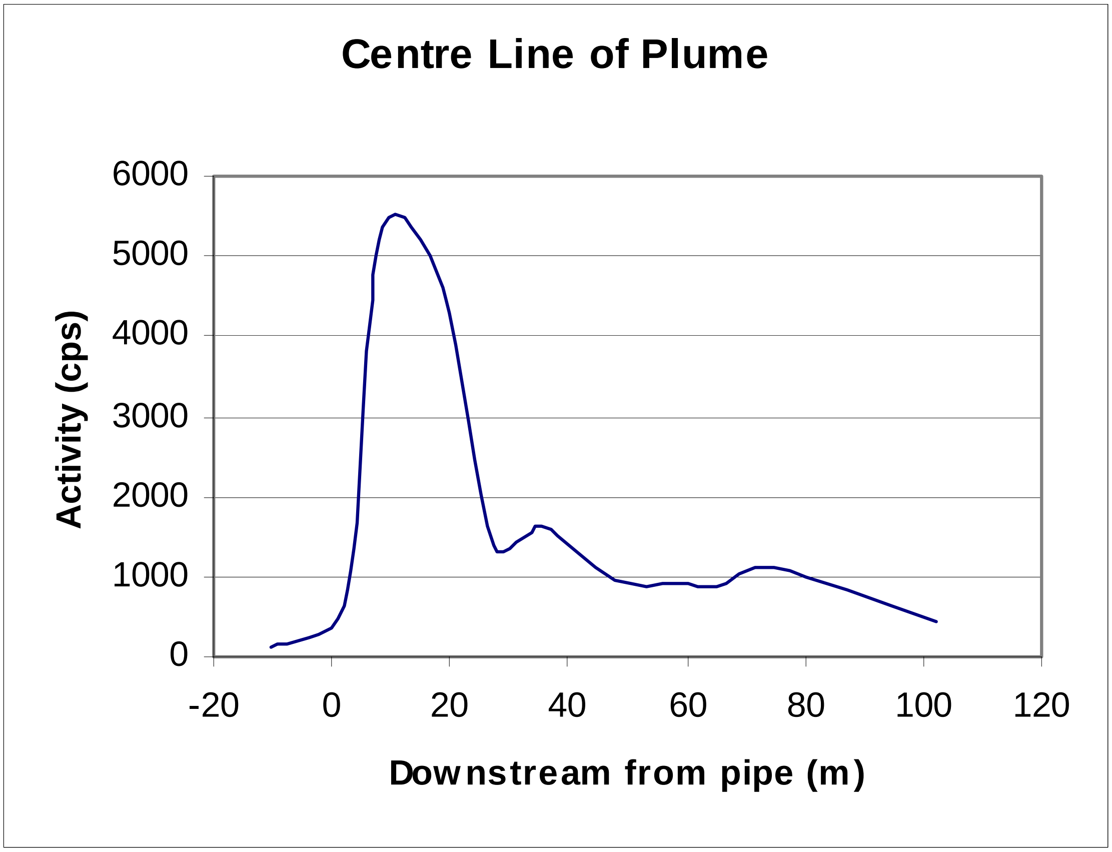


Figure 3

Activity in Counts per Second (Cps) Along the Centre of the Plume Downstream From the End of the Discharge Pipe



The plume shape (Figure 2) is similar to that observed earlier for the survey of spilled HB40 (Guthrie and Acres 1979). There is an elongated region of contamination between the outfall pipe and the small downstream point of land. There is another elongated region of lesser contamination in the next bay. There is less contamination off shore from the point because the current accelerates there, which removes sediments from the riverbed.

The gamma survey results were plotted with software that allows definition of isopleths. It will compute the area in square meters bounded by each isopleth line. These were used to compute an inventory of contaminant in the sediment of the evaluation area (Table 3). The observed activity at the isopleth line (counts per second or cps) was corrected for background, converted to dose rate (nGy/h) using the calibration developed for the sediment survey and converted to concentration of ^{137}Cs (Bq/g) based on a calibration point where sediment analysis was completed for sediment from a gamma survey position. Assuming a sediment density of 1500 kg/m^3, consistent with the dense clay observed and a contamination depth of 5 cm (discussed in detail in the next section), the contamination per unit area was computed. This value multiplied by the corresponding area between this isopleth and the next gives the inventory between adjacent isopleths in Bq. These values were summed for all the isopleths, resulting in an estimate of total inventory of 1.3 GBq. It is relevant to note that this is substantially less than the annual releases of ^{137}Cs prior to 1985 when the reactor was operating. Because there is no evidence of buried contamination below 5 cm, it is assumed that the ^{137}Cs absent in the local sediment was flushed downstream. There is evidence of loss of contamination from the area in the annual monitoring data. Samples are collected annually from approximately the same locations (probably within 10-20 m). Samples 150 m from the outfall show a general decrease in concentration with time, at least from 1992 to 1998 (earlier data were recorded in different units and are not easily compared).

B1.2.4 Results and Interpretation of Sediment and Clam Analysis

The sediment samples were subjected to a broad range of analyses, following a detailed Data Quality Objectives plan. There were five types of samples (Table 4). Certain analytes were decided a priori, others were contingent on the results of analysis of another analyte. Some analytes such as fission products and the organic coolant used in the reactor (HB40) were assumed to be contaminants from the effluent, others such as ^{210}Pb and ^{226}Ra were assumed to be almost entirely of natural origin. In general, the concentrations of the contaminant analytes were positively correlated: when ^{137}Cs was elevated, there was a greater likelihood that other contaminant analytes would also be elevated.

In most of the short-core samples, the activity was higher in the surface 1-cm slice than in the rest-of-core. It was also usually higher in the fine fraction than in the coarse fraction. Because this is an erosional zone, there has to be a conceptual model of why any of the contamination remains in the local sediment. As described in the conceptual model in section B1.1.4, contaminants may enter the river dissolved or already sorbed onto particles. Dissolved and fine-particle contaminants would tend to be swept downstream by the river current, so the observed contamination of the fine sediments near the outfall requires some explanation. There could be some sedimentation of fines around sediment-bottom features such as boulders and some diffusion and sorption of dissolved contaminant into the clay sediment. Coarse particulate contaminants will be more likely to remain near the outfall. Once deposited, contaminants may desorb from coarse particles and sorb to the clays, because of the very high sorptive capacity of the clays. It is hypothesised that the fine clay sediments were contaminated largely by diffusion as the bulk of the contamination was flushed past in the water column. This is an inefficient process, and may account for the low recovery of ^{137}Cs in the sediment compared to the amount released.

The concentrations of contaminants correlated well to the pattern observed by gamma survey, with some exceptions. Although the analytical results showed progressive decreases in concentration with distance from the outfall, there were certain samples that had notably elevated concentrations. These are analogous to the elevated contamination described around a boulder in section B1.2.1. In one of these samples, the elevated activity was in the coarse fraction, different from the expected behaviour of ^{137}Cs that sorbs strongly to clay. The coarse fraction was manually separated, and the activity was found to be associated with small black flakes. Elevated activity was also observed in the long cores associated with black tar-like material.

The observation of a progressive decrease in sediment contaminant concentrations coupled with points of elevated activity led to a revised conceptual model of the contaminant distribution. It would now appear that much of the contamination was spread in a fluid-based process, either in solution or as fine particles that created a fairly regular-shaped plume of contamination. In addition, there are spots of elevated activity that appear to be the result of particulate contamination. Not enough of these spots were found to determine if they are distributed in a pattern concentric with the observed plume, although that would be a logical hypothesis.

The analysis of the black organic materials indicated that the UV absorbance method was not well correlated to the presence of HB40. The UV method had been developed as a reactor process control tool, it was sufficiently well correlated to HB40 when HB40 was the dominant source of organic material. Natural organic materials absorb UV, and so this method is not well suited to analysis of environmental samples. The use of gas chromatography coupled with mass spectroscopy (GC/MS) is much more specific to HB40. The HB40 underwent changes as it was irradiated and so both new and irradiated HB40 was used to develop standards and identify the diagnostic peaks. In general, the relative concentrations of the lighter fractions of HB40 decreased with time and use and the heavier fractions increased. The HB40 may also undergo transformation in the environment, but no information was available on this. Thus, there may still be some uncertainty about the specificity of the GC/MS analysis for HB40 in the environment. The results of HB40 analysis indicate that it is present, but only as a small fraction of the organic detected by UV absorbance. Even the organic coating found inside the pipe contained very little HB40, suggesting that it may be another material such as a sealant that could have been used when the pipe was installed. Such material would be expected to sorb some HB40 from the water because both are strongly hydrophobic.

There was a correlation observed between radioactivity and the presence of organic in the sediment. If the organic were HB40, it may contain some radioactivity directly from the reactor, but this depends upon the amount of fuel failure in the reactor at the time of the release. As such, there is no necessary linkage between HB40 and radioactive contamination, but there is a correlative linkage in that both would be derived from the effluent stream.

The interpretation of the results of the analysis of clamshell and soft tissue are somewhat limited by the detection limits: the soft tissue samples in particular were quite small (Table 5). Nonetheless, ^{137}Cs was found in most samples (7 from the composite sampling area, 13 from elsewhere near the outfall). There was considerable variation, the average was 0.16 Bq/g dry weight (n=20) with slight.

Table 3

Estimation of the Inventory of Cs-137 In Sediments in the Study Area Just Downstream of the Outfall

Areas are computed from measured count rate (Cps) isopleths. Conversion to activity concentration (Bq/G) is based on a calibration point between gamma survey and analytical result.

Isopleth (cps)	Net Count Rate (ncps)	Isopleth Area (m^2)	Net Area (m^2)	Isopleth Dose Rate (nGy/hr)	Activity Concentration (Bq/g)	Total Activity (GBq)	Bkg (cps)
100	0	1598.71	6.8	8	0.27	0.000	100
150	50	1591.90	3.9	23	0.81	0.000	
200	100	1587.99	15.6	38	1.34	0.002	
250	150	1572.39	44.3	54	1.88	0.006	
300	200	1528.14	50.1	76	2.69	0.010	
400	300	1478.03	193.6	107	3.76	0.055	
500	400	1284.44	244.9	161	5.65	0.104	
750	650	1039.54	556.1	237	8.34	0.348	
1000	900	483.45	204.2	352	12.37	0.189	
1500	1400	279.21	159.3	581	20.44	0.244	
2500	2400	119.92	89.1	963	33.88	0.226	
4000	3900	30.81	28.7	1346	47.33	0.102	
5000	4900	2.15	2.1	1560	54.86	0.009	
		Total=	1598.706		Total =	1.295	

Dose rate to activity concentration calibration points:

Core #3	2900	nGy/h	102	BqCs/g	0.0352	ratio

Assumptions:

cps per nGy/h	3.27
Bq/g per nGy/h	0.035
density kg/m^3	1500
depth (m)	0.05

Table 4

General Analysis Plan for the Samples Collected

Deviation from this plan only occurred when sample volumes were insufficient or where exploratory analysis of samples not scheduled for analysis were done.

Analyte	Grab Samples (n = 4)	Shore-Core Samples (n = 71)	Composite Samples (n = 3)	Long-Core Samples (n = 6)	Clams (n = 14 in First Sampling, More in Preparation)
Gamma spec, two detection levels (count times) used	All	All surface slices, selected rest-of-core slices. Coarse and fine fractions separated	All. Coarse and fine fractions separated	Every cm near the surface and at intervals with depth, ^{210}Pb in two selected cores	All, shell and soft tissue, no dissection of soft tissue
Total alpha and total beta	All	As above	All	None	All, as above
Radiochemical ^{90}Sr, generally only when gamma spec was elevated	Selected	Selected	All	None	None
UV absorbance as an indicator of organic	All	All surface slices, selected rest-of-core slices	All	None	None
HB40 analysis by GS/MS, only if UV absorbance indicated concentration about 75 ppm	Selected	Selected		None	None
Metals	None	None	All	None	None

Table 5

Radiological Dose to Clams From Measured Tissue Radionuclide Concentrations

Only Cs-137 was detectable. External dose is computed using the observed sediment concentration in the composite sample.

Clam Data	Measured Tissue Concentration in Clams (Bq/g Dry Tissue)	Measured Tissue Concentration in Clams (Bq/g Fresh Tissue)	Composite Sample of Sediment (Bq/kg Dry Sediment)	Net RBE	Internal DCF (Gy/a)/ (Bq/kg Fresh Tissue)	External DCF In Water (Gy/a)/ (Bq/m^3)	External DCF In Sediment (Gy/a)/ (Bq/kg Wet Sediment)	Clam Internal Dose (Gy/a)	Clam External Dose (Gy/a)	Clam Total Dose (Gy/a)
Average (n=20)	0.16	0.03	2.6	1	4.10E-06	2.68E-09	4.02E-06	1.31E-07	7.34E-06	7.47E-06
Maximum	0.75	0.15	2.6	1	4.10E-06	2.68E-09	4.02E-06	6.15E-07	7.34E-06	7.95E-06

Note:
- RBE is the relative biological effectiveness of alpha emissions compared to photon emissions.
- The dry-weight/wet-weight ratio is assumed to 0.2 (Bird and Schwartz (1996).
- The sediment is assumed to have the bulk density of clay, 1500 kg/m^3, and a resulting wet/dry weight ratio of 1.43.

trends to higher tissue concentrations close to the outfall. Among the 7 clams with detectable levels of Cs taken from the composite sampling area, there was an indication (not significant) of a negative correlation between flesh Cs concentrations and length or biomass. There were no distinct differences among the species in where they were found or in their tissue concentrations.

The composite sediment samples (Table 6) were taken in the centre-of-plume area, based on the gamma survey observations in the field, and were intended to represent an area of about 100 m^2. These were collected specifically to allow extensive analysis of many analytes, including analytes that require specialized sample handling such as HB40 and Hg. The composite also represents a spatial average concentration, with a scale consistent with the migration of clams. There were other composites collected from upstream (background) and from the downstream bay. The observed concentrations of radionuclides were relatively low even in the centre-of-plume (Table 6). Some concentrations of metals and other elements were elevated in the centre-of-plume area compared to background (Table 7). There was more elevation of metal concentrations in the downstream bay, but the sediment materials were different there and the background sample does not represent this area. In addition, this area may be affected by the sewage lagoon outfall that is nearby. None of the observed metal concentrations were above the probable effect levels that have been established by the Canadian Council of Ministers of the Environment (1999) and all but Cd were below the Interim Sediment Quality Guidelines (ISQG). For Cd, the detection limit was higher than the ISQG. A useful visual observation was that many of the individual jars that were composited from the centre-of-plume area (10 subsamples) contained small clams, about 1-cm diameter. Clearly the clam population is thriving in this area.

Three long-core samples were taken in the centre-of-plume and three upstream. One of each set was analysed for ^{210}Pb by gamma spectroscopy (14-hour counts), and the remainder for ^{137}Cs (4-hour counts). The cores in the centre-of-plume area were not randomly collected, they were taken where the gamma survey showed especially high radioactivity. There was either compression or plugging in the core tubes (see notes accompanying Figure 4): the core tubes were pressed to about 50-cm depth, but only about 25-cm depth of core was collected. Most likely, core tubes became plugged with the very dense clay and did not collect sediment beyond about 25 cm. This means the recorded depths must be considered minimum possible depths, the actual depths may be greater, although probably not the full depth that the core was pressed into the sediment. Core #2 (Figure 4) had visible black organic material in the top 5 cm. The results show a rapid decrease in ^{137}Cs concentration with depth. There is little evidence of clean sediment on top (Core #2 had gravel on top that had low concentrations of contaminant). This suggests there is no burial of contamination, and the concentration gradient with depth is consistent with diffusion of contaminant into the sediment profile as the contamination mechanism. Bioturbation may have a role, but the clay was dense and showed no signs of bioturbation. It appears this sediment is of glacial origin and there is no net deposition in the area. Accordingly, there should be no peak elevated concentration of ^{137}Cs with depth as is observed as a result of bomb fallout Cs in depositional areas. Some of the bottom segments of the cores were slightly elevated above background but well below the concentrations observed at the surface. There is a possibility the bottom of the core was subject to contamination because it was exposed during handling. The ^{210}Pb profiles decrease progressively with depth as expected. There was analytical interference between ^{137}Cs and ^{210}Pb in the surface slices at the centre-of-plume, so that accurate measurements of present ^{210}Pb deposition are not possible. Interpretation of the ^{210}Pb in terms of sediment age has not been done at this time.

The cores from the background area had ^{137}Cs concentrations just marginally above detection limits at some depths, and below detection limits for the remainder. Of the detectable concentrations, the range was 0.002 to 0.02 Bq/g dry weight. There was no trend to increase or decrease with depth (ranging 18 to 28 cm), except that the highest value (0.02 Bq/g), which was 3.5-fold higher than all other samples, was observed at the second-from-top slice (5-6 cm). This point may be anomalous. The lack of trend with depth is consistent with the concept of this as an erosional zone where there may be no bomb fallout ^{137}Cs remaining. The ^{210}Pb data from the background core showed no trend with depth (range 0.019 to 0.047 Bq/g dry weight), again consistent with erosion.

B1.3 EVALUATION

B1.3.1 Scenarios, Endpoints and Approaches

The shoreline within 1 km of the outfall is controlled by AECL, so that there will be no water extraction for human use and quite restricted access to the shoreline close to the outfall. Because of this, water quality as a result of sediment contamination is not an issue. In addition, water quality is monitored routinely. The shoreline is muddy, narrow, tangled with fallen trees, and generally not conducive to use, even if people reach it by boat. Because of this, the evaluation emphasizes ecological impact.

Many organisms may interact with the contaminated sediments, despite the fact they are in 3- to 4-m deep water. Clams are an obvious endpoint because they were present and measured, they are long-lived and relatively sessile, and they dwell in or on the sediment. Benthic insect invertebrates may be important, but are short-lived and emergent species are only seasonally present. Bottom feeding fish are present and small clams have been found in netted fish. A very large turtle was observed in the area and may feed on clams. Aquatic mammals such as otters would feed on the clams, although there was no evidence in the form of scats or other sign on the shore.

Clams were chosen as the assessment endpoint. The dosimetry calculations based on tissue concentrations (Amiro 1997) are the same for all organisms, so only the potential for biomagnification would indicate the need to evaluate higher trophic levels. Exposures to predators of the clams were not estimated because:

- the possible predictors are quite mobile and will feed outside the contaminated area, thus diluting their ingestion of contamination by some unknown amount; and
- most radionuclides do not biomagnify, and are at their highest concentration in biota most closely associated with the contaminated media.

Human exposures from ingestion from the sediment are not likely. Clams and other benthic invertebrates such as crawfish are not commonly consumed by people in this area. Fish may be contaminated, but monitoring of fish has shown only slightly elevated contamination downstream. As a result, only external exposure is plausibly important and even this is improbable. The scenario chosen was external exposure from proximity to the sediment. This is assumed to include scenarios such as handling a boat anchor that was rooted in the sediment.

Table 6

Results Of Gamma Spectroscopy of Composite Samples

Activities are shown as bq/g, with the corresponding 2 sigma error if the level was considered detectable. Shaded cells indicate non-detectable. The other radionuclides reported, sr-90, mn-54, co-57, c0-58, zn-65, nb-94, ag-110m, i-131, cs-134, ce-144, eu-152, pb-210, u-235, np-237 and am-241 were all non-detectable with 14-hour counts.

		K-40		**Co-60**		**Cs-137**		**Eu-154**		**Ra-226**		**Th-232**	
Comp-1	Fine	0.40	0.03	0.002	0.001	2.61	0.03	0.005	0.004	< 0.12	----	0.016	0.005
	Coarse	0.55	0.03	0.002	0.001	1.00	0.01	< 0.006	----	< 0.08	----	0.018	0.004
Comp-2	Fine	0.42	0.03	< 0.002	----	0.003	0.001	< 0.006	----	< 0.03	----	0.017	0.005
	Coarse	0.61	0.05	< 0.002	----	< 0.002	----	< 0.007	----	0.011	0.003	0.016	0.005
Comp-3	Fine	0.41	0.05	< 0.003	----	0.86	0.02	< 0.009	----	< 0.02	0.02	0.026	0.013
	Coarse	0.66	0.04	< 0.002	----	0.48	0.01	< 0.008	----	< 0.07	----	0.036	0.008

Table 7

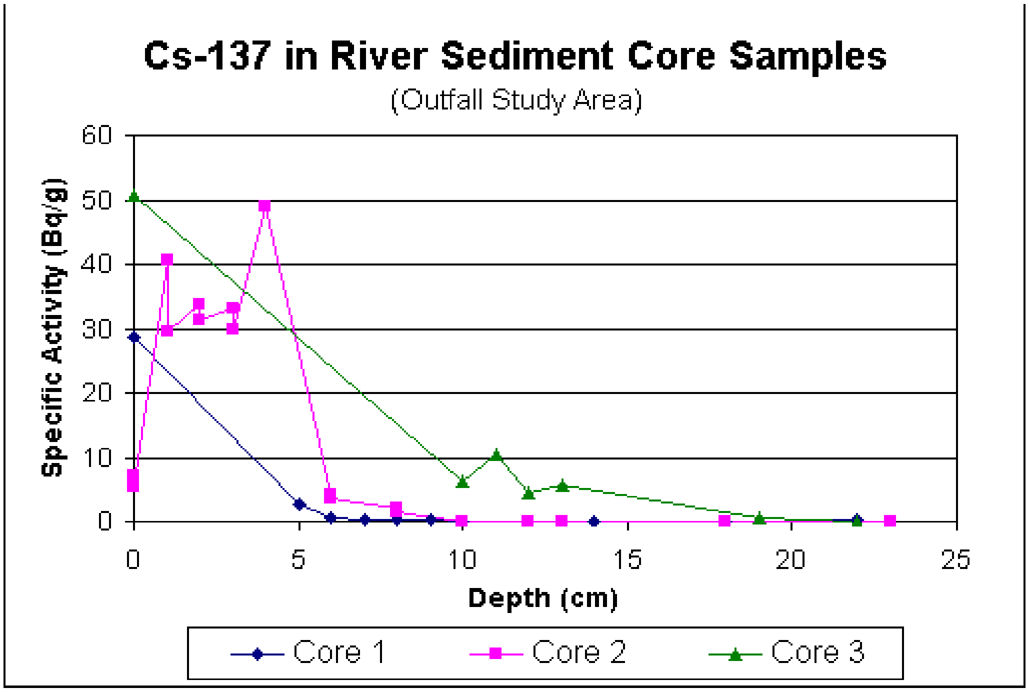
Concentrations of Metals and Other Elements in Composite Sample of Surface Sediments (Mg/Kg Dry Weight)

Also shown are the Interim Freshwater Sediment Quality Guidelines (ISQG) and Probable Effect Levels (PEL) suggested by CCME (1999).

	Centre-of-Plume First Duplicate	Centre-of-Plume Second Duplicate	Background Area	Downstream Area	ISQG (CCME 1999)	PEL (CCME 1999)
Ag	<1.3	<1.2	<1.3	<1.3		
Al	1920	1800	1700	4500		
B	<1.3	<1.2	<1.3	<1.3		
Be	<1.3	1.4	<1.3	<1.3		
Cd	<1.3	<1.2	<1.3	1.6	0.6	3.5
Co	2.2	2.6	2.4	4.8		
Cr	6	5.8	4.9	11.4	37	90
Cu	5.8	5.3	2.4	8	36	200
Fe	4300	4300	4400	8300		
Hg	0.008	---	0.0034	0.0054	0.17	0.49
Li	5	4.8	4.9	8.6		
Mo	4.4	4.6	2.8	2.3		
Ni	5.1	7.8	4.7	12.3		
P	290	290	230	370		
Pb	<1.3	<1.2	<1.3	<1.3	35	1.4
Sr	<1.3	<1.2	<1.3	<1.3		
V	4.7	4	3.9	10.6		
Zn	15.7	13.7	10.8	28	120	320

Figure 4

Plot of ^{137}Cs with Depth in Three Cores Taken in the Centre-of-Plume Area. There was either compression or plugging in the core tubes during sampling. The core tubes were pressed to about 50-cm depth, but only about 25-cm depth of core was collected. Most likely, core tubes became plugged with the very dense clay and did not collect sediment beyond about 25 cm.



Notes:

Core 1: Recorded depth 45 cm, actual core length 23 cm.
No layering or striations, loose and coarse gravel for the first 2 cm with a clump of organic "tarry" stuff, a large rock and air space between 2-5 cm, and clay thereafter.

Core 2: Recorded depth 50 cm, actual core length 24 cm.
No layering or striations, packed coarse gravel for the first 2 cm, the next 2 cm has a shiny black substance (organic in nature), between 4-12 cm is sandy gravel and clay thereafter.

Core 3: Recorded depth 50 cm, actual core length 28 cm.
No layering or striations, loose and coarse gravel and large rocks for the first 10 cm. The loose material in the top 10 cm fell apart and could not be sliced into smaller layers. In all cores, the clay was darker with depth.

The dominant contaminant measured was ^{137}Cs, but other radionuclides and other contaminants were measured, others were known to have been released, and others are probably present given the operations of the Laboratory. In order to estimate concentrations of contaminants not measured, scaling factors were developed (section B1.3.2).

Because of the highly localized, spotty nature of some of the more contaminated sediments, it is probable that the highest concentration was not sampled. To deal with this issue, the statistical distribution of ^{137}Cs concentrations among the short-core and grab samples was examined. These were not fully random samplings, but they followed a grid pattern that reflected the expected distribution of contaminant. As such, they were a stratified random sampling of the sediments. The statistical distribution of concentration values was skewed and generally conformed to lognormal, as expected. Assuming lognormal, it was possible to define the concentrations corresponding to the 99^{th} and 99.9^{th} percentiles. These were above any observed concentrations, and should represent upper extreme concentrations. This is a very conservative analysis: even if found to be toxic there is a low probability that such isolated amounts of contamination could have an effect on a population of organisms. The effects analysis (section B1.3.3) used the concentrations in the composite samples and these upper probability concentrations. Scaling factors were used to estimate the concentrations of concomitant contaminants at the upper percentile levels.

B1.3.2 Scaling Factors and Assessment Concentrations

Scaling factors as used here are ratios computed as concentrations of difficult-to-measure contaminants divided by concentrations of commonly measurable or marker contaminants. For releases from nuclear facilities, ^{137}Cs is frequently used as the marker contaminant. The ratios are computed from concentrations observed in samples from undiluted sample points, and are then applied to situations where because of dilution only the marker contaminant can still be reliably detected. In this case, the scaling factors are used to estimate concentrations in the environment. Ideally, the undiluted sample point is related in some process way to the diluted sample point, for example the former is upstream of the latter.

Two sources of data were used to derive scaling factors. One was the annual release information (Table 1) already described, which are very relevant data because the concentrations are those in the discharge water before it is released to the river. Scaling factors, as the ratio of the releases of other radionuclides to that of ^{137}Cs, were computed, with half-life correction to the present (2000). These are shown in Table 1, and it is apparent that some scaling factors differ between when the reactor was operational and the post-operational period after shut down in 1985. The age of the contamination in the sediment is not clear. Ratios of $^{134}Cs/^{137}Cs$ are used to age fission product emissions, because they behave in the same manner but have about 15-fold different half-lives. A lower ratio is an older release. The ratio was about 0.0002 in the sediment compared to 0.0007 (decay corrected to 2000, Table 1) in releases from 1982 to 1985 and 0.0022 after 1985. Background ^{137}Cs concentrations are not an issue in the sediment because ^{137}Cs concentrations were high where ^{134}Cs was detected. These ratios suggest the contamination in the sediment may be even older than the records shown in Table 1. (The lower ratio may also result from isotopic exchange of ^{134}Cs with bomb fallout ^{137}Cs in the water and sediments) Because of this, it was decided to use the average scaling ratios for the period 1982 to 1999, rather than the more recent data alone.

The other source of data for scaling factors was the sediment samples themselves. In some cases, several radionuclides other than ^{137}Cs were detectable in the sediments, and scaling factors based on these observations are the most relevant for extrapolating contaminant concentrations in other sediments. The concentrations in the ten samples with the highest observed ^{137}Cs concentrations are shown in Table 8. These samples very often also had the highest concentrations of the other analytes. Scaling factors were computed for each of these samples, and were averaged across the samples. The coefficients of variation were in the order of 30 to 130%. Because these are more appropriate for estimation of sediment concentrations, these scaling factors were used in preference to those from Table 1. In the absence of scaling factors from sediment analysis, those in Table 1 were used, recognizing that there are other processes that will change the scaling once the contaminants leave the ALWTC and enter the environment.

There are several possible approaches to define the sediment concentrations to use in this assessment. One could use averages, maxima, or other values. Table 8 shows a number of possible assessment concentrations. The concentrations shown for the composite sample include observed and estimated values. The maximum observed concentrations for each radionuclide are all observed (no scaling factors used), and for all but ^{65}Zn, ^{210}Pb and ^{226}Ra, these were observed in the ten samples with the highest ^{137}Cs concentrations. This is expected for ^{210}Pb and ^{226}Ra, because they are not contaminant radionuclides and so are not associated by source with the ^{137}Cs. The 99th and 99.9th percentile concentrations are all estimates using the statistical distribution to estimate ^{137}Cs and scaling factors for the others.

B1.3.3 Estimated Tissue Concentrations and Radiological Dose

Two sets of estimated tissue concentrations and corresponding radiological doses are shown: Table 9 for the composite sample as collected in the river and Table 10 for the 99.9th percentile concentrations based on the statistical distribution of ^{137}Cs concentrations. These represent the doses that could be attributed to the average centre-of-plume sediments and the most contaminated sediments (even though the latter were not physically sampled). The internal dose conversion factors (DCFs) are taken from Amiro (1997), or were computed in the same way as Amiro (1997). For alpha emitters, a relative biological effectiveness of 20 was assigned to all emissions (not just the alpha emissions) from that radionuclide. Doses from short half-life progeny radionuclides, such as ^{137m}Ba from ^{137}Cs, were included in the DCFs for the parent (see footnotes of Tables 9 and 10). Progeny radionuclides were assumed to be in secular equilibrium with the parents, except for the decay series of ^{210}Pb from ^{226}Ra because concentrations for ^{210}Pb were measured.

The external DCFs were derived from Amiro (1997) or Holford (1989) using the protocols of Amiro (1997) for the latter. The tissue bioconcentration factors (BCFs) were taken from Bird and Schwartz (1996) (with the exception of ^{144}Ce from IAEA 1994). The values for fish are shown as defaults, and the values for more relevant organisms are listed. The bolded values (Tables 9 and 10) were used. Because the BCFs are from water to tissue, it was necessary to estimate the equilibrium water concentrations corresponding to the sediment concentrations. These could be envisioned as sediment pore water concentrations. A sediment bulk density of 1500 kg/m^3 was used in this calculation. The estimated internal tissue concentrations in the clams are shown, along with the internal, external and total dose from each radionuclide.

Table 8

Scaling Factors (Concentrations of Difficult-To-Detect Radionuclides Divided by Concentration of ^{137}Cs) Observed in the Ten River Sediment Samples with the Highest ^{137}Cs Concentrations, and For Date-Corrected Releases from the ALWTC

These were used to compute radionuclide concentrations for four contamination situations.

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Average Observed Scaling Factor**	**CV**	**ALWTC Scaling Factor**	**Composite Observed**	**Maximum Observed**	**99th Percentile Cs**	**99.9th Percentile Cs**
Cs-137	117.00	116.00	30.40	27.10	25.20	21.30	20.50	16.30	15.10	14.80	1	0	1	2.610	117	210	950
Sr-90	0.61		1.87	0.67	5.87		0.15	1.34	0.44	0.15	0.057	135%	0.48	0.020	5.9	12	54
Alpha	1.39		0.89	1.21	2.71			0.31	1.12	0.22	0.043	83%	0.07	0.183	2.7	15	67
Beta	99.90		19.69	23.40	16.88		20.70	5.95	9.06	10.86	0.718	27%	3.51	1.874	100	151	682
Co-60	0.026		0.014	0.036	0.041	0.021	0.018	0.022	0.030		0.0011	53%	0.002	0.002	0.041	0.48	2.185
Zn-65											---	---	---	---	0.007	---	---
Ru-106											---	---	0.13	0.339	---	27	124
Cs-134				0.003		0.005					0.00017	52%	0.002	0.004	0.005	0	2.09
Ce-144											---	---	0.15	0.031		32	143
Eu-154	0.104	0.747	0.085	0.046	0.123	0.014	0.019	0.077			0.0029	77%	---	0.005	0.747	0.60	2.73
Pb-210											---	---	---	---	0.76	---	---
Ra-226							0.01				0.0007	---	---	---	0.890	---	---
Th-232	0.201		0.048	0.020		0.035	0.032	0.054			0.0018	48%	---	0.018	0.201	0.37	1.66
Am-241	0.900	2.190	0.223	0.213	0.302	0.037	0.075	0.457			0.0109	80%	---	0.024	2.19	2.29	10

Note:

- Average observed scaling factor is based on results of sediment samples, bolded values are used.
- CV is the coefficient of variation in the observed scaling factors.
- ALWTC scaling factors are those observed before discharge to the river, bolded and shaded values are used.
- Bolded shaded concentrations for composite are either observed or observed detection limits, non-bolded values are based on scaling factors and are used if these radionuclides were not analysed or the estimate was below the reported detection limits.
- Maximum observed concentrations are maximum across all samples, and so do not represent any one sample.
- 99th percentile concentrations are based on the 99th percentile of Cs-137 concentrations (higher than observed anywhere), and scaling factors are used to compute the other concentrations.
- 99.9th percentile is computed in the same way as the 99th percentile.

Table 9

Dose Estimates for Clams Living in Sediment Represented by the Composite Sample, Including Radionuclides Estimated With Scaling Factors

Parent and Progeny	Composite Sample (Bq/kg DW)	Net RBE	Iinternal DCF (Gy/a)/ (Bq/kg fresh tissue)	External DCF in Water (Gy/a)/ (Bq/m^3)	External DCF in Sediment (Gy/a)/ (Bq/kg wet)	BCF for Fish (L/kg DW) (Bird and Schwartz 1996)	Organism Listed by Bird and Schwartz (1996)	BCF for Clams and Related Organisms (L/kg DW) (Bird and Schwartz 1996)	Sediment/ Water Partition Coefficient, Kd (L/kg DW)	Estimated Tissue Concentration in Clams (Bq/kg Fresh Tissue)	Clam Internal Dose (Gy/a)	Clam External Dose (Gy/a)	Clam Total Dose by Radionuclide (Gy/a)
					1500								
Cs-137	2.610	1	4.10E-06	2.68E-09	4.02E-06	380	gastropod	3.5	1000	1.83E-03	7.49E-09	7.34E-06	7.34E-06
Sr-90	0.020	1	9.92E-07	3.07E-10	4.61E-07	1200	clam	1460	1000	5.84E-03	5.79E-09	6.44E-09	1.22E-08
Y-90	0.020	1	4.73E-06	2.18E-09	3.27E-06	1200			170	0.00E+00	0.00E+00	4.57E-08	4.57E-08
Co-60	0.002	1	1.30E-05	1.74E-08	2.61E-05	70	clam tissue	660	5000	5.28E-05	6.86E-10	3.65E-08	3.72E-08
Zn-65	0	1	2.98E-06	2.32E-09	3.48E-06	3250			500	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ru-106	0.339	1	8.16E-06	1.64E-08	2.46E-05	15	snail	0.024	55	2.96E-05	2.41E-10	5.83E-06	5.83E-06
Cs-134	0.004	1	8.67E-06	6.53E-09	9.80E-06	380			280	0.00E+00	0.00E+00	2.74E-08	2.74E-08
Ce-144	0.031	1	6.80E-06	1.48E-10	2.22E-07	30			10000	0.00E+00	0.00E+00	4.81E-09	4.81E-09
Eu-154	0.005	1	7.60E-06	5.40E-09	8.10E-06	125			500	0.00E+00	0.00E+00	2.83E-08	2.83E-08
Pb-210	0	1	2.17E-07	2.21E-11	3.32E-08	40	snail	170	270	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Bi-210m	0	20	3.94E-05	5.86E-10	8.79E-07	40			100	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Po-210	0	20	5.46E-04	3.44E-14	5.16E-11	40			150	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ra-226	0	20	4.92E-04	3.20E-11	4.80E-08	30			500	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rn-222	0	20	2.24E-03	8.91E-09	1.34E-05				0	0	0.00E+00	0.00E+00	0.00E+00
Th-232	0.018	20	4.12E-04	6.22E-12	9.33E-09	45			10000	0.00E+00	0.00E+00	1.17E-10	1.17E-10
Am-241	0.024	20	5.72E-04	1.48E-10	2.22E-07	90	snail	7000	5000	6.72E-03	3.84E-06	3.73E-09	3.85E-06
Total											3.86E-06	1.33E-05	1.72E-05
Total of WL-derived											3.86E-06	1.33E-05	1.72E-05
PSL2 benthos													6.00E-01
IAEA (1992) for all animals													4.00E-01
UNSCEAR (1996) lowest (for bird reproduction)													5.00E-02

Table 9 Note:

- Dose conversion factors (DCFs) from Amiro (1997), or were computed following the methods of Amiro (1997).
- RBE for alpha emitters applied to internal DCF only.
- Progeny with half-lives less than one day accounted for in the parent DCF, therefore Cs-137 includes (in a yield ratio of 0.946) Ba-137m, Ru-106 includes Rh-106 and Rh-106m, Ce-144 includes Pr-144.
- Assume progeny with half lives between 1 d and 20 a are in secular equilibrium with parent.
- Assume progeny following Rn-222 from decay of Ra-226 are included in the measured Pb-210 and its decay series.
- Assume no net ingrowth from Th-232 and Am-241.
- The sediment bulk density is assumed to be 1500 kg/m^3, giving a wet/dry weight ratio of 1.43.
- Fish bioconcentration factors (BCFs) used as defaults in the absence of data for molluscs, fish values from Bird and Schwartz except for Ce which is from IAEA (1994). The values used are shaded.
- Tissue fresh weight/dry weight ratio assumed to be 5 (Bird and Schwartz 1996).
- Kd values from IAEA (1994) where available, other Kd for sand soils used, taken in priority order from Sheppard et al. 1995, Davis et al. 1993 and IAEA 1994. Kd for Rh set equal to that for parent Ru.

Table 10
Dose Estimates for Clams Living in Sediment Containing the 99.9th Percentile Concentration of ^{137}Cs, Along with Radionuclides Estimated with Scaling Factors Corresponding to that ^{137}Cs Concentration

Parent and Progeny	99.9th Percentile Cs (Bq/kg DW)	Net RBE	Internal DCF (Gy/a)/ (Bq/kg fresh tissue)	External DCF in Water (Gy/a)/ (Bq/m^3)	External DCF in Sediment (Gy/a)/ (Bq/kg wet)	BCF for Fish (L/kg DW) (Bird and Schwartz 1996)	Organism Listed by Bird and Schwartz (1996)	BCF for Clams and Related Organisms (L/kg DW) (Bird and Schwartz 1996)	Sediment/ Water Partition Coefficient, Kd (L/kg DW)	Estimated Tissue Concentration in Clams (Gy/a)/(Bq/kg fresh tissue)	Clam Internal Dose (Gy/a)	Clam External Dose (Gy/a)	Clam Total Dose by Radionuclide (Gy/a)
					1500								
Cs-137	950	1	4.10E-06	2.68E-09	4.02E-06	380	gastropod	3.5	1000	6.65E-01	2.73E-06	2.67E-03	2.67E-03
Sr-90	54	1	9.92E-07	3.07E-10	4.61E-07	1200	clam	1460	1000	1.57E+01	1.56E-05	1.73E-05	3.29E-05
Y-90	54	1	4.73E-06	2.18E-09	3.27E-06	1200			170	0.00E+00	0.00E+00	1.23E-04	1.23E-04
Co-60	2.2	1	1.30E-05	1.74E-08	2.61E-05	70	clam tissue	660	5000	5.81E-02	7.55E-07	4.02E-05	4.09E-05
Zn-65	0.000	1	2.98E-06	2.32E-09	3.48E-06	3250			500	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ru-106	124	1	8.16E-06	1.64E-08	2.46E-05	15	snail	0.024	55	1.08E-02	8.83E-08	2.13E-03	2.13E-03
Cs-134	2.09	1	8.67E-06	6.53E-09	9.80E-06	380			280	0.00E+00	0.00E+00	1.43E-05	1.43E-05
Ce-144	143	1	6.80E-06	1.48E-10	2.22E-07	30			10000	0.00E+00	0.00E+00	2.22E-05	2.22E-05
Eu-154	2.73	1	7.60E-06	5.40E-09	8.10E-06	125			500	0.00E+00	0.00E+00	1.55E-05	1.55E-05
Pb-210	0.76	1	2.17E-07	2.21E-11	3.32E-08	40	snail	170	270	9.57E-02	2.08E-08	1.76E-08	3.84E-08
Bi-210m	0.76	20	3.94E-05	5.86E-10	8.79E-07	40			100	0.00E+00	0.00E+00	4.67E-07	4.67E-07
Po-210	0.76	20	5.46E-04	3.44E-14	5.16E-11	40			150	0.00E+00	0.00E+00	2.74E-11	2.74E-11
Ra-226	0.890	20	4.92E-04	3.20E-11	4.80E-08	30			500	0.00E+00	0.00E+00	2.99E-08	2.99E-08
Rn-222	0.890	20	2.24E-03	8.91E-09	1.34E-05				0	0.00E+00	0.00E+00	8.32E-06	8.32E-06
Th-232	1.66	20	4.12E-04	6.22E-12	9.33E-09	45			10000	0.00E+00	0.00E+00	1.09E-08	1.09E-08
Am-241	10	20	5.72E-04	1.48E-10	2.22E-07	90	snail	7000	5000	2.90E+00	1.66E-03	1.61E-06	1.66E-03
Total											1.68E-03	5.05E-03	6.72E-03
Total of WL-derived											1.68E-03	5.04E-03	6.72E-03
PSL2 benthos													6.00E-01
IAEA (1992) for all animals													4.00E-01
UNSCEAR (1996) lowest (for bird reproduction)													5.00E-02

Table 10 Note:

- Dose conversion factors (DCFs) from Amiro (1997), or were computed following the methods of Amiro (1997).
- RBE for alpha emitters applied to internal DCF only.
- Progeny with half-lives less than one day accounted for in the parent DCF, therefore Cs-137 includes progeny 0.946 Ba-137m, Ru-106 includes Rh-106 and Rh-106m.
- Progeny with half-lives less than one day accounted for in the parent DCF, therefore Cs-137 includes progeny 0.946 Ba-137m, Ru-106 includes Rh-106 and Rh-106m, Ce-144 includes Pr-144.
- Assume progeny following Rn-222 from decay of Ra-226 are included in the measured Pb-210 and its decay series.
- Assume no net ingrowth from Th-232 and Am-241.
- The sediment bulk density is assumed to be 1500 kg/m^3, giving a wet/dry weight ratio of 1.43.
- Fish bioconcentration factors (BCFs) used as defaults in the absence of data for molluscs, fish values from Bird and Schwartz except for Ce which is from IAEA (1994). The values used are shaded.
- Tissue fresh weight/dry weight ratio assumed to be 5 (Bird and Schwartz 1996).
- Kd values for sand soils used, taken in priority order from Sheppard et al. 1995, Davis et al. 1993 and IAEA 1994. Kd for Rh set equal to that for parent Ru.

The calculations can be followed in Tables 9 and 10, and are described here column-wise from left to right. The sediment concentration, RBE, internal and external DCFs are all inputs. The external DCF from sediment is the same as that for water, multiplied by the assumed sediment bulk density of 1500 kg/m^3 (following Amiro (1997). The BCF and Kd values are also inputs.

The estimated tissue concentration is the sediment concentration multiplied by the BCF and divided by the Kd and the wet-to-dry weight ratio of tissue:

> (Bq/kg dry sediment * L/kg dry tissue) / (L/kg dry sediment * kg wet tissue/kg dry tissue) = Bq/kg dry tissue

The estimated internal dose to clams (Gy/a) is the product of the internal DCF ((Gy/a)/(Bq/kg fresh tissue) and the estimated tissue concentration (Bq/ kg fresh tissue). The estimated external dose to clams is from sediment immersion only (because it has a 1500-fold greater DCF than from water immersion and the Kd values are all large), and is the product of the sediment concentration and the external DCF divided by the sediment wet/dry weight ratio:

> (Bq/kg dry sediment * (Gy/a)/(Bq/kg wet sediment)) / (kg wet sediment/kg dry sediment) = Gy/a

Total dose from each radionuclide is the sum of the internal and external dose estimates. Summing across radionuclides (down the last column of Tables 9 or 10), the total dose for clams in the composite sediment was 0.017 mGy/a, well below even the most conservative dose guideline (United Nations Scientific Committee on the Effects of Atomic Radiation 1996, Table 9) of 50 mGy/a. For the 99.9th percentile case, the total estimated dose was 6.7 mGy/a, still below the guidelines. This indicates there is very little potential for harm to populations of clams, and the analysis is sufficiently conservative that this can be extended with some confidence to all organisms living in or on the sediment or feeding from the sediment.

The dose corresponding to the ^{137}Cs concentrations observed in the clam tissue plus the composite sample external radiation was 0.008 mGy/a (Table 5), about 2-fold lower than the estimates based on the BCF values (because only ^{137}Cs was measured in the clam tissues). The measured tissue concentrations of ^{137}Cs (Table 5) agreed reasonably well with the estimated tissue concentrations (Table 9).

The dose estimates to clams are dominated by dose from ^{137}Cs, ^{241}Am and ^{106}Ru (and progeny of ^{106}Ru). For ^{241}Am, this is because of the high internal DCF, reflecting that ^{241}Am is an alpha emitter. For ^{106}Ru, this is because of external exposure, but it must be kept in mind that ^{106}Ru and progeny have not been detected in the sediment samples. External dose is the important exposure route for ^{137}Cs.

Dose to humans in proximity to a semi-infinite plane of contaminated sediment for 1% of the year was computed (Table 11). The concentrations of the 99.9th percentile case were used, because these concentrations were higher than any observed, including in the black tar-like materials found (Table 12). The DCFs are from Holford (1989). The total dose rate for this very conservative case was 0.04 mSv/a, below the risk-based criteria of 0.05 mSv/a. Any actual risk would be many orders of magnitude lower because:

- 1% occupancy is nearly impossible along this shoreline or in other exposure scenarios;
- the total spatial extent of contaminated sediment in the investigation area is small and does not constitute a semi-infinite plane; and
- there was no sediment found to have the 99.9^{th} percentile concentration and if it exists it will be a very small volume of sediment.

To summarise the dose estimates, there is a very low probability of harm to non-human biota or humans from the sediment contamination left in the present location. With engineered or natural displacement, the potential for impact is even lower because of further dispersion and dilution in the river. In effect, the operation of the Whiteshell Laboratories within it's regulated release permits has led to no significant impact in the river sediments, a confirmation that the original planning was sufficiently well founded.

B1.4 CONCLUSIONS

The conclusions of this evaluation deal with the description of the contamination present in the sediments, the outfall itself, and the possible doses to non-human biota and humans. In point form:

- The centre-of-plume is downstream and outward from the pipe outlet.
- There is a rapid decrease in sediment contaminant concentration with distance from the outfall.
- There are very localized spots of higher activity, some associated with black organic material.
- Only a very small fraction of the radionuclides released are still present in the sediment near the outfall.
- The contamination in the sediment may be relatively old since it has a $^{134}Cs/^{137}Cs$ signature that appears to pre-date 1982.
- Although there is visible black organic material and a UV absorbance indicative of organic material, very little of this is confirmed to be HB40, the reactor coolant.
- Certain metal concentrations may be slightly elevated but are generally below guideline values.
- Even with extremely conservative dose estimation methods, the doses to non-human biota (clam as the specific endpoint) and humans (based on external exposure) are below accepted guidelines.

Table 11

Dose to Hypothetical Human Spending About 100 Hours Per Year Adjacent to a Surface Contaminated to the Same Extent as the 99.9th Percentile Sediment

This represents the very improbable case that the riverbed sediments are exposed or that riverbed sediments are collected and handled.

Parent and Progeny	99.9th Percentile Cs (Bq/kg DW)	Ground Exposure DCF (Sv/a)/(Bq/kg)	Dose (Sv/a)
Cs-137	950	1.09E-06	1.04E-05
Sr-90	54	2.38E-10	1.28E-10
Y-90	54	7.27E-09	3.93E-09
Co-60	2.66	4.76E-06	1.27E-07
Zn-65	0.007	1.10E-06	7.59E-11
Ru-106	551	5.80E-06	3.20E-05
Cs-134	2.09	2.88E-06	6.02E-08
Ce-144	466	2.30E-08	1.07E-07
Eu-154	2.73	2.30E-06	6.28E-08
Pb-210	0.76	4.31E-10	3.28E-12
Bi-210m	0.76	4.48E-07	3.40E-09
Po-210	0.76	1.59E-11	1.21E-13
Ra-226	0.890	3.30E-06	2.94E-08
Rn-222	0.890	0	0.00E+00
Th-232	1.66	1.40E-10	2.33E-12
Am-241	10	7.90E-09	8.18E-10
Total			4.27E-05
Total of WL-derived contamination			4.27E-05
Risk-based limit			5.00E-05

Assumptions:
- Occupany factor (CSA 1987) = 0.01.
- The contaminated surface is semi-infinite in areal extent, clearly conservative in this case.

Note:
- Progeny with half-lives less than one day accounted for in the parent DCF, therefore Cs-137 includes progeny 0.946 Ba-137m, Ru-106 includes Rh-106 and Rh-106m.
- Assume progeny with half lives between 1 d and 20 a are in secular equilibrium with parent.
- Assume progeny following Rn-222 from decay of Ra-226 are included in the measured Pb-210 and its decay series.
- Assume no net ingrowth from Th-232 and Am-241.

Table 12

Concentrations of HB40 and Radionuclides Observed in Black, Tar-Like Material and Black Particles Found Near Outlet Pipe.

Shaded cells are non-detectable and the detection limit is shown.

Location	**Organic by UV (ug/g)**	**HB40 (ug/g)**	**Sr-90 (Bq/g)**	**Beta (Bq/g)**	**Co-60 (Bq/g)**	**Cs-134 (Bq/g)**	**Cs-137 (Bq/g)**	**Eu-154 (Bq/g)**	**Th-232 (Bq/g)**	**Am-241 (Bq/g)**
Tar-like material 1.5 m inside pipe			NR	5.76	<0.019	<0.012	0.19	<0.045	<0.036	<0.029
Black residue at pipe outlet					<0.009	<0.008	0.08	<0.039	<0.019	<0.023
2 m downstream from pipe outlet, fine fraction	370	<60	0.15	20.70	0.018	0.008	20.50	0.019	0.032	0.075
2 m downstream from pipe outlet, coarse fraction	1140	(1)			<0.138	<0.123	116.00	0.747	<0.393	2.190
2 m downstream from pipe outlet, black particles	28000	(1)			<0.084	<0.073	58.50	0.381	<0.230	1.260

Note:

- Organic by UV absorbance is a proxy measure of organic coolant.
- HB40 analysis by gas chromatography/mass spectroscopy is definitive for HB40, a footnote (1) indicates no analysis available as of Nov 29.

B1.5 References

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Appendix B.2

Plan for Radioactivity Survey and Sampling of Winnipeg River Sediments

B2 INTRODUCTION

An assessment of the contaminants in the Winnipeg River, that resulted from the Whiteshell Laboratories (WL) process water outfall is required to support development of a reference approach to eventual decommissioning for inclusion in the WL Decommissioning Project Comprehensive Study Report (CSR).

A scoping survey was conducted recently to inspect the outfall pipe and river bottom topography and to provide an indication of the type and extent of contaminants. A more detailed characterization of the river sediments is required to prepare a preliminary estimate of the contaminant inventory and evaluate the potential impact on the environment.

B2.1 Purpose of Survey

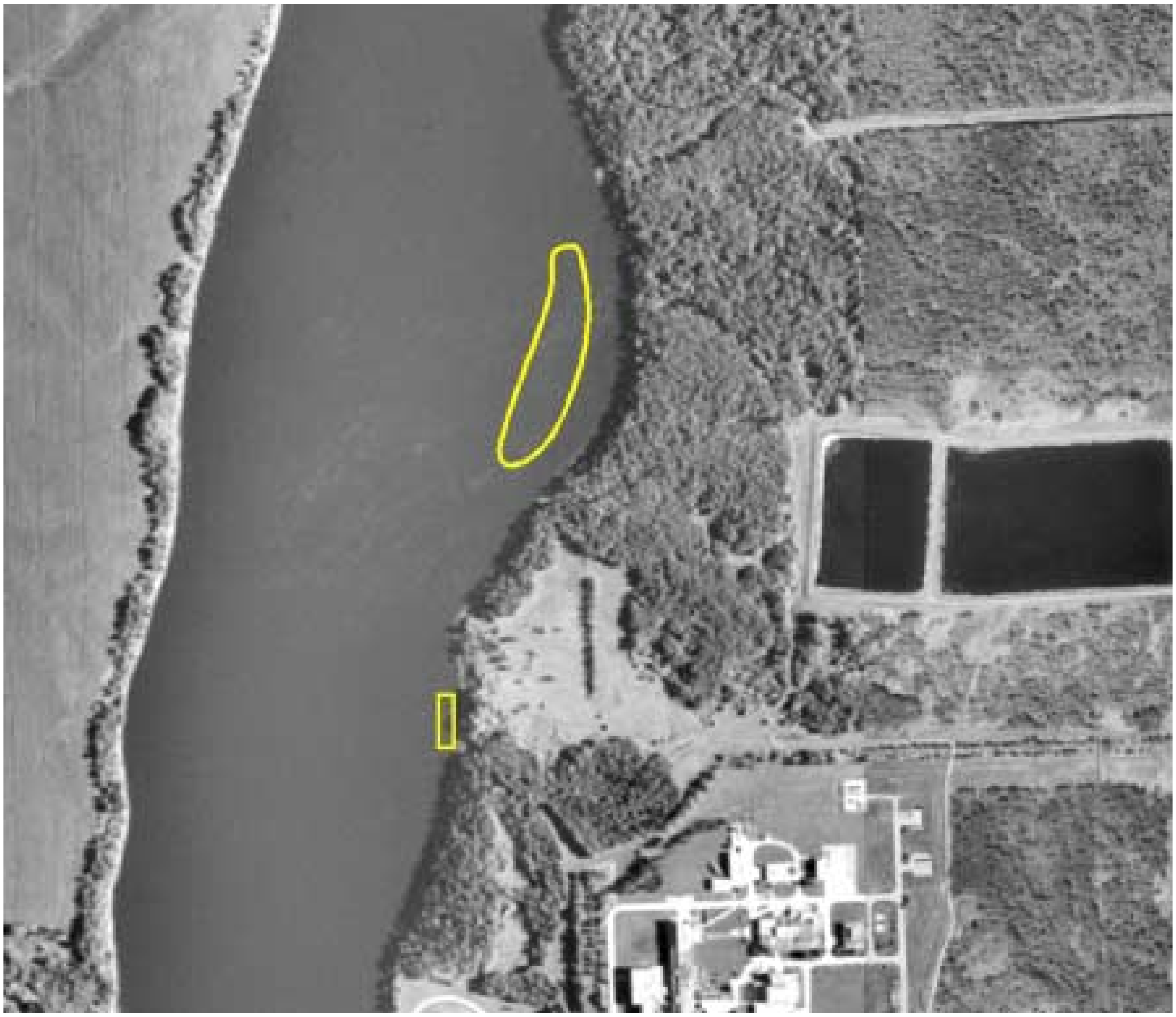
The purpose of the survey is to obtain sufficient data to prepare a preliminary estimate of the current inventory of contaminants downstream of the WL process water outfall that resulted from WL site operations. The survey is limited to areas with known radiological deposition (called study areas throughout this report) with the potential to exceed 10 times the background activity levels as identified by AECL environmental monitoring data and historical river assessment documents. Refer to Figure 1 for the location of the study areas.

B2.2 Survey Objectives

There are six main objectives of the characterization survey:

- determine if the radionuclide distribution is relatively constant throughout the study areas;
- determine a gross count rate to dose rate conversion factor at the surface of the sediment (referenced to air kerma dose rate);
- map the extent of the radiological contaminants in the study areas;
- obtain river surface sediment samples of background and the highest activity areas to evaluate the types of contaminant present;
- obtain river sediment core samples of background and the highest activity areas to evaluate the types of contaminant present and the contaminant depth profile; and
- obtain clam samples of background and the highest activity areas to evaluate the potential impact on aquatic biota.

Figure 1
River Sediment Study Areas



B2.3 Data Quality Objectives (DQO) Requirements

The following data will be obtained to accomplish the survey objectives:

In-Situ Gamma Spectra of the River Sediments:

- In-situ gamma spectra will be obtained using a portable NaI(Tl) based system with a 3 x 3 inch detector encased in a waterproof housing.
- 300-second samples will be taken with the detector perpendicular to, and in contact with, the river sediment.
- In-situ gamma spectra will be used to evaluate the radionuclide distribution of the river sediments and for development of a count rate to dose rate conversion factor.
- Both the upstream and study areas will be evaluated. A minimum of 4 background area and 10 study area spectra will be obtained.

  - Upon completion of the in-situ gamma survey, the instrument will be sent to Bob Grasty, of Gamma-Bob Inc., for calibration to dose rate at the geometry used for the survey. A calibration report that includes dose conversion factors for use with the sample spectra will be supplied on completion of the calibration.

Gross Count Rate Data of the River Sediments:

- Gross count rate data will be obtained using a data logger and 2 x 2 inch NaI(Tl) detector system.
  - The data will be taken with the detector perpendicular to, and in contact with, river sediments.
  - 30-second samples will be taken to ensure that the error at 1 sigma is < 1% for areas ≥ 400 cps.
- Data will be obtained from transects across the study areas to determine the extent of the contaminants that exceed 10 times background.
- Gross count rate data will be obtained at each sample point where gamma spectra are acquired for use in development of a count rate to dose rate conversion factor.
- A minimum of 10 transects will be obtained from the study area near the outfall.
- A minimum of 5 transects will be obtained from the downstream study area.

River Sediment Sampling for Radiological and Non-Radiological Contaminants:

- A composite sample of the top 1 - 2 cm of sediment will be obtained from the centre of the highest activity area within each study area. The size of the sampling area will be determined from the gamma survey results.
- An upstream sample of similar sized area will be obtained for use as background data.
- A total of approximately 1 kg of sediment will be obtained from a composite of a minimum of 10 samples within the upstream background and study areas, to ensure a representative sample is obtained of sufficient volume for broad contaminant screening by ICP-AES and GC-MS.
- A minimum of 3 core samples will be taken from the highest activity area and evaluated to determine a contaminant depth profile. The core sample will be taken as deep as possible and an attempt will be made to ensure a minimum depth of 50 cm is obtained. At least 3 additional samples will be taken from an analogous upstream area.
- A minimum of 10 clams will be obtained from the highest activity area. A minimum of 5 clams will also be obtained from an analogous upstream area.

B2.4 Survey Methodology

The scoping survey was conducted using divers staged from a movable floating platform (raft) with supplied air and remote communication and video capability. This provided immediate feedback of the conditions encountered by the diver and the ability to direct the diver's inspection and sampling activities. The main problems encountered with this method were difficulties in stabilizing the raft during windy conditions and in keeping the diver moving in a straight line.

The following methodology will be implemented to optimize the execution of the survey:

- Weighted lines, marked in 2 metre increments, will be used to mark out the transects.
- A differentially corrected Global Positioning System (GPS) system will be used to position the weighted lines.
- 100 feet of cable will be used for the gross count rate instrument to minimize the number of times the raft will have to be relocated on each transect.
- Improved anchoring will be implemented to stabilize the raft during windy and fast current conditions.

Upstream Area Gamma Data Collection

The upstream area gamma data will be collected on the first day to familiarize the divers with the equipment and sampling requirements and methodology. The scoping survey indicated that the average background gross count rate is ~ 80 cps. The background gamma data will be collected using the following procedure:

1. Anchor the raft at least 50 metres upstream of the outfall pipe in an area with similar flow patterns to the area immediately downstream of the outfall pipe.
2. Scan the area 10 metres out from shore using the gross gamma instrument to verify that the background count rate is uniform.
3. Obtain a minimum of 4 in-situ gamma spectra at different locations using a 300-second count.
4. Obtain gross gamma count rates and GPS location data at each of the sample points selected in Step 3.

Study Area Gamma Data Collection

Only two areas have been identified with the potential to exceed 10 times the background level. This includes the area immediately downstream of the outfall pipe and a bay approximately 500 metres downstream of the outfall pipe. For the area immediately downstream of the outfall, the scoping survey results indicate that the area that exceeds 10 times background is limited to a 20 metre wide area that begins ~ 10 metres off the shoreline and extends from the outfall pipe to ~ 70 metres downriver. The maximum level identified in the second study area during the scoping survey was ~ 7 times background.

The following methodology will be used to perform the gamma survey in these areas:

Study Area Around Outfall Pipe

1. Perform transects from the shoreline out to a point where the activity level is ≤ 5 times background (i.e., 400 cps) for 5 consecutive sample points **and** the results continue to display a decreasing trend in the activity level.
2. Conduct transects at the following locations and/or as identified during the sampling process.
    - 1 metre upstream of the pipe outlet.
    - Directly out from the pipe outlet.

- 1 metre downstream of the pipe outlet.
- At 10-metre increments downstream of the pipe outlet until the criteria in Step 1 are met.

3. Obtain the transect data points at a minimum of 2-metre increments.
4. Obtain a minimum of 10 total transects.
5. Log the gross gamma data at each sample point using 30-second integrated counts.
6. Obtain a minimum of 6 in-situ gamma spectra in the area using 300-second counts. Ensure the samples are representative of the entire area that exceeds the 10 times background criteria. Log the GPS location at each sample point.

Study Area 500 Metres Downstream of Outfall Pipe

1. Perform transects from the shoreline out to a point where the activity level is ≤ 5 times background (i.e., 400 cps) for 5 consecutive sample points **and** the results continue to display a decreasing trend in the activity level.
2. Perform the first transect in the middle of the bay at 2-metre increments.
3. Perform additional transects at 20-metre increments upstream and downstream of the initial transect.
4. Perform a minimum of 5 total transects.
5. Log the gross gamma data at each sample point using 30-second integrated counts.
6. Obtain a minimum of 4 in-situ gamma spectra in the area using 300-second counts. Ensure the samples are representative of the highest activity section of this study area. Log the GPS location at each sample point.

Study Area Sediment and Clam Sample Collection

The scoping survey results indicate that the maximum activity level in the study area immediately downstream of the outfall pipe is ~ 100 times background. Based on the results of the gross gamma survey, a composite sediment sample will be obtained from this area using the following guidelines:

1. Obtain a minimum of 10 samples from the area that exceeds 25 times background for the composite samples.
2. Obtain the composite samples from the first 2 cm of sediment.
3. Obtain a minimum of 1 kg total sediment material.
4. Obtain three core samples from the highest activity area. Ensure that the samples are representative of the entire area and spaced at least 2 metres apart.
5. Obtain as deep a core sample as possible and attempt to ensure that a minimum depth of 50 cm is collected.
6. Obtain a minimum of 10 clams from the same area where the composite sediment sample was obtained.
7. Repeat Steps 1 through 3 for the highest activity section of the study area 500 metres downstream of the outfall pipe.
8. If activity levels that approach 25 times background are identified in this area, obtain 3 core samples.

Upstream Area Sediment and Clam Sample Collection

Obtain background sediment sample upstream of the outfall pipe using the following guidelines:

1. Obtain sediment samples from the same area as the background gamma samples.
2. Obtain a minimum of 10 samples from the area for the composite samples from the first 2 cm of sediment.
3. Obtain a minimum of 1 kg total sediment material.
4. Obtain three core samples from the area.
5. Obtain as deep a core sample as possible and attempt to ensure that a minimum depth of 50 cm is collected.
6. Obtain a minimum of 5 clams from the area.

GPS Data Collection

A GPS system will be used to log the in-situ gamma spectroscopy and core sediment sampling locations. The GPS antenna is located on a small inflatable raft and is connected to the diver by a rope. The GPS system is differentially corrected so the positional error should be less than 2 metres when the river flow and depth is taken into account.

1. Log a GPS location at each gamma and core sediment sample location in both the background and study areas.
2. Ensure the rope attached to the bottom of the GPS raft is pulled tight prior to logging the location.

B2.5 Survey Equipment

- The in-situ gamma spectra will be acquired using an Exploranium GR-320 spectrometer with a 3 x 3 inch NaI(Tl) detector encased in a waterproof housing. 60 feet of cable will be used to provide some flexibility in location of the raft.

- The gross count rate data will be acquired using a Ludlum 2350 Data Logger and Model 44-10 NaI(Tl) detector (2 x 2 inch). The data-logging feature will be used to identify and record each sample point result. 100 feet of cable will be used with the detector.

- A Model PRO XRS Trimble GPS system will be used to identify each survey location. This system is differentially corrected using the RACAL LANDSTAR satellite system. 100 feet of cable will be used with the GPS antenna.

B2.6 REFERENCES

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Appendix B.3

Winnipeg River Sediment Survey and Analysis Summary

B3.1 INTRODUCTION

An assessment of the contaminants in the Winnipeg River that resulted from the Whiteshell Laboratories process water outfall was conducted during September 2000. The purpose of the survey was to obtain sufficient data to prepare a preliminary estimate of the current inventory of contaminants. This was required to support development of a reference approach to eventual decommissioning for inclusion in the Whiteshell Laboratories Decommissioning Project Comprehensive Safety Report (CSR).

The survey was limited to two areas with known radiological deposition at levels with the potential to exceed 10 times the background activity levels as identified by AECL environmental monitoring data and historical river assessment documents. It was conducted using divers equipped with two gamma detectors, configured for underwater use and a Global Positioning System (GPS) to log data collection locations.

The survey also included the collection of clam and composite surface and core sediment samples as well as video footage of the outfall pipe and river bottom. The survey requirements and intended methodology are detailed in the first reference document of this report. This report provides a summary of the survey details and presents the results of the gamma survey component.

B3.2 SURVEY SUMMARY

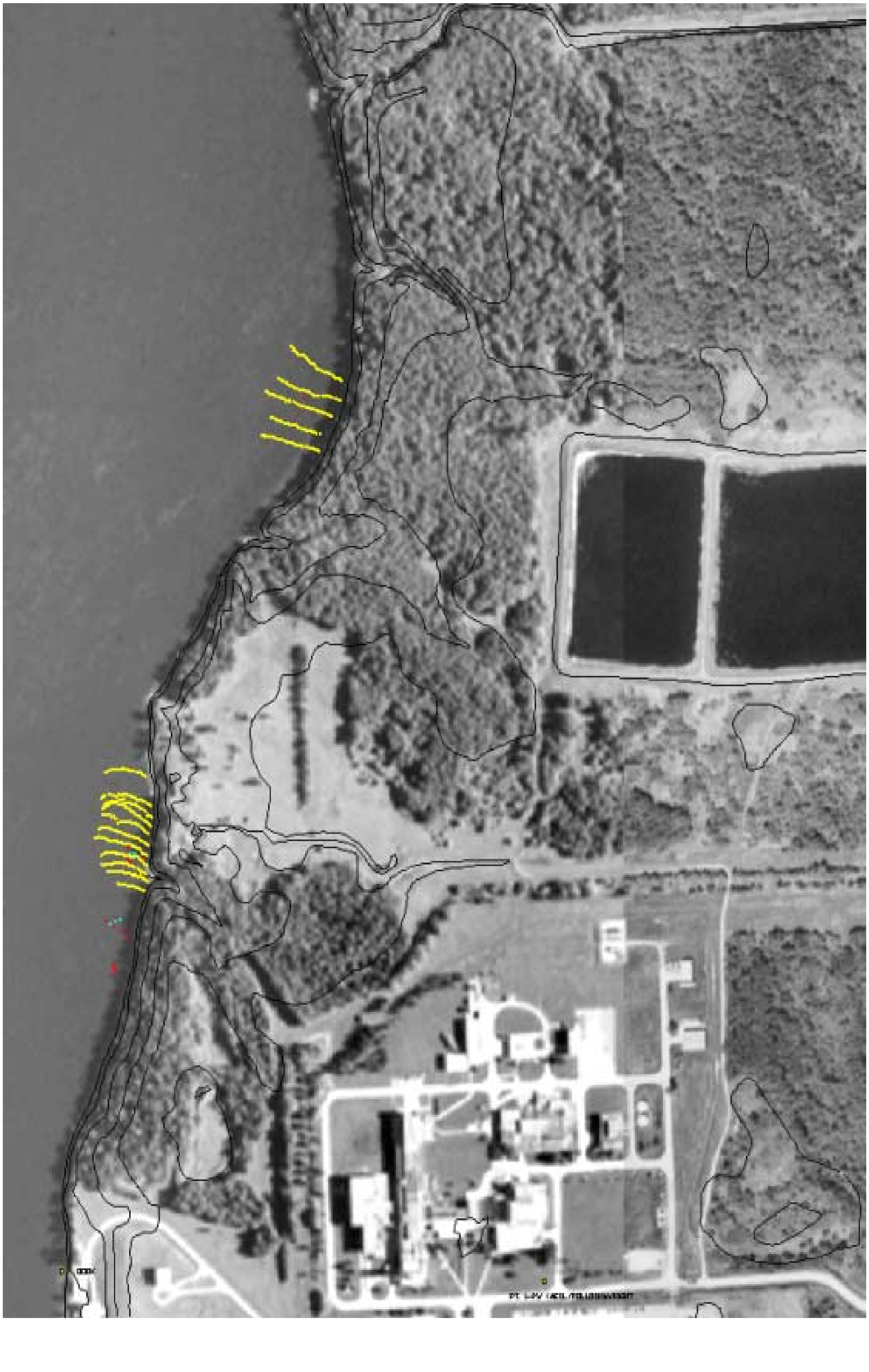
B3.2.1 General Information

The survey was conducted over a period of 6 days and included an upstream background reference area and two study areas. The Outfall Study Area is located near the Whiteshell Laboratories process water outfall pipe and the Downstream Study Area is centred in a bay 500 metres downstream of the outfall pipe.

Transect sample locations were identified by placing a weighted line marked in 2-metre increments along the river bottom. The line was anchored to the shore and stretched out slightly upriver of a line perpendicular to the shoreline using a boat. The end of the line was marked with a buoy and weighted with an anchor to ensure a rapid decent. The intent was to obtain a line perpendicular to the shoreline once the line had settled to the bottom. Due to the strong river current in the Outfall Study Area, the resulting transect lines in this area were not straight and bowed downriver in the middle section of each transect. Sample data was obtained at 2-metre increments along each transect line.

The survey and diving operations were staged from a small barge. Once a transect was marked, the barge was positioned along the transect by anchoring to both the shore and out in the river with long ropes. This allowed the barge to be moved, as required, to follow the divers progress.

Refer to Figure 1 for the location of the Study Areas.



B3.2.2 Instrumentation

The following instrumentation was used to perform the survey:

- Ludlum Model 2350 Data Logger with Model 44-10 NaI(Tl) Detector (Thallium activated Sodium Iodide Detector).
- Exploranium GR-320 Portable Gamma Spectroscopy System with a 3 inch x 3 inch NaI(Tl) Detector.
- Trimble GPS System.

The 2350 Data Logger and NaI(Tl) detector system was used to record gross gamma count data at 2-meter increments along each transect line. The detector was mounted in a waterproof housing and a 100-metre cable was connected to minimize the repositioning requirements of the barge. The discriminator on the data logger was lowered by 10% to correct for signal loss due to the cable length. All background gamma readings were obtained with 60-second counts. All transect gamma readings were taken with 30-second counts. Refer to Figure 2 for a picture of the system.

Figure 2
Ludlum Model 2350 with Underwater Detector

The GR-320 was used to obtain spectral data from several locations in the background and study areas. The detector was mounted in a waterproof housing and a 60-metre cable was connected. This data was used to cross-calibrate the gross gamma count rate readings to air kerma equivalent dose rates. The spectral data was also used to identify any gamma emitting contaminants that were encountered. Once the survey was completed, the GR-320 system was sent to Gamma-Bob, Inc. to process the spectral information and calibrate the system, as used, to air kerma equivalent dose rate. All in-situ gamma spectra were acquired with 300-second counts. Refer to Figure 3 for a picture of the system.

Figure 3
Exploranium GR-320 with Underwater Detector

The GPS antenna was mounted on a small floatation device and connected by a rope to the diver. Whenever survey data was obtained, the rope was pulled taut and the GPS location logged. A few of the data points were not logged close to shore where tree interference prevented adequate reception from the GPS satellites. Refer to Figure 4 for a picture of the barge and GPS in use.

Figure 4
Use of GPS System to Log Underwater Survey Locations

B3.2.3 Background Areas

Two background areas located ~ 50 and 100 metres upstream of outfall pipe were evaluated. Both rocky and silty bottomed areas were included to account for the different conditions encountered during the survey. The following data was collected from this area:

- 9 in-situ gamma spectroscopy readings;
- 3 core samples (~30 cm deep);
- 1 large area surface sediment composite sample; and
- 6 clams.

B3.2.4 Outfall Study Area

The Outfall Study Area extends from approximately 10 metres above the outfall pipe to 100 metres downstream of the pipe and includes an area of approximately 6300 m^2. The following data was collected from this area:

- 310 gamma readings from 12 transects that ranged from 34 metres to 64 metres long;
- 6 in-situ gamma spectroscopy readings;
- 3 core samples (~30 cm deep);

- 1 large area surface sediment composite sample; and
- 11 clams.

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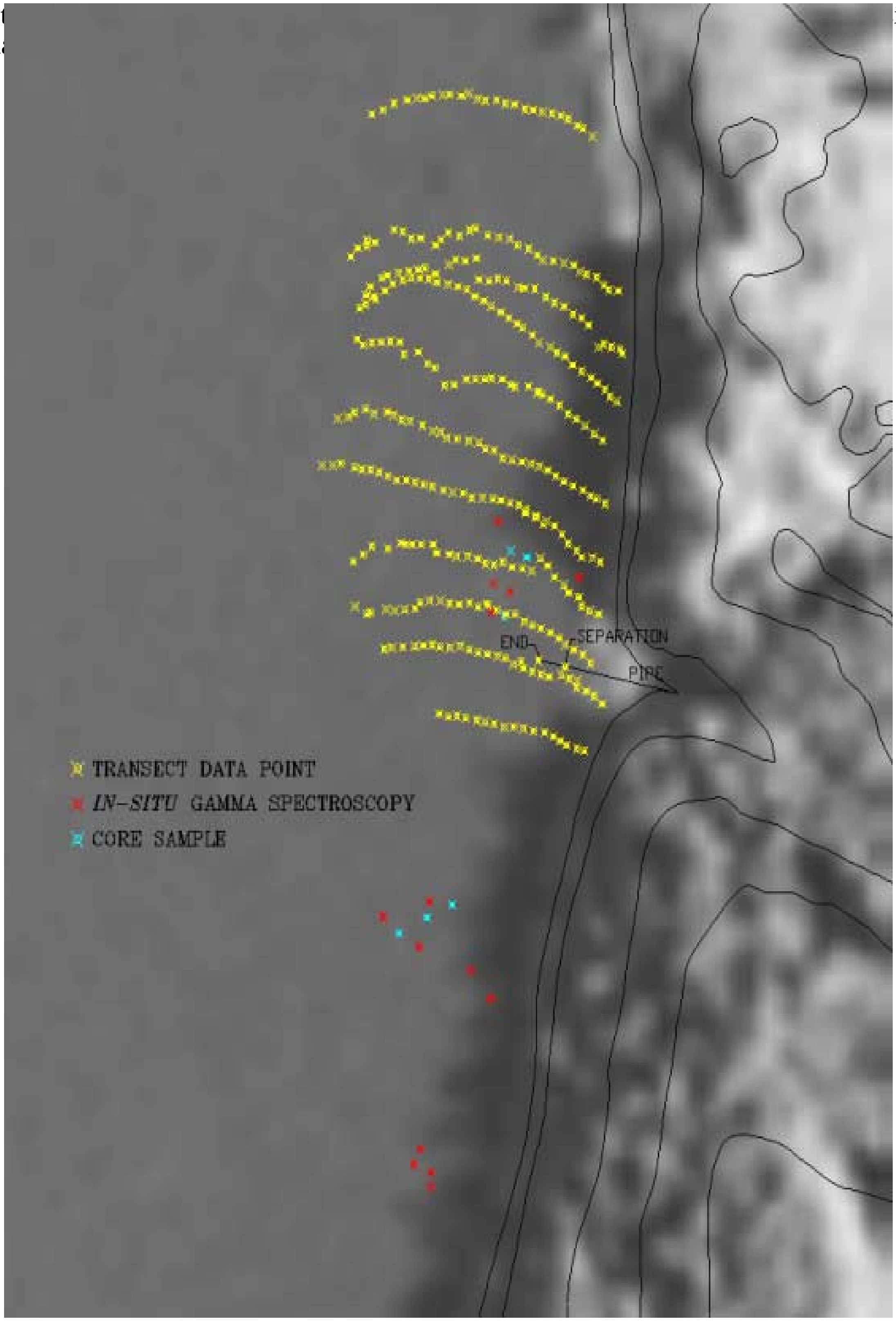


B3.2.4 Downstream Study Area

The Downstream Study Area is centred 500 metres downstream from the outfall pipe. The following data was collected from this area:

- 184 gamma readings from 5 transects that ranged from 66 metres to 86 metres long;
- 4 in-situ gamma spectroscopy readings;
- 1 large area surface sediment composite sample; and
- only 1 clam as they were mostly absent from the area.

B3.3 SURVEY RESULTS

B3.3.1 Outfall Study Area

The river bottom varies from fine silt near the shore to very rocky in the area downstream of the outfall pipe. The average background count rate in the rocky area is estimated to be ~ 100 cps.

- Maximum reading ~ 54 times background, average ~ 4 times background.
- Area representing 10 times background (Evaluation Area) is limited to the area from the outfall pipe end, out 20 metres and downstream ~ 80 metres (1600 m^2).
- The average reading in the Evaluation Area is ~ 7 times background.

Refer to Table 1 and Figure 6 for a summary of the results.

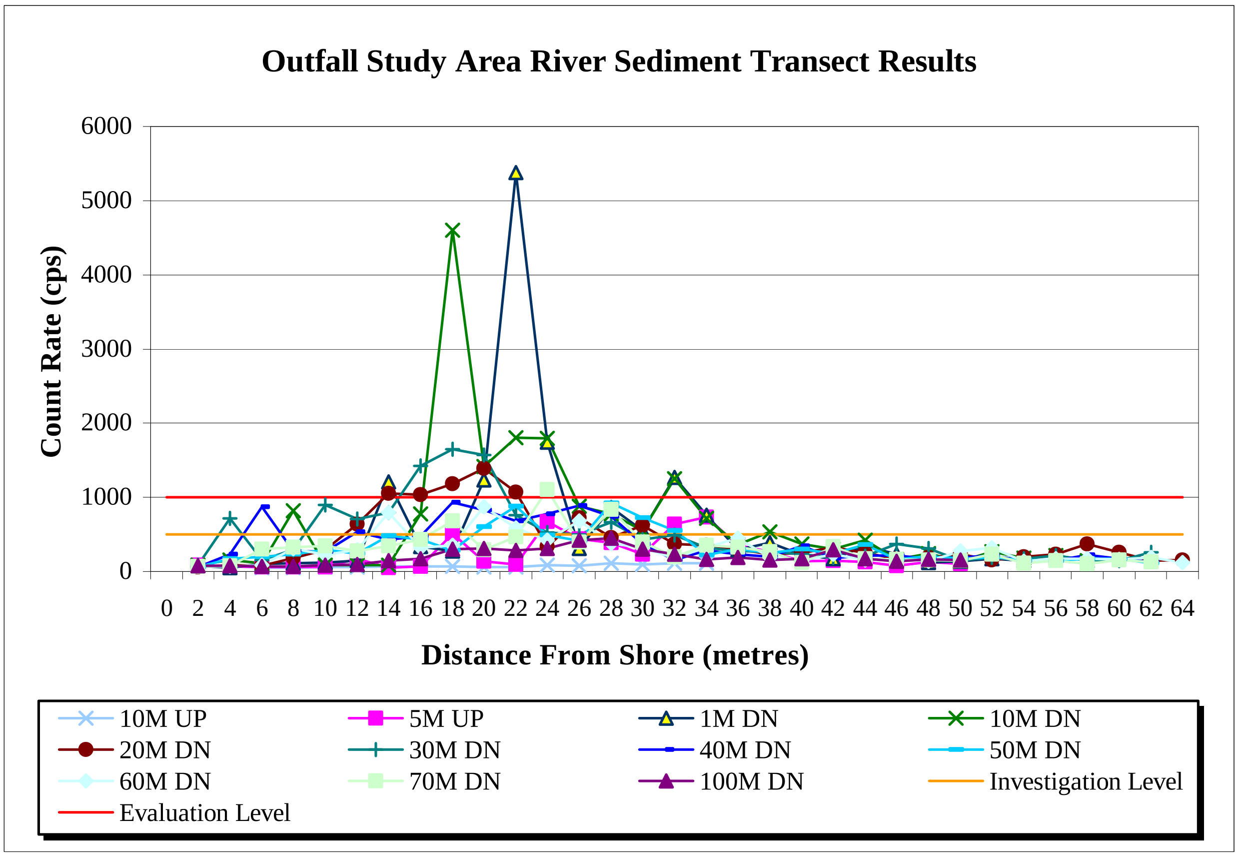
Table 1
Outfall Study Area Gross Count Rate Data
(cps)

Distance From Shore	Transect Location With Respect to Outfall Pipe										
	10 m Up	5 m Up	1 m Down	10 m Down	20 m Down	30 m Down	40 m Down	50 m Down	60 m Down	70 m Down	100 m Down
2		87.8	76.1	84.9	63.8	85.2	61.1	61.8	71.7	70.4	74.0
4	80.8	65.3	50.7	155.9	86.3	718.2	236.2	172.4	65.2	77.6	79.7
6	52.8	59.7	102.1	112.3	78.9	157.8	870.9	202.6	85.5	300.0	71.4
8	52.9	60.9	110.9	820.1	185.3	291.6	277.2	235.0	306.6	328.6	66.3
10	56.4	57.4	118.3	82.1	293.5	901.3	264.3	297.2	222.2	344.0	89.2
12	58.6	170.0	145.6	82.5	639.1	711.5	539.1	240.4	289.5	276.4	98.0
14	70.5	48.5	1205.4	88.4	1052.3	797.3	430.0	485.9	798.5	344.7	150.1
16	65.8	66.6	336.8	780.8	1036.4	1428.6	473.1	434.2	320.4	429.3	172.9
18	66.5	508.1	279.6	4600.3	1184.6	1648.1	934.7	282.1	356.9	682.7	299.0
20	63.9	140.9	1237.2	1418.8	1386.0	1567.9	830.5	605.3	870.4	296.4	311.5
22	57.8	99.1	5378.8	1802.8	1069.3	763.4	685.8	877.1	585.5	468.3	287.6
24	84.1	671.5	1740.8	1794.4	334.5	529.3	779.4	490.4	425.0	1104.4	312.0
26	79.9	444.4	314.4	881.5	726.3	500.6	885.2	418.5	685.6	398.2	421.2
28	109.4	387.8	860.5	777.0	460.4	667.6	744.5	925.9	377.8	833.3	450.2
30	95.3	234.0	548.3	548.6	621.2	430.8	371.2	727.2	315.6	395.6	305.4
32	111.5	641.1	1272.9	1253.5	367.5	490.5	155.4	550.8	181.0	197.6	230.3
34	110.0	731.5	756.2	712.7	352.2	315.5	288.1	228.6	324.1	351.4	163.4
36		355.1	290.4	364.8	305.9	273.3	233.7	304.2	450.3	324.0	190.5
38		266.9	387.4	538.2	234.5	263.6	196.1	251.3	187.7	264.6	151.8
40		139.9	222.3	369.2	254.0	231.4	344.3	302.4	146.0	120.9	175.4
42		149.9	173.4	301.1	329.6	191.0	182.9	239.9	233.2	336.2	294.2
44		129.1	348.9	425.6	246.3	210.0	219.5	362.2	159.1	173.9	172.3
46		81.2	231.1	166.9	170.9	374.9	219.6	166.9	170.8	165.1	137.6
48		133.3	124.5	245.6	186.8	312.2	170.9	209.5	136.8	156.7	165.4
50		100.8	138.8	142.1	230.5	148.7	186.3	174.2	273.5	146.4	154.0
52			174.9	270.7	153.1	186.8	212.7	192.3	322.4	229.7	
54			147.2	184.7	198.2	169.6	148.2	152.7	139.2	110.3	
56				213.8	236.1	211.9	147.9	147.3	176.3	145.0	
58				143.3	369.4	159.2	227.9	174.5	171.4	101.0	

Distance From Shore	Transect Location With Respect to Outfall Pipe										
	10 m Up	**5 m Up**	**1 m Down**	**10 m Down**	**20 m Down**	**30 m Down**	**40 m Down**	**50 m Down**	**60 m Down**	**70 m Down**	**100 m Down**
60					260.4	146.8	174.1	173.6	165.8	156.9	
62					146.9	257.4	130.3	108.8	187.9	129.5	
64					157.7				120.1		
Maximum	111.5	731.5	5378.8	4600.3	1386.0	1648.1	934.7	925.9	870.4	1104.4	450.2
Average	76.0	233.2	621.2	667.7	419.3	488.4	374.9	328.9	291.3	305.1	200.9
Evaluation Area Average			1123.8	1197.1	702.4	744.3	539.1	506.3	452.2	468.5	

Note: The shaded area encompasses all data point that exceed 10 times background and therefore represents the Evaluation Area.

Figure 6
Outfall Study Area Transect Results



Refer to Figure 7 for a map of the Outfall Study Area results and Figure 8 for a map of the Evaluation Area results.

Figure 7
Map of Outfall Study Area Transect Results

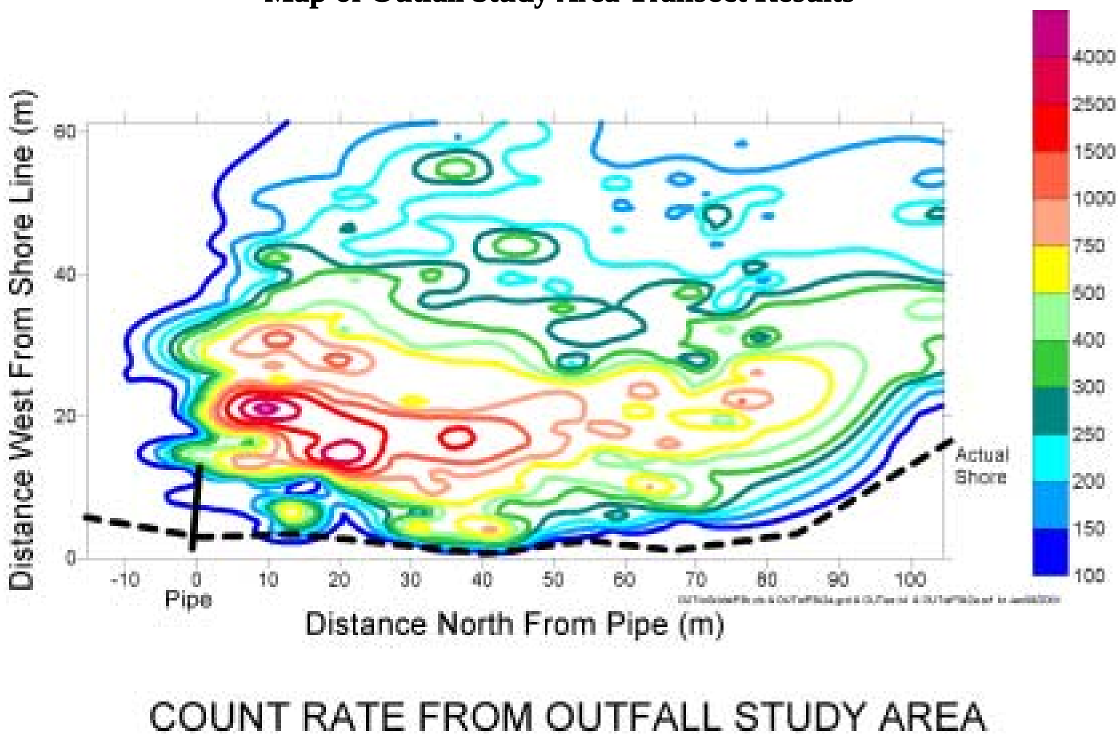
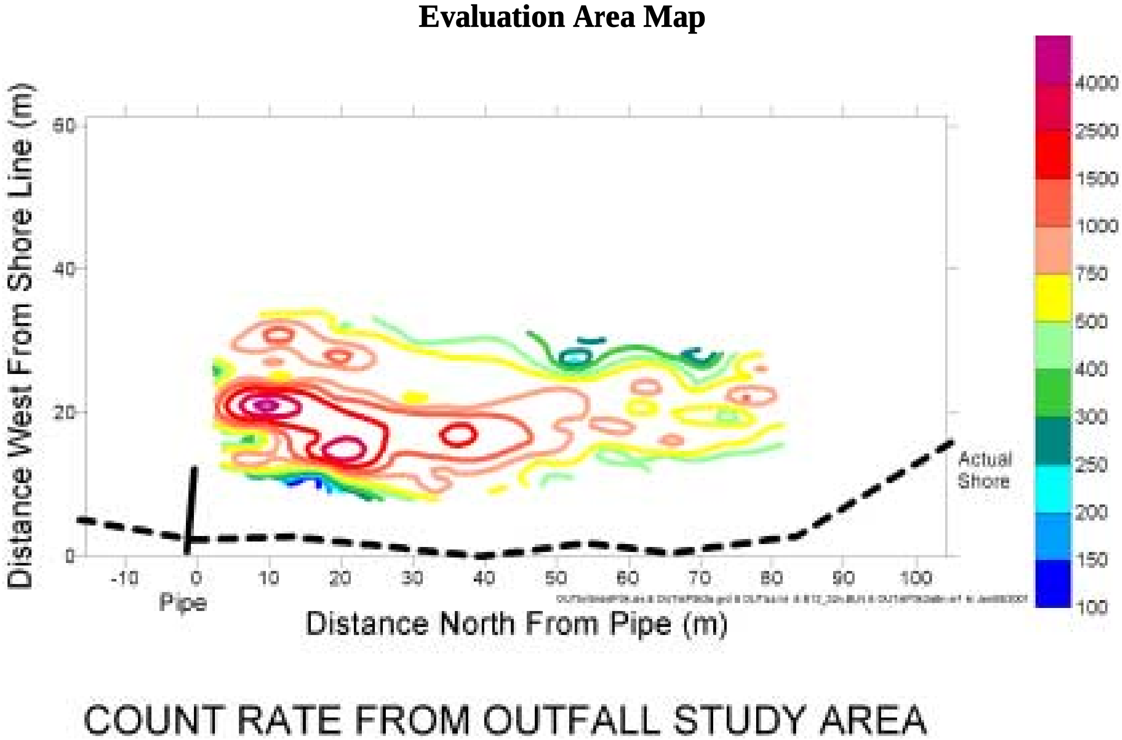


Figure 8
Evaluation Area Map



B3.3.2 Downstream Study Area

The Downstream Study Area is a large bay with a slight upriver (back eddy) flow. The bottom consists mostly of fine silt with very few rocks present indicating a depositional zone. The average background count rate in this area is estimated to be ~ 70 cps.

- No area > 10 times background identified.
- Maximum reading ~ 6.5 times background, average ~ 2 times background.

Refer to Table 2 and Figure 9 for a summary of the results. Refer to Figure 10 for a map of the results.

Table 2
Downstream Study Area Gross Count Rate Data
(cps)

Distance	**Transect Location With Respect to Centre of Bay**				
From Shore	**40 m Up**	**20 m Up**	**Centre**	**20 m Down**	**40 m Down**
0					
2	54.6	107.9	100.8	87.3	117.4
4	75.1	110.2	91.9	80.6	118.0
6	90.3	75.1	87.2	82.4	94.3
8	84.4	86.9	81.9	84.7	79.7
10	87.8	83.9	98.8	70.8	83.1
12	95.1	90.8	81.8	74.2	79.2
14	71.8	74.7	82.8	84.9	99.8
16	81.5	85.5	97.6	72.6	103.6
18	92.1	109.5	206.4	141.2	65.9
20	88.1	123.6	138.3	204.0	76.5
22	92.9	161.8	120.6	185.1	110.3
24	163.4	201.2	101.1	142.2	75.2
26	205.1	95.2	99.9	131.5	87.3
28	85.0	89.8	88.4	248.3	71.3
30	83.6	92.6	136.9	271.0	72.5
32	86.1	86.8	308.7	283.4	171.6
34	90.4	79.4	376.4	141.3	209.5
36	135.5	235.3	166.5	150.4	171.3
38	134.7	316.7	208.5	189.4	217.9
40	142.0	308.3	217.1	281.5	143.5
42	123.3	147.1	173.8	330.8	157.7
44	171.2	456.3	172.9	269.7	145.9
46	175.9	282.8	350.2	275.7	183.6
48	171.9	153.0	224.6	168.8	111.5
50	324.5	205.4	140.2	162.3	105.3
52	208.7	166.7	197.4	134.6	251.4
54	271.9	156.3	149.9	118.8	103.8
56	154.1	147.6	131.0	135.0	125.2
58	190.8	256.3	176.2	148.6	112.6
60	174.6	175.6	169.7	136.4	89.4

Distance From Shore	Transect Location With Respect to Centre of Bay				
	40 m Up	**20 m Up**	**Centre**	**20 m Down**	**40 m Down**
62	131.4	160.4	164.1	180.6	123.5
64	110.6	128.9	190.1	149.3	111.5
66	157.1	172.0	138.6	124.8	93.3
68	168.7	162.2	187.1	196.9	
70	148.8	136.0	130.9	140.1	
72			99.1	161.3	
74			126.2	171.4	
76			153.0	145.8	
78			237.2		
80			125.3		
82			141.8		
84			127.9		
86			139.4		
Maximum	324.5	456.3	376.4	330.8	251.4
Average	134.9	157.8	156.7	162.0	120.1

Figure 9
Downstream Study Area Transect Results

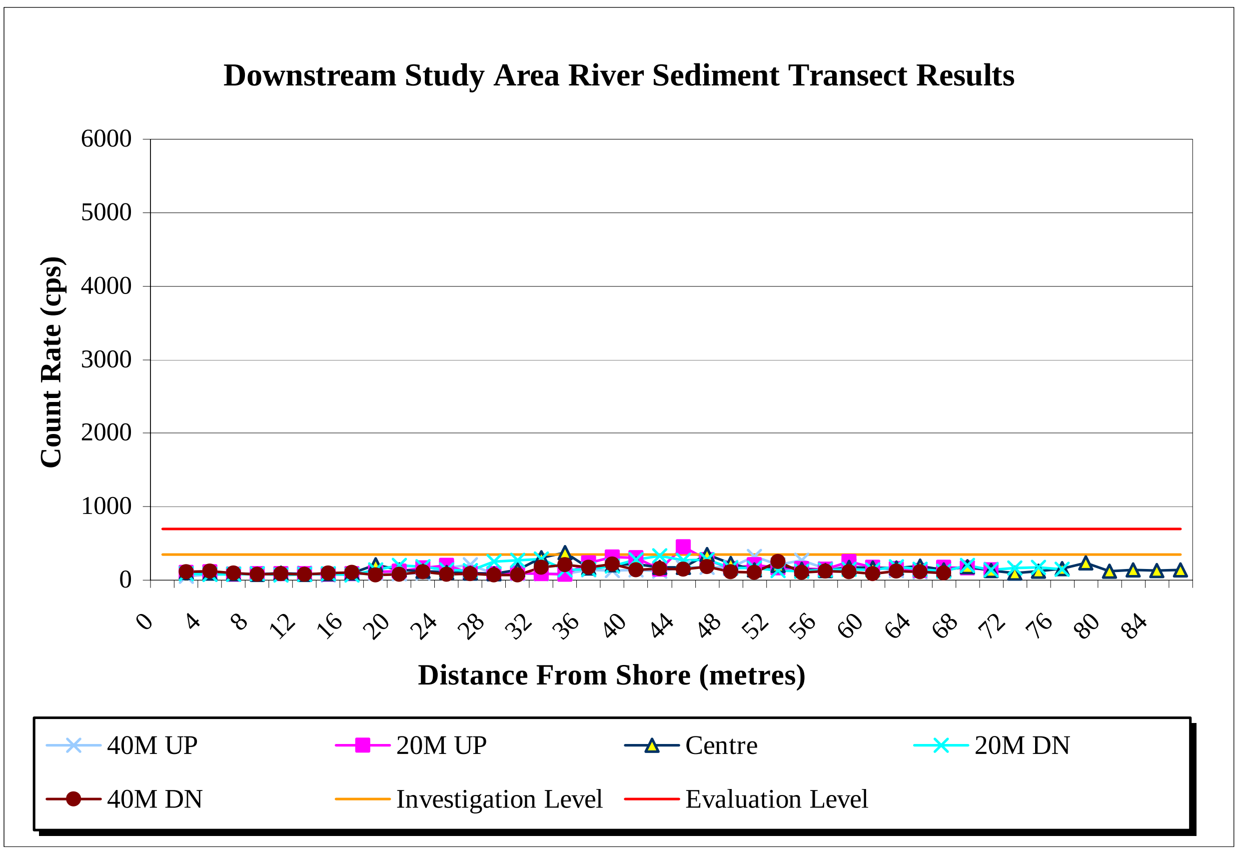
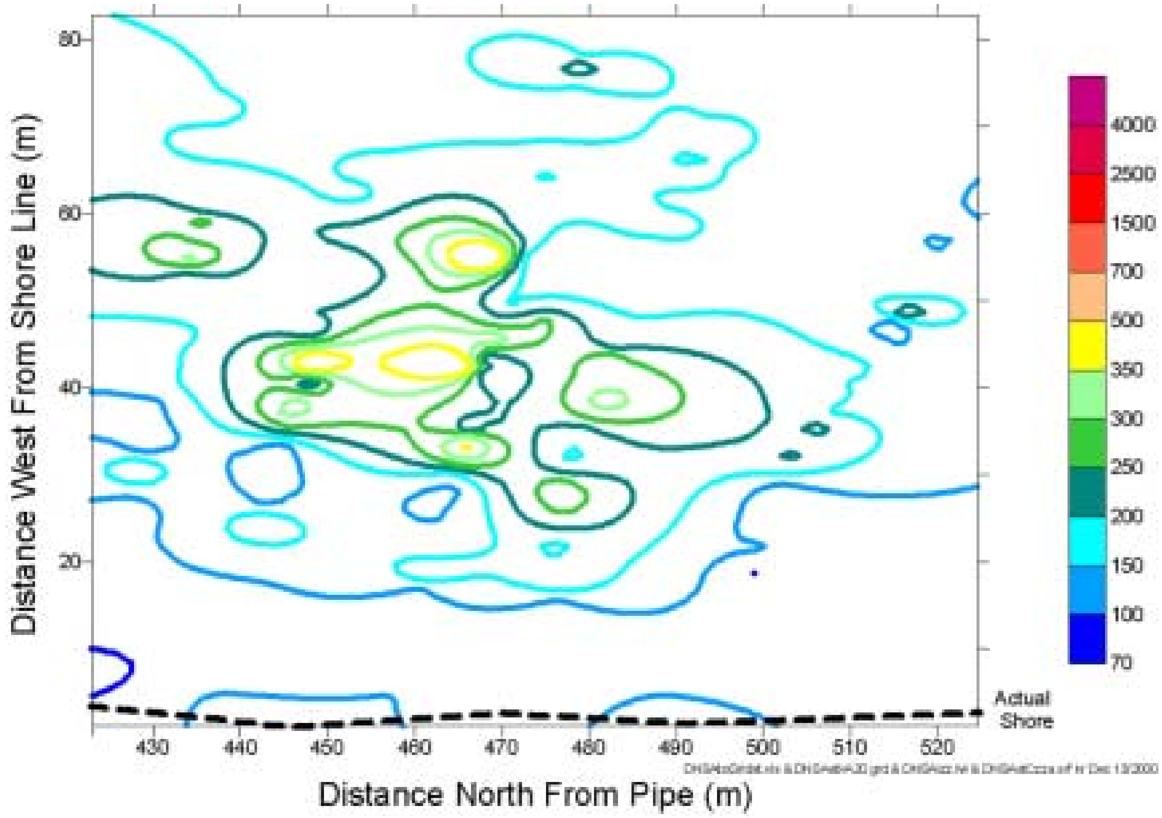


Figure 10
Map of Downstream Study Area Transect Results



COUNT RATE FROM DOWN STREAM STUDY AREA

B3.3.3 *In-Situ* Gamma Spectroscopy Results

Refer to Table 3 for a summary of the in-situ gamma spectroscopy results for the background reference and study areas.

Table 3
In-situ Gamma Spectroscopy Results

Outfall Study Area*			Rocky Upstream Area		
Air Kerma (nGy/h)	**Count Rate (cps)**	**Conv. Factor (cps/nGy/h)**	**Air Kerma (nGy/h)**	**Count Rate (cps)**	**Conv. Factor (cps/nGy/h)**
659.9	2210.3	3.35	67.4	143.3	2.13
2897.2	7926.3	2.74	56.2	125.1	2.23
607.3	1842.2	3.03	43.4	95.1	2.19
886.1	3098.0	3.50	44.2	93.1	2.11
336.1	1263.2	3.76			
Average		3.3	52.8	114.2	2.2
Stdev		0.4	11.4	24.3	0.1
Min		2.7	43.4	93.1	2.1
Max		3.8	67.4	143.3	2.2

Downstream Study Area*			Silty Upstream Area		
Air Kerma (nGy/h)	Count Rate (cps)	Conv. Factor (cps/nGy/h)	Air Kerma (nGy/h)	Count Rate (cps)	Conv. Factor (cps/nGy/h)
188.3	495.4	2.63	39.6	90.2	2.28
74.5	218.8	2.94	32.1	72.8	2.27
150.4	443.9	2.95	36.2	76.5	2.11
89.8	259.3	2.89	37.4	80.3	2.15
			31.7	69.8	2.20
			44.2	93.1	2.11
Average		2.9	36.9	80.5	2.2
Stdev		0.1	4.7	9.4	0.1
Min		2.6	31.7	69.8	2.1
Max		3.0	44.2	93.1	2.3

* Only ^{137}Cs and ^{40}K were identified by in-situ gamma spectroscopy.

B3.4 SUMMARY

- The maximum reading in the Outfall Study Area is ~ 54 times background and the average is ~ 4 times background.
- The Evaluation Area (the area including all data points that exceed 10 times background) is limited to the area from the outfall pipe end, out 20 metres and downstream 80 metres (1600 m^2).
- The average reading in the Evaluation Area is ~ 7 times background.
- No area in the Downstream Study Area that exceeds 10 times background was identified.
- The maximum reading in the Downstream Study Area is ~ 6.5 times background and the average is ~ 2 times background.
- ^{137}Cs and ^{40}K were the only contaminants identified by in-situ gamma spectroscopy.

B3.5 REFERENCES

Grasty, R.L. 2000. *Calibration of an Underwater Detector*. Gamma-Bob Report 00-3.

Rhodes, M.J. 2000. *Survey Plan for Winnipeg River Sediment Downstream from the Whiteshell Laboratories Outfall Pipe.* 03702-002 Rev. 0.

Sheppard, S.C. 2000. *Development of an Investigation Cutoff for River Sediment Contaminated as a Result of Whiteshell Laboratories Process Water Discharge.* 03702-001 Rev. 0. ECOMatters Inc.

APPENDIX C

LOW-LEVEL WASTE TRENCHES ASSESSMENT

Appendix C addresses the question of risk to public health and the environment from in-situ disposal of wastes in the trenches in the Waste Management Area (WMA). The Appendix consists of five parts:

- Appendix C.1 presents the analysis and the findings on feasibility.
- Appendix C.2 describes the trench inventory.
- Appendix C.3 describes the sampling plan used to secure the data to test the hypothesis that the trenches have been effective in containing any stored contaminants.
- Appendix C.4 presents the analysis of the core samples.
- Appendix C.5 reviews the hydrology of the Waste Management Area and presents data which confirms that the WMA is generally a discharge area.

Appendix C.1

Risk Evaluation of In-Situ Disposal of Low-Level Waste

C1.1 INTRODUCTION AND OBJECTIVES

The Waste Management Area (WMA) contains a number of trenches with varying amounts of low-level radioactive and conventional waste. It is proposed to manage a most of LLW waste trenches in-situ. Therefore it is necessary to confirm that soil and hydrogeological conditions around the trenches are such that there will be no leaching or transport of contaminants resulting in significant effects on the environment or human health.

For the project period (60 years), the WMA remains under regulatory controls which provide a mechanism to respond to any changes detected in the storage environment. This period will also be utilized to develop fully the safety case leading to a confirmation and approval of in-situ disposal as a final end-state.

The specific objectives of this evaluation are:

- To demonstrate in a preliminary way the level of risk to human health as a result of in-situ disposal of low-level waste (LLW) emplaced in the WMA earthen trenches.
- To confirm that there will be no contaminant transport beyond the WMA boundary resulting in significant effects on the environment or human health over a 200-year period (potential institutional control period).
- To provide an information base to establish a monitoring program necessary to confirm in-situ disposal as the final end-state, taking into account the requirements of R-104.

Two steps are involved in this evaluation. The first is the development of a conceptual model of the trench storage/disposal environment and confirmation of aspects of this with on-site measurements. The second involves contaminant migration modelling and exposure pathways analysis.

C1.1.1 General Description

The Waste Management Area (WMA) of Whiteshell Laboratories has been operational for several decades, during which time the technology for waste storage/disposal has evolved from storage directly in earthen trenches to storage in above-ground engineered concrete bunkers. As part of the planning for the decommissioning of the Whiteshell Laboratories (WL), this evaluation addresses in-situ disposal of much of the LLW in the unlined trenches.

In addition to the various LLW trenches and bunkers, the WMA contains tile holes for intermediate-level waste (ILW), an incinerator used for combustion of spent HB40 organic coolant and solvents, a baler used to compact waste packages, and a high-level liquid waste storage tank (Figure 1). These other facilities have little or no effect on the performance of the unlined trenches although pumping of foundation drainage tiles elsewhere in the WMA may affect water table levels in the unlined trenches. Emissions from other WMA facilities do affect the interpretation of monitoring results for the unlined trenches. These points are discussed below.

The inventory in the trenches is reasonably well known from the operational records (Appendix C.2). Some of the unlined trenches will have to be remediated because they contain materials that are inappropriate for in-situ disposal. Relevant characteristics of the inventory are:

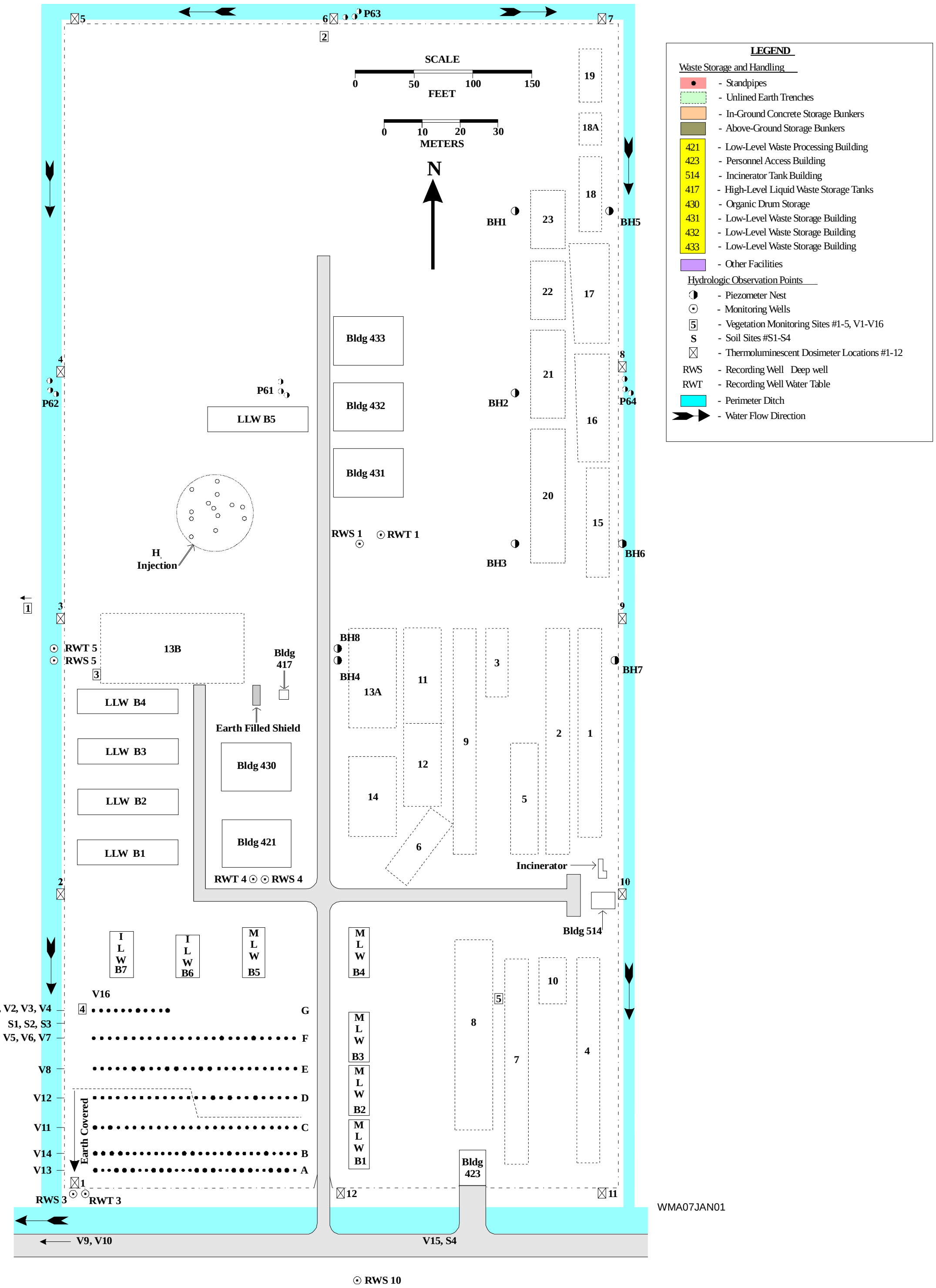
- Inventories of total radioactivity are probably overestimates because of the recording method, which used the activity of the highest single item and attributed that level to the full shipment.
- Radionuclides that did not contribute to the external radiation field, such as beta emitters, are estimated based on ancillary information and may not be represented fully.
- Fissile and fuel waste materials were excluded by policy, if any is present it would be in very low amounts.
- Radionuclide composition is not well known, but can be estimated given the typical radionuclide composition of measured waste streams, in particular the low-level active liquid waste stream which was well characterized.
- Specific locations of individual waste packages within each trench are unknown.

Trenches 6 and 10 are excluded from this evaluation. These trenches require remediation because the wastes emplaced include components that are not LLW (e.g. fuel channels in trench 6 contain long-lived activation products).

There has been no intrusive sampling of the trenches. More detailed verification of the waste inventory will be conducted as part of any remediation activities required to retrieve wastes unsuitable for in-situ disposal. For example, during the excavation of the unsuitable trenches, it will be possible to do detailed analyses on samples of the LLW to verify the inventory estimation data. In addition, during the 60-year Whiteshell Laboratories Decommissioning Project period, there will be a follow-up monitoring program to more fully characterize the aspects of the WMA important to in-situ disposal.

Figure 1

Plan-View Diagram of the WMA, Showing the Location of the Unlined Trenches, and the Well, Peizometer and Vegetation Sampling Points



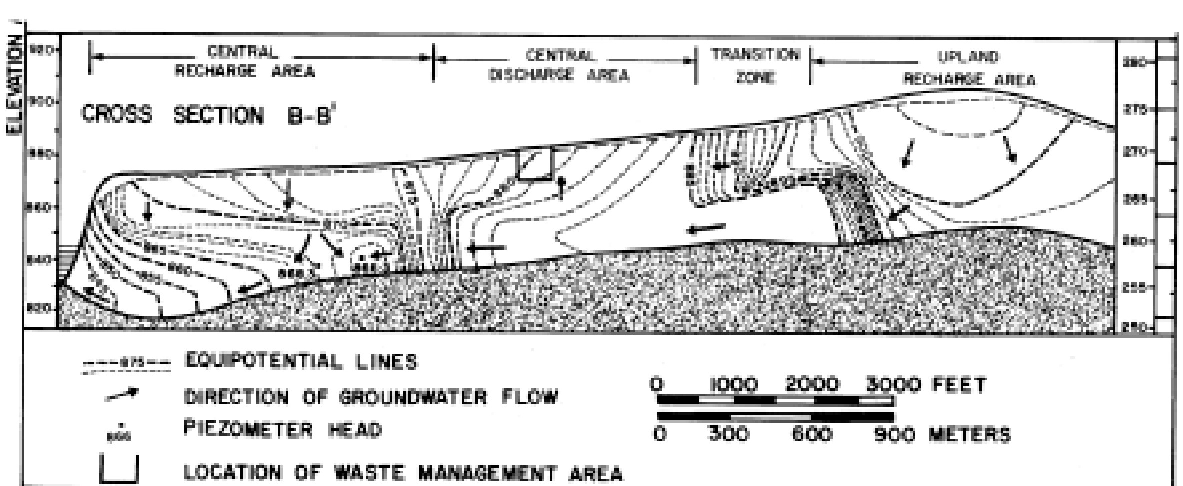
C1.1.2 Hydrologic Position

The location of the WMA was chosen because it is situated in a groundwater discharge area. This conclusion was based on the opinion of recognised hydrogeologists (Cherry et al. 1973, Cherry and Robertson 1988). The terrain is quite level. The source of groundwater is a slightly elevated area to the east (Figure 2) and the ultimate discharge is to the Winnipeg River in the west. The overburden consists of relatively permeable sand overlying bedrock. With the exception of the upland recharge area, located approximately 1.5 km east of the WMA, the sand unit is covered by a low permeability clay-till unit. The groundwater transit time for the flow path from the upland recharge area to the WMA is estimated to be at least 100 years (Robertson and Cherry 1985). The WMA is between the Winnipeg River and upland recharge area and has an upward flux gradient for water much of the time. This has been monitored in piezometers that compare the hydraulic head in the surficial materials (5 m depth) with deeper layers (10 m depth).

Generally, the natural head at 10 m depth is higher, meaning that the head gradient is upward leading to water discharge toward the surface. This is an artesian situation. The initial hydrogeological investigations assumed this to be true for much of the year, although reversals where the head gradient was downward and water would be expected to move downward were noted. The rationale for locating the WMA in a discharge area was to avoid contamination of the underlying sand and gravel aquifer (because the net flux is upward).

A hydrogeology review of WMA water table and deep wells data collected from 1983 to 1999 was conducted to provide confirmation that the WMA remains a water discharge zone. The review focused on two well sets thought to be representative (RW1 and RW5). Data for the RW1 location indicated that the well construction has been compromised and accordingly the data were inconclusive. The RW5 location clearly indicated that the area remains a water discharge zone. The results are documented in Appendix C.5.

Figure 2
Sketch of Hydrology and Water Flow Pattern



The performance of the trenches to date has been satisfactory, based on the historic and present level of monitoring. There have been no known releases from the unlined trenches.

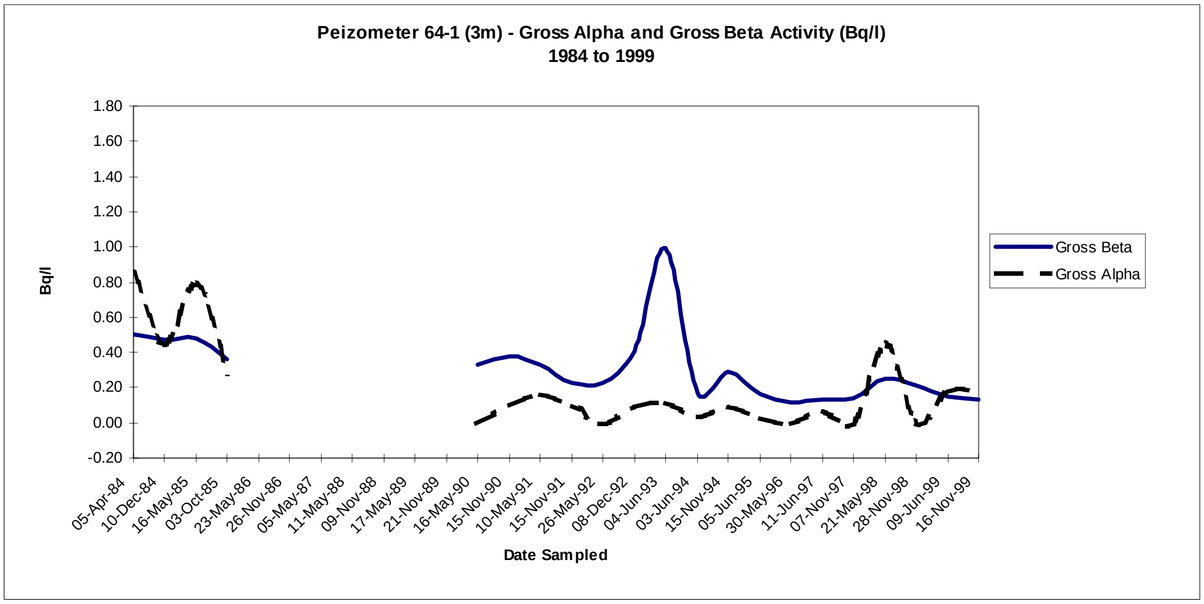
Analyses of peizometers and monitoring wells around the trenches (locations indicated in Figure 1) show no consistent indication of contamination. There are certain samples in certain years that appear to have elevated radioactivity (e.g. Figure 3), but these are not sustained year-to-year. It is assumed these are some type of artifact, either contaminated surface water entered the well or there may have been cross contamination during sample collection and analysis. If the groundwater was contaminated, the surrounding solid matrix would be contaminated and the water would remain contaminated for at least several consecutive years.

Analyses of peizometers and monitoring wells around the trenches (locations indicated in Figure 1) show no consistent indication of contamination. There are certain samples in certain years that appear to have elevated radioactivity (e.g. Figure 3), but these are not sustained year-to-year. It is assumed these are some type of artifact, either contaminated surface water entered the well or there may have been cross contamination during sample collection and analysis. If the groundwater was contaminated, the surrounding solid matrix would be contaminated and the water would remain contaminated for at least several consecutive years.

Figure 3

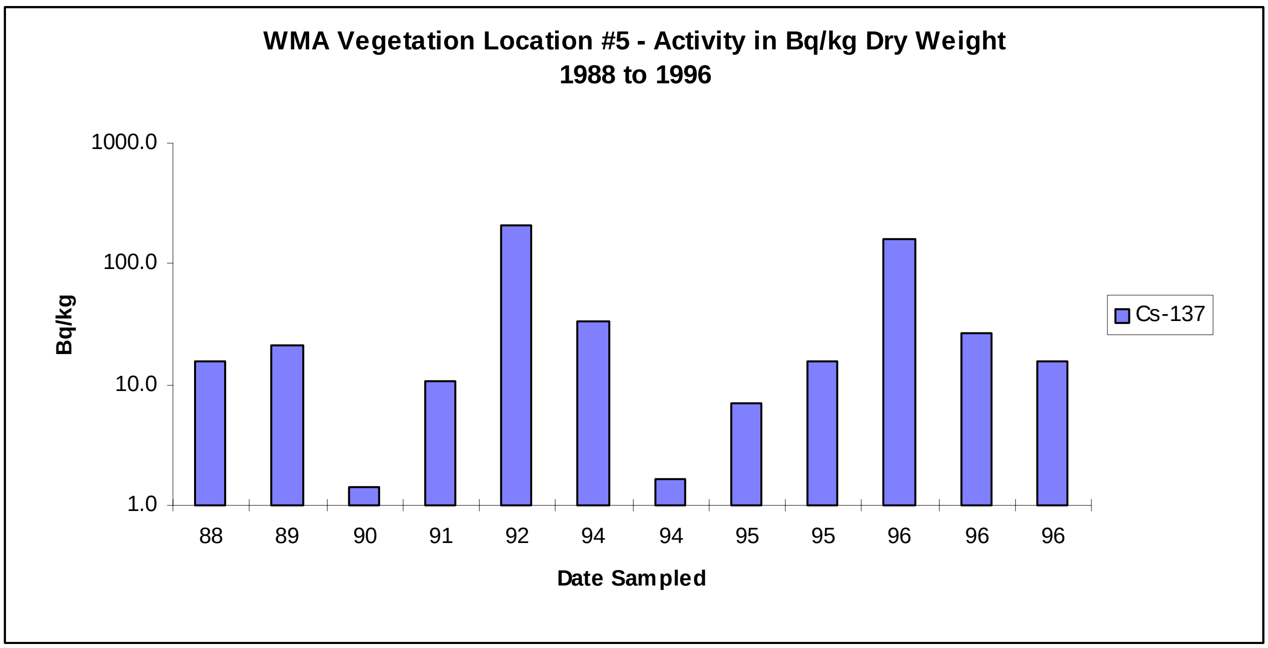
Example of Radioactivity Observed in Monitoring Wells Around the WMA

This is the 3 m depth at well cluster 64, just east of Trench 16. Missing data was the result of changes in the sampling plan.



Vegetation sampling is done routinely around and in the WMA. Some of the sampling sites are specific to areas known to be contaminated by operations. The others were established to monitor the potential deposition of contamination from the air as a result of the baler and incinerator operations. As such, the vegetation sampling is not designed to monitor trench performance. The vegetation analysis data are exceptionally variable (Figure 4), with concentration differences year to year of several orders of magnitude. The low observed concentrations are consistent with background. It is assumed the high concentration samples are related to deposition of radioactivity from the incinerator onto the foliage just prior to sampling. Again, the vegetation samples would be more consistent year to year if the soil or groundwater were the sources of contamination. Certainly, the results do not indicate there were releases from the trenches.

Figure 4
Concentration of ^{137}Cs in Vegetation Between Trenches 7 and 8



Note: Log scale, concentrations change 150-fold from 1990 to 1992. This is probably the result of atmospheric deposition associated with other operations and not releases from the trenches.

C1.2 ASSUMPTIONS RELATIVE TO CONTAMINANT MIGRATION

The trenches vary in size and shape, and may also vary slightly in depth. The corners have been located by conventional survey and the area surveyed with EM31 geophysical techniques that non-obtrusively map features with depth. The process of filling the trenches entailed excavation and then dumping of packaged waste, followed by covering with material similar to that excavated. The inventory is provided in Appendix C.2. Key points from the Appendix and notes from interviews with staff indicate that:

- 97% of the waste packages were plastic bags, the remainder were drums (3%), cans (0.2%), barrels (0.02%) and other lesser quantities.
- Trenches were sometimes flooded with water when open, and are below the water table level much of the year.
- Most of the surficial material has properties consistent with Lake Agassiz glacial lacustrine clay, which is fractured with the potential for preferential water flow paths.
- Some trenches were covered with contaminated soil removed from other facilities on the Whiteshell site, thus contamination in these areas does not indicate a release from the trench.
- Some covered trenches were used as the staging area for the incinerator for handling and storage of drums of potentially contaminated organic coolant awaiting incineration. Contamination in these locations does not indicate a release from the trench.
- There is no evidence of continued subsidence of the waste after the initial subsidence following trench closure.

The conceptual model of the trenches was developed from synthesis of all of the available information, and includes the following features:

- The trenches are on average 4 m deep with 1 m of cover composed of the local clay.
- The water table is high enough to submerge most or all of the trench contents some of the year.
- The water table fluctuates enough that it is assumed water drains from the trench on occasion.
- The degree of degradation of waste is unknown, but with water saturation the waste may not oxidise rapidly: the cloth and paper may have degraded, metals will have partially corroded and the plastics may be relatively intact.
- The waste mass as a whole probably has a lower density and a higher hydraulic conductivity than the surrounding clay.
- Because at least some waste packages will have partially maintained their integrity, not all of the water in the trench will move freely and not all of the radionuclide inventory will be subject to migration.
- There is the potential for the hydraulic head in the trench to be higher than that in the surrounding clay, resulting in a gradient to cause water to flow outward.

- There is potential for the ‘bath tub effect’, where the waste trench floods and the water escapes through a hydraulic conduit (region of higher hydraulic conductivity than the bulk of the surrounding clay) in the trench wall, resulting in lateral flow along a relatively narrow flow path.
- With water tables at times within a metre of the surface, a head gradient may follow the local topography, where the local low is the perimeter ditch.
- The site will remain protected, and the exclusion zone can be designed to match or exceed the required area to ensure that ‘natural attenuation’ controls the release (by natural attenuation, the implication is the rate of migration away from the site is counterbalanced by the rate of decomposition, in this case mostly by radioactive decay).
- With the WMA as a discharge area, there may be migration of contaminants upward with accumulation in the cap soils, analogous to the salt accumulations found in discharge areas on the prairies, where the accumulation may be at the surface or at some specific sub-surface horizon.

This conceptual model develops hypotheses about the behaviour of the contaminants from the unlined trenches. It was possible to partially test most of these hypotheses without intrusion into the trenches.

C1.3 HYPOTHESIS-DIRECTED INVESTIGATIONS

Two coring campaigns were undertaken to evaluate hypotheses about the trench environment (detailed in Appendix C.3). These were not intended as comprehensive investigations, but are suitable for preliminary assessment and are useful in planning of the follow-up monitoring program. The results (Appendix C.4) obtained assist in interpretation of the potential migration pathways.

C1.3.1 Upward Migration of Contaminants

The first hypothesis is that there is no significant upward migration of contaminants. With the trenches being wet or water-saturated much of the time, and with groundwater seeping to surface, the question becomes: where does the water go? Evaporation is an obvious route of water loss.

This situation is very analogous to the salt-affected soils common in the Prairies and is consistent with the observation of surface salt deposits in drainage ditches in the WMA area. Salt-affected soils often occur at the edge of an area of moist soil. The soil is moist because groundwater is discharging. The groundwater may flow vertically as free water in saturated flow, but more likely travels the last few metres as unsaturated flow, often called capillary rise. As it nears or reaches the surface, the water evaporates leaving behind the dissolved salts and any non-volatile contaminants. In some cases the salt accumulates on the surface, in others it will accumulate at a specific depth governed by the relative rates of capillary rise and leaching.

In the WMA, this process could lead to contamination of the clay (soil) cap materials. In order to partially test this hypothesis, a series of core samples were taken in the cap materials of three trenches. The trenches were chosen to represent below-average, average and above-average inventories of radionuclides. The cores were about 1 m long, taken in 10 cm increments to minimise compression. They were visually examined, surveyed for radioactivity, and prepared for analysis. Each sample was split, half sent for chemical analysis and the other half dried and subjected to gamma spectroscopy. The trenches sampled were chosen to avoid cover soil that was known to be contaminated because of other operations, such as the incinerator. However, there remains a potential for these other sources of contamination to interfere with the testing of the hypothesis.

Results from sampling the cap material (Appendix C.4) confirm that they are a mixture of the local soils, in that there were observations of organic layers at depth that were likely topsoil originally. There were few occurrences of detectable radionuclide contamination. The top 10 to 20 cm had detectable ^{137}Cs in 9 of 15 cores. This could reflect recent contamination from other WMA operations, or it could indicate that plant roots have extracted ^{137}Cs from depth and this was subsequently deposited on the surface. Because there is no indication of a progressive profile of ^{137}Cs concentrations, it is unlikely that the ^{137}Cs in the surface layers is the result of upward migration or capillary rise within the cap soil matrix.

In two cores there was contamination in the 90 to 100 cm layers. This may be the result of direct contamination from mixing of trench materials, but is more likely the result of limited convection/dispersion upward from the trench. This condition was observed in only two cores. In one core, there was ^{137}Cs contamination in two layers in the 50 to 70 cm depths. This layer was quite black with natural organic matter and this may indicate it was topsoil previously. As such, the ^{137}Cs concentrations are consistent with levels from bomb fallout or previous contamination and does not indicate capillary rise.

Conductivity was measured in many of the cores. Conductivity (electrical) can be an important indicator of soil transport processes. In all the cores where a full profile was measured (only three cores were done in every layer) several layers of elevated conductivity were noted at mid-core depths. This occurrence in each core measured was enough to suggest it was a process-related phenomenon. There was no contamination in these more-saline layers. These layers may indicate the initial formation of a saline horizon consistent with a capillary rise scenario.

In summary, the results are very preliminary, but there is no significant movement upward of contamination even after over 20 years of contact with the waste in the trenches. There are observations that would be consistent with extraction of ^{137}Cs by plant roots, and some evidence of a very small amount of upward movement of salts and contaminants from the trench into the cap materials in a few samples. Contaminant migration, if it occurred, is less than 10 cm since closure 20 years ago.

C1.3.2 Lateral Near-Surface Migration of Contaminants

The second hypothesis is that there has been no significant lateral migration of contaminants from the trenches. The 'bath tub effect' gained some notoriety in the 1980's as an unexpected pathway for contaminant to reach the surface from LLW trenches (Sheppard 1997). Perhaps the most famous example was the West Valley LLW trenches in New York State. Here the trenches tended to be flooded because the cap had a higher hydraulic conductivity than the material around the sides and bottom of the trench. The trenches filled with water until the water level reached a point in the wall of the trench that had a higher hydraulic conductivity than the rest of the trench wall. At West Valley, this was at a discontinuity layer between weathered till on the surface and unweathered till below. The water and contaminants flowed out of the trench wall laterally to a nearby stream, resulting in contamination beyond the controlled area. The trenches in the WMA have at least some of these characteristics.

In order to investigate this hypothesis of near-surface lateral transport, it was decided to core beside selected trenches to a depth of 4 m. Because the bathtub effect results in releases wherever the hydraulic flow path is fastest and these are not physically or visually evident, there is a statistical nature to the sampling. It may only be by chance that the relatively narrow lateral flow path is sampled. The cores were taken in 60 cm sections 3 m away from where the trench wall was expected to be, because of the possibility for inaccuracies about the trench dimensions in the excavation records. If cores contained any material that was not of natural origin, they were to be discarded. The core sections were analysed whole using a specially designed rig that held a portable gamma spectroscopy detector 30 cm away from and perpendicular to the mid point of the core. Calibration standards were made using water-filled core tubes spiked with known amounts of radioactivity. Detailed analysis was performed on the bottom 10 cm of each 60-cm core section.

The results showed no contamination with depth (Appendix C.4). The soil in these core locations is undisturbed at depth, but the surface was disturbed by contouring and landscaping of the WMA and previously by agricultural activities. There was minor contamination of the top layer (60 cm) in 3 of 8 cores. This is mostly likely ^{137}Cs from the incinerator operations and perhaps bomb fallout. The cores give no evidence of the bathtub effect, although to fully test this hypothesis would require many more cores, with coring much closer to the trench wall and analysis of the most mobile radionuclides such as ^{3}H. This will be done during the 60-year project period.

C1.4 CONTAMINANT MIGRATION MODELLING

A scoping level estimate of migration potential is carried out to address the potential impacts of the fission/activation/corrosion products before they decay to negligible concentrations.

C1.4.1 Exposure Scenario

For this analysis, the only receptor considered is a member of the public. Worker health and safety is an operational issue. Ecological risk effects are important, but are considered a refinement not relevant at this level of evaluation. The human receptor was assumed to be able to access the present WMA perimeter, even though there will be a larger controlled area up to and after the 60 year project period.

There are three general migration/exposure scenarios that could be assessed (Table 1), each with different exposure routes, endpoints and risks. Table 1 lists some of the arguments that led to the decision to place emphasis on the near-surface lateral migration pathway. The three exposure scenarios are not necessarily mutually exclusive. The model used for near-surface lateral migration applies equally well to downward migration, assuming the media have the same properties. Thus, the estimated concentrations in the perimeter ditch could be interpreted as concentrations in a well intercepting groundwater beneath the WMA.

Table 1
Three General Exposure Pathways, Listing the Human and Ecological Receptors and the Arguments For Detailed Evaluation

Upward migration	Near-surface lateral migration	Downward migration
Contamination of soil and vegetation on the trench covers	**Contamination** of local discharge, likely in the perimeter and roadside ditches	**Contamination** of the sand and gravel aquifer
Exposure of workers by external exposure and dust inhalation	**Exposure** of the public by food-chain pathways	**Exposure** of the public by ingestion of well water
Exposure of plants and small animals living in the WMA	**Exposure** of plants and animals	**Exposure** of aquatic organisms if the contaminant reaches the river
Not assessed in detail. Needs to be considered in the context of other contamination already on the surface, and is largely a worker health and safety issue rather than a public exposure issue.	Assessed in detail. The hydrology of a discharge area does not exclude this pathway, and path lengths are short so that transit times could be short.	Not assessed in detail. General hydrology of the site limits or eliminates this pathway.

In order to evaluate the exposure to contaminants in the trenches, there are three general areas that must be described: the release of contaminants from the waste materials, the migration from the waste to the receptor, and the receptor itself.

Releases

The release from the waste is very difficult to quantify, because the long-term performance of the waste packages is unknown. Presumably the contaminants are released with time as the waste materials degrade. This could be because of decomposition of organic (paper and fabric) waste, corrosion of metals or degradation of the plastic and rubber. Once released, the contaminants may re-sorb to residual materials in the waste mass and may migrate within the waste mass. If the waste mass is porous and water-saturated as hypothesized, there may be an opportunity for mixing throughout the trench. For the sake of modelling, the contaminants are assumed to be fully released from the waste materials, able to mix throughout the trench, but sorbed to the residual material in a way that slows their release into the surrounding substrate. The assumption about mixing throughout the trench mostly reflects the lack of information to assign certain contaminants to certain sections of the trench, rather than an assumption of diffusive mixing.

Migration

The migration through the substrate is assumed to follow typical convection-dispersion model formulations for migration in saturated porous and fractured media. The hydraulic properties of the fractured clay are as reported by Grisak and Cherry (1975). This is an important feature. Retardation during migration is dependent on the capacity factor, which is a property of the substrate that reflects both porosity and sorption (described with equations in section C1.4.2.3). In a fractured clay, there are two levels of porosity, the fractures themselves and the inter-particle pore spaces. For strongly sorbing contaminants, the migration velocity is dominated by sorption and the question of which porosity to use is less important. For contaminants that do not sorb (which are the important contaminants), the choice of porosity is more important. Flow by way of fractures is much more rapid than flow in the clay matrix, so the conservative assumption is to use the fracture porosity. Implied in this is that sorption is to the fracture surfaces only, not the full clay particle surfaces. Indeed, the mobile contaminants will also migrate into and in the clay matrix, but this is very slow compared to the fracture flow. The hydraulic conductivity data of Grisak and Cherry (1975), as used here, reflect fracture flow. The fractures in the clay may be coated with materials that affect sorption. The sorption data chosen, in general, were geometric mean values and therefore tend to be lower than the overall average values. Lower sorption values are conservative for migration risk estimates, because they imply more rapid migration. More site-specific sorption data is a priority for almost all migration risk assessments.

For the near-surface lateral flow scenario, the cross-sectional area of the flow path must be considered with care. The full trench-wall area could be considered as the area, assuming the migration was as a large front. On the other hand, a small conduit of more permeable clay, reflecting the bathtub scenario, could be defined. This is an important decision and not one that can be determined *a priori*, so both were modelled using ^{90}Sr as the example.

Receptors

The receptor is an abstraction, at least for the public receptor because there is no public access now. It has not been determined in detail how the boundary of the protected area will change in the next 60 years, but it is very likely that it will be larger than the WMA itself. As such, the public will not have access to the perimeter ditch. They may have access to the connected ditch along the road. Non-human receptors will have full access to the environment outside the fenced WMA, and most will have access inside the fence. However, non-human receptors are not considered at this stage, nor is consumption of game.

It is assumed that public receptors can access the ditch along the road, and that because spring runoff is rapid the concentrations in the road ditch are assumed to be the same as those in the perimeter ditch. For some trenches (Trenches 7 and 8), the road ditch is the assumed discharge point for releases. In addition, it is conservative to evaluate the potential contamination in the perimeter ditch because it is the closest potential discharge point from the trenches.

The ditches have water for only a short time each year. Thus, they could not be a reliable source of water for irrigation and would not be used for direct consumption by humans. These pathways can be ignored. The ditches could conceivably provide water for grazing livestock (and wildlife), the plants in the ditches could be grazed and the soil may contain enough salt to be selectively consumed by animals. These scenarios were used for the exposure assessment. In addition, it is possible to compare estimated soil and water concentrations in the ditch to established guidelines for several of the contaminants.

C1.4.2 Analytical Model of Contaminant Migration

C1.4.2.1 Introduction

The theoretical development of a set of mathematical equations that can be used as an assessment tool to predict the success of in-situ disposal is described below. The tool developed is intended to be simple, transparent and conservative, but not necessarily predictive. The meaning of conservative in this sense is that the tool will tend to over-predict radionuclide release rates and concentrations.

C1.4.2.2 Basic Assumptions

It is assumed that the trenches are saturated with water and that the release of the inventory in the trenches begins abruptly after closure. All contaminants are assumed to have a spatially uniform concentration within a trench and that sorption within a trench can be characterized by a linear distribution coefficient. The migration of the contaminants outside a trench is treated as a one dimensional flow path in the direction of the near-surface groundwater flow. Within this flow path mass transport is characterized with one dimensional convection-dispersion equation with linear sorption. Near-surface groundwater flow rates can be determined from Darcy's law using the average slope of the water table to a predicted discharge point as the water head gradient.

C1.4.2.3 Governing Equations and Conditions

The Darcy velocity in the one-dimensional flow path can be determined from:

$$q = Ws$$

Here:

q is the Darcy velocity,
W is the hydraulic conductivity, and
s is the average slope of the water table to discharge.

The radionuclide capacity factor in the trench, K_t can be determined from:

$$K_t = \varepsilon_t + \rho_t P_t$$

Here:

ε_t is the porosity within the trench,
ρ_t is the bulk density of the contents of the trench, and
P_t is the radionuclide distribution coefficient within the trench.

The radionuclide release rate from the trench can be expressed as:

$$\frac{dM}{dt} = M_o \delta(t) - qAC - \lambda M$$

Where:

$$M = CVK_t$$

Here:

M is the total mass of radionuclide in the trench,
C is the concentration in the trench,
A is the cross-sectional area of the trench normal to the direction of groundwater flow,
V is the volume of the trench,
λ is the radionuclide decay constant,
M_o is the initial mass of radionuclide in the trench, and
δ is the Dirca delta function.

To obtain the concentration of the radionuclide at a distance x in the flow path from the trench to a discharge point, the concentration within the trench as a function of time can be correlated with the response function of Heinrich and Andres (1985).

C1.4.2.4 Verification of the Coded Model

The above model was coded in MATHCAD, a software package designed to facilitate complex mathematical tasks. In order to verify that the model was specified and coded correctly, a mass balance check was done. This consisted of mathematically integrating with time the contaminant releases from the trench. The integral for concentration can be difficult to evaluate by standard methods because one term approaches infinity as time approaches zero. To circumvent this, a Laplace transform method was used. For the no radioactive decay scenario, the sum of the amount released and the amount remaining was confirmed to be equal to the initial inventory. This verifies that the model does not create or destroy mass (estimates) during computation.

C1.4.3 Analysis Strategy

There are a large number of trench and contaminant permutations and to keep this evaluation consistent with a very preliminary screening level, a selected subset were evaluated. In addition, for some of the contaminants there are drinking water or other environmental acceptance guidelines. Where these were available, they were used as a trigger for more detailed pathways analysis. If concentrations at the exposure point, the ditch, were below human health protection guidelines, then no further pathways analysis was done. Three major contaminant types were studied: radionuclides, metals and organics.

The summary of the trench radionuclide inventories from the WMA monthly reports (Table 2 from Appendix C.2) accounting for radioactive decay to January 1, 2001 (Michael Rhodes - personal communication) was reviewed with respect to each radionuclide present in the WMA trenches. The summary of this inventory report shows that ^{90}Sr and ^{137}Cs are the most abundant radionuclides, they make up over 50 % of the radionuclide inventory. ^{90}Sr and ^{137}Cs are both fission products with intermediate radiological half-lives, 29 and 30.17 years, respectively. Of these two, ^{90}Sr is generally the more mobile in soils and groundwaters.

Other radionuclides in this inventory that are mobile include tritium (^{3}H), ^{14}C and ^{99}Tc. Tritium has a short half-life (12.3 years). However, it will migrate with subsurface water flow with little or no retardation. Carbon-14 and ^{99}Tc have much longer half-lives, 5730 years and 2.13×10^5 years, respectively. As for the other radionuclides (isotopes of Fe, Ni, Co, Nb, Sb, Pm, Ra, Am, Cm, Pu, Th and U) present in the LLW trenches (Appendix C.2), they are relatively insoluble in groundwater and immobile in soils. Actinides have been observed to migrate in sand media because of colloid formation. Colloid migration is extremely limited in a clay soil due to restrictive pore sizes and has not been considered in this preliminary evaluation.

The mobility of these radionuclides is decided primarily by landscape features, radiological decay and soil retention characteristics. Landscape features include, for example, the slope of the terrain and the soil hydraulic conductivity. Soil retention is primarily driven by sorption, modelled using the soil distribution coefficient or Kd value. In fact, a preliminary sorting of the radionuclides by soil Kd value is a good way of determining their migration potential. This shows that the migration from a homogeneous site, based only on soil retention, would be from greatest to least migration in the order– ^{3}H, ^{99}Tc, ^{14}C, ^{90}Sr, ^{55}Fe, ^{125}Sb, ^{134}Cs, ^{137}Cs, ^{60}Co, ^{59}Ni, ^{63}Ni, ^{94}Nb, ^{147}Pm, ^{238}U, $^{238-241}$Pu, Th, ^{244}Cm.

The inventories for each radionuclide, by trench, were reviewed and the trench with the largest activity amount (in Bq) of each radionuclide was selected for migration modelling. Table 2 documents the trench chosen and the inventory in that trench expressed as a percentage of the entire WMA site inventory. Literature values of soil Kd, appropriate for a clay soil were selected, and these values and their sources are also shown in Table 2. For Cs and Sr, there are data specifically measured for the WMA. The lowest value reported was used, adding another dimension of conservatism to this calculation.

The next most important specification was the trench position, the configuration of the source term with respect to the flow path and the gradient of the surrounding terrain. The area or footprint of each trench was determined from Figure 1 of Appendix C.2, similar to Figure 1) and the depth of all trenches was assumed to be 4 m. The volume of the waste in each trench was thus defined. The sorption potential and the retention capacity within the body of the trench itself is unknown. It is assumed that it is one-tenth the retention capacity of the surrounding soil. A lower retention in the trench is a conservative assumption because it means the contaminants will be released more quickly.

Table 2

Data Required for Modelling the Migration of Radionuclides Present in the Whiteshell Labs WMA LLW Trenches

Radionuclide	**Half-Life**	**Soil Kd for Clay[1] (L/kg)**	**Trench with Largest Inventory (by Nuclide)**	**Trench Inventory (as % of Whole WMA Inventory)**	**Source For Kd data**
Sr-90	28.6 a	**10** to 27 110 (3.6 to 32000)	#9	2.008 Ci (11.9%)	Mills and Zwarich 1980 Sheppard and Thibault 1990
Cs-137	30.17 a	**300** 1900	#2	4.325 Ci (24.7%)	Mills and Zwarich 1980 Sheppard and Thibault 1990
Cs-134	2.062 a	**300** 1900	#18 (and closest to ditch)	0.001 Ci (14.3%)	Mills and Zwarich 1980 Sheppard and Thibault 1990
C-14	5730 a	**6.7** (3.2 to 16.5)	#1	0.32 Ci (52.6%)	Sheppard et al. (1994)
Tc-99	2.1×10^5 a	**1** 0.1 aerobic, 82 anaerobic)	#16	3.7 Ci (99.97%)	Sheppard and Thibault 1990 Sheppard et al. 1990
Co-60	5.27 a	**550** (20 to 14000)	#23	0.775 Ci (25%)	Sheppard and Thibault 1990
Fe-55	2.7 a	**165** (15 to 2100)	#23	0.599 Ci (37.2%)	Sheppard and Thibault 1990
H-3	12.33 a	**0**	#7	4.896 Ci (86.9%)	Assumed no retention
Ni-59	8×10^4 a	**650** (305 to 2467)	#8	0.008 Ci (12.1%)	Sheppard and Thibault 1990
Ni-63	100 a	**650** (305 to 2467)	#8	1.011 Ci (12.3%)	Sheppard and Thibault 1990
Nb-94	2×10^4 a	**900**	#23	0.003 Ci (13%)	Sheppard and Thibault 1990
Sb-125	2.73 a	**250**	#17 (and closest to ditch)	0.001 Ci (14.3%)	Sheppard and Thibault 1990

Table 2 (continued)

Data Required for Modelling the Migration of Radionuclides Present in the Whiteshell Labs WMA LLW Trenches

Radionuclide	Half-Life	Soil Kd for Clay[1] (L/kg)	Trench with Largest Inventory (by Nuclide)	Trench Inventory (as % of Whole WMA Inventory)	Source For Kd data
Pm-147	2.62 a	**1300** to 6000 assuming behaves like Sm and Cm	#20	0.022 Ci (13.5%)	Sheppard and Thibault 1990
Ra-226	1600 a	**9100** (696 to56000)	#9	0.030 Ci (93.8%)	Sheppard and Thibault 1990
Am-241	432 a	**8400** (25 to 400000)	#8 (closest to the ditch)	0.010 Ci (12.6%)	Sheppard and Thibault 1990
Cm-244	18.11 a	**6000**	#7 (closest to the ditch)	0.002 Ci (9.5%)	Sheppard and Thibault 1990
Pu-238	87.74 a	**5100** (316 to 190000)	#8 (closest to the ditch)	0.011 Ci (12.1%)	Sheppard and Thibault 1990
Pu-239	2.4×10^4 a	**5100** (316 to 190000)	#2	0.023 Ci (13.4%)	Sheppard and Thibault 1990
Pu-240	6537 a	**5100** (316 to 190000)	#9	0.029 Ci (12.2%)	Sheppard and Thibault 1990
Pu-241	14.7 a	**5100** (316 to 190000)	#9	0.805 Ci (11.3%)	Sheppard and Thibault 1990
U-238	4.5×10^9 a	**1600** (46 to 395100)	#2	Ci (100%)	Sheppard and Thibault 1990

[1] Kd values shown are from one or two references (cited in the right had column), and generally show the geometric mean and the range. Values used in the modelling are shown in bold font.

Most of the trenches containing the LLW (Trenches 1-5, 7-9, 11-23) are within the eastern half of the WMA and also along the easternmost fence line. We have used the recent GPS elevation survey of that portion of the site to determine the gradients. This elevation map shows that the eastern portion of the WMA and these trenches are 2 m above the surrounding ditches. This 2-m head difference has been used for all trenches. The distance of the closest trench face to the surrounding WMA ditch was used as the face from which the inventory nuclides are migrating. For Trenches 7 and 8, the migration direction was to the south ditch along the road, for all other trenches the migration direction was to the east perimeter ditch. The distance from this trench face was then measured and converted using the scale in Figure 1 of Appendix C.2. The flow path gradient was calculated using the rise of 2 m and the distance from each trench face to the ditch. If another trench was in between the trench face being modelled and the ditch, the width of this intervening trench was discounted from the distance, effectively assuming this trench has no retention capacity. All other parameter values, such as hydraulic conductivity for the surrounding clay soil, fracture porosity and tortuosity of the clay matrix were selected from appropriate sources and are documented in Table 3.

Table 3
Migration Model Parameters, Their Units, Values And Source

Parameter Description & Symbol	Units	Value	Source
Porosity within the trench, εt	m^3 pore space · m^{-3} trench	0.8	Best estimate – assuming the bags were not packed into the trench
Bulk density of the contents of the trench, ρt	kg · m^{-3}	800	Best estimate – assuming the bags were not packed into the trench and assuming materials include paper, cloth, etc.
Radionuclide distribution coefficient for ^{90}Sr within the trench, Pt	$m^3 \cdot kg^{-1}$	0.0010	Based on a value 10-fold lower than the range given by Mills and Zwarich 1980 (10 to 27 L/kg) and also agrees with the lower end of the range of 0.05 to 190 L/kg for ^{90}Sr in sandy soils (Sheppard and Thibault 1990). A surrogate for poorly sorbing media.
Radionuclide capacity factor in the trench, Kt	m^3 pore space · m^{-3} trench	calculated	-
Radiological half-time for ^{90}Sr , thalf	a	28.6	Handbook value
Saturated hydraulic conductivity of the fractured clay, Ks	m $\cdot a^{-1}$	6.3 x 10^{-2}	Grisak and Cherry (1975)
Average slope of the water table to discharge, s	m	0.29	Calculated using a rise of 2 m over a run of 7 m – from trench face to centre of ditch
Porosity along the flow path, εp	m^3 pore space · m^{-3}	2 x 10^{-5}	Estimated
Bulk density along the flow path, ρp	kg $\cdot m^{-3}$	1350	Estimated
Radionuclide distribution coefficient for ^{90}Sr in the flow path, Pp	$m^3 \cdot kg^{-1}$	0.010	Based on the lowest value of the range given by Mills and Zwarich 1980 (10 to 27 L/kg) and also agrees with the lower end of the range of 3.6 to 32000 L/kg for ^{90}Sr in clay soils (Sheppard and Thibault 1990).
Free water radionuclide diffusion coefficient, Do	$m^2 \cdot$ a	0.047	Handbook value
Tortuosity factor for the flow path, τ	-	0.3	Estimated
Longitudinal dispersion length for the flow path, αl	m	0.7	Set at 0.1 of dispersion path length

C1.4.4 Model Application Using ^{90}Sr as an Example

It is anticipated that ^{90}Sr is a good indicator of trench performance because it is a relatively mobile contaminant and is present in moderately large amounts. An example simulation of the dispersion of ^{90}Sr from Trench 9 is presented in detail. This requires information about the trench waste inventory, the dimensions of the trench and the distance and elevation from the trench face to the ditch surrounding the WMA. The trench inventory of ^{90}Sr is 2 Ci (74 GBq). The length of the trench is 58 m, the width is 6 m and the depth is 4 m giving an internal volume of 1.39 x 10^3 m^3. It is assumed the full inventory of ^{90}Sr is evenly mixed in the trench and the complete inventory is ready at t = 0 to disperse through east facing sidewall of the trench. The parameters and their values required to describe the water flow and radionuclide retardation properties of the clay surficial material surrounding the trench are all given in Table 3.

The model coded in MATHCAD was used to estimate concentration with time and distance from the trench. Figure 5 shows the concentration (Bq/m^3) with time 7 m from the trench face (7 m was chosen because ^{90}Sr never reaches the ditch, 28 m away). The model suggests that concentrations at 7 m only peak after 740 years at about 4.7 x 10^{-9} Bq m^{-3}. The second plot (Figure 6) shows the ^{90}Sr concentrations from right next to the trench face, 0.6 m from the trench face, out to 5 m away after 250, 750 and 800 years. The most important point to note from the second plot is that radioactive decay proceeds faster than the migration and halts the main mass of the plume and contains it within a few metres from the trench face. The concentration that reaches 7 m is extremely small, not detectable analytically and twelve orders of magnitude below the present day maximum acceptable concentration for ^{90}Sr in drinking water of 5 Bq L^{-1} (Canadian Council of Ministers of the Environment 1999).

To illustrate the effectiveness of radiological decay for ^{90}Sr, another simulation was done for Sr assuming no decay. Without decay, the Sr continued to migrate outward, with a peak concentration of 3.1 x 10^6 Bq (equivalent) m^{-3} at 7 m in 10000 years. Even when the Sr was assumed to not decay, it did not reach the 7-m distance for over 400 years. This illustrates 1) how important decay is to the removal of ^{90}Sr, and 2) even without decay the migration is slow.

Another scenario to examine is the concept that the trench discharges through a small portion of the trench wall. To do this, as an extreme case, the full inventory of the trench was assumed to leave the trench by a 2 m^2 area of trench wall, and the full inventory was present in an adjacent 12 m^3 of the trench. This is a 116-fold smaller area of release than the full trench wall. With this ‘window’ release point, the peak concentration occurred at 740 years, the same time as the case where it was allowed to migrate from the entire trench. The rate of release is not expected to change: in effect the window scenario only increases the concentration which (with the Kd model of sorption) does not change the migration rate. With the ‘window’ release, the concentration at 7 m was much higher, at 5.5 x 10^{-7} Bq m^{-3}. This is 117-fold higher with the ‘window’ release compared to the whole-trench release (but is still below the drinking water standard for ^{90}Sr). This is the same number (within computational error) as the difference in the area of release. Clearly the concentration at a point in the environment scales directly with the area of release. This simplifies the evaluation, because in the ditch the releases are mixed again along the length of the ditch, either by water flow in the ditch or because the receptor integrates exposure along the ditch (for example, a cow will graze more than just the contaminated point in the ditch). In our example, the ‘window’ release resulted in 117-fold higher contaminant concentration in 116-fold smaller area of land. This would only result in higher exposure to very sessile receptors. A large grazing animal is considered as part of the exposure pathway, there is no need to explicitly model ‘window’ release scenarios.

Figure 5

Example Results Showing the Concentration of ^{90}Sr (Bq/m^3 Water) with Time at 7 m From the East Facing Wall of Trench 9 (Not in the ditch which is further away) Assuming a 2 Ci Inventory in the Trench

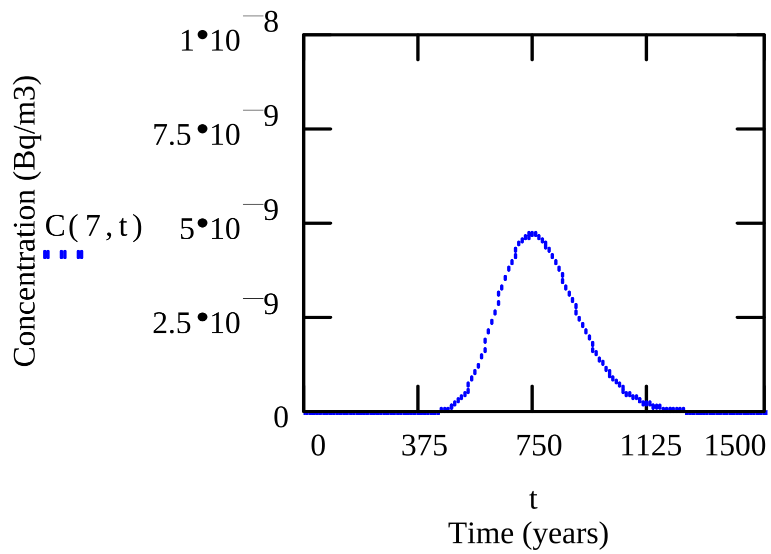


Figure 6

Example Results Showing the Concentration of ^{90}Sr (Bq/m^3 Water) with Distance from the Trench Face After 250, 750 and 800 Years

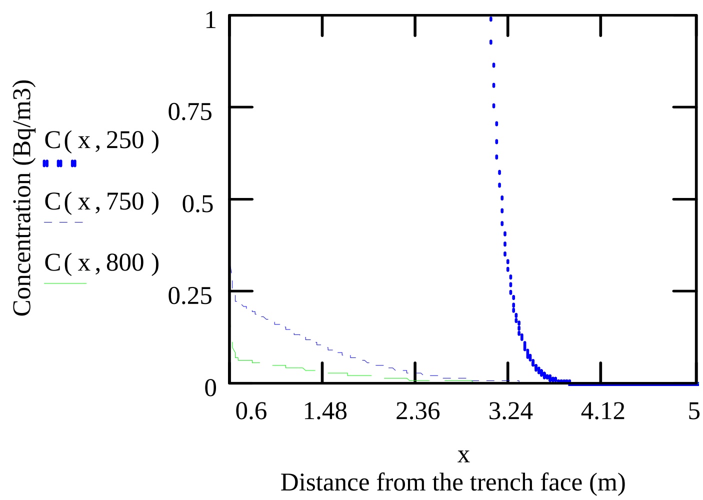


Table 4
Results of Simulations with WMA Inventory Radionuclides

Radionuclide	Concentration at the Closest Ditch in 2020 (Bq/m³ water)	Concentration at the Closest Ditch in 2060 (Bq/m³ water)	Concentration at the Closest Ditch in 2200 (Bq/m³)	Time to Peak Concentration at Ditch[a] (years after closure)	Peak Concentration at the Ditch (Bq/m³)
H-3, assuming no loss to atmosphere	1.1×10^{2}	5.0×10^{-2}	0	1	3.7×10^{7} (at present)
H-3, with loss to atmosphere	0	0	0	1	5.1×10^{-10} (at present)
C-14, assuming no volatilization	0	0	2.6×10^{-9}	2900	6.1×10^{5}
C-14, with volatilization	0	0	0	Volatilized	0
Fe-55	0	0	0	Decays	-
Ni-59	0	0	0	>200	-
Ni-63	0	0	0	>200	-
Co-60	0	0	0	Decays	-
Sr-90	0	0	0	Attenuated	-
Nb-94	0	0	0	>200	-
Tc-99, assuming oxygenated media	9.4×10^{1}	4.0×10^{5}	4.5×10^{7}	375	7.3×10^{7}
Tc-99, with anaerobic media	0	0	0	20000	2.1×10^{6}
Sb-125	0	0	0	Decays	-
Cs-134	0	0	0	Decays	-
Cs-137	0	0	0	>200	-
Pm-147	0	0	0	Decays	-
Ra-226	0	0	0	>200	-
Am-241	0	0	0	>200	-
Cm-244	0	0	0	>200	-
U-238	0	0	0	>200	-
Pu-238	0	0	0	>200	-
Pu-239	0	0	0	>200	-
Pu-240	0	0	0	>200	-
Pu-241	0	0	0	>200	-

[a] 'Volatilized' means the contaminant was lost to the atmosphere and did not migrate to the ditch; 'Decays' means the radionuclide largely decays before it leaves the trench; 'Attenuated' means the radionuclide does migrate but decays fast enough that it does not reach the ditch; and '>200' means the radionuclide is strongly sorbed, has a long half-life and release from the trench would be far in the future.

C1.4.5 Results of Simulations for Radionuclides

Simulations were carried out for each radionuclide present in the inventory, including fission products, activation products and corrosion products. Results of these calculations are presented as concentrations in the closest ditch after 20, 60 and 200 years from the present, 2001 (Table 4). The peak concentration in the ditch and the time of this peak are also given where appropriate.

As stated earlier, the trench with the largest inventory for each contaminant was selected to conservatively bias this work. In addition, the upper bound estimates (10 times actual inventory) for the inventory were used as the starting inventory values for each trench. The results of the initial calculations show that three radionuclides could eventually migrate as far as the ditch surrounding the present Whiteshell WMA (Table 4). These are ^{3}H (from Trench 7), ^{99}Tc (from Trench 16) and ^{14}C (from Trench 1) as expected from the ranking of the sorption values for these radionuclides.

Based on the initial modelling, ^{3}H would be present in the ditch now. The initial model does not account for isotopic exchange of ^{3}H with H_2 or water in the atmosphere, a process that will markedly decrease the actual concentration in the soil pore water. Essentially, the ^{3}H will leave the soil as a gas or vapour. To account for this exchange, it is necessary to estimate a loss rate from soil to the atmosphere. A fractional loss per annum based on water budget assumptions was estimated. It is assumed that the ^{3}H is present as tritiated water (HTO): elemental tritium (HT) would volatilize or oxidize to HTO and organically bound ^{3}H (OBT) would oxidize to HTO. The HTO will mix with and behave like the water in the soil. Water in the soil comes from precipitation and groundwater discharge, and leaves by surface runoff and evapotranspiration. Drainage is not a dominant loss route because this is predominantly a discharge area. Runoff occurs only for a brief interval in the spring. Thus, most of the water loss is by evapotranspiration. In adjacent lysimeters, Sheppard et al. (1984) measured evapotranspiration from a static 0.5-deep water table of over 3 m per annum, well above the precipitation amounts. Clearly, there is substantial potential for evapotranspiration. Following this argument, one could conservatively assume that at least half the annual water input to the soil leaves by evaporation. This translates to an environmental half-time of 1.4 a (loss rate = 0.5 a^{-1}, half-time = 0.693/0.5 = 1.4 a). Using this as the environmental half time for HTO is very conservative because the actual water loss rate is higher. However, the model including volatilization estimated concentrations of ^{3}H in the ditch that are trivial (Table 4).

For ^{99}Tc, the calculated migration plume could enter the ditch in 20 years. The concentration in the ditch based on the assumptions made is 94 Bq ^{99}Tc m^{-3} pore water. After 60 years, the ^{99}Tc concentration is 4×10^{5} Bq ^{99}Tc m^{-3} pore water in the ditch and the peak concentration of 7×10^{7} Bq ^{99}Tc m^{-3} pore water does not occur until after 375 years. The ^{99}Tc, however, does not have a short half-life and will migrate for some time and distance along the groundwater flow path. Slight retention along the flow path and spreading of the plume will provide some attenuation. That ^{99}Tc is important is not surprising, this is one of the key radionuclides in many radioactive waste disposal assessments because of its high mobility, long half-life and ready uptake in the foodchain. There are two other aspects to consider for Tc. The sorption coefficient, Kd, used was very low (and conservative), corresponding to an oxygenated environment. The trenches are flooded much of the year and the clay soil has mottled colouring indicating some chemically reducing conditions. Under reducing conditions, the more appropriate Kd for Tc is 80-fold larger. With this Kd, the release to the ditch is delayed (but not markedly diminished). In addition, any migration of Tc in the clay matrix, as opposed to fractures, will further retard migration by increasing the path length and because of the greater likelihood of anaerobic conditions. The other aspect to consider for Tc (and for the other contaminants as well) is the exposure pathway. This is dealt with in Section C1.4.1.

The ^{99}Tc is in a trench that has a long wall immediately adjacent to the perimeter ditch. The estimates described above are for a release from the whole-trench wall and subsequent contamination of a similar length of ditch. If the release were channelled through a small release point (see examples in section C1.4.4), the concentration could be substantially higher, but the length of ditch directly affected would be correspondingly smaller.

For ^{14}C, the calculated migration plume could enter the ditch after 200 years. After 200 years, the ^{14}C concentration is 3 x 10^{-9} Bq ^{14}C m^{-3} pore water. The peak concentration of 6.1 x 10^{5} Bq ^{14}C m^{-3} pore water does not occur until after 2900 years. As with ^{3}H, some fraction of the ^{14}C will leave the soil and go to the atmosphere as $^{14}CO_2$, with a half-life in the order of 14 d (Sheppard et al. 1994). Using this environmental half-life, no ^{14}C reaches the ditch (Table 4).

C1.4.5.1 Summary of the Radionuclide Migration Modelling

Three radionuclides have the potential to exit the WMA through migration over a 200-year period, these are ^{3}H, ^{99}Tc and ^{14}C. The other radionuclides will remain within a few metres of their present location in the trenches for exceptionally long periods of time (thousands of years) unless some direct conduit through surface perforation or extreme fracture cracking of the clay occurs.

These three radionuclides are primarily confined to one trench: 87% of the entire WMA site inventory of ^{3}H is in Trench 7, all of the site inventory of ^{99}Tc is in Trench 16 and 52.6% of the WMA site inventory of ^{14}C is in Trench 1.

Of the three radionuclides that do migrate significantly, only ^{99}Tc is potentially present in non-zero concentrations in the ditch adjacent to the WMA in as early as 20 years. The ^{3}H and ^{14}C will be lost to the atmosphere, and when this is modelled there is no release of these radionuclides to the perimeter ditch. The migration of ^{99}Tc is much slower if the sorption characteristics of anaerobic environments is assumed. Better estimates of the soil sorption coefficient for both ^{14}C and ^{99}Tc in the WMA clay substrate under both aerobic and anaerobic conditions are recommended before further modelling. If the ^{99}Tc were released through a small portion of the trench wall, the concentrations in the ditch could be much higher. It is not possible to model this possibility with more accuracy until more detailed on-site investigations are completed.

Concentrations of ^{99}Tc cannot be compared with environmental regulatory guidelines since none have been set. A risk assessment based on dose to humans from a milk and beef cow grazing in this area and assuming the plants they eat are taking up Tc from the surrounding area is presented in Section C1.4.5.2.

The computed concentration of ^{3}H in the ditch 14 m from the trench face after 60 years, assuming degassing occurs, is more than 13 orders of magnitude below the present-day drinking water standard as shown below:

At present: 5.1 x 10^{-10} Bq ^{3}H m^{-3} pore water (5.1 x 10^{-7} Bq ^{3}H L^{-1})

Maximum Acceptable Drinking Water Concentration – 7000 Bq ^{3}H L^{-1}
(Canadian Council of Ministers of the Environment 1999)

C1.4.5.2 Exposure Assessment for ^{99}Tc

The exposure scenario for contamination in the ditch is that it is open for access by cattle. It is assumed the cow obtained 10% of its annual water intake and 10% of its forage intake from the ditch. This is quite conservative given that cattle could only access the ditch in non-winter months and the ditch would represent only a small fraction of the vegetation a cow might access in the area. It is further assumed that all the soil ingested by the cow comes from the ditch, to allow conservatively for ingestion of the soil as a salt source. It is assumed that the critical individual obtains all his/her milk and meat from a cow with these habits. Transfer factors to model this pathway are taken from Zach and Sheppard (1992), with the exception of human food consumption values which are derived from Health Canada intake surveys (Health Canada 1994). Per unit concentration in water (Bq L^{-1}), the corresponding committed effective dose is 2.24×10^{-9} Sv a^{-1} (Table 5). This value compares well with the corresponding value of 4.60×10^{-7} Sv a^{-1} listed by Posiva (2000) as their all-inclusive pathways dose factor. With the conservative case of low Kd, the water concentration in the ditch at 60 years was 2.5×10^{4} Bq ^{99}Tc m^{-3}, which corresponds to a dose of 0.056 µSv a^{-1}, well below guideline values. At the peak concentration of 7.2×10^{7} Bq ^{99}Tc m^{-3}, the dose is 0.16 mSv a^{-1}, which is above the guideline value of 0.05 mSv a^{-1}. However, this exposure is unlikely because it implies one cow virtually tethered to the ditch for 10% of the year.

Table 5

Parameters Used to Compute the Dose (Sv a^{-1}) From Relevant Pathways Following Contamination of Water With 1 Bq L^{-1} Of Tc-99. See Text for the Sources of the Input Parameters

Parameters	Values
Input concentration (Bq/L water)	1
Soil solid/liquid partition coefficient, Kd (L/kg)	1
Soil concentration (Bq/kg dry soil)	1
Plant/soil concentration ratio (unitless)	2.4
Plant concentration (Bq/kg dry plant)	2.4
Total water ingestion rate by cow (L/d)	60
Total plant ingestion rate by cow (kg dry/d)	15
Soil ingestion rate from ditch by cow (kg dry/d)	1
Fraction of cow water intake from ditch	0.1
Fraction of cow plant intake from ditch	0.1
Intake to flesh transfer factor (d/kg)	8.50E-03
Intake to milk transfer factor (d/L)	9.90E-04
Concentration in meat (Bq/kg wet)	9.01E-02
Concentration in milk (Bq/L)	1.05E-02
Human intake of meat (kg/d)	0.07
Human intake of milk (L/d)	0.3
Dose conversion factor (Sv/(Bq)	6.50E-10
Dose from ditch-cow-human pathway (Sv/a)	2.24E-09

C1.4.6 Modelling of Migration of Heavy Metals

The Whiteshell Laboratories WMA inventory report lists two heavy metals or metalloids of note in Table 5 of Appendix C.2. Trench 1 contains 3000 lbs (1361 kg) of As and Trench 7 contains 1800 lbs (817 kg) of lead. The analysis is the same as for the radionuclides with the exception that there is no radiological decay.

All of the parameter values are the same with the exception of the sorption coefficient for clay soil. For Pb, we choose the value of 13500 L kg^{-1} from an enhanced database including data for clay soils (ECOMatters 1999 – personal communication). The recommended value for clay soils in an earlier referenceable compendium is 550 L kg^{-1} (Sheppard and Thibault 1990). In this same enhanced database, the recommended value for As in sandy soils is 11 L kg^{-1}. Values as low as 0.7 have been reported for As – a highly mobile heavy element in some speciation states. Since the correct speciation for As in the trenches cannot be determined, it was assumed that the most mobile species and the conservative value of 0.7 L kg^{-1} was used.

C1.4.6.1 Results and Summary of Migration Modelling of Heavy Metals

For stable Pb, the model indicates that it will remain in place as do the highly sorptive radionuclides. For As in Trench 1, the model shows a nonzero concentration in the ditch after about 30 years. At 60 years, the concentration of As in the ditch pore water 7 m from the trench face could be 7.7×10^{-4} kg As m^{-3} or 770 µg As L^{-1}. The peak concentration of 0.5 kg As m^{-3} or 500 mg As L^{-1} occurs at about 450 years. These concentrations are well above the Canadian Council of Ministers of the Environment (1999) human drinking water standard of 25 µg L^{-1} (Canadian Council of Ministers of the Environment 1999). Better estimates of the soil sorption coefficient for As in the WMA clay substrate under both aerobic and anaerobic conditions are recommended before further modelling. Very likely Trench 1 will have to be remediated to remove the potential hazard resulting from arsenic.

C1.4.7 Modelling of Migration of Organic Contaminants

There is limited information on the presence of organic contaminants. Certainly a large quantity of plastic and rubber disposables were emplaced. There are records of specific emplacements of DDT, glycol, solvents and organic residues such as still bottoms, recorded in terms of numbers of drums (Appendix C.2). The inventory, degradation rate, mobility and biological impact for these materials is less well known than for radionuclides.

The organic still bottoms and high-boiler residues were emplaced in the trenches because they were not fluid or were too viscous to incinerate. These same properties indicate low environmental mobility and probably a low rate of biodegradation. As such, the residues are probably still present in the trench and have not migrated appreciably. Toxicity information is also difficult to specify. Without more information, attempting to model migration is not useful. However, the most likely conclusion is that mobility is very low and the material will remain in the trench.

The solvents listed generically are probably xylene, benzene and acetone, because these were the predominant solvents used (Robert Helbrecht - personal communication). Chlorinated solvents were specifically forbidden in the reactor area because chlorine caused fouling in the reactor. This policy also resulted in decreased use of chlorinated solvents on the rest of the site. Xylene, benzene and acetone range in solubility in water from moderate to miscible (186, 1780 and 6×10^5 mg L^{-1}, respectively), and are quite volatile (vapour pressures of 1074, 12700 and 30300 Pa, respectively). They are all less dense than water. They have relatively short degradation and volatilization half-lives in soil, 1700 d for xylene, 550 d for benzene and probably more rapid for acetone. The trench that contains these solvents was closed in 1975 and so even xylene has undergone 5 half-lives. To evaluate the potential impact, it was assumed that there were 5 drums of each solvent (only 5 drums of solvent in total are indicated in the waste inventory), they were assumed to mix throughout the trench and to degrade with time (Table 6). Because of degradation, the concentrations remaining in the trench were far below the Canadian Council of Ministers of the Environment (1999) guidelines. There was no need to consider migration.

The DDT is an important contaminant because of its known carcinogenic and other ecological effects. The distinct hazards of DDT are related to biologically incorporated residues: DDT is not very mobile in soil. The inventory notes do not indicate a quantity of active ingredient, so it was conservatively assumed the DDT was dissolved in a very efficient solvent (acetone) and the mass of DDT per drum was computed with this solubility (Table 6). There is a wide range in soil degradation half-times reported for DDT, with distinct differences between aerobic and anaerobic metabolism. A half time of 2 years was chosen as a relatively long value among those reviewed. As with the solvents, degradation left very low concentrations in the trench and there was no need to consider migration.

Table 6

Estimated Concentrations of Solvents and DDT 60 Years from Present Assuming No Migration from the Trench. Migration will Result in Further Dilution

Material	**Half Time In Soil (d)**	**Total Volume In Drums (L)**	**Density of Pure Solvent or Solubility of DDT in Solvent (kg/L)**	Estimated Mass **in the Trench (kg)**	**Volume of Trench (m^3)**	**Concentration in Trench, Assuming No Loss (kg/ m^3)**	**Concent-ration in Trench at Present, with Loss (kg/ m^3)**	**Concent-ration in Trench in 2060, with Loss (kg/m^3)**	**Concent-ration in Trench in 2060 Per Unit Mass (mg/kg)**	**CCME (1999) Guideline Limit for Concentration in Agricul-tural Soil (mg/kg)**
Xylene	1700	900	0.8802	792	960	0.83	2.0E-02	8.4E-13	1.1E-15	200
Benzene	550	900	0.8765	789	960	0.82	8.3E-06	3.5E-16	4.4E-19	0.05
Acetone	550	900	0.7899	711	960	0.74	7.5E-06	3.2E-16	4.0E-19	---
DDT	730	360	0.58	209	224	0.93	1.6E-04	1.9E-30	2.3E-33	0.7

Note:
- Soil half times from Mackay et al. (1992) and CCME (1999), half time for acetone set the same as benzene although it is probably much shorter.
- Volume assumes all drums were 45 gallon, and there were 5 drums of each solvent (there were 5 drums total).
- Density taken from the CRC Handbook, DDT solubility is based on best common solvent.
- Conversion of concentration per volume in trench to concentration per mass assumes a bulk density of 750 kg/ $m^{3.}$

- The CCME guidelines for agricultural soil is the most restrictive of the categories used by CCME (1999).

C1.4.7.1 Results and Summary of Migration Modelling of Organic Contaminants

The results of the degradation rate calculations (Table 6) indicate that the remaining concentrations of the solvents and DDT are very small. If they migrate, this will increase the dilution and may increase the rate of degradation. It is unlikely that these materials present a hazard.

The organic still bottom and high-boiler residues are probably intact where they were emplaced. These are expected to be very insoluble in water and relatively resistant to degradation. These materials were processed in a way that concentrated the degradation-resistant compounds in the trench. There is no indication that a more mobile organic material is present as a by-product waste. As such, these materials likely do not represent a hazard for an off-site receptor.

C1.6 SUMMARY AND CONCLUSIONS

The evaluation of the LLW inventory, contaminant transport mechanisms and possible receptors indicates the following:

- A highly conservative method of calculating the radionuclide inventory has been used identifying the upper bound of the radionuclide inventory as 40 TBq of initial radioactivity.
- The majority of radionuclides in the inventory have relatively short half-lives. There are non-radiological contaminants of concern which will likely require selective remediation.
- There probably has been volatilization of the small amounts of ^{3}H and ^{14}C.
- The sorptive clay soils around the trenches provide a natural attenuation (retards contaminant transport).
- There is no indication of significant upward or lateral migration in the near trench zone.
- Migration of dominant radioactive contaminants ^{137}Cs and ^{90}Sr occurs at a rate slower than the rate of radioactive decay for these radionuclides.
- The WMA remains a water discharge zone consistent with the original hydrogeological zone model.
- Exposure pathways resulting from the groundwater flow patterns and physical isolation are relatively indirect making it difficult for any contaminant to reach a receptor.
- Institutional control will be required beyond the project period to confirm the performance of the disposal environment.

This analysis concludes that in-situ disposal for all but four LLW trenches presents no significant risk to human health or the environment. Trenches excluded are:

- Trench 6 and 10 - unsuitable as part of waste inventory review (Appendix C.2).
- Trench 16 – marginally high ^{99}Tc.
- Trench 1 – unacceptably high arsenic inventory.

This evaluation is based on the best information available. During the 60-year project period, AECL will continue to collect hydrologic and waste inventory data, as part of a follow-up monitoring program (see Section 9.5.2 in the main report) designed to obtain the information necessary to complete a final evaluation of in-situ disposal. Additional areas that will have to be addressed include:

- Confirmation through data collected during trench remediation work that no other limiting contaminants (e.g. ^{129}I and ^{36}Cl) are present.
- Confirmation of the safety factor for the inventory estimates based on information gathered during remediation of Trenches 1, 6,10 16 during the 60-year project period.
- Further confirmation of the hydrogeological system.
- Confirmation of the contaminant transport system (specifically: better characterization of the clay materials around the trenches, the hydraulic properties, the contaminant sorption properties and Kds).
- Complete risk analysis of in-situ disposal addressing the requirements of R-104.

In-situ disposal of LLW is subject to regulatory review and approval and must address all the basic requirements applicable to the long-term aspects of radioactive waste disposal. Those aspects are currently documented in CNSC Regulatory Policy R-104. The basic requirements emphasize minimizing the burden on future generations and protecting the environment and human health. The maximum acceptable risk is 10^{-6} fatal cancers and serious genetic effects in a year. For the WMA trench environment a control period of up to 200 years (the period required for ^{90}Sr and ^{137}Cs to decay to negligible levels) is required. AECL will develop a safety case to demonstrate compliance with those requirements to confirm in-situ disposal of LLW as a final end-state. The data required to support the safety case for the final end state will be collected through the follow-up monitoring program.

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Appendix C.2

WMA Trenches Low-Level Waste Inventory

C2.1 OBJECTIVE

The objective of this study was to provide an estimate of the inventory of low-level radioactive waste stored in earth trenches in the Whiteshell Laboratories Waste Management Area at a level of detail sufficient to evaluate the impact of in-situ management for the waste.

These estimates have been prepared to support a screening assessment for the in-situ concept. Further detailed evaluation to support the final endstate condition will be conducted as part of a follow-up monitoring program.

C2.2 BACKGROUND

From 1967 to 1985, LLW was buried in unlined trenches approximately 6 m wide by 4 m deep with lengths up to 60 m. Trenches were covered with at least 1 m of excavated material after they were filled. There are 25 filled trenches located in the WMA (Figure 1). Trenches were excavated with a backhoe and wastes were transferred into the trench with a front-end loader. The trenches provided storage for LLW with radiation fields up to 1.0 mGy/h (100 mrad/h) at 30 cm from the package. The use of the trenching concept was discontinued when upgraded above-ground LLW storage facilities were put into service in the fall of 1985.

Two trenches are excluded from this inventory estimate because they are considered unsuitable for in-situ management. Trench 10, because it was used to filter a small volume of WR-1 waste water, and Trench, 6 because it contains irradiated WR-1 fuel channels containing long-lived activation productions.

The remaining 23 trenches are the focus of this inventory estimate. The estimate relies on original WMA logs, which record the volumes of waste placed in the trenches, the radiation levels of the waste, the calculated amount of fission, corrosion and activation products and individual radionuclide data. The operating history is also documented to indicate the process in place to ensure control over waste emplacement.

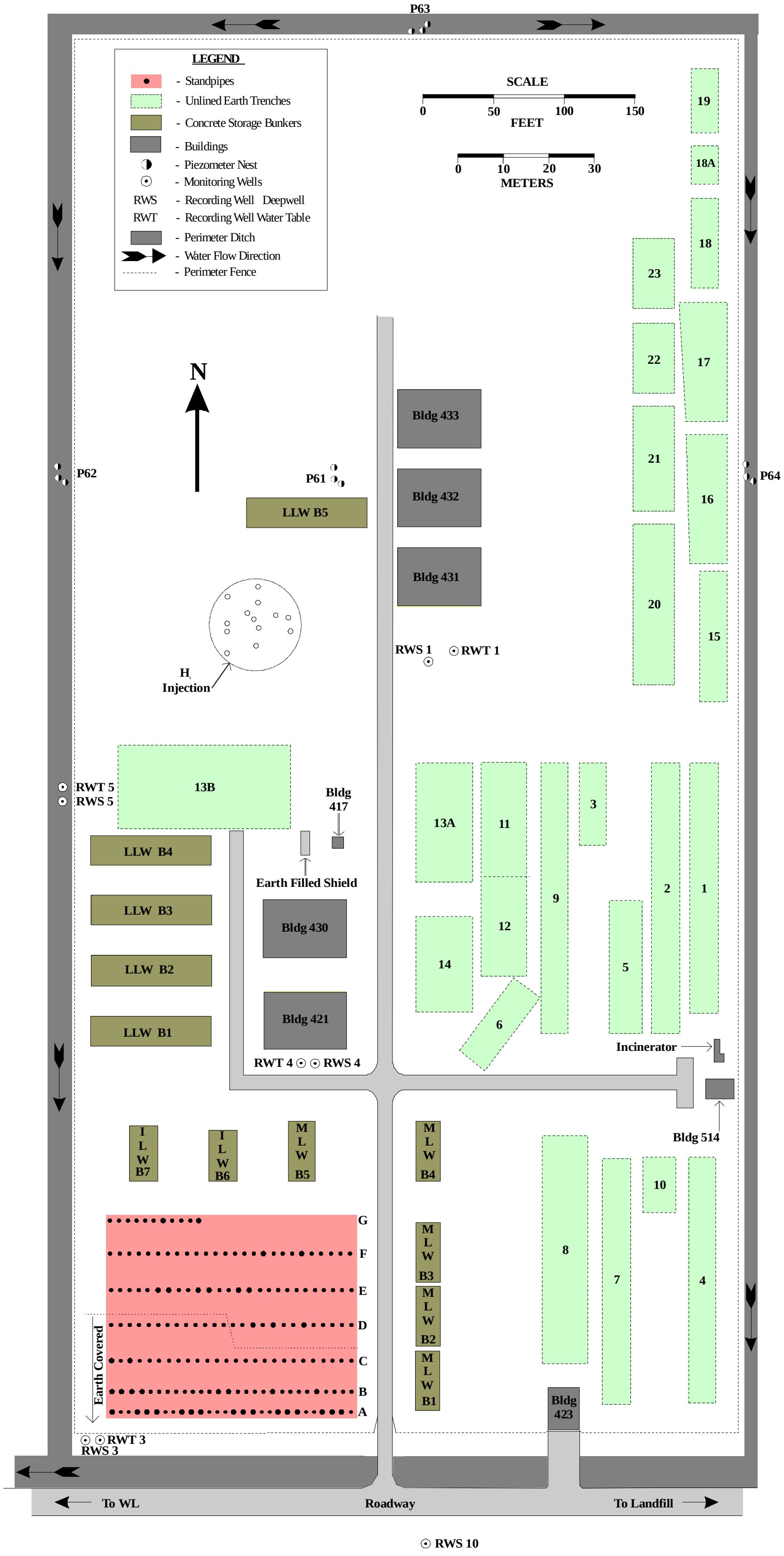

Figure 1 **Whiteshell Laboratories Waste Management Area**

C2.3 TRENCH WASTE ACCEPTANCE CRITERIA

Only packages of low-level radioactive waste (LLW) were stored in the 23 trenches included in this evaluation (Trenches 1 - 5, 7 - 9, and 11 - 23).

Low-level radioactive solid wastes are defined as unshielded packages that meet the following requirements for each package[1,2,3,4,5,6]:

(a) The field at 30 cm from the surface of the package (taken with the beta shield open) shall be less than 1 mGy/h (100 mrad/h) and the beta exposure rate on contact with the package shall be less than 10 mGy/h (1 rad/h).

(b) The total beta-gamma activity shall be less than 200 MBq (5 mCi).

(c) The total alpha activity shall be less than 4 MBq (0.1 mCi).

(d) The total amount of fissionable materials shall be less than 1 mg of plutonium, 1 mg of ^{233}U, or 1 mg of ^{235}U.

(e) The total amount of natural uranium, depleted uranium or thorium shall be limited to 50 g.

These wastes, consisting mainly of used labware, rubber gloves, wipers, and mops were typically delivered to the WMA sealed in plastic bags (double bagged) or drums. Other LLW includes discarded equipment with low levels of fixed contamination packaged in cardboard or wood containers and drums of waste from the WR-1 organic coolant purification systems.

Waste generators were responsible for the selection of materials to be disposed of as active waste and for ensuring that the wastes identified for LLW storage met the conditions specified in (a) to (e) above. Condition (a) was the only one that was easily verified and the measurement was required to be taken with an AEP 2153 Multi-Purpose Survey Meter with the beta shield open. The other conditions were assessed in the light of the operators' familiarity with the waste or by radionuclide specific analysis.

C2.4 LOW-LEVEL WASTE HANDLING, COLLECTION AND STORAGE PRACTICES

C2.4.1 Laboratory Waste Handling and Packaging

The process for handling low-level active waste at Whiteshell Laboratories was established on implementation of LLW trench operations and evolved during the history of the site. Prior to 1975, procedures from Chalk River Laboratories (CRL)[1] were implemented at Whiteshell Laboratories. The operating practices and controls were developed into a formal procedure in 1975, WEP-75-123 (copy unavailable), to provide Whiteshell Laboratories specific procedures for active waste disposals from research laboratories. In 1978, this procedure was revised[2] and in 1980 it was replaced by Appendix F in Cowdrey (1980) for the safe handling of radioactive materials manual for the Whiteshell Laboratories.

Routine low-level active waste was segregated at the source into compactable and non-compactable categories using separately marked containers. Typical compactable waste included materials such as paper, gloves, mops and rags and non-compactable waste included metal and empty glassware. Each waste container was lined with a paper bag inside of a plastic bag. Materials capable of puncturing the plastic bag were sealed in a cardboard or plastic container prior to placing in the waste collection container. Waste such as lengths of piping or materials that were too large for the active waste containers were considered non-routine waste and were packaged separately under consultation with a radiation surveyor.

Routine waste was removed, sealed, double bagged at a minimum and moved to a staging area when an active waste container was 2/3 full or when the low-level waste classification limit was approached. The waste generator was responsible for estimating and documenting the type and quantity of radioactive material in the waste, performing the initial dose rate assessment and completing the waste transfer documentation.

Fissile materials are managed by the AECL criticality control program and accountable quantities were not allowed in the low-level trenches. Waste that was known to contain fissile materials, in quantities that satisfied condition (d), required additional documentation prior to transfer to the waste management area.

Non-routine waste was packaged and processed as it was generated under the guidance of a radiation surveyor. The surveyor was responsible for assessing non-routine low-level waste contents and completing the documentation.

Refer to Appendix 1 for the forms used prior to 1982 and Appendix 2 for the form implemented in 1982.

Johnson (1978) and Appendix F of Cowdrey (1980) both indicate that the only significant change from the earlier procedures (WEP-75-123) related to having the laboratories assume total responsibility for declaring waste “low-level” where previously all responsibility for the classification, packaging, handling and documentation of low-active waste shipments resided with the surveyors.

C2.4.2 Waste Management Area Storage Practices

Once low-level waste shipments were received at the Waste Management Area (WMA), the surveyor assessed the packages to verify their low-level status, recorded the shipment details in the log and then transferred the packages to a storage building to await burial in a trench. The log information included the following for each shipment:

- date;
- total number of packages;
- maximum dose rate at 30 cm;
- total estimated volume, activity and radionuclide content; and
- storage location.

The majority of the packages placed in trenches were either plastic bags (96.7 %) or 100 to 200 litre drums (3.0 %). Refer to Table 1 for a summary of the package types for each trench. Based on the information in Table 1, the estimated total volume of waste in the trenches (excluding Trench 6 & 10) is approximately 6100 m^3.

Table 1
WMA Trench Package Summary

Trench	Bags	Barrels	Bottles	Boxes	Cans	Clay Columns	Drums	Filters	Totals
1	4063				37		10	2	4112
2	4697			1	92		127	18	4935
3	2261			2			5		2268
4	4189						89	17	4295
5	0						311		311
7	5616	2		2	7		28	17	5672
8	10480	11		9	8	2	232	5	10747
9	15482						440		15922
11	3604			10			196		3810
12	2450			8			175		2633
13A/B	6675						72		6747
14	1180								1180
15	2155			1			69		2225
16	758						122		880
17	3356		1	2	8		122		3489
18/18A	2286	7		2	3		71		2369
19	293			4			15		312
20	2877	7		3	11		86		2984
21	2438			4	7		58		2507
22	1062				1		64		1127
23	2246				1		121		2368
Totals	**78168**	**27**	**1**	**48**	**175**	**2**	**2413**	**59**	**80893**
% Total	96.63%	0.03%	0.00%	0.06%	0.22%	0.00%	2.98%	0.07%	

Monthly, tri-monthly and annual reports were generated from the log data that included a summary of the estimated activities that were transferred to each trench and storage facility and a description of the contents of any non-routine waste additions. In the early 1980s, a database was generated to record the shipment details. This database was replaced in 1989 and hard copies of the reports generated from the original database were retained.

C2.4.3 In-field Applications of Waste Management Requirements

The majority of the waste activity estimates for the low-level trenches were based on the assumption that 1 mCi of waste would produce 20 mRad/hr at 30 cm (1.85 MBq/mR/hr). This conversion factor for estimating waste activity originated in 1964 and is documented in references 7 and 8. The total activity for each shipment was estimated using the following equation:

$$A = \frac{N \times DR_{30}}{20}$$

Where:

Where:	A	=	activity in mCi.
	N	=	number of packages in the shipment.
	DR_{30}	=	maximum dose rate at 30 cm in mRad/hr for the shipment using an AEP 2153 with the beta window open (i.e., a composite measurement).

The dose rate applied was the maximum dose rate measured at 30 cm for the entire shipment with an AEP 2135 Multi-Purpose Survey Meter with the beta window open. As can be seen from the equation above, a conservative approach of applying the maximum dose rate to each package in the shipment was used. With few exceptions, this approach was applied to all waste packages received without radionuclide specific activity estimates supplied.

Use of this equation and approach remained unchanged during the entire history of LLW trench operation.

C2.5 TRENCH WASTE ESTIMATES

The most detailed historical waste characterization data resides in the monthly reports contained in the WMA logs. The data from these reports was entered into a database to assist with this inventory evaluation. A summary of the data is provided in Tables 2 and 3. The historical records refer to Trenches 13A and 13B as Trench 13 and Trenches 18 and 18A as Trench 18 therefore, both cases are treated as single trenches for inventory purposes. For most of the history of the trenches, the data was recorded in units of curies (Ci).

Table 2
Summary of Trench Radionuclide Inventories from WMA Monthly Reports
(inventories expressed in units of curies)

Trench	FP	CP	AP	H-3	C-14	Na-22	P-32	Cr-51	Fe-59	Co-60	Sr-90	Tc-99	I-131	Cs-137	Ir-192	Au-198	Hg-203	Ra-226	Totals
1	2.50	0.82	0.13		0.032						0.001			0.002					**3.48**
2	2.10	1.65	0.11	0.005									0.300	0.750					**4.91**
3	1.34	0.52	0.07	0.007															**1.94**
4	2.08	3.65	0.05	0.003			0.020								0.800				**6.60**
5																			**0.00**
7	3.67	2.72	0.38	2.518	0.013	0.002		0.050	0.053	0.051			1.000	0.002	1.900	0.300			**12.66**
8	4.50	4.62	0.07	0.148		0.022				0.001					4.200	0.003	0.003		**13.57**
9	4.52	4.55	0.00	0.127	0.013		0.005								0.090			0.003	**9.31**
11	1.03	1.23		0.029															**2.28**
12	0.57	0.48																	**1.05**
13A/B	2.32	3.05																	**5.37**
14	0.75	0.42																	**1.17**
15	1.31	0.47																	**1.78**
16	0.50	0.26									0.001	0.370		0.032					**1.16**
17	1.67	1.48		0.008															**3.16**
18/18A	2.01	0.13	0.57																**2.71**
19	0.24		0.10																**0.33**
20	2.28		1.16																**3.44**
21	1.40		2.81																**4.21**
22	0.91		1.50																**2.40**
23	1.11		4.18																**5.30**
Totals	**36.80**	**26.03**	**11.11**	**2.845**	**0.058**	**0.024**	**0.025**	**0.050**	**0.053**	**0.052**	**0.002**	**0.370**	**1.300**	**0.786**	**6.990**	**0.303**	**0.003**	**0.003**	**86.81**

Notes: FP = fission products, CP = corrosion products and AP = activation products.

Table 3
Trench Actinide Summary From WMA Monthly Reports
(grams)

Trench	Thorium	U-238	Pu-239	Pu
1			0.007	
2		160.0	0.023	
3				
4				0.004
5				
7	3300.0			0.002
8				
9				
11				
12				
13A/B		9.0		
14				
15				
16				
17				
18/18A				
19				
20				
21				
22				
23				
Totals	**3300.0**	**169.0**	**0.030**	**0.006**

The data from the shipment logs was also entered into a database and queried for the total activity in each trench. Refer to Table 4 for a comparison of the totals obtained from both records sources. The WMA annual reports record the total unlined trench activity (excluding 6 and 10) as 104.1 Ci. Therefore, the estimate from historical records of the total activity placed in the trenches is between 83.9 Ci (plus ~ 2.7 mCi contribution from the recorded actinides) and 104.1 Ci (3.1 TBq to 3.9 TBq). An estimate of the quantity of $^{239/240}$Pu associated with the recorded fission products is an additional 350 mg (based on the ratios in a typical 500 day old bundle).

Table 4
Comparison of Monthly Report and Individual Shipment Records for Total Activity Emplaced in Unlined Trenches
(Ci)

Trench	Monthly Reports	Individual Shipments	Trench	Monthly Reports	Individual Shipments
1	3.48	3.43	14	1.17	1.05
2	4.91	4.91	15	1.78	1.90
3	1.94	1.93	16	1.16	0.66
4	6.60	6.11	17	3.16	2.70
5*	0.00	0.00	18/18A	2.71	2.59
7	12.66	12.30	19	0.33	0.33
8	13.57	13.40	20	3.44	3.52
9	9.31	8.60	21	4.21	4.61
11	2.28	2.31	22	2.40	2.11
12	1.05	1.13	23	5.30	5.04
13A/B	5.37	5.25	**Totals**	**86.81**	**83.88**

Trench 5 was used for disposal of “high boilers” and “still bottoms” from the WR-1 organic coolant purification still. This material was stored in 200 litre drums and was solid at room temperature. No activities were entered for these packages and an estimate of the average activity of this material is 50 Bq/mLl. A total of 300 drums were emplaced in the trench for a total estimated activity of 3.0 GBq (8.1 mCi).

The information in the WMA logs indicates that some of the earlier trenches contain additional materials of concern. The non-radiological contaminants identified include arsenic, DDT, glycol, solvents and lead. The presence of these materials in the LLW trenches may raise the need for selective removal and/or partial remediation of the affected trenches. When these activities are conducted, additional waste characterization data will be obtained to verify the trench inventories.

Refer to Table 5 for a summary of the non-routine waste emplacement obtained from the historical records. The Morning Light waste referred to in the table is low-level waste generated during the retrieval, cleanup and inspection activities associated with a Russian satellite that came down over the Northwest Territories in 1978. This waste does not include any satellite debris which is stored in separate facilities in the WMA.

Table 5
Trench Operational Period and Special Waste Additions

Trench	Operational Period	Additional Information
1	Feb 1967 – Sept 1968	Includes 3000 lbs of arsenic compound.
2	Oct 1968 – Jan 1970	
3	Feb 1970 – Aug 1970	Includes 2 drums of DDT.
4	Sept 1970 – June 1971	
5	Aug 1971 - July1975	Includes 4 drums of glycol, 5 drums of solvent and 300 drums of concentrated organic residue (high boilers and still bottoms).
7	June 1971 – July1972	Includes 3300 grams of thorium oxide and 1800 lbs of lead.
8	Aug 1972 – June 1974	
9	July 1974 – June 1976	
11	July 1976 – May 1977	
12	May 1977 – Nov 1977	Includes the old waste management office trailer.
13A/B	Nov 1977 – June 1979	Includes Morning Light waste.
14	June 1979 – Nov 1979	
15	Nov 1979 – Aug 1980	
16	July 1980 – Nov 1980	Includes Morning Light waste.
17	Dec 1980 – Nov 1981	
18/18A	Nov 1981 – Sept 1982	
19	Sept 1982 – Nov 1982	
20	Nov 1982 – Oct 1983	
21	Nov 1983 – May 1984	
22	June 1984 – Nov 1984	
23	Nov 1984 – June 1985	

The primary source of radiological contaminants at the Whiteshell Laboratories site was from WR-1 operations. Detailed characterization data is available for the waste that was generated during the decommissioning of the WR-1 facility (1990 – 1995). Table 6 summarizes the results of a characterization campaign conducted in 1991 and documented in references 9, 10, 11, 12 and 13. This table also includes an estimate of the distribution of each radionuclide at the time of shutdown of the WR-1 reactor in May of 1985.

Table 6
WR-1 Waste Characterization Data

Radionuclide	Oct – 1991 Distribution	Half-Life	May – 1985 Distribution
^{137}Cs	60%	30.17a	8.4%
^{90}Sr	35%	28.6a	4.9%
^{60}Co	2%	5.271a	0.6%
^{144}Ce	1%	284.3d	36.6%
^{134}Cs	1%	2.052a	1.0%
^{57}Co	1%	270.9d	48.5%

Another source of radionuclide specific characterization data that may indicate the typical isotopic mixture of routine, low-level waste streams is the annual liquid effluent release data from the Active Liquid Waste Treatment Centre (ALWTC). These reports were initiated in 1982 and are only available for the last 4 years of the operation of the trenches. Refer to Table 7 for a summary of the data.

Table 7
ALWTC Isotopic Release Data
(GBq)

Year	Co-60	Sr-90	Ru-106	Cs-134	Cs-137	Ce-144	Other	Total
1982	0.2	21.2	35.2	5.6	51.8	25.5	3.0	142.5
1983	0.2	20.7	19.6	10.4	51.8	15.9	4.4	123.0
1984	0.1	40.7	6.3	3.7	40.7	9.3	5.9	106.7
1985	0.1	14.8	2.8	1.4	27.4	3.7	1.2	51.4
Average	0.1	24.4	16.0	5.3	42.9	13.6	3.6	105.9
s	0.1	11.3	14.7	3.8	11.6	9.4	2.0	39.2
Ratio	0.1%	23.0%	15.1%	5.0%	40.5%	12.8%	3.4%	

The conversion factor that was used to estimate waste curie content from survey meter readings (i.e., 1 mCi per 20 mR/hr @ 30 cm) was developed for use in the field and is based on a number of simplifying assumptions including the following:

- Typical contaminants are comprised of 1 to 2 year old mixed fission products.
- The burnup of the fuel used to determine the conversion factor is typical of what is emplaced in the trenches.
- The rule applies regardless of package size (i.e. no volume weighting is incorporated when the inventory is calculated).

- The rule applies regardless of the package density and packaging material (i.e. the affect of self-shielding is disregarded).
- The maximum dose rate measured is applicable to all of the packages in a shipment.
- The minimum reading on the survey meter is applicable for packages with no discernable dose rate (i.e. the minimum dose rate applied was 0.2 mR/hr).

Some of these assumptions will overestimate and some will underestimate the inventory. To provide a margin of safety for screening assessment purposes, the above assumptions, supporting documentation and method of implementation were evaluated and modelled in Microshield© to determine the upper bound values to use to calculate the current radionuclide inventory in the LLW trenches.

Tables 8 and 9 provide a summary of the upper bound, decay corrected and inventory calculation results. The following assumptions and methodology were incorporated into the calculations:

- The upper bound inventory estimate is 10 times the recorded inventory.
- All original fission, corrosion and activation product estimates have been converted to radionuclide specific inventories.
- A 500-day-old, full burnup bundle is representative of the emplaced fission product mixture.
- The waste fission product actinide content includes actinides in the same percentages as present in the fuel bundle.
- The ^{241}Am estimate includes in-growth from the decay of ^{241}Pu.
- All actinide weights have been converted to activity.
- The initial activation and corrosion product estimates have been combined and the ratios identified in WR-1 decommissioning documentation[14] have been applied to calculate the radionuclide specific inventories.
- The Trench 5 upper bound estimate is based on 50 Bq/ml of mixed fission products in a total of 302, 200 litre drums.
- All estimates are decay corrected to January 2001 and are provided in the units currently in use (GBq).

Table 8 only includes the significant remaining fission, activation and corrosion products. Table 9 includes all of the actinides evaluated.

Table 8
Current Upper Bound LLW Trench Inventory Estimate
(Fission, Activation and Corrosion Products)
(GBq)

Trench	H-3	C-14	Fe-55	Ni-59	Co-60	Ni-63	Sr/Y-90	Nb-94	Tc-99	Sb-125	Cs-134	Cs-137	Pm-147	Totals
1		11.8	0.1	0.1	0.7	7.2	34.4	0.0		0.0	0.0	28.4	0.0	82.7
2	0.3	0.1	0.2	0.1	1.5	13.6	29.8	0.0		0.0	0.0	160.0	0.0	205.7
3	0.5	0.0	0.1	0.0	0.6	4.6	19.5	0.0		0.0	0.0	15.9	0.0	41.2
4	0.2	0.1	0.5	0.2	4.0	29.0	30.7	0.1		0.0	0.0	25.1	0.0	90.0
5							1.3			0.0	0.0	1.0	0.0	2.3
7	181.1	5.0	0.6	0.2	4.1	24.4	55.5	0.1		0.0	0.0	45.7	0.1	316.8
8	11.6	0.1	1.3	0.3	7.0	37.4	70.8	0.1	0.0	0.0	0.0	57.6	0.1	186.3
9	11.0	4.9	2.0	0.3	8.7	36.8	74.3	0.1		0.0	0.0	60.3	0.2	198.6
11	2.7	0.0	0.8	0.1	2.8	10.0	17.5	0.0		0.0	0.0	14.2	0.1	48.2
12		0.0	0.4	0.0	1.2	3.9	9.9	0.0		0.0	0.0	8.0	0.0	23.5
13A/B		0.1	3.0	0.2	8.9	25.2	41.2	0.1		0.0	0.0	33.4	0.2	112.3
14		0.0	0.5	0.0	1.4	3.5	13.7	0.0		0.0	0.0	11.1	0.1	30.3
15		0.0	0.7	0.0	1.7	3.9	24.2	0.0		0.0	0.0	19.5	0.2	50.2
16		0.0	0.4	0.0	1.0	2.2	9.4	0.0	136.9	0.0	0.0	14.9	0.1	165.0
17	1.0	0.0	3.0	0.1	6.2	12.5	31.8	0.0		0.0	0.0	25.6	0.4	80.6
18/18A		0.0	1.8	0.0	3.3	5.9	39.0	0.0		0.0	0.0	31.4	0.5	82.0
19		0.0	0.3	0.0	0.5	0.8	4.7	0.0		0.0	0.0	3.8	0.1	10.1
20		0.0	3.8	0.1	6.2	9.9	45.3	0.0		0.0	0.0	36.4	0.8	102.7
21		0.1	11.3	0.2	16.7	24.1	28.4	0.1		0.0	0.0	22.8	0.6	104.2
22		0.0	6.9	0.1	9.6	12.9	18.6	0.0		0.0	0.0	15.0	0.5	63.6
23		0.1	22.2	0.3	28.7	36.2	23.2	0.1		0.0	0.0	18.6	0.6	130.0
Totals	**208.5**	**22.5**	**59.5**	**2.4**	**114.5**	**304.1**	**623.2**	**0.9**	**136.9**	**0.3**	**0.3**	**648.9**	**4.7**	**2126.6**

Table 9

Current Upper Bound LLW Trench Inventory Estimate (Actinides)

(GBq)

Trench	Ra-226	U-234	U-235	U-236	U-238	Pu-238	Pu-239	Pu-240	Pu-241	Pu-242	Am-241	Cm-242	Cm-244	Totals
1		0.0	0.0	0.0	0.0	0.2	0.5	0.6	11.4	0.0	1.7	0.0	0.0	**14.5**
2		0.0	0.0	0.0	0.0	0.2	0.8	0.5	10.4	0.0	1.4	0.0	0.0	**13.3**
3	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.3	6.9	0.0	0.9	0.0	0.0	**8.5**
4		0.0	0.0	0.0	0.0	0.2	0.4	0.6	13.3	0.0	1.6	0.0	0.0	**16.1**
5		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.1	0.0	0.0	**0.6**
7	0.1	0.0	0.0	0.0	0.0	0.3	0.6	0.9	21.4	0.0	2.5	0.0	0.1	**25.9**
8		0.0	0.0	0.0	0.0	0.4	0.7	1.1	27.1	0.0	2.8	0.0	0.1	**32.2**
9	1.1	0.0	0.0	0.0	0.0	0.4	0.7	1.1	29.8	0.0	2.8	0.0	0.1	**35.9**
11		0.0	0.0	0.0	0.0	0.1	0.2	0.2	7.3	0.0	0.6	0.0	0.0	**8.4**
12		0.0	0.0	0.0	0.0	0.1	0.1	0.1	4.2	0.0	0.3	0.0	0.0	**4.8**
13A/B		0.0	0.0	0.0	0.0	0.2	0.3	0.5	17.9	0.0	1.3	0.0	0.1	**20.3**
14		0.0	0.0	0.0	0.0	0.1	0.1	0.2	6.1	0.0	0.4	0.0	0.0	**6.9**
15		0.0	0.0	0.0	0.0	0.1	0.2	0.3	10.9	0.0	0.7	0.0	0.0	**12.3**
16		0.0	0.0	0.0	0.0	0.0	0.1	0.1	4.2	0.0	0.3	0.0	0.0	**4.8**
17		0.0	0.0	0.0	0.0	0.2	0.3	0.4	14.7	0.0	0.9	0.0	0.0	**16.5**
18/18A		0.0	0.0	0.0	0.0	0.2	0.3	0.5	18.4	0.0	1.1	0.0	0.1	**20.5**
19		0.0	0.0	0.0	0.0	0.0	0.0	0.1	2.2	0.0	0.1	0.0	0.0	**2.5**
20		0.0	0.0	0.0	0.0	0.2	0.3	0.5	21.9	0.0	1.2	0.0	0.1	**24.2**
21		0.0	0.0	0.0	0.0	0.1	0.2	0.3	14.0	0.0	0.7	0.0	0.0	**15.4**
22		0.0	0.0	0.0	0.0	0.1	0.1	0.2	9.3	0.0	0.4	0.0	0.0	**10.2**
23		0.0	0.0	0.0	0.0	0.1	0.2	0.3	11.7	0.0	0.5	0.0	0.0	**12.9**
Totals	**1.2**	**0.0**	**0.0**	**0.0**	**0.0**	**3.4**	**6.3**	**8.8**	**263.7**	**0.0**	**22.3**	**0.0**	**0.8**	**306.5**

C2.6 SUMMARY

- An evaluation of the historical low-level trench records and procedures indicates that the recorded total activity emplaced in the trenches of ~ 4TBq (108 Ci) is considered to be accurate to within 1 order of magnitude. This represents an upper bound of approximately 40 TBq (1080 Ci) of initial activity.
- The majority of the radionuclides placed in the trenches have a relatively short half-life (<2.06 years) and have virtually decayed away. The predominant radionuclides remaining are ^{90}Sr, ^{137}Cs and small amounts of ^{3}H, ^{14}C, ^{99}Tc and actinides. Decaying to the present year, the current upper bound total activity is estimated to be 2.5 TBq.
- The records indicate that the non-radiological contaminants of concern are arsenic in Trench 1; DDT in Trench 2; concentrated organic residue (high boilers and still bottoms), glycol and solvents in Trench 5; and lead in Trench 7.
- The presence of non-radiological contaminants in the LLW trenches may raise the need for selective removal and/or partial remediation of the affected trenches. When these activities are conducted, additional waste characterization data will be obtained to verify the trench inventories.

C2.7 REFERENCES

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Appendix 1
Waste Disposal Forms Used Prior to 1982

DISTRIBUTION
White Copy – H & S Br.
Yellow – Eng. Services Br.
Pink – Shipper

ATOMIC ENERGY OF CANADA LIMITED
HEALTH AND SAFETY

DISPOSAL OF ACTIVE WASTE

NAME OF BRANCH			DATE
MATERIAL	RADIONUCLIDE	AMOUNT (CURIES)	RADIATION LEVELS
			CONTACT: AT 1 FOOT:
SPECIAL INSTRUCTIONS			
AUTHORIZED SIGNATURE		BRANCH SURVEYOR	

(FOR USE OF HEALTH & SAFETY BRANCH)

LOCATION IN DISPOSAL AREA

HEALTH & SAFETY BRANCH

Form Y5-92363 Rev. 8/75

SPECIAL DISPOSAL OF ACTIVE WASTE CONTAINING FISSIONABLE MATERIAL

BRANCH........ DATE........

MATERIAL	ACTIVITY			INSTRUCTIONS
	NATURE	AMOUNT	RADIATION	

AUTHORIZED SIGNATURE .... R.I.S. SURVEYOR........

DISPOSAL IN DISPOSAL AREA:

1 Copy – H & S Br.
1 Copy – Eng. Services Br.
1 Copy – Shipper
FORM 482

HEALTH & SAFETY BRANCH

Appendix 2
Waste Disposal Form Used After 1982

Refer to S.P.P. 6.23 or 6.24.
When transfer **approved**,
distribute copies as follows:

1st copy ESRS Branch (Stn. 44)
2nd copy Accompany Waste
3rd copy Branch of Origin

WHITESHELL LABORATORIES

Radioactive and Toxic Waste Transfer and Storage Record

Building No. of Origin:	Branch of Origin:	Date:
Description: ( ) Active or ( ) Inactive		Recommended for (check one) ( ) Normal Disposal ( ) Incineration ( ) Temporary Surface Storage Likely storage period ________ months

Type of Material: Non-Fuel	Type of Material: Toxic Waste	Origin of Radioactivity
01 ( ) scrap	01 ( ) solvents	01 ( ) irradiated fuel
02 ( ) ash	02 ( ) acids	02 ( ) unirradiated fuel
03 ( ) sludge	03 ( ) oil	03 ( ) fission products
04 ( ) filters	04 ( ) carcinogens	04 ( ) separated plutonium
05 ( ) resin	05 ( ) P.C.B.	05 ( ) activation products
06 ( ) trash	06 ( ) organic coolant	06 ( ) other
07 ( ) shield plugs	07 ( ) general drainings	07 ( ) non-active
08 ( ) fuel channels	08 ( ) other	G/L No. / Ref. No.
09 ( ) sources	09 ( ) alpha	Fissionable Material
10 ( ) other	10 ( ) mercury	Type / Amount (g)
	11 ( ) volatiles	

Description of Container: Type	Material	Filler	Specific Nuclides (in half life 1 year)
01 ( ) box	01 ( ) plastic	01 ( ) none	Nuclide / Becquerels
02 ( ) bag	02 ( ) wood	02 ( ) plastic	
03 ( ) can	03 ( ) metal	03 ( ) vermiculite	
04 ( ) bottle	04 ( ) glass	04 ( ) other	
05 ( ) drum	05 ( ) other		
06 ( ) other			
07 ( ) none			(1 Ci = 3.7×10^{10} Bq)

Radiation: On Contact	Radiation: at 0.30 m (1 ft.)	Total Volume	Number of Items
mR/h	mR/h	______ m^3 (1 ft^3 = 0.03 m^3) or ______ L (1 gal = 4.5 L)	Storage Location

REMARKS: (Note any precautions or additional information).

Signatures: ____________________
Originating Branch Representative

____
RIS Representative

Form Y0592372 Rev. 96/02

Appendix 2
Waste Disposal Form Used After 1982

EXPLANATION OF FORM

A. This form is to provide:

(i) An adequate description of the radioactive material and/or toxic waste being handled and its destination for:

- the originators (WL Branches)
- the handlers (ESRS Branch and EP&S Branch)
- the receiver (WL Environmental Officer)

(ii) Data for the computerized inventory record of the WL Waste Management Area.

B. **Mark all (_)** that are applicable and fill in Description and Remarks section as considered necessary.

C. **Gain/Loss Numbers** must be recorded for all Fertile and Fissile material.

D. **Becquerels are required only for specific nuclides** which are well identifiable as pertaining to the material. e.g. ^{60}Co, ^{137}Cs, ^{90}Sr, the transuranics. If there is any doubt or if further information is needed, contact WL Waste Management Active Area Surveyor, ext. 2364/6108 or pager #4.

E. The **Storage Location** is to be filled out by the WL Waste Management Active Area Surveyor.

F. Material will not be accepted for temporary storage until approved by the WL Waste Management Active Area Surveyor.

G. If you have any difficulties with the form, contact your building Health Surveyor or the WL Waste Management Active Area Surveyor, ext. 2364/6108 or pager #4.

Appendix C.3

Sampling and Analysis Plan for Whiteshell Laboratories LLW Trench Cover and Trench Lateral Cores

C3.1 INTRODUCTION

This report describes the procedures used for collecting data to support evaluation of the performance of the low-level waste (LLW) trenches at Whiteshell Laboratories (WL) Waste Management Area (WMA). The work is to support the reference approach to decommissioning, as outlined in the Comprehensive Study Report. In this approach, all trenches except Trench 6 and Trench 10 are planned to be managed in-situ. Near completion of Phase 3 of the decommissioning project, an additional environmental assessment may be carried out to support the long-term in-situ disposal option.

Figure 1 is a layout of the Whiteshell Laboratories Waste Management Area. The location of LLW trenches are indicated by dashed lines and these are numbered from 1 through 23.

C3.2 PURPOSE OF SAMPLING

The objective of the sampling plan is to test the containment hypothesis that caps covering the WMA trenches and the material adjacent the trenches have been effective in containing any radioactive, heavy metal or other contaminants that potentially could be mobilized via shallow groundwater transport. Two key transport pathways are being reviewed. These are upward migration from the source through the cap material and lateral migration from the source into the adjacent geological barrier.

C3.3 APPROACH TO DATA COLLECTION AND ANALYSES

In order to test the containment hypothesis, two sampling schemes and other data gathering techniques were used. The trench caps were probed and sampled using a hand-operated coring device (Figures 2 and 3), while a drilling and sampling program was used to assess the geologic barrier adjacent to the trenches (Figure 1). Other data gathering included inspection, ground-based geophysics and construction information review.

Data collection was comprised of both office and fieldwork. An integral part of fieldwork was sampling and analysis of soil cores from the caps of three example trenches and lateral boreholes. The selection process for the example trenches and lateral boreholes is given in Section C3.4.

The following methods were used to obtain data to meet the primary the sampling plan objectives.

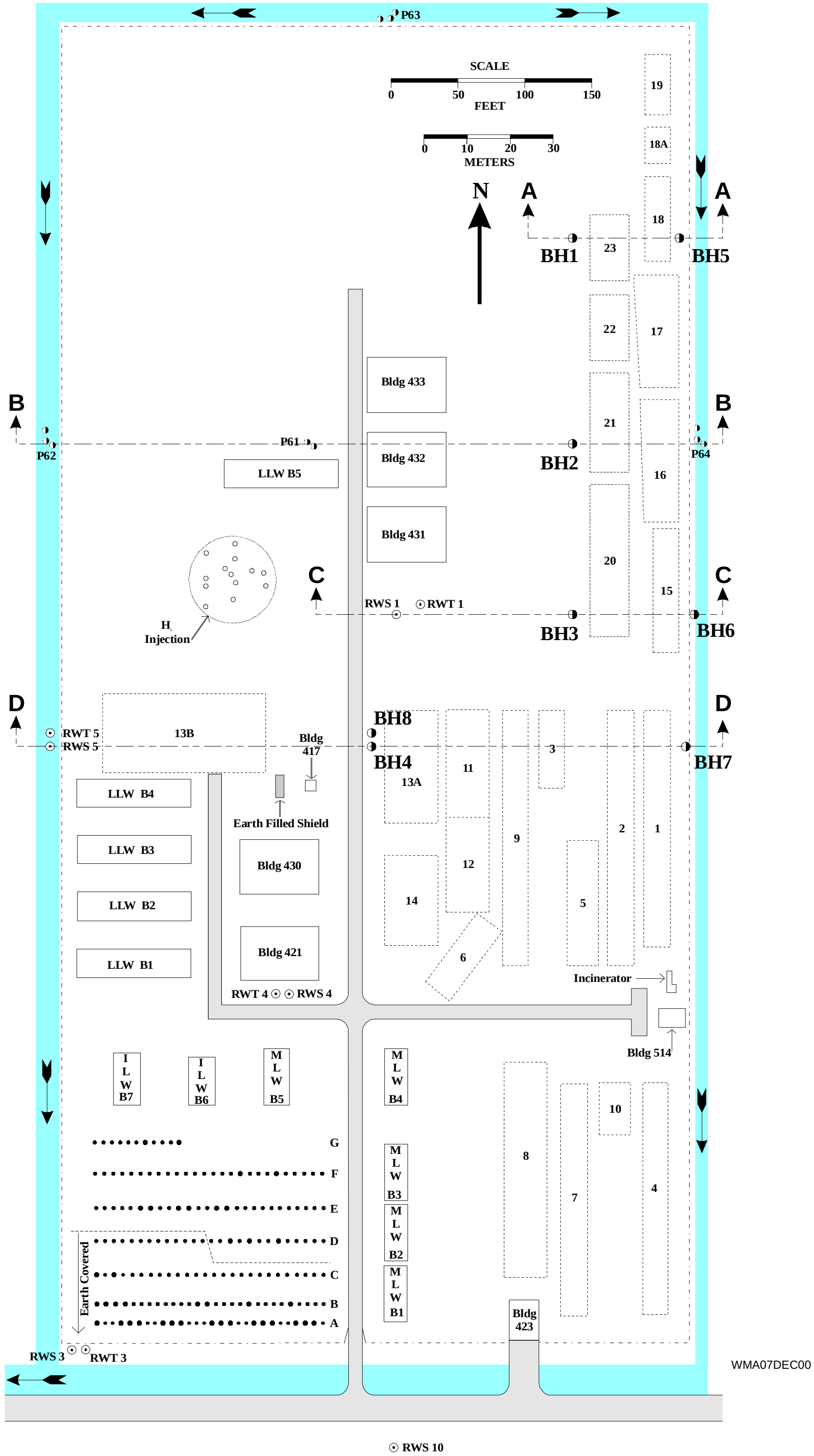

Figure 1

Plan Showing the Whiteshell Laboratories Waste Management Area and the LLW Trenches and Lateral Boreholes

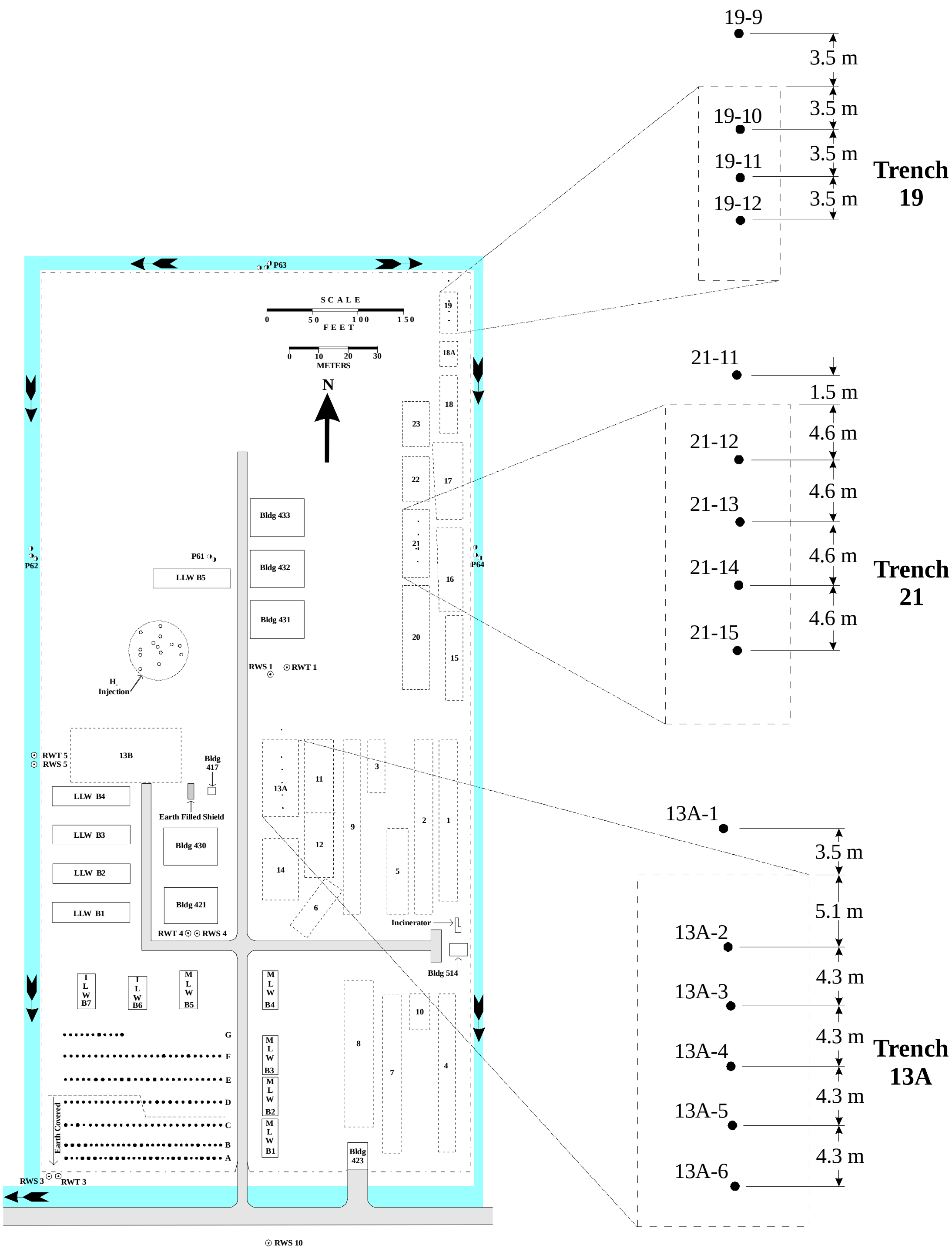

Figure 2

Plan Showing the Location of the LLW Trench Cover Holes

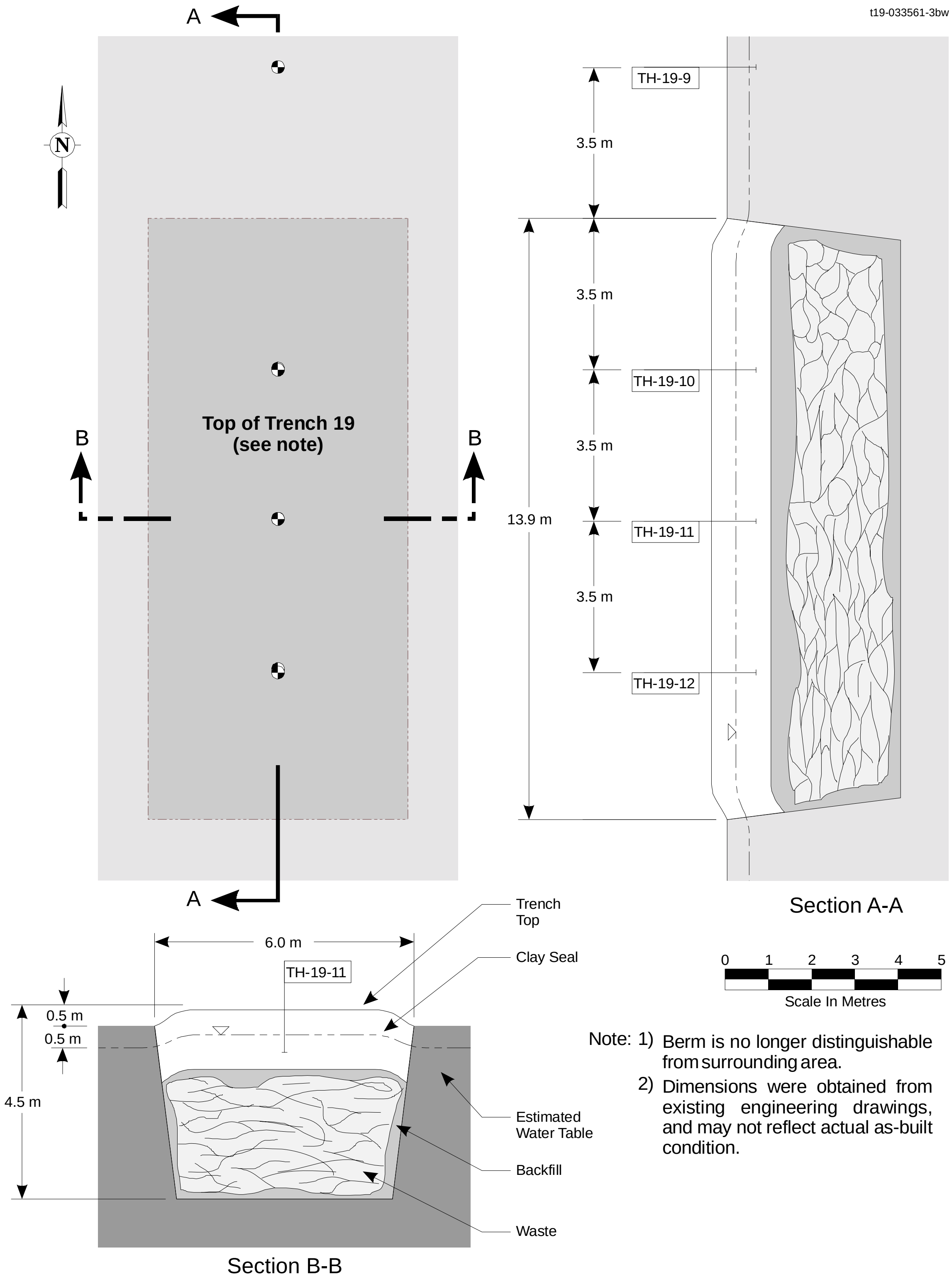

Figure 3

Plan and Section Views of the Waste Management Area Low-Level Waste Trench #19

Showing Trench Probe Holes

C3.3.1 Soil Sampling and Analysis

Trench cover coring was carried out in mid October under dry conditions using a hand-driven sampling tool. The soil was damp and remained open to the bottom of each hole. Holes were driven to 1 m depth and advanced 10 cm at a time. Ten samples were taken of each hole. Each sample was individually extracted into a PVC sleeve, packaged, labelled and numbered. Samples were sorted, audited in the laboratory and placed in a freezer prior to analysis.

Lateral boreholes were drilled by a geotechnical contractor during the last week of November. A track-mounted hollow stem drill was utilized having a wire-line core barrel unit attached to the auger bit. A 60 cm (2 foot) length of clear acrylic liner sleeving was loaded into the core barrel. As the auger core barrel was advanced two feet, the cored material was extruded into the acrylic liner. Then, it was retrieved through the hollow stem tubing using the wire system. Sample tubes were labelled, capped, bagged in plastic sleeves and placed into a freezer.

Both the trench cover and lateral cores were logged as to the soil and materials that were encountered. All the trench cover material was in disturbed soil and backfill with varying degrees of compaction. The core recovered was typically compressed to about 50 – 70% of the drilled depth. However, depth control was maintained because samples were taken every 10 cm.

The lateral holes were usually in undisturbed material to about 1 – 1.5 m below the ground surface. Below 1.5 m, geological features were noted. These included lithological changes, water inflows, stains and the size/shape of clasts. Core recovery was measured and any recovery issues were noted. In general, the material consists of massive clay to about 2.5 – 3 m depth and changes to a silty clay glacial till below that depth. This is consistent with geological information reported by Cherry and Robertson (1988).

Samples were sent to the laboratory for analysis. Figure 4 is a flow chart showing the strategy used to analyze both lateral and cap cores.

For the case of lateral cores, the following actions were carried out:

- Initial gamma spectrometry screening of all 60 cm core segments. This was done using a portable γ spectrometer that was mounted on a stand at a fixed distance from the samples. The spectometer was calibrated for energy response using a mixed radionuclide source. Counts were done for one-half hour and this allowed detection to the limit of 0.1 to 0.2 Bq/g of Cs. Gamma spectrometry was used to facilitate detection of any anomalous zones or hot spots of gamma emitters.

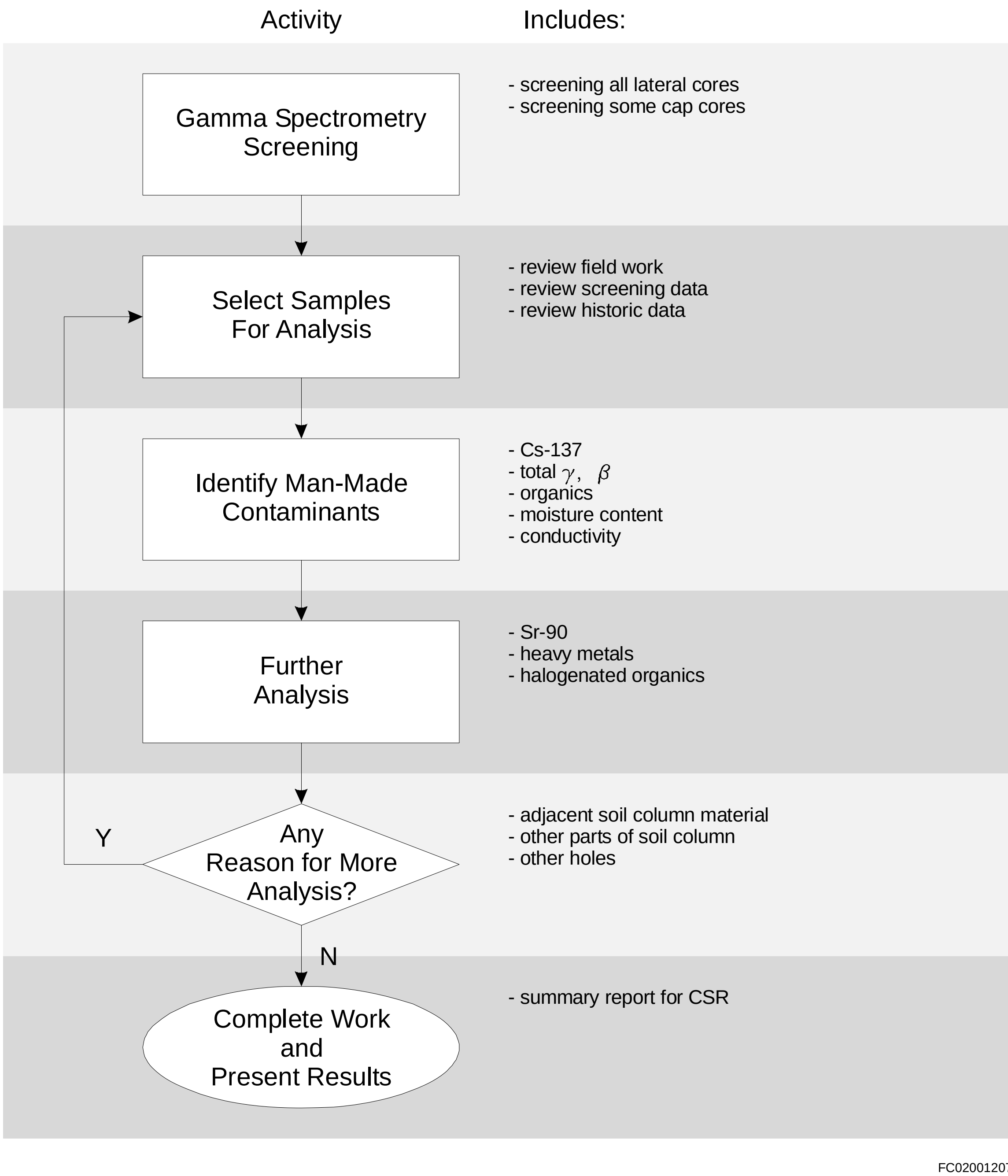

Figure 4
Method for Analysis Cap and Lateral Core Samples

- Once initial screening was completed samples were selected for more detailed analysis. No gamma emitters were detected in the initial screening therefore, it was concluded that only two boreholes (BH5 and BH7) were selected for detailed analysis. The selection was based on a review of modelling needs, local hydrogeological conditions and waste inventory records. A variety of analyses were done including total γ, total β, total halogenated organics, conductivity, and pH.

- Samples from the previous step were also analyzed for ^{90}Sr, halogenated organics and heavy metals. These are the same samples as selected for the previous step. It is recorded as another step in the process because different analytic techniques were necessary.

- All samples are archived to allow for further analysis if additional detail is required.

A similar analysis process was followed for the cap cores. Initial screening was only done on the control cores placed adjacent to the caps. Then a subset of the cap core samples was selected for identification of man-made contaminants. Criteria used in the selection process included:

- selection samples from the top and bottom of the 1 m cores;
- samples containing iron staining;
- samples having elevated counts from pancake detector; and
- samples from the worst case trench (i.e. Trench 13A).

Only three of the hottest samples were selected for further analysis (i.e. ^{90}Sr, heavy metals and halogenated organics).

Photography was carried out to record all steps in the sampling process. This included some photos of the cored cap and lateral geological materials.

Sample locations were surveyed using conventional and GPS technology and these were plotted into a base plan of the WMA. A few simple profiles were constructed for plotting trench cap and borehole data. All holes were resealed using solid bentonite material that was tamped in place.

A portion of every tenth sample will be retained for independent analysis to meet QA requirements. As well, any material remaining will also be archived for a two year period for any future analytical requirements.

C3.3.2 Inspecting Trench Caps

Inspection of trench caps at ground surface was done to provide information on the performance of these structures. Initially, all the trenches were ground truthed (Bailie 1985). Next, a visual inspection was made of these structures. Any unusual perturbations occurring on the caps or the nearby ground were documented. Any nearby standing water was noted.

Ground conductivity or electrical geophysical transects were utilized across the three identified trenches and throughout the area of low-level waste trenches. This technique assisted in confirmation of the integrity of the cap, the volume of waste within the trench and locating the interface between the waste and the edge of the trench.

C3.3.3 Evaluating Trench Construction and Waste Emplacement Methods

The trench construction and waste emplacement specifics were determined using a variety of techniques, such as:

- consulting AECL design records;
- interviewing the current Waste Management Operations staff;
- interviewing former Waste Management Operations staff; and
- reviewing site photographic records.

C3.4 DEFINITION OF BOUNDARIES OF THE STUDY AREA

The spatial boundary for the project is the Whiteshell Laboratories Waste Management Area. The work was conducted to evaluate WMA trenches (Figure 1). However, trench cover sampling was only carried out on the three example trenches (Figure 2).

The three example trenches were selected through review of WMA records on the basis of the following conditions:

1. 13A - more contaminants than an average trench;
2. 19 - less contaminants than an average trench; and
3. 21 - average amount of contaminants.

Cap holes were cored only to 1 m depth. This depth was chosen to avoid penetrating through the cap into waste material.

The following criteria were used for selection and coring of trench lateral boreholes.

- Holes were placed 3 – 4 meters from a trench wall. This distance margin was necessary as the accuracy of the trench wall location was unknown and there was a need to ensure that no hole would cross any trench waste material.

- Holes were drilled to 5.5 m length to ensure penetration would be made to the same depth level as the trench bottoms.

- Seven hole sites (BH 1 through BH7 in Figure 1) were chosen on the east and west sides of the trenches (an eighth borehole was subsequently added since the upper core of BH4 did not produce reliable sample recovery). Considerations used for selecting the sites were:

  - proximity to boreholes from previous programs, thereby allowing cross-sections to be constructed;
  - distributing holes to gain a maximum coverage of the site;
  - placing some holes in local down gradient conditions (e.g. near the ditch on the east side of the site); and
  - placing other holes on the west side of the trenches (e.g. attempting to measure contamination movement from the trenches toward the river).

Other criteria used in the selection of bore hole sites for trench cover and lateral holes were:

- avoidance of areas where there is a higher risk that the trench cover utilized contaminated soils; and
- avoidance of areas which may have been contaminated by waste management operations (e.g. organic drum storage area located north of the incinerator).

C3.5 EQUIPMENT FOR THE FIELD AND SAMPLING PLAN

- Hand-Operated Coring Equipment.
- Track-Mounted Hollow Stem Auger and Soil Sampling System.
- Ludlum Model 177 Contamination Meter.
- GPS System or Conventional Survey Instruments to identify sample locations or other points of interest.
- Conventional Survey Instruments for profiling and locating trench data.
- Surface Resistivity Instrumentation.

C3.6 REFERENCES

Bailie, J.E. 1985. *Plan Showing Survey of Waste Storage Area in SW1/4, Sec. 28, TP14, Rge. 11, EMP, Near Pinawa, Manitoba*.

Cherry, J.A. and W.D. Robertson. 1988. *Summary Report: The Hydrogeology of the Radioactive Waste Management Area and Vicinity.* WNRE-737.

Appendix C.4

Trench Cover and Lateral Core Sampling Analysis Summary

C4.1 INTRODUCTION

This document contains analytical data and results from the sampling plan carried out to evaluate the performance of the low-level waste (LLW) trenches at the Whiteshell Laboratories (WL) Waste Management Area (WMA).

This summary is a follow-up to the sampling and analysis plan documented in Appendix C.3. Figures 1 and 2 of the sampling plan show the layout and location of the trenches, trench lateral boreholes and the trench cap holes. Soil cores taken from these holes were analyzed for radionuclide content and to determine soil chemistry.

C4.2 PURPOSE OF THE SUMMARY DOCUMENT

The primary objective of the document is to summarize analysis results from the trench lateral and the trench cap borehole samples. This data will be used to support evaluation of the trench in-situ containment hypothesis.

C4.3 SAMPLING SUMMARY

C4.3.1 General

The methodology used for trench selection and for sampling the cap and lateral boreholes described in detail in Appendix C.3.

C4.3.2 Trench Cap Samples

Trench cap samples were taken using a hand-driven sampling tool. Each hole was driven to 1.0 m depth below the ground surface and samples were extracted from the coring tube every 10 cm. A total of 150 core segment samples were obtained from 15 boreholes (i.e. ten samples from each borehole).

The holes were distributed on three example trenches (Appendix C.3, Figure 2) as follows:

- Trench 13A – five holes (13A-2 to 13A-6) in the trench cap material and a control hole (13A-1) outside the trench boundary on the north side.
- Trench 19 – three holes (19-10 to 19-12) in the trench cap material and a control hole (19-5) outside the trench boundary on the north side.
- Trench 21 – four holes (21-12 to 21-15) in the trench cap material and a control hole (21-11) outside the trench boundary on the north side.

The cap holes were typically spaced 3-4 m apart and placed on the long axis of each trench. Technical staff felt that this coring arrangement would be most likely to intercept any contaminant that might move upward from the waste source into the cap barrier material.

The samples were numbered using a scheme that has four elements. The first element is TH, which simply means, "trench hole". The second element is the trench number (i.e. 13A, 19 and 21). The third element is the hole number. The range of numbers is as given above. The numbers for trenches 19 and 21 do not begin at 1 because several additional trial holes were advanced prior to the holes that were finally used for this summary document. These were not used in this analysis because there was not enough depth control in the trial holes. However, trial hole samples are archived for any further analysis requirements. The final element in the numbering system is depth. Sample segments were labelled according to their depth in centimetres below the ground surface. An example of a sample number is TH 13A-1 (0-10). This is the first (the northernmost) hole driven in the ground just north of trench 13A boundary and the core segment sample was at a depth of 0-10 cm.

During extraction of samples from the coring tube, a qualified radiation protection surveyor surveyed all samples with a portable contamination rate meter. No anomalous readings were observed. However, any slightly elevated values were recorded on the borehole log sheet. Then, samples were described on the log sheet, packaged and sent for analysis. The soil description was important because it could be used to help explain any differences in analysis results. As well, it facilitated confirmation of the integrity of cap barrier material.

Table 1 provides a summary description of the key attributes of the cap core samples.

C4.3.2.1 Sample Preparation and Analysis Methodology

Prior to submitting for analysis, all of the cores were collectively screened in an area of low background, using a portable NaI (TI) gamma spectrometer system, to verify that no significant external hazard existed.

Table 2 contains a summary listing of the various analyses that were carried out and the approach that was used for each of these analytical techniques.

Table 1
Description of Trench Cap Core Samples

Core ID	Sample Depth (cm)	Description/Comments	Sample Length (cm)
TH 13A-1	0-10	Grass, organic, sand, clay	11.5
	10-20	Organic, clay	9.0
	20-30	Clay	8.5
	30-40	Clay	8.0
	40-50	Clay	8.5
	50-60	Clay	8.0
	60-70	Clay	8.5
	70-80	Clay	8.5
	80-90	Significant compression when taken out, dark brown clay	10.0
	90-100	Clay	8.25
TH 13A-2	0-10	Dark brown organics	10.5
	10-20	Medium brown clay	7.3
	20-30	Medium brown clay, sand and large rock	8.6
	30-40	Medium brown clay - 200 cpm	7.6
	40-50	Medium brown clay - 300 cpm	7.9
	50-60	Medium brown clay - 200 cpm	7.7
	60-70	Medium brown clay –damp rock	7.3
	70-80	Medium brown clay	9.5
	80-90		8.2
	90-100		8.4
TH 13A-3	0-10		10.0
	10-20	Gravel and sand, some clay	8.0
	20-30	Clay	9.0
	30-40	Clay	11.0
	40-50		11.0
	50-60		7.0
	60-70		9.6
	70-80	Clay	7.5
	80-90	Clay	6.4
	90-100	Clay - very little sample (lost the first time)	4.8
TH 13A-4	0-10	Mainly organics some sandy clay	11.0
	10-20	Sand and gravel, clayey	7.4
	20-30	Clay and gravel, some sand	10.0
	30-40	Dark brown clay, some organics	7.0
	40-50	Dark brown clay, some organics	7.5
	50-60	Grey brown clay, some organics	7.1
	60-70	Grey brown clay, lots of organics	7.5
	70-80	Top is organics, wood, then clay	11.5

Core ID	Sample Depth (cm)	Description/Comments	Sample Length (cm)
	80-90	Top organics, they clay	11.1
	90-100	Greyish clay	11.2
TH 13A-5	0-10	Organics over clay	8.0
	10-20	Clay, some sand near bottom	7.0
	20-30	Clay, trace organics	7.8
	30-40	Clay, trace organics	9.0
	40-50	Clay, trace organics	9.2
	50-60	Clay, trace organics	7.1
	60-70	Clay, trace organics	6.4
	70-80	Clay, trace organics	8.3
	80-90	Clay, trace organics, weak Fe stain	8.5
	90-100	Clay, organics, trace sand	7.7
TH 13A-6	0-10		7.6
	10-20	Clay and trace organics, 400-500 cpm	7.0
	20-30	Clay on top, sand and gravel below	8.2
	30-40	Clay and organics, 200 cpm	7.8
	40-50	Clay, minor organics	7.2
	50-60	Clay, organic smear	8.0
	60-70	Clay, or limey clay, dry, some Fe stain, some organics	7.5
	70-80	Limey clay top, dry, some Fe stain, some organics, piece of "concrete".	8.6
	80-90	Clay, some Fe stain	10.0
	90-100	Clay, trace sand	8.6
TH 21-11	0-10	Clay, no organics	8.0
	10-20		5.8
	20-30	Clay, trace organics	8.1
	30-40	Clay, trace organics	7.9
	40-50	Clay, trace organics, minor gravel	6.4
	50-60	Clay, trace organics	7.7
	60-70	Clay, trace organics, sand	7.8
	70-80	Some sluff in hole, clay, trace organics	7.6
	80-90	Some sluff in hole, clay, trace organics	6.0
	90-100	Wood at end of hole, not sure if it was sluff	11.4
TH 21-12	0-10	Clay, trace organics	8.4
	10-20	Clay, trace organics, trace gravel	7.1
	20-30	Clay, trace organics	7.3
	30-40	Clay, trace organics	6.4
	40-50	Clay, trace organics	7.5
	50-60	Clay, trace organics	7.2
	60-70	Clay, trace organics, weak Fe stain	7.8
	70-80	Clay, trace organics, weak Fe stain	8.4
	80-90	Clay, trace organics	7.0
	90-100	Clay, trace organics, light grey	10.5

Core ID	Sample Depth (cm)	Description/Comments	Sample Length (cm)
TH 21-13	0-10	Clay, Fe stain	11.1
	10-20	Clay, trace organics, medium brown	5.8
	20-30	Clay, trace organics, medium brown	8.0
	30-40	Clay, trace organics, medium brown, some pebbles	6.2
	40-50	Clay, trace organics, medium brown, sand	6.4
	50-60	Clay, trace organics	6.7
	60-70	Clay, trace organics	6.5
	70-80	Clay, grey, trace organics, sand	7.4
	80-90	Clay, grey, trace organics, sand, Fe stain	8.0
	90-100	Clay, trace organics	8.5
TH 21-14	0-10	Medium brown clay, trace organics	10.3
	10-20	Medium brown clay	7.0
	20-30	Medium brown clay, no organics	5.2
	30-40	Medium brown clay, trace organics	5.6
	40-50	Medium brown clay, trace organics	6.5
	50-60	Medium brown clay, trace organics, trace sand	8.0
	60-70	Medium brown clay, trace organics, trace sand	8.5
	70-80	Medium brown clay, trace organics, trace sand,limestone clasts (?clay)	7.5
	80-90	Medium brown clay, trace organics, trace sand, white (limey stain)	8.0
	90-100	Medium brown clay, trace organics, trace sand, white (limey stain)	9.4
TH 21-15	0-10	Medium brown clay, trace organics	8.8
	10-20	Medium brown clay, trace organics	7.0
	20-30	Medium brown clay, trace organics	6.5
	30-40	Medium brown clay, trace organics	7.0
	40-50	Medium brown clay, trace organics, trace sand	6.5
	50-60	Medium brown clay, trace organics	6.8
	60-70	Medium brown clay, trace organics	8.4
	70-80	Medium brown clay, trace organics, trace Fe stain	10.4
	80-90	Medium brown clay, some white clay clasts	7.0
	90-100	Medium brown clay, some white clay clasts, trace organics, trace sand	9.4
TH 19-9	0-10	Medium brown clay, trace organics	8.0
	10-20	Medium brown clay, trace organics	6.5
	20-30	Medium brown clay, 2 cm organics at bottom	6.2
	30-40	Clay and organics, dark brown	6.8
	40-50	Clay with some organics, dark brown	7.0
	50-60	Medium-dark brown clay, minor organics	6.0
	60-70	Medium-dark brown clay, minor organics	8.5
	70-80	Medium to dark brown clay	7.0
	80-90	Medium to dark brown clay	6.6
	90-100	Medium to dark brown clay	8.0

Core ID	Sample Depth (cm)	Description/Comments	Sample Length (cm)
TH 19-10	0-10	Medium brown clay, minor pebbles	8.5
	10-20	Clay, minor organics	6.5
	20-30	Clay, wood , roots, ? Fe traces	5.8
	30-40	Clay, wood, roots, ? Fe traces	5.9
	40-50	Black, soil horizon	6.5
	50-60	Clay, some organics	5.5
	60-70	Clay, some organics	6.5
	70-80	Clay, some organics	6.5
	80-90	Clay, organics traces, white clay clasts	8.3
	90-100	Clay, organics traces, trace white clay clasts	8.2
TH 19-11	0-10	Medium brown clay with roots from grass	10.5
	10-20	Medium brown clay, poor recovery, grass roots	5.4
	20-30	Medium brown clay, roots	6.5
	30-40	Medium brown clay	6.5
	40-50	Medium brown clay, trace organics	6.0
	50-60	Medium brown clay, some organics	5.5
	60-70	Medium brown clay, some black organics	8.5
	70-80	Medium brown clay, some black organics, trace orange stain	5.0
	80-90	Medium brown clay, some black organics, traces wood, roots	6.5
	90-100	Medium brown clay, some black organics	7.9
TH 19-12	0-10	Medium brown clay, some black organics, roots (grass)	7.0
	10-20	Medium brown clay, pebbles, trace organics	5.8
	20-30	Medium brown clay, pebbles, trace organics	6.5
	30-40	Medium brown clay, trace organics	6.0
	40-50	Medium brown clay, some organics, 20 mm at bottom organics	5.5
	50-60	Top 30 mm clay, remainder black organics	6.2
	60-70	Black organics	6.3
	70-80	Black organics, some clay, organics are peaty	6.8
	80-90	Clay and black organics, dark brown clay	7.8
	90-100	Clay and black organics	7.8

Note: The following geologic terms are used in the above table:

1. Clast – a cobble, pebble or stone that is typically embedded in a finer grain matrix.
2. Organics – soil material comprised of organic matter (e.g. peat or muck).
3. Sluff – material that typically falls from the sides to the bottom of a hole.

Table 2
Trench Cap Samples: Key Analytical Activities

Item	Analysis	Samples Tested	Analysis Approach
1.	Detailed Gamma Spectrometry	All 150 core segments (10 cm segments)	Counting for key transport radionuclide ^{137}Cs.
2.	^{90}Sr	TH 13A-2 (0-10) TH 13A-5 (0 –10) TH 21-11 (80 – 90) TH 21-11 (90 –100)	All cores identified as having elevated values of ^{137}C, subsequently analyzed for ^{90}Sr.
3.	Total Organic Halides (TOX)	TH 13A-2 (0-10) TH 13A-5 (0-10) TH 21-11 (80-90) TH 21-11 (90-100)	Same as item 2 above.
4.	Heavy Metals	TH 13A-2 (0-10) TH 13A-5 (0-10) TH 21-11 (80-90) TH 21-11 (90-100)	Same as item 2 above.
5.	Conductivity and pH	80 core segments	All priority 1[(1)] samples and several complete cores having an anomalous profile.

Cores were screened to identify priority 1 samples for this analysis as follows:

- Top or bottom of the core column.
- Cores having anomalous materials (e.g. Fe staining or organic material).
- Cores having slightly elevated counts as measured in the field.

Each core segment was "wet" weighted split in half and submitted for pH, conductivity and TOX analysis. The remaining half was dried (wet and dry weighted recorded), ground and submitted for gamma spectrometer analysis. ^{90}Sr and total metals analyses were performed on the dried portion of selected samples.

Detailed gamma spectrometry (Item 1) was completed on all 150 cores. A one-hour count was selected because it provided sufficient statistical evaluation for ^{40}K and a minimum detection limit for ^{137}Cs of approximately 0.03Bq/g. All counting was done in an automated system under controlled conditions using a traceable mixed gamma standard. ^{90}Sr (Item 2) analysis was only done on the few samples having elevated ^{137}Cs. A radiochemical separation and liquid scintillation counting technique was used. Similarly, TOX measurements (Item) and heavy metals (Item 4) were also made on the same four samples. Conductivity and pH (Item 5) were measured in 80 cores.

C4.3.3 Trench Lateral Boreholes

Trench lateral boreholes were drilled by a drilling contractor. Each hole was drilled to a depth of 5.4 m (18 feet) below the ground surface and samples were extracted in an acrylic liner. The liner was removed from the core barrel every 60 cm (2 feet). A theoretical total of 63 core segment samples (Table 3) were obtained from the first seven boreholes (BH-1 to BH-7). However, in a few cases only small amounts of sample, or no sample, were recovered. An additional hole (BH-8) was drilled because the recovery in BH-4 was poor at shallow depth. This hole was only drilled to a depth of 2.44 m (8 feet). Another four core segment samples were recovered for a theoretical total of 67. The actual number of core segments recovered is 65.

The holes were distributed throughout the waste management area as indicated on Figure 1 of appendix C.3. The borehole sites were generally chosen to be near the three example trenches (Trench 13A, 19 and 21). As well, the boreholes were located about 2 to 4 meters away from the surveyed edge of the trenches in order to intercept any lateral migrating contaminant. Several holes (BH-5, 6 and 7) were placed near the east ditch of the WMA. The hypothesis was that these holes would be able to intercept any contaminant migrating from the trench toward the ditch.

The samples were identified using a scheme that has three elements. The first element is BH, which simply means, “borehole”. The second element is the number, which ranged from 1 through 8. The final element is the numbering system with depth. Sample segments were labelled according to their depth in centimetres below the ground surface. An example of the sample segment is given as follows, BH-2 (180-240). This sample is from borehole number 2, located just west of Trench 21, at a depth of 180-240 cm below the ground surface.

During extraction of samples from the core barrel, a qualified radiation protection surveyor surveyed all samples with a portable contamination rate meter. No anomalous readings were observed. However, any slightly elevated values were recorded on the borehole log sheet. Then, samples were described on the log sheet, packaged and sent for analysis. The soil description was important because it could be used to help explain any differences in analysis results. As well, it facilitated identification of the disturbed zone and lithological changes that occurred with depth.

Table 3 provides a summary description of the key attributes of lateral core samples. The fields in this table include the core ID, sample depth, length of material recovered and the percentage recovery.

Table 3
Description of Lateral Core Samples

Core ID	Sample Depth (cm)	Description/Comments	Sample Recovery (cm)	% Recovery
BH1	0-60	0-5 cm Soil - black, humus, vegetation, 5-30 cm clay	30	50%
	60-120	60-96 cm - clay, brown grey	65	108%
	120-180	Clay, brown grey, pulled and left sample down the hole	25	42%
	180-240	Clay, brown grey, damp, traces of calcareous material	60	100%
	240-300	Clay, brown grey, damp, traces of calcareous material	65	108%
	300-360	Clay, grey, wet, traces of Fe stain appears to be along bedding, wet near end of run	53	88%
	360-420	Lost the run, dropped down the hole and probably was pushed aside	0	0%
	420-480	Wet material, grinding till, sandy, light grey	15	25%
	480-540	Wet material, grinding till, sandy & pebbles, light grey, wet	13	21%
BH2	0-60	Clay, brown grey, subrounded pebbles (15 mm), flecks of carbonate	50	83%
	60-120	60 – 92 cm clay, brown grey, 92-115 cm topsoil, black organic material, mixed with clay	55	92%
	120-180	Clay, grey with black tinge, disturbed soil	34	56%
	180-240	Clay, brown clay, looks like native material	60	100%
	240-300	Clay and silt, minor sand, tan to light brown, became more crunchy progressing to till	60	100%
	300-360	Clay and silt, minor sand, tan to light brown, crunchy drilling	69	115%
	360-420	Clay, silt, minor sand, light tan, wet	65	108%
	420-480	Clay, silt, minor sand, wet, pebbles (subangular < 15 mm dia.), no water in hole	63	104%
	480-540	Clay, silt, wet, pebbles (subangular to <25 mm dia.), no water in hole	60	100%?
BH3	0-60	Clay, grey, trace sand, silt, minor < 50 mm topsoil at top of plug	38	64%
	60-120	60 – 108 cm clay, grey, 108 – 120 cm topsoil, black	60	100%
	120-180	Clay, grey with silt, some subangular pebbles, calcareous and greenstone	68	113%
	180-240	Clay, grey with silt, subangular pebbles	66	110%
	240-300	Clay, colour appears to have changed to the tan on this run	60	100%
	300-360	Clay, tan with silt, traces of sand, water appears to have come in via sand lens	15	25%
	360-420	Clay, light tan colour, minor subangular pebbles (< 7 mm dia.) plastic	65	108%
	420-480	Clay, grey in colour, minor subangular pebbles, weak Fe stain	69	115%
	480-540	Clay, greyish colour, minor subangular pebbles, weak Fe stain, hole was dry	63	104%
BH4	0-60	Clay, mixed with topsoil, counts highest at the 0 level	55	92%
	60-120	Clay, mixed with gravel, hit layer of stones that caused problem with recovery	8	13%
	120-180	No recovery	0	0%
	180-240	Clay, dark brown, no recovery, disturbed material, some organics	58	96%
	240-300	Clay, grey, weak Fe stains, appears undisturbed	51	85%

Core ID	Sample Depth (cm)	Description/Comments	Sample Recovery (cm)	% Recovery
	300-360	Clay, grey, weak Fe stains, appears undisturbed, no pebbles, becoming more silty at bottom	68	113%
	360-420	Clay till, brown grey with weak Fe stains	51	85%
	420-480	Clay till, brown grey with weak Fe stains, subangular pebbles < 15 mm dia.	70	117%
	480-540	Clay till, brown grey with weak Fe stains, subangular pebbles to < 15 mm dia.	65	108%
BH5	0-60	Clay, dark grey, loss of material because of frost in ground	30	50%
	60-120	Clay, brown grey	40	67%
	120-180	Clay, brown grey, massive, plastic, more crumbly than most other drill sites	65	108%
	180-240	Clay, grey brown, crumbly with pebbles, clast- or slag- like material (black ~ 25 mm dia.)	65	108%
	240-300	Clay, light to medium brown, crumbly with calcareous clasts, subangular to about 40 mm dia.	65	108%
	300-360	Clay, light to medium borwn, crumbly with subangular clasts of greenstone, clast about 15 mm dia.	70	117%
	360-420	Clay, damp, brown grey, clasts - greenstone, subangular	65	108%
	420-480	Clay, damp, brown grey, pebbles - granite, massive	66	110%
	480-540	Clay, damp, brown grey, pebbles - granite, massive. No water in hole, dry all the way down.	65	108%
BH6	0-60	Clay, grey brown, frost on the top caused problems with recovery	14	23%
	60-120	Clay, grey brown, some calcareous clasts	38	63%
	120-180	Clay, grey brown	65	108%
	180-240	Clay, grey brown, some weak Fe stains	65	108%
	240-300	Clay, brown grey, minor calcareous clasts	60	100%
	300-360	Clay, brown grey	65	108%
	360-420	Clay, grey, weak Fe stains	60	100%
	420-480	Clay, grey	65	108%
	480-540	Clay, grey, minor rounded pebbles, dropped a tape down the hole and it was dry	65	108%
BH7	0-60	Clay, pockets of coarse sand and gravel (backfill), pockets of topsoil	56	94%
	60-120	60 – 80 cm - Pocket of coarse sand (backfill), clay, grey, minor humus material	56	94%
	120-180	Clay - grey, subangular pebbles, 65 mm dia., damp	65	108%
	180-240	Clay, brown grey, weak Fe stain, no gravel or pebbles, material doesn't stick to auger	64	106%
	240-300	Clay, brown grey, weak Fe stain, minor subangular pebbles	65	108%
	300-360	Clay (tan grey), sand, hit water at about 335 cm	40	67%
	360-420	Clay, brown grey, minor subangular pebbles (<15 mm)	63	104%
	420-480	Clay, brown grey, minor subangular pebbles (< 15 mm), black clast (< 50 mm dia.) with weak Fe stain, crumbled apart	63	104%
	480-540	Clay, brown grey, weak Fe stain, top run had remainder of black clast	56	94%

Core ID	Sample Depth (cm)	Description/Comments	Sample Recovery (cm)	% Recovery
BH8	0-60	Fill, clay, gravel and sand, humus, some elevated leadings right at grout surface	35	58%
	60-120	Fill, gravel and sand, clay, minor humus, Fe stained	30	50%
	120-180	Some black asphalt material at top, clay at 170 cm, grey, weak Fe stain, at 170 cm started hitting native material	53	88%
	180-240	Clay, plastic, grey, no Fe stain	65	108%

Note: The following geologic terms are used in the above table:
1. Clast – a cobble, pebble or stone that is typically embedded in a finer grain matrix.
2. Organics – soil material comprised of organic matter (e.g. peat or muck).

C4.3.3.1 Sample Preparation and Analysis Methodology

Table 4 contains a summary listing of the various analyses that were carried out and the approach that was used for each of these analytic techniques.

Table 4
Trench Lateral Samples: Key Analytical Activities

Item	Analysis	Samples Tested	Analysis Approach
1.	Screening Gamma Spectrometry	All 65 core segments (60 cm core segments)	Screening cores to determine an appropriate handling process
2.	Detailed Gamma Spectrometry	All 65 core segments (10 cm core segments)	Counting for key transport radionuclide ^{137}Cs.
3.	^{90}Sr	All BH-5 & BH-7 core segments (18 - 10 cm core segments)	Two boreholes chosen at sites where expected gradient toward the ditch.
4.	TOX	All BH-5 & BH-7 core segments (18 - 10 cm core segments)	Same as 3 above.
5.	Conductivity and Ph	All BH-5 & BH-7 core segments (18 - 10 cm core segments)	Same as 3 above.
6.	Heavy Metals	All BH-5 & BH-7 core segments (18 - 10 cm core segments	Same as 3 above.

Screening gamma spectrometry (Item 1) was carried out on all of the 60 cm trench lateral core segments. This was performed using a portable HPGe gamma spectrometer system mounted vertically on a jig 30 cm above the centre of each sample. A traceable, water equivalent mixed gamma standard, housed in the same 60 cm enclosure as the samples, was used to calibrate the system an a one-hour count was selected to obtain a detection limit of < 300 Bq/core segment. The average wet weight of the samples was 2900 grams and the average detection limit was 0.135 Bq/g wet weight.

After the initial screening, the samples were sent to the laboratory for further processing. Each core segment was "wet" weighed and the bottom 10 cm was cut-off for additional analysis. Half of all 10 cm sections were dried (wet and dry weights recorded), ground and submitted for gamma spectroscopy analysis. The remaining half of all BH-5 and BH-7 10 cm sections were submitted for pH, conductivity and TOX analysis. ^{90}Sr and total metals analyses were also performed on the dried half of all BH-5 and BH-7 10 cm sections.

Detailed gamma spectrometry (Item 2) was completed on all 65 core segments. A one-hour count was chosen because it gave good statistical evaluation of the ^{40}K and a ^{137}Cs detection limit of 00.03 Bq/g. All counting was done in an automated system under controlled conditions using a water equivalent, traceable mixed gamma standard. ^{90}Sr (Item 3) was performed using a radiochemical separation and liquid scintillation counting technique.

C4.4 ANALYTICAL RESULTS

Analytical results are presented in Tables 5 to 8.

C4.4.1 Trench Cap Samples

Table 5 provides a summary of trench cap core radioactivity, TOX values, electrical conductivity and pH. Table 6 presents a summary of the trench cap cover metals analysis results.

An increase in conductivity was noted in trench hole TH 13A-2 associated with the medium brown clay and there was also a slight increase in radioactivity in the field measurements. Although ^{137}Cs was not detected in the detailed gamma spectrometry analysis, small amounts of ^{232}Th were noted. An increase in conductivity was noted in the 20 to 60 cm core depth.

A similar increase in conductivity was noted in trench hole 13A-4 also in a brown clay zone at the 40 to 50 cm depth.

For trench hole 13A-6, an increase in conductivity was noted at the 40 to 50 cm depth and it continued to the 90 cm depth. The increase in conductivity was consistent with organic material and Fe oxide coloured stains noted in the sample.

Trend analysis for conductivity and pH is limited to these three cores because these are the only ones having continuous conductivity and pH data. For other samples, an increase in conductivity was noted when clay became medium to dark brown or whenever organics were noted.

Four samples were analysed for TOX. For trench hole 13A-5 from 0-10 cm, an elevated TOX level of 29 ppm was detected and organics were noted in the sample description. The increase in organics could explain the increased TOX value.

These same four samples were analyzed for ^{90}Sr. Only one core sample, TH-21-11, 90-100 cm, contained ^{90}Sr activity at the detection limit (0.031 Bq/g).

The concentrations for all naturally occurring radionuclides were as expected and consistent with environmental monitoring data.

Table 5

Trench Cap Core Activity, Organic Halides, Conductivity and pH Results

Core ID	Sample Depth (cm)	Sr-90 (Bq/g)	2s Error (Bq/g)	Cs-137 (Bq/g)	2s Error (Bq/g)	TOX (ppm)	Conductivity (mS/m)	pH
TH 13A-1	0-10			0.011	0.005		41	7.86
	10-20			0.012	0.005		45	8.02
	20-30			0.057	0.017			
	30-40			< 0.019				
	40-50			< 0.019				
	50-60			< 0.018				
	60-70			< 0.015				
	70-80			< 0.016				
	80-90			< 0.008			52	8.34
	90-100			< 0.008			56	8.39
TH 13A-2	0-10	< 0.03		0.034	0.015	< 22	45	7.29
	10-20			< 0.007			310	7.58
	20-30			< 0.006			270	7.67
				< 0.005				
	30-40			< 0.007			149	7.58
	40-50			< 0.012			200	7.53
	50-60			< 0.010			113	7.66
	60-70			< 0.017			76	7.99
				< 0.011				
	70-80			< 0.015			74	7.88
	80-90			< 0.007			58	7.74
	90-100			< 0.011			57	7.79
TH 13A-3	0-10			0.014	0.009		67	7.14
	10-20			< 0.007			31	7.80
	20-30			< 0.016				
	30-40			0.009	0.007			
	40-50			< 0.016				
	50-60			< 0.018				
	60-70			< 0.020				
	70-80			< 0.010			67	7.61
	80-90			< 0.006			62	7.78
	90-100			< 0.009			63	7.74
TH 13A-4	0-10			0.018	0.007		77	7.21
	10-20			< 0.011			46	7.41
	20-30			< 0.015			57	7.74

Core ID	Sample Depth (cm)	Sr-90 (Bq/g)	2s Error (Bq/g)	Cs-137 (Bq/g)	2s Error (Bq/g)	TOX (ppm)	Conductivity (mS/m)	pH
	30-40			< 0.018			83	7.69
	40-50			< 0.018			126	7.70
	50-60			< 0.019			84	7.33
	60-70			< 0.020			61	7.66
	70-80			0.018	0.012		60	7.57
	80-90			0.008	0.005		78	7.70
	90-100			< 0.006			53	7.69
TH 13A-5	0-10	< 0.03		0.016	0.006	29.00	40	7.52
	10-20			0.071	0.009		72	7.78
	20-30			< 0.017				
	30-40			< 0.017				
	40-50			< 0.019				
	50-60			< 0.018				
	60-70			< 0.017				
	70-80			< 0.018				
	80-90			< 0.006			58	7.70
	90-100			0.009	0.005		70	7.86
TH 13A-6	0-10			0.011	0.007		50	7.75
	10-20			< 0.006			61	7.97
	20-30			< 0.005			47	8.30
	30-40			< 0.006			77	7.97
	40-50			< 0.009			166	7.87
	50-60			< 0.006			195	7.88
	60-70			< 0.006			175	7.80
	70-80			< 0.009			112	7.85
				< 0.007				
	80-90			< 0.008			95	7.83
	90-100			< 0.008			70	8.02
TH 21-11	0-10			< 0.010			32	7.13
	10-20			< 0.016			15.8	7.86
	20-30			< 0.017				
	30-40			< 0.017				
	40-50			< 0.018				
	50-60			< 0.017				
	60-70			< 0.018				
	70-80			< 0.018				
	80-90	< 0.03	0.003	0.047	0.010	< 23	51	7.85
	90-100	0.031	0.003	0.022	0.009	< 24	67	7.92
TH 21-12	0-10			< 0.010			37	7.33
	10-20			< 0.007			15.2	8.25
	20-30			< 0.018				
	30-40			< 0.018				
	40-50			< 0.016				

Core ID	Sample Depth (cm)	Sr-90 (Bq/g)	2s Error (Bq/g)	Cs-137 (Bq/g)	2s Error (Bq/g)	TOX (ppm)	Conductivity (mS/m)	pH
	50-60			< 0.016				
	60-70			< 0.010				
	70-80			0.007	0.005			
	80-90			< 0.017			40	7.98
	90-100			< 0.018			51	7.93
TH 21-13	0-10			< 0.007			16.3	7.96
	10-20			< 0.006			15.1	8.29
	20-30			0.019	0.016			
	30-40			< 0.036				
	40-50			< 0.032				
	50-60			< 0.030				
	60-70			< 0.032				
	70-80			< 0.033				
	80-90			< 0.006			49	8.16
	90-100			< 0.007			53	8.09
TH 21-14	0-10			0.005	0.004		41	7.11
	10-20			< 0.017			30	7.43
	20-30			< 0.028				
	30-40			< 0.031				
	40-50			< 0.035				
	50-60			< 0.032				
	60-70			< 0.030				
	70-80			< 0.005			54	8.10
	80-90			< 0.006			62	7.92
	90-100			< 0.013			55	7.83
TH 21-15	0-10			< 0.010			20	8.14
	10-20			< 0.009			36	8.18
	20-30			< 0.015				
	30-40			< 0.012				
	40-50			< 0.009				
	50-60			< 0.014				
	60-70			< 0.009				
	70-80			< 0.014				
	80-90			< 0.013			53	8.33
	90-100			< 0.008			54	8.06
TH 19-9	0-10			0.007	0.006		23	7.76
	10-20			< 0.017			15.7	8.01
	20-30			< 0.036				
	30-40			< 0.020				
	40-50			< 0.032				
	50-60			< 0.033				
	60-70			< 0.035				
	70-80			< 0.034				

Core ID	Sample Depth (cm)	Sr-90 (Bq/g)	2s Error (Bq/g)	Cs-137 (Bq/g)	2s Error (Bq/g)	TOX (ppm)	Conductivity (mS/m)	pH
	80-90			< 0.011			200	7.81
	90-100			< 0.016			180	7.95
TH 19-10	0-10			< 0.035				
	10-20			< 0.030				
	20-30			< 0.008			14	8.31
	30-40			< 0.013			20	8.00
	40-50			< 0.036				
	50-60			< 0.038				
	60-70			< 0.032				
	70-80			< 0.034				
	80-90			< 0.008			105	7.54
	90-100			< 0.006			162	7.45
TH 19-11	0-10			< 0.011			37	7.59
	10-20			< 0.019			30	7.42
	20-30			< 0.031				
	30-40			< 0.034				
	40-50			< 0.035				
	50-60			< 0.034				
	60-70			< 0.034				
	70-80			< 0.029				
	80-90			< 0.008			60	7.75
	90-100			< 0.007			105	7.36
TH 19-12	0-10			0.015	0.006		24	7.78
	10-20			< 0.010			11	8.11
	20-30			< 0.017				
	30-40			< 0.016				
	40-50			< 0.019				
	50-60			0.036	0.013			
	60-70			0.044	0.018			
	70-80			< 0.022				
	80-90			< 0.010			179	7.23
	90-100			< 0.014			120	7.50

Notes:
1. TOX = total organic halides.
2. Organic halides and conductivity relative precision (2*s*) is ± 10%.
3. Organic halides results are in ppm wet weight.
4. Radionuclide results are in Bq/g dry weight.

Table 6

Trench Cap Core Metal Analysis Results

(ppm/dry weight)

Core ID	Sample Depth (cm)	B	Be	Cd	Co	Cr	Cu	Mo	Ni	Sr
TH 13A-2	0-10	6.1	1.3	2	6.8	17.1	14.8	11.6	19.9	< 1.2
TH 13A-5	0-10	6	< 1.3	1.7	6.4	14	11.9	14.2	15.4	2.2
TH 21-11	80-90	11.9	2.3	2.4	8.3	19.6	14.4	4.3	21	< 1.3
TH 21-11	90-100	5.1	< 1.3	1.7	7.4	19	11.6	11.8	16.7	< 1.3

Core ID	Sample Depth (cm)	V	Zn	Al	Fe	P	Ag	Li	Pb	T1
TH 13A-2	0-10	17.7	35	7600	13500	370	< 6	11	< 6	< 6
TH 13A-5	0-10	13	29	6400	11800	430	< 7	12	< 7	< 7
TH 21-11	80-90	25	48	10400	15100	740	< 6	11	< 6	< 6
TH 21-11	90-100	17.8	35	8300	13500	380	< 7	12	< 7	< 7

Note: Precision at 2*s* for all metal results is ± 10%.

Minor amounts of ^{137}Cs were noted at the surface level (0-30 cm) in trenches 13A, 21 and 19. In trench hole 13A-4, minor amounts of ^{137}Cs were noted at the 70 to 90 cm level. Slightly elevated values were also noted in TH-21-11 (80-100 cm) and TH-21-12 (70-80 cm) these correlated with Fe stain and organic content. An elevated value occurred in trench hole 19-12 (60-80 cm). This was also correlative with black organic material which is likely topsoil mixed during trench construction and covering operations.

No elevated levels of heavy metal were identified.

C4.4.2 Trench Lateral Samples

Table 7 is a summary of the lateral core radioactivity, TOX, electrical conductivity and pH results. Table 8 presents a summary of the lateral core metals analysis results.

Conductivity and pH analyses were carried out on BH-5 and BH-7. There was no significant variation in conductivity or pH in these holes. The values ranged from about 8 – 8.8, while conductivity ranged from 9 to 22 mS/m.

Two positive values were noted for TOX. These were in BH-5 at 0–60 cm (26 ppm) and 120-180 cm (27 ppm) depth. TOX values were at the detection limit for the technique.

The concentrations for all naturally occurring radionuclides were as expected and consistent with environmental monitoring data.

For ^{137}Cs there were three samples where the results exceeded the detection limit in the top segment. BH-3 (0-60) was 0.005 ± 0.005Bq/g, BH-4 (0-60) was 0.023 ± 0.007 Bq/g and BH-6 (0-60) was 0.013 ± 0.007 Bq/g. The average detection limit for all of the ^{137}Cs analysis (from detailed results) was 0.007 Bq/g.

No elevated levels of metals were identified.

Table 7
Lateral Core Activity, Organic Halides, Conductivity and pH Results

Core ID	Sample Depth (cm)	Screening Results Cs-137 (Bq/Core)	Screening Results Cs-137 (Bq/g)	Detailed Analysis Results Sr-90 (Bq/g)	2s Error (Bq/g)	Cs-137 (Bq/g)	2s Error (Bq/g)	TOX (ppm)	Cond. (mS/m)	pH
BH1	0-60	< 270	< 0.167			< 0.007				
	60-120	< 263	< 0.079			< 0.006				
	120-180	< 285	< 0.374			< 0.006				
	180-240	< 270	< 0.100			< 0.006				
	240-300	< 271	< 0.088			< 0.006				
	300-360	< 262	< 0.086			< 0.004				
	360-420	NA	NA			NA				
	420-480	< 278	< 0.734			< 0.004				
	480-540	< 271	< 0.799			< 0.005				
BH2	0-60	< 261	< 0.107			< 0.006				
	60-120	< 267	< 0.097			< 0.008				
	120-180	< 273	< 0.197			< 0.006				
	180-240	< 262	< 0.094			< 0.005				
	240-300	< 268	< 0.090			< 0.006				
	300-360	< 257	< 0.072			< 0.005				
	360-420	< 274	< 0.078			< 0.010				
	420-480	< 267	< 0.073			< 0.006				
	480-540	< 259	< 0.070			< 0.005				
BH3	0-60	< 280	< 0.148			0.005	0.005			
	60-120	< 278	< 0.096			< 0.007				
	120-180	< 259	< 0.073			< 0.005				
	180-240	< 287	< 0.088			< 0.006				
	240-300	< 255	< 0.075			< 0.004				
	300-360	< 262	< 0.278			< 0.006				
	360-420	< 274	< 0.071			< 0.007				
	420-480	< 256	< 0.067			< 0.007				
	480-540	< 273	< 0.073			< 0.004				

Core ID	Sample Depth (cm)	Screening Results		Detailed Analysis Results						
		Cs-137 (Bq/Core)	Cs-137 (Bq/g)	Sr-90 (Bq/g)	2s Error (Bq/g)	Cs-137 (Bq/g)	2s Error (Bq/g)	TOX (ppm)	Cond. (mS/m)	pH
BH4	0-60	< 280	< 0.102			0.023	0.007			
	60-120	NA	NA			NA				
	120-180	NA	NA			NA				
	180-240	< 275	< 0.109			< 0.006				
	240-300	< 270	< 0.118			< 0.005				
	300-360	< 273	< 0.128			< 0.008				
	360-420	< 264	< 0.092			< 0.012				
	420-480	< 260	< 0.069			< 0.010				
	480-540	< 280	< 0.079			< 0.005				
BH5	0-60	< 277	< 0.307	< 0.03	0.003	< 0.006		26	39.0	7.72
	60-120	< 272	< 0.124	< 0.03	0.003	< 0.005		< 25	22.0	8.17
	120-180	< 283	< 0.076	< 0.03	0.003	< 0.004		27	18.1	8.57
	180-240	< 279	< 0.077	< 0.03	0.003	< 0.004		< 25	19.0	8.73
	240-300	< 288	< 0.081	< 0.03	0.003	< 0.004		< 22	13.6	8.49
	300-360	< 271	< 0.067	< 0.03	0.003	< 0.004		< 23	10.6	8.79
	360-420	< 279	< 0.069	< 0.03	0.003	< 0.004		< 24	8.9	8.47
	420-480	< 275	< 0.072	< 0.03	0.003	< 0.004		< 26	16.7	8.22
	480-540	< 186	< 0.048	< 0.03	0.003	< 0.004		< 25	22.0	7.96
BH6	0-60	< 275	< 0.763			0.013	0.007			
	60-120	< 272	< 0.117			< 0.005				
	120-180	< 265	< 0.129			< 0.007				
	180-240	< 265	< 0.070			< 0.005				
	240-300	< 256	< 0.067			< 0.005				
	300-360	< 266	< 0.067			< 0.004				
	360-420	< 268	< 0.069			< 0.004				
	420-480	< 262	< 0.063			< 0.005				
	480-540	< 268	< 0.071			< 0.006				
BH7	0-60	< 281	< 0.094	< 0.03	0.003	< 0.004		< 22	8.6	8.37
	60-120	< 260	< 0.095	< 0.03	0.003	< 0.008		< 22	22.0	8.29
	120-180	< 270	< 0.077	< 0.03	0.003	< 0.013		< 25	11.4	8.20
	180-240	< 264	< 0.071	< 0.03	0.003	< 0.007		< 23	17.4	8.62
	240-300	< 269	< 0.077	< 0.03	0.003	< 0.009		< 23	17.3	8.79
	300-360	< 284	< 0.116	< 0.03	0.003	< 0.004		< 26	12.4	8.65
	360-420	< 259	< 0.065	< 0.03	0.003	< 0.004		< 26	16.3	8.50
	420-480	< 282	< 0.072	< 0.03	0.003	< 0.007		< 26	15.5	8.25
	480-540	< 282	< 0.077	< 0.03	0.003	< 0.009		< 25	12.0	8.65

Core ID	Sample Depth (cm)	Screening Results Cs-137 (Bq/Core)	Cs-137 (Bq/g)	Detailed Analysis Results Sr-90 (Bq/g)	2s Error (Bq/g)	Cs-137 (Bq/g)	2s Error (Bq/g)	TOX (ppm)	Cond. (mS/m)	pH
BH8	0-60	< 269	< 0.167			< 0.006				
	60-120	< 270	< 0.219			< 0.005				
	120-180	< 274	< 0.124			< 0.006				
	180-240	< 274	< 0.090			< 0.006				

Notes:

1. TOX = organic halides, Cond. = conductivity.
2. Organic halides and conductivity relative precision (2*s*) is ± 10%.
3. Organic halides results are in ppm wet weight.
4. Screening sample results are in Bq/g wet weight.
5. Detailed analysis radionuclide results are in Bq/g dry weight.

Table 8

Lateral Core Metal Analysis Results (ppm / dry weight)

Core ID	Sample Depth (cm)	B	Be	Cd	Co	Cr	Cu	Mo	Ni	Sr
BH5	0-60	3.7	1.8	4.2	11.7	34	11	< 1.2	24	< 1.2
	60-120	9.5	< 1.2	1.3	5.2	12.3	10.1	13.1	13.5	1.6
	120-180	5.1	< 1.3	1.5	3.9	11.9	8.9	14	10.6	1.4
	180-240	6	< 1.3	< 1.2	4	10.5	8.8	16.4	9.3	9.8
	240-300	5.9	< 1.3	< 1.3	3.5	12.9	9.5	13.4	12.7	1.3
	300-360	12	1.3	1.3	3.5	12.5	9.7	14	12.8	2.6
	360-420	7.4	< 1.3	< 1.3	3.3	10.9	8.8	13.5	10.9	< 1.3
	420-480	6	< 1.3	< 1.3	4.8	12.3	10.4	14.5	14.5	< 1.3
	480-540	6.5	< 1.3	1.3	4.3	12.1	10.1	13.1	11.7	1.9
BH7	0-60	17.5	< 1.2	< 1.2	2.1	4	6.7	12.3	7.5	3.7
	60-120	4.4	1.6	3.1	11.3	25	31	7.8	33	< 1.3
	120-180	4.6	< 1.2	1.2	4.9	12.5	9.5	13.8	12.5	4.9
	180-240	11.9	< 1.3	1.8	5.4	14.3	12.1	14.5	15.4	< 1.3
	240-300	5.8	< 1.3	1.5	5	12.3	11.5	15	14.8	< 1.3
	300-360	55	1.8	2.7	7.9	23	15.3	17.3	26	18.1
	360-420	26	< 1.3	< 1.3	3.7	11.5	8.6	14	11.5	< 1.3
	420-480	20	< 1.3	1.4	5.2	21	10.3	12.7	15.7	< 1.3
	480-540	27	< 1.3	< 1.3	4	10.8	7.4	13.2	9.8	< 1.3

Core ID	Sample Depth (cm)	V	Zn	Al	Fe	P	Ag	Li	Pb	Tl
BH5	0-60	33	47	18600	28000	270	< 6	23	< 6	10
	60-120	9.9	21	4700	8700	360	< 6	11	< 6	< 6
	120-180	9.3	19.7	4500	8300	380	< 6	8	< 6	< 6
	180-240	8.4	17.3	3600	7800	350	< 6	7	< 6	< 6
	240-300	9.8	21	4600	8800	370	< 6	8	< 6	< 6
	300-360	9.9	23	4600	8700	340	< 6	9	< 6	< 6
	360-420	8.9	20	4100	7800	370	< 6	9	< 6	< 6
	420-480	10.5	21	4500	8200	350	< 6	9	< 6	< 6
	480-540	9.9	23	4500	8300	340	< 6	9	< 6	< 6
BH7	0-60	4.1	12.8	1620	4000	310	< 6	7	< 6	< 6
	60-120	27	57	13800	21000	440	< 6	17	< 6	< 6
	120-180	10.3	22	4700	8700	310	< 6	9	< 6	< 6
	180-240	13	31	5800	10500	410	< 7	12	< 7	< 7
	240-300	11	24	4700	9300	420	< 6	10	< 6	< 6
	300-360	17.7	48	9100	16800	740	< 7	15	< 7	21
	360-420	9	23	4300	8200	410	< 6	10	< 6	< 6
	420-480	14.4	27	5400	10300	340	< 7	13	< 7	< 7
	480-540	6.9	19	3100	6900	350	< 6	8	< 6	< 6

Note: Precision at 2*s* for all metal results is ± 10%.

Appendix C.5

WMA Hydrogeology Review

C5.1 INTRODUCTION

The purpose of the hydrogeology data review was to confirm that the hydrogeology flow model developed by the University of Waterloo still applies. In particular that model indicated that the WMA was situated in a water discharge area.

C5.2 PROJECT BACKGROUND

The Waste Management Area comprises roughly 4.5 ha to the north of the main AECL Pinawa Plant area and consists of a series of historical subsurface pit and bunker disposal sites, as well as aboveground storage tanks and maintenance facilities.

The subsurface stratigraphy of this area generally comprises 5 m of surficial lacustrine clay, underlain by 2 m of clay loam till, and a basal sandy drift. Within these units, perched ground water is commonly encountered near the clay/till interface (upper aquifer) as well as in basal sand (lower aquifer). Groundwater flow within both of these units was determined to be westerly, towards the Winnipeg River.

Various hydrogeological investigations of this area have been conducted throughout the history of the Whiteshell facility, both as part of site specific investigations and general overall assessments. As part of these previous investigations, five pairs of nested groundwater level monitoring wells were installed with one completed in the upper aquifer (approximately 5 m below grade) and a second well adjacent to it, completed in the lower aquifer (approximately 10 m below grade).

Each of these monitoring wells were equipped with rotating drum paper chart recorders to provide a continuous record of water table fluctuations in these wells over time. The chart records covered a period of one week to three months requiring that they be changed at regular intervals. The used charts were then filed.

For identification purposes those wells completed in the upper aquifer were designated as RWT (Recording Water Table) 1 to 5, while those completed in the lower aquifer were designated simply as Recorder Wells (RW) 1 to 5. The distribution of these wells around the Waste Management area is also shown in Appendix C.3, Figure 1.

C5.3 SCOPE OF WORK

The results of a 1985 Waterloo Research Institute review of the hydrogeology of the WMA indicated that the piezometric head in the lower aquifer was consistently higher than that in the upper aquifer, suggesting that this area could be considered as a discharge area. As a means of confirming that this groundwater discharge condition still existed in the WMA, it was suggested that the chart records be reviewed and converted to digital format to allow for development of a full record of water level changes.

AECL provided Wardrop with their full inventory of paper chart records. Upon initial inspection of these records, Wardrop hydrogeologists made the following observations (Wardrop 2000):

- Chart records for the period 1978 to 1984 were based on one week intervals.
- Chart records for the period 1984 to summer 2000 were generally based on one month intervals.
- Most of the paper charts had been reused between two and four times resulting in numerous intersecting lines on each.
- Recording of beginning and ending dates and water levels for each line was inconsistent.

Due to the magnitude of the data conversion effort and the noted deficiencies in the data, complete conversion of all paper records to digital format was not considered to be appropriate at this time. It was decided to confirm water table fluctuations, conversion and review of the monthly records for the period 1984 to present in one upstream (relative to apparent groundwater flow direction) and one downstream well. Well nests 1 (located in centre of WMA) and 5 (located along west side of WMA) were, therefore, chosen for data conversion.

Conversion of the paper records to digital format consisted of the following tasks:

- Review of paper charts and delineation of individual lines.
- Tracing of appropriate, individual lines using a digitizing tablet to produce an electronic copy.
- Transfer of digitized lines into Microsoft™ Excel spreadsheet format for manipulation and presentation.

C5.4 DELINEATION OF INDIVIDUAL LINES

Each of the chart records from wells RW-1, RWT-1, RW-5 and RWT-5 were numbered in chronological order from the beginning of the record to the most recent chart. Each of the lines present on each of the charts was then defined, colour coded and numbered for future reference. A spreadsheet of the chart numbers and associated lines was then developed and the line's individual beginning and ending dates, beginning and ending water levels, and any significant comments noted on the charts, all as recorded by AECL personnel were included.

In addition to this, each of the dates recorded was converted to a numerical value in accordance with Excel's internal methodology to provide a series of completely numerical values.

C5.5 TRACING OF LINES

Those lines which could be visually followed and which contained date and water table values were then converted to electronic format using a digitizing tablet and associated Didger™ software. Digitizing of the line data comprised taping the chart to the tablet surface, calibrating the tablet to the appropriate scale by identifying three known points and manually inputting their time (numerical value) and water level values. The line on the paper chart was then traced with the appropriate mouse. Subsequent lines were entered in the same way with each page being calibrated individually, to produce a single continuous record of the available data.

Upon completion of the well record, the graphical line was converted to a series of data points representative of the shape of the line and exported as a text file.

C5.6 TRANSFER OF DATA

The Didger software itself does not provide for data manipulation or presentation enhancements of the graphical data so the exported data points were imported into Excel. The numerical date values were then converted back to calendar dates. In that the original water level readings on the individual charts were recorded as being the depth below the top of casing measuring point in centimeters, this value was then automatically converted to a geodetic elevation in meters above mean sea level (m ASL), based on surveyed elevation values for each well as provided by AECL.

Graphical plots of the entire record were then prepared using Excel capabilities.

C5.7 GENERAL OBSERVATIONS

C5.7.1 Monitoring Wells RW-1/RWT-1

Upon the completion of the data review and compilation process, the completed groundwater level record was examined in detail by Wardrop and AECL staff, both in terms of the complete record and on a year-by-year basis.

General review of the hydrographs produced for RW-1 and RWT-1 showed the water levels in the upper and lower aquifers to be at similar elevations with numerous apparent reversals in vertical gradients. In addition to this, substantial gaps in the data were noted.

As part of the quality control/quality assurance process, Wardrop performed a further review of the data gaps and areas of apparent flow reversal. All the chart recorder sheets of concern were checked for chart recorder errors, omissions or data reduction difficulties.

With respect to the hydrograph for RW-1, the only significant data conversion error was a time scale error noted in the 1997 data. The majority of large data gaps were chart recorder errors, resulting in loss of data. These errors included the incorrect installation of chart record paper, wearing out of recorder pens, dead recorder batteries or loss of downhole floats. In some cases, the chart was not changed for extended periods, producing illegible results. Often, the charts were reused extensively, making interpretations very difficult. Incorrect and/or missing starting and finishing water level information also resulted in relatively large amounts of the data being unusable.

The chart records of RWT-1 were more complete, however, some problem areas with the paper charts were noted, as previously noted for RWT-1. Overall, Wardrop has used as much data as possible to complete these records.

With respect to the gradient reversals and apparent interaction of the upper and lower water levels, the following issues were noted:

- RW-1 was "pumped out" many times per year as part of ongoing groundwater sample collection activities, aquifer testing or other general site operational activities. Often, the water levels recovered irregularly after the drawdown events (i.e., different recharge rates, water levels subsequently exceeded or remained lower than initial static levels).
- On several occasions, the water level in monitoring well RWT-1 (upper aquifer) was noted to be at the top of the well casing and the words "flooding" were written on the chart.

- Several 1.0 m rises in water levels were noted in the data set. These were interpreted to be some sort of slug test. The water levels recovered slowly from these slug tests.

As a result of these issues, it is believed that the water levels observed in well nest 1 have been heavily affected by on-site activities; therefore, they are not representative of the natural groundwater level fluctuations or gradients within the general area around the WMA.

C5.7.2 Monitoring Wells RW-5 / RWT-5

Inspection of the RW-5 and RWT-5 data found that, in general, the water level in the lower aquifer was higher than in the upper aquifer, indicative of an upward vertical hydraulic gradient and of groundwater discharge conditions. Some data gaps were again noted on the chart records and were subjected to further examination. Most of these issues were again found to largely be the result of mechanical problems with the chart recorders.

Examination of the charts for this well nest found isolated incidents of apparent gradient reversals. However, the overall record shows two distinct water bearing zones with the lower unit having a higher potentiometric surface than the upper unit.

C5.8 CONCLUSIONS

Overall, the electronic record as developed by Wardrop is representative of the data collected by AECL during the period of monthly monitoring records for well nest number 1 and number 5, and is as complete as possible based on the quality of the data recorded on the paper charts. Based on these records, wells RW-5 and RWT-5 show a distinct upward groundwater gradient, representative of discharge conditions and in concurrence with the findings of the 1985 hydrogeological investigation (Robertson and Cherry).

Inspection of the water level record for wells RW-1 and RWT-1 shows highly fluctuating water levels with a variable vertical gradient. Since the water levels for both the upper and lower aquifer units are frequently at similar elevations in this well nest, it is possible that leakage between the units has occurred due to poor well construction or well failure. It is also possible that historical and on-going site operations, well sampling, and pumping events within the WMA have impacted these water levels.

Examination of the hydrographs produced manually by Robertson and Cherry (1985) for well nests 1 and 5 for the period 1972 to 1983 show that both well nests demonstrated upward hydraulic gradients for more than 95% of this record. Notable indications of the potential degradation of this upward gradient in well nest 1 occurred only in 1983. Considering the limited distance between these well (less than 100 m), the fairly homogeneous nature of the subsurface stratigraphy throughout this area and limited elevation change, it is considered unlikely that natural discharge conditions could have changed such that discharge conditions were maintained in one well and reversed in the second. It is more likely that the fluctuating water levels recorded in well nest 1 are the result of some other external influence such as pumping, dewatering or well failure.

C5.9 REFERENCES

Wardrop Engineering. 2000. *Borehole Instrument Hydrograph Data Review for Whiteshell Laboratories Waste Management Area*. 03703-008, Rev. 0P0.

APPENDIX D

ENVIRONMENTAL SCREENING MATRICES

Table D.1
Example of Initial Environmental Screening Table

	Environmental Component / Project Activity	Air	Radioactivity	Geology	Hydrogeology	Hydrology	Terrestrial Biology	Aquatic Biology	Socio-Economic	Worker Health and Safety	Public Health	Physical / Cult. Heritage	Land & Resource use	Archaeology	Aboriginal Interests	Off-Site Transportation
Phase 1	1. Removing Fixed Surplus Materials	N	N	N	N	N	N	N	N	P	N	N	N	N	N	P
	2. Decontaminating	N	N	N	N	N	N	N	N	P	N	N	N	N	N	N
	3. Surveying & Assessment of Hazards	N	N	N	N	N	N	N	N	P	N	N	N	N	N	N
	4. Additional Decontaminating	N	N	N	N	N	N	N	N	P	N	N	N	N	N	N
	5. Fixing in Place	N	N	N	N	N	N	N	N	P	N	N	N	N	N	N
	6. Disconnecting Services	P	P	P	P	P	P	P	P	P	P	N	N	N	P	N
	7. Sealing Facilities	N	N	N	N	N	N	N	N	P	N	N	N	N	N	N
	8. Monitoring & Surveillance	P	P	N	N	N	N	N	N	P	N	N	N	N	N	N
Phase 2	9. Monitoring	P	P	N	N	N	N	N	N	P	N	N	N	N	N	N
	10. Maintaining	P	P	P	P	P	N	P	P	P	P	N	N	N	P	N
Phase 3	11. Resurveying	N	N	N	N	N	N	N	N	P	N	N	N	N	N	N
	12. Decontaminating Building Services	P	P	P	P	P	P	P	P	P	P	N	N	N	P	I
	13. Decontaminating Building Structural Materials	P	P	P	P	P	P	P	P	P	P	N	N	N	P	I
	14. Demolishing	P	P	N	N	N	N	N	N	N	N	N	N	N	N	I
	15. Remediating Soil	P	P	P	P	P	P	P	P	P	P	N	N	P	P	N
	16. Unconditional Release of Building Site	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N

Note:
I = Identified Environmental Effect P = Possible Environmental Effect N = No Environmental Effect

Assessment of component eliminated

Assessment of activity eliminated

Evaluated as having no effect in subsequent analysis

Evaluated to have an effect in subsequent analysis

Table D.2

Initial Environmental Screening Shielded Facilities

	Project Activity \ Environmental Component	Air	Radioactivity	Geology	Hydrogeology	Hydrology	Terrestrial Biology	Aquatic Biology	Socio-Economic	Worker Health and Safety	Public Health	Physical/Cult. Heritage	Land & Resource use	Archaeology	Aboriginal Interests	Off-Site Transportation
Phase 1	1. Removing Fixed Surplus Materials	N	N	N	N	N	N	N	N	P	N	N	N	N	N	P
	2. Decontaminating	N	N	N	N	N	N	N	N	P	N	N	N	N	N	N
	3. Surveying & Assessment of Hazards	N	N	N	N	N	N	N	N	P	N	N	N	N	N	N
	4. Additional Decontaminating	N	N	N	N	N	N	N	N	P	N	N	N	N	N	N
	5. Fixing in Place	N	N	N	N	N	N	N	N	P	N	N	N	N	N	N
	6. Disconnecting Services	P	P	P	P	P	P	P	P	P	P	N	N	N	P	N
	7. Sealing Facilities	N	N	N	N	N	N	N	N	P	N	N	N	N	N	N
	8. Monitoring & Surveillance	P	P	N	N	N	N	N	N	P	N	N	N	N	N	N
Phase 2	9. Monitoring	P	P	N	N	N	N	N	N	P	N	N	N	N	N	N
	10. Maintaining	P	P	P	P	P	N	P	P	P	P	N	N	N	P	N
Phase 3	11. Resurveying	N	N	N	N	N	N	N	N	P	N	N	N	N	N	N
	12. Decontaminating Building Services	P	P	P	P	P	P	P	P	P	P	N	N	N	P	I
	13. Decontaminating Building Structural Materials	P	P	P	P	P	P	P	P	P	P	N	N	N	P	I
	14. Demolishing	P	P	N	N	N	N	N	N	N	N	N	N	N	N	I
	15. Remediating Soil	P	P	P	P	P	P	P	P	P	P	N	N	P	P	N
	16. Unconditional Release of Building Site	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N

Note:

I = Identified Environmental Effect P = Possible Environmental Effect N = No Environmental Effect

- Assessment of component eliminated
- Assessment of activity eliminated
- Evaluated as having no effect in subsequent analysis
- Evaluated to have an effect in subsequent analysis

Table D.3

Initial Environmental Screening Van de Graaff Accelerator

	Environmental Component / Project Activity	Air	Radioactivity	Geology	Hydrogeology	Hydrology	Terrestrial Biology	Aquatic Biology	Socio-Economic	Worker Health and Safety	Public Health	Physical / Cult. Heritage	Land & Resource Use	Archaeology	Aboriginal Interests	Off-site Transportation
Phase 1	1. Disassembling Equipment	**N**	**P**	**N**	**N**	**N**	**N**	**N**	**N**	**P**	**N**	**N**	**N**	**N**	**N**	**N**
	2. Releasing to Off-site	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**P**
	3. Releasing to Recycle or Waste Management Area	**N**	**P**	**N**	**N**	**N**	**N**	**N**	**N**	**P**	**N**	**N**	**N**	**N**	**N**	**N**
	4. Decontaminating to Building Level	**N**	**P**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**

I = Identified Environmental Effect P = Possible Environmental Effect N = No Environmental Effect

- (blue) Assessment of component eliminated
- (yellow) Assessment of activity eliminated
- (green) Evaluated as having no effect in subsequent analysis
- (red) Evaluated to have an effect in subsequent analysis

Table D.4
Initial Environmental Screening Neutron Generator

	Environmental Component / Project Activity	Air	Radioactivity	Geology	Hydrogeology	Hydrology	Terrestrial Biology	Aquatic Biology	Socio-Economic	Worker Health and Safety	Public Health	Physical/Cult. Heritage	Land & Resource Use	Archaeology	Aboriginal Interests	Off-site Transportation
Phase 1	1. Disassembling Equipment	N	P	N	N	N	N	N	N	P	N	N	N	N	N	N
	2. Releasing to Off-site	N	N	N	N	N	N	N	N	N	N	N	N	N	N	P
	3. Releasing to Recycle or Waste Management Area	N	P	N	N	N	N	N	N	P	N	N	N	N	N	N
	4. Decontaminating to Building Level	N	P	N	N	N	N	N	N	N	N	N	N	N	N	N

I = Identified Environmental Effect P = Possible Environmental Effect N = No Environmental Effect

Assessment of component eliminated

Assessment of activity eliminated

Evaluated as having no effect in subsequent analysis

Evaluated to have an effect in subsequent analysis

Table D.5

Initial Environmental Screening - Concrete Canister Storage Facility

	Project Activity \ Environmental Component	Air	Radioactivity	Geology	Hydrogeology	Hydrology	Terrestrial Biology	Aquatic Biology	Socio-Economic	Worker Health and Safety	Public Health	Physical/Cult. Heritage	Land & Resource Use	Archaeology	Aboriginal Interests	Off-Site Transportation
Phase 1	1. Maintaining Operations	P	P	N	N	N	N	N	N	P	N	N	N	N	N	N
Phase 2	2. Assessing Facilities Integrity	N	N	N	N	N	N	N	N	P	N	N	N	N	N	N
	3. Placing in Passive Operation State	P	N	N	N	N	N	N	N	P	N	N	N	N	N	N
Phase 3	4. Monitoring & Surveillance	N	N	N	N	N	N	N	N	P	N	N	N	N	N	N
	6. Retrieving / Recovering Fuels	P	P	N	N	N	N	N	N	P	N	N	N	N	N	N
	7. Transporting HLW Off-Site	P	N	N	N	N	N	N	N	P	N	N	N	N	N	I
	8. Assessing / Surveying, Characterizing	N	N	N	N	N	N	N	N	N	I	N	N	N	N	N
	9. Decontaminating	P	P	N	N	N	N	N	N	P	N	N	N	N	N	N
	10. Demolishing	P	N	N	N	N	N	N	N	P	N	N	N	N	N	N
	11. Disposing (WMA and Recycling)	P	P	N	N	N	N	N	N	N	N	N	N	N	N	P
	12. Rehabilitating	P	N	P	P	P	P	P	P	P	N	N	N	N	P	N

I = Identified Environmental Effect P = Possible Environmental Effect N = No Environmental Effect

Assessment of component eliminated

Assessment of activity eliminated

Evaluated as having no effect in subsequent analysis

Evaluated to have an effect in subsequent analysis

Table D.6

Initial Environmental Screening – Waste Management Area

	Environmental Component / Project Activity	Air	Radioactivity	Geology	Hydrogeology	Hydrology	Terrestrial Biology	Aquatic Biology	Socio-Economic	Worker Health and Safety	Public Health	Physical/Cult. Heritage	Land & Resource Use	Archaeology	Aboriginal Interests	Off-Site Transportation
Phase 1	1. Maintaining Current Operation	I	I	I	I	I	I	I	I	P	P	N	P	N	P	N
	2. Accepting Decontaminated Waste	P	P	P	P	P	P	P	P	P	P	NP	NP	P	P	N
	3. Surveying / Assessing, Developing Long Term Maintenance Plan	N	N	P	P	N	N	N	N	P	N	N	N	N	N	N
Phase 2	4. A. Defining Separate Operating Area (fencing etc.)	N	N	P	N	N	P	N	N	N	N	N	N	N	N	N
	4. B. Operating Existing Facilities	P	P	I	I	I	I	I\	P	P	P	N	P	N	P	N
	5. Recovering & Processing Waste	I	I	I	I	I	I	I	I	I	P	N	P	N	P	N
	6. Constructing New Storage Space	I	I	I	I	P	P	P	P	P	N	N	P	P	P	P
	7. Utilizing New Facility	P	P	I	I	I	I	I\	P	P	P	N	P	N	P	N
	8. Placing Non-storage Facilities in Passive Operating State	P	P	P	P	P	P	P	P	P	N	N	P	N	P	N
Phase 3	9. Operating Reduced Area	I	I	I	I	I	I	I	I	P	P	N	P	N	P	N
	10. Monitoring & Surveillance of Passive Area	N	N	N	N	N	N	N	N	P	N	N	N	N	N	N
	11. Identifying Waste Requiring Removal	P	P	P	P	P	P	P	P	P	N	N	N	N	P	N
	12. Removing Waste from Bunkers and Buildings	I	I	I	I	I	I	I	I	I	P	N	P	N	P	N
	13. Processing and Packaging	P	P	N	N	N	N	N	N	P	N	N	N	N	N	N
	14. Off-site Transportation	P	N	N	N	N	N	N	N	N	P	N	N	N	N	I
	15. Identifying In-situ Waste Management Requirements	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
	16. Decontaminating	P	P	P	P	P	P	P	P	P	N	N	P	P	P	N
	17. Constructing New Storage Area	P	P	P	P	P	P	P	P	P	N	N	P	P	P	P
	18. Demolishing / Consolidating	P	N	N	N	N	P	N	N	P	N	N	N	N	N	N
	19. Rehabilitating / Restoring	P	P	P	P+	P+	P+	P+	P	P	N	P+	P	P	P	N

I = Identified Environmental Effect P = Possible Environmental Effect N = No Environmental Effect

(blue)	Assessment of component eliminated
(yellow)	Assessment of activity eliminated
(green)	Evaluated as having no effect in subsequent analysis
(red)	Evaluated to have an effect in subsequent analysis

Table D.7
Initial Environmental Screening – Building 300

	Environmental Component / Project Activity	Air	Radioactivity	Geology	Hydrogeology	Hydrology	Terrestrial Biology	Aquatic Biology	Socio-Economic	Worker Health and Safety	Public Health	Physical/Cult. Heritage	Land & Resource Use	Archaeology	Aboriginal Interests	Off-Site Transportation
Phase 1	1. Assessing and Surveying Hazards	N	P	N	N	N	N	N	N	P	N	N	N	N	N	N
	2. Decontaminating	N	P	N	N	N	N	N	N	P	N	N	N	N	N	N
	3. Surveying to Commercialize or Retain	N	P	N	N	N	N	N	N	P	N	N	N	N	N	N
Phase 2	4. Monitoring & Surveillance	N	P	N	N	N	N	N	N	P	N	N	N	N	N	N
Phase 3	5. Assessing	N	P	N	N	N	N	N	N	P	N	N	N	N	N	N
	6. Decontaminating / Remediating / Removing to Storage	P	P	N	N	N	N	N	N	P	N	N	N	N	N	N
	7. Demolishing / Transferring Ownership	P	N	P	N	N	P	N	N	N	N	N	N	N	N	N
	8. Disposing / Recycling	N	N	N	N	N	N	N	N	N	N	N	N	N	N	P
	9. Rehabilitating	N	N	P	N	N	P	N	P	N	N	N	P	N	P	N

I = Identified Environmental Effect P = Possible Environmental Effect N = No Environmental Effect

Assessment of component eliminated

Assessment of activity eliminated

Evaluated as having no effect in subsequent analysis

Evaluated to have an effect in subsequent analysis

Table D.8
Initial Environmental Screening – Decontamination Centre

	Project Activity \ Environmental Component	Air	Radioactivity	Geology	Hydrogeology	Hydrology	Terrestrial Biology	Aquatic Biology	Socio-Economic	Worker Health and Safety	Public Health	Physical/Cult. Heritage	Land & Resource Use	Archaeology	Aboriginal Interests	Off-Site Transportation
Phase 1	1. Assessing and Surveying Hazards	N	P	N	N	N	N	N	N	P	N	N	N	N	N	N
	2. Decontaminating	N	P	N	N	N	N	N	N	P	N	N	N	N	N	N
	3. Surveying to Commercialize or Retain	N	P	N	N	N	N	N	N	P	N	N	N	N	N	N
Phase 2	4. Monitoring & Surveillance	N	P	N	N	N	N	N	N	P	N	N	N	N	N	N
Phase 3	5. Assessing	N	P	N	N	N	N	N	N	P	N	N	N	N	N	N
	6. Decontaminating / Remediating / Removing to Storage	P	P	N	N	N	N	N	N	P	N	N	N	N	N	N
	7. Demolishing / Transferring Ownership	P	N	P	N	N	P	N	N	N	N	N	N	N	N	N
	8. Disposing / Recycling	N	N	N	N	N	N	N	N	N	N	N	N	N	N	P
	9. Rehabilitating	N	N	P	N	N	P	N	P	N	N	N	P	N	P	N

I = Identified Environmental Effect P = Possible Environmental Effect N = No Environmental Effect

- (Blue) Assessment of component eliminated
- (Yellow) Assessment of activity eliminated
- (Green) Evaluated as having no effect in subsequent analysis
- (Red) Evaluated to have an effect in subsequent analysis

Table D.9
Initial Environmental Screening – Building 402

	Environmental Component / Project Activity	Air	Radioactivity	Geology	Hydrogeology	Hydrology	Terrestrial Biology	Aquatic Biology	Socio-Economic	Worker Health and Safety	Public Health	Physical/Cult. Heritage	Land & Resource Use	Archaeology	Aboriginal Interests	Off-Site Transportation
Phase 1	1. Assessing and Surveying Hazards	N	P	N	N	N	N	N	N	P	N	N	N	N	N	N
	2. Decontaminating	N	P	N	N	N	N	N	N	P	N	N	N	N	N	N
	3. Surveying to Commercialize or Retain	N	P	N	N	N	N	N	N	P	N	N	N	N	N	N
Phase 2	4. Monitoring & Surveillance	N	P	N	N	N	N	N	N	P	N	N	N	N	N	N
Phase 3	5. Assessing	N	P	N	N	N	N	N	N	P	N	N	N	N	N	N
	6. Decontaminating / Remediating / Removing to Storage	P	P	N	N	N	N	N	N	P	N	N	N	N	N	N
	7. Demolishing / Transferring Ownership	P	N	P	N	N	P	N	N	N	N	N	N	N	N	N
	8. Disposing / Recycling	N	N	N	N	N	N	N	N	N	N	N	N	N	N	P
	9. Rehabilitating	N	N	P	N	N	P	N	P	N	N	N	P	N	P	N

I = Identified Environmental Effect P = Possible Environmental Effect N = No Environmental Effect

- [blue] Assessment of component eliminated
- [yellow] Assessment of activity eliminated
- [green] Evaluated as having no effect in subsequent analysis
- [red] Evaluated to have an effect in subsequent analysis

Table D.10
Initial Environmental Screening – Non-Nuclear Buildings

	Environmental Component / Project Activity	Air	Radioactivity	Geology	Hydrogeology	Hydrology	Terrestrial Biology	Aquatic Biology	Socio-Economic	Worker Health and Safety	Public Health	Physical/Cult. Heritage	Land & Resource Use	Archaeology	Aboriginal Interests	Off-Site Transportation
Phase 1	1. Assessing and Surveying Hazards	N	P	N	N	N	N	N	N	P	N	N	N	N	N	N
	2. Decontaminating	N	P	N	N	N	N	N	N	P	N	N	N	N	N	N
	3. Surveying to Commercialize or Retain	N	P	N	N	N	N	N	N	P	N	N	N	N	N	N
Phase 2	4. Monitoring & Surveillance	N	P	N	N	N	N	N	N	P	N	N	N	N	N	N
Phase 3	5. Assessing	N	P	N	N	N	N	N	N	P	N	N	N	N	N	N
	6. Decontaminating / Remediating / Removing to Storage	P	P	N	N	N	N	N	N	P	N	N	N	N	N	N
	7. Demolishing / Transferring Ownership	P	N	P	N	N	P	N	N	N	N	N	N	N	N	N
	8. Disposing / Recycling	N	N	N	N	N	N	N	N	N	N	N	N	N	N	P
	9. Rehabilitating	N	N	P	N	N	P	N	P	N	N	N	P	N	P	N

I = Identified Environmental Effect P = Possible Environmental Effect N = No Environmental Effect

Assessment of component eliminated

Assessment of activity eliminated

Evaluated as having no effect in subsequent analysis

Evaluated to have an effect in subsequent analysis

Table D.11

Initial Environmental Screening – Inactive Landfill

	Environmental Component / Project Activity	Air	Radioactivity	Geology	Hydrogeology	Hydrology	Terrestrial Biology	Aquatic Biology	Socio-Economic	Worker Health and Safety	Public Health	Physical/Cult. Heritage	Land & Resource Use	Archaeology	Aboriginal Interests	Off-site Transportation
Phase 1	1. Maintaining Operations	N	N	N	P	P	N	P	P	N	N	N	P	N	P	N
Phase 2	2. Surveying and Assessing / Developing Remediation Plan	P	P	P	P	N	N	N	N	P	N	N	N	N	N	N
Phase 3	3. Stabilizing and Closure	P	P	P	P	P	P	P	P	P	N	N	P	N	N	P
	4. Monitoring and Surveillance	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N

I = Identified Environmental Effect P = Possible Environmental Effect N = No Environmental Effect

- (blue) Assessment of component eliminated
- (yellow) Assessment of activity eliminated
- (green) Evaluated as having no effect in subsequent analysis
- (red) Evaluated to have an effect tin subsequent analysis

Table D.12

Initial Environmental Screening – Sewage Lagoon

	Environmental Component / Project Activity	Air	Radioactivity	Geology	Hydrogeology	Hydrology	Terrestrial Biology	Aquatic Biology	Socio-Economic	Worker Health and Safety	Public Health	Physical/Cult. Heritage	Land & Resource Use	Archaeology	Aboriginal Interests	Off-Site Transportation
Phase 1	1. Maintaining Operations	N	N	N	P	P	P+	P	P	N	N	N	P	N	P	N
Phase 2	2. Surveying and Assessing / Developing Remediation Plan	N	N	P	P	N	N	N	N	P	N	N	N	N	N	N
Phase 3	3. Stabilizing to Closure	P	P	P	P	P	P	P	P	P	P	N	P	P	P	N
	4. Monitoring & Surveillance	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N

I = Identified Environmental Effect P = Possible Environmental Effect N = No Environmental Effect

Assessment of component eliminated

Assessment of activity eliminated

Evaluated as having no effect in subsequent analysis

Evaluated to have an effect in subsequent analysis

Table D.13
Initial Environmental Screening – Buried Services

	Environmental Component / Project Activity	Air	Radioactivity	Geology	Hydrogeology	Hydrology	Terrestrial Biology	Aquatic Biology	Socio-Economic	Worker Health and Safety	Public Health	Physical/Cult. Heritage	Land & Resource Use	Archaeology	Aboriginal Interests	Off-Site Transportation
Phase 1	1. Maintaining Operations	N	P	N	N	P	N	P	P	P	P	N	P	N	P	N
	2. Shutting Down (includes Flushing and Decontaminating)	N	P	N	N	P	N	P	P	P	P	N	P	N	P	N
	3. Surveying & Assessing Hazards	N	N	P	P	N	N	N	N	P	N	N	N	N	N	N
Phase 2	4. Recovering / Remediating	P	P	I	P	N	P	N	N	P	N	N	N	N	N	N
	5. Monitoring and Surveillance	N	N	N	N	N	N	N	N	P	N	N	N	N	N	N
Phase 3	6. Surveying, Assessing and Defining	N	N	P	P	N	N	N	N	P	N	N	N	N	N	N
	7. Separating, Removing to Storage	P	P	I	P	P	P	P	P	P	P	N	P	N	P	N
	8. Further Remediation and Rehabilitation	P	N	P	N	N	P	N	N	P	N	N	N	N	N	N

I = Identified Environmental Effect P = Possible Environmental Effect N = No Environmental Effect

Assessment of component eliminated

Assessment of activity eliminated

Evaluated as having no effect in subsequent analysis

Evaluated to have an effect in subsequent analysis

Table D.14

Initial Environmental Screening – Affected Lands

	Environmental Component / Project Activity	Air	Radioactivity	Geology	Hydrogeology	Hydrology	Terrestrial Biology	Aquatic Biology	Socio-Economic	Worker Health and Safety	Public Health	Physical / Cult. Heritage	Land & Resource Use	Archaeology	Aboriginal Interests	Off-site Transportation
Phase 1	1. Monitoring and Surveillance	N	N	N	N	N	N	N	N	P	N	N	N	N	N	N
	2. Surveying and Assessing / Developing Re	N	N	P	P	N	P	N	N	P	P	N	P	N	N	N
Phase 2	3. Remediating; Processing, Treating, Removing to On-Site Storage	P	P	I	P	P	P	P	P	P	P	N	P	P	P	N
	4. Monitoring and Surveillance on Residual Contaminated Land	N	N	N	N	N	N	N	N	P	N	N	N	N	N	N
Phase 3	5. Surveying & Assessing	N	N	P	P	N	P	N	N	P	P	N	P	N	N	N
	6. Remediating; Processing, Treating, Removing to On-Site Storage	P	P	I	P	P	P	P	P	P	P	N	P	P	P	N
	7. Rehabilitating and Releasing	P	N	P	N	N	P	P	N	P	N	N	P	N	N	N

I = Identified Environmental Effect P = Possible Environmental Effect N = No Environmental Effect

Assessment of component eliminated

Assessment of activity eliminated

Evaluated as having no effect in subsequent analysis

Evaluated to have an effect in subsequent analysis

Table D.15
Initial Environmental Screening – Off-Site Contaminated Lands (North Ditch)

	Environmental Component / Project Activity	Air	Radioactivity	Geology	Hydrogeology	Hydrology	Terrestrial Biology	Aquatic Biology	Socio-Economic	Worker Health and Safety	Public Health	Physical/Cult. Heritage	Land & Resource Use	Archaeology	Aboriginal Interests	Off-Site Transportation
Phase 1	1. Surveying	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Phase 2	2. Remediating	P	P	P	P	P	P	P	P	P	P	N	P	P	P	P
	3. Rehabilitating and Releasing	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N

I = Identified Environmental Effect P = Possible Environmental Effect N = No Environmental Effect

Assessment of component eliminated

Assessment of activity eliminated

Evaluated as having no effect in subsequent analysis

Evaluated to have an effect in subsequent analysis

Table D.16

Initial Environmental Screening – Off-Site Contamination: River Sediments Removal Option

	Environmental Component / Project Activity	Air	Radioactivity	Geology	Hydrogeology	Hydrology	Terrestrial Biology	Aquatic Biology	Socio-Economic	Worker Health and Safety	Public Health	Physical / Cult. Heritage	Land & Resource Use	Archaeology	Aboriginal Interests	Off-Site Transportation
Phase 1	1. Surveying and Assessing, Developing Remediation Plan	**N**	**N**	**P**	**P**	**I**	**N**	**I**	**I**	**P**	**P**	**N**	**P**	**P**	**I**	**N**
Phase 2 and 3	2. Remediating, Processing, Treating, Removing	**N**	**P**	**P**	**P**	**I**	**N**	**I**	**I**	**P**	**P**	**P**	**P**	**P**	**I**	**P**
	3. Monitoring & Surveillance	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**N**	**P**	**N**	**N**	**N**	**N**	**N**	**N**
	4. Surveying & Assessing	**N**	**N**	**P**	**P**	**I**	**N**	**I**	**I**	**P**	**P**	**N**	**P**	**P**	**I**	**N**
	5. Remediating Processing, Treating, Removing and Transferring	**P**	**N**	**P**	**P**	**P**	**N**	**P**	**P**	**P**	**P**	**P**	**P**	**N**	**P**	**P**
	6. Rehabilitating and Releasing	**P**	**N**	**P**	**N**	**P**	**P**	**P**	**P**	**P**	**P**	**P**	**P**	**N**	**P**	**N**

I = Identified Environmental Effect P = Possible Environmental Effect N = No Environmental Effect

- Assessment of component eliminated
- Assessment of activity eliminated
- Evaluated as having no effect in subsequent analysis
- Evaluated to have an effect in subsequent analysis

APPENDIX E

PUBLIC CONSULTATION

Appendix E.1

AECL's On-Going Communications Program

AECL Whiteshell Laboratories Decommissioning
Comprehensive Study Report

APPENDIX E.1

AECL COMMUNICATIONS SUMMARY

DATE/ LOCATION	FORMAT	GROUPS BRIEFED	PURPOSE/ OBJECTIVE	ISSUES RAISED	FOLLOW-UP
Feb 16, 1999	Briefing	L.G.D of Pinawa	Presentation on WL decommissioning plans, Letter of Intent to AECB, timelines, constraints and overall decommissioning objectives.	• if AECL is ceasing its operations than it must move its waste. • concerns expressed that decommissioning is being pushed off to the future for our children to pay • business opportunities for WL need to happen soon because the "creditability of the area will soon be lost" • concerns expressed over the overall decommissioning direction	All questions addressed at meeting. AECL will provide future updates on project work.
Feb 16, 1999	Briefing	Manitoba Dept. of the Environment	Presentation on WL decommissioning plans, Letter of Intent to AECB, timelines, constraints and overall decommissioning objectives.	• does AECL recognize public concerns regarding nuclear waste remaining at site? • will AECL's decommissioning plan trigger a comprehensive environmental study? • does ALARA take into account the best available technology?	AECL will continue to provide updates on project work.
Feb 17, 1999	Briefing	Darren Praznik, MLA for Lac du Bonnet Members of the Pinawa, Beausejour and Lac du Bonnet Municipalities	Presentation on WL decommissioning plans.	• MB government opposes WL Decommissioning plan • if you move jobs and staff to Eastern Canada you cannot leave behind your waste • 30 people left behind during Phase III to monitor site and the waste is not acceptable to the MB government and may not be acceptable under provincial legislation.	AECL will continue to answer questions and provide updates on project work.
Feb 26, 1999	Briefing	David Iftody, MP	Presentation on WL decommissioning plans.	• concerns about AECL doing its own decommissioning work. • concerns for employment at site	AECL will continue to inform Mr. Iftody on project work.
Mar 9, 1999	Briefing	Winnipeg Free Press	Presentation on WL decommissioning plans. Presentation on AECL-EDAW relationship.	• what kind and how much nuclear waste is at WL site? • if AECB is the judge of AECL who is the judge of the AECB? • to what extent can you isolate buildings for future commercialization?	The Free Press wrote an op-ed article that said AECL's decommissioning approach was reasonable.

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June 22, 1999	Briefing	RM of Lac du Bonnet	To update the RM on the progress of WL decommissioning planning and to explain constraints facing AECL in the decommissioning of WL.	• loss of RM residents as they are being transferred to Ontario concerns RM • how many employees left at WL in the next 5 years? • when will badly contaminated buildings at WL be destroyed and moved away?	AECL will continue to inform and update the RM on the progress of WL decommissioning planning.
June 23, 1999	Briefing	RM of Whitemouth	To update the RM on the progress of WL decommissioning planning and to explain constraints facing AECL in the decommissioning of WL.	• will URL keep operating, will it be used to store nuclear waste? • will contractors be trained? • are Chalk River Hot Cells being refurbished? • is CNPL willing to come back?	AECL will continue to inform the RM on decommissioning project work.
June 24, 1999	Briefing	Town of Lac du Bonnet	To update the Town on the progress of WL decommissioning planning and to explain constraints facing AECL in the decommissioning of WL.	• why doesn't AECL continue to use the buildings? • how will site be secured, will people be trained? • If you move your jobs to Ontario you should take your waste with you	AECL will continue to inform the Town Council on decommissioning project work.
June 24, 1999	Briefing	Town of Beausejour	To update the Town on the progress of WL decommissioning planning and to explain constraints facing AECL in the decommissioning of WL.	• is AECB happy to leave waste at WL if stored safely? • what is the cost of decommissioning? • will site wastes be monitored? • is AECL asking for approval of this plan?	AECL will continue to inform the Town Council on decommissioning project work.
Nov 23, 1999	Briefing	MaryAnn Mihychuk, Manitoba Minister of Industry, Trade and Mines	Briefing on decommissioning, including information on how decommissioning would affect the availability of surplus lands and buildings on the south side of the WL site.	• how much decommissioning work can be performed by local residents to survey unaffected lands for release? • what is the total capital building costs that the federal government has invested in WL/Pinawa? • how long will it take to complete an EA for lands and buildings on the south side of the WL site?	Nothing specific requested by Manitoba Government. Routine information exchange will continue as necessary.

DATE OF CONTACT: 1999 February 16

NATURE OF CONTACT:

Briefing to the Manitoba Department of the Environment on Whiteshell Laboratories Decommissioning

Meeting Attendees

Denis Brown, Manitoba Department of Environment , Steinbach office
Larry Strachan, Manitoba Department of Environment, Winnipeg
David Wotton, Manitoba Assistant Deputy Minister of Environment
David McNaughton, Canadian Environmental Assessment Agency, Winnipeg
Doug Champ, Director of Decommissioning AECL
Bob Helbrecht, Project Manager Whiteshell Laboratories Decommissioning
Larry Shewchuk, Manager Corporate Media Relations AECL

PURPOSE / OBJECTIVE:

Bob Helbrecht gave a presentation on Whiteshell Laboratories Decommissioning plan, letter of intent to AECB, scope of project, constraints, explanation of decommissioning phases and timelines.

ISSUES / CONCERNS

The following questions by the Manitoba Department of Environment:

- What is ALARA? Does ALARA take into account the best available technology?
- What is the timing for completion on the planning documents and environmental assessment papers to the AECB?
- Will the environmental assessment document cover all three phases of Whiteshell's decommissioning plan?
- WILL AECB approval process need to be staged in the same manner as Whiteshell Laboratories Decommissioning Plan?
- Will AECL's decommissioning plan trigger a comprehensive environmental study?
- Who will run the public consultation process AECB or AECL?
- Have you hired external consultants to help you on the environmental assessment work?
- WILL AECB's response to the letter of intent become public?
- Do you recognize public concerns regarding nuclear waste remaining on the Whiteshell Laboratories site?
- How do you work to ensure transparency in your public consultation process?
- Will you be looking at global decommissioning practices to undertake Whiteshell Laboratories decommissioning work?

DECISION REACHED: N/A

FOLLOW-UP REQUIRED:

AECL will continue to provide updates on project work.

SUBMITTED BY:

Larry Shewchuk

DATE OF CONTACT: February 16th 1999.

NATURE OF CONTACT:

Briefing to Pinawa LGD on Whiteshell Laboratories Decommissioning

Meeting Attendees:

Pinawa Town Council: Mayor, Len Simpson,
Councillor/Deputy Mayor, Lorne Kiely
Councillors, Blair Skinner, Allan Cassidy
Doug Champ, AECL Director of Decommissioning
Bob Helbrecht, Project Manager Whiteshell Laboratories Decommissioning
Larry Shewchuk, Manager Corporate Media Relations AECL

PURPOSE / OBJECTIVES:

- Bob Helbrecht gave a presentation on Whiteshell Laboratories decommissioning plans, Letter of Intent to AECB, timelines, constraints, and overall decommissioning objectives.

ISSUE / CONCERN:

- Mayor Simpson said if AECL is ceasing operations then it must move its waste. AECL's plan is not acceptable. It should consider a DRG facility.
- Mayor Simpson expressed concern that historic records could be lost once employees go and there will not be the ability to track where waste is on site,
- Councillor Cassidy does not wish to have a large site of nuclear waste with a fence around it with no one left to look after it.
- Mayor Simpson expressed concern that AECL is not doing enough in terms of Whiteshell Laboratories decommissioning compared to what OECD countries do in their decommissioning work.
- Mayor Simpson expressed concern AECL is trying to do decommissioning work only to fit within its available funding. Doug Champ replied that AECL is doing its decommissioning under ALARA principles.
- Mayor Simpson cites Tunney's Pasture near Ottawa as an example of how decommissioning can be done to green fields and would like to see Whiteshell Laboratories decommissioned to a green field situation.
- Mayor Simpson expressed the point that the LGD wants all serviced land available to the LGD to attract new business. It is the only available serviced land AECL has.
- Mayor Simpson expressed concern having waste near the area will not made the serviced land attractive to outside investors.
- Mayor Simpson expressed concern about rumors he has heard that the inground bunkers fill with water every time it rains.
- Mayor Simpson expressed concern about the lack of jobs for professionals living in Pinawa.
- Councillor Cassidy says he wouldn't want to see a situation in which volunteer fire fighters of Pinawa are being asked to put out a blaze at an active building on the Whiteshell Laboratories site without proper training in dealing with radioactive materials.
- Mayor Simpson expressed concern that the town has no trust left with AECL in his view.
- Mayor Simpson expressed concern that decommissioning is being pushed off to the future for our children to pay. He recognizes that AECL cannot afford to pay the full cost of decommissioning and that this is something that the federal government must provide.
- Mayor Simpson expressed concern about young people leaving town. Expressed additional concern that the EDAW will walk away from its mandate at some point in 1999.
- Mayor Simpson expressed concern that new business opportunities for Whiteshell Laboratories needs to happen soon because the "creditably of the area will soon be lost."
- Councillor Kiely expressed concern over the overall decommissioning direction. He doesn't like the answers the town is getting.
- Councillor Kiely said he didn't have a problem with AECL's preliminary steps however he did have a problem with waste being left behind.

Questions:

Blair Skinner, "When will the Public Consultation process begin and how will it work?"

Mayor Simpson, "Why not build an engineered facility to store all the waste rather than leave materials in trenches?"

Mayor Simpson, "Is the Winnipeg River characterized as part of the decommissioning work?"

DATE OF CONTACT: Wednesday February 17, 1999

NATURE OF CONTACT:

Whiteshell Laboratories Decommissioning
Briefing for Darren Praznik, MLA Lac Du Bonnet,
Members of the Pinawa, Beausejour and Lac Du Bonnet Regional Municipalities

Meeting Attendees

Darren Praznik, MLA Lac Du Bonnet (Manitoba Minister of Highways)
Members of Beausejour Town Council
Members of Lac Du Bonnet Regional Municipality and Town Council
Members of the Economic Authority of Whiteshell

Doug Champ, Director of Decommissioning, AECL
Bob Helbrecht, Program Manager Whiteshell Laboratories Decommissioning
Larry Shewchuk, Manager Corporate Media Relations, AECL

Media - The Paper, The Beausejour Brokenhead Review, The Lac Du Bonnet Leader

In total about 20 people attended this session at the Beausejour Town Council Office.

PURPOSE / OBJECTIVE:

Bob Helbrecht gave a presentation outlining stages, timelines, constraints and site overview and overall objectives concerning Whiteshell Laboratories Decommissioning.

ISSUE / CONCERN:

Following Mr. Helbrecht's presentation Mr. Praznik gave a response on behalf of the Manitoba Government. Mr. Praznik said he opposes Whiteshell Laboratories Decommissioning plan. He said that if Whiteshell Laboratories is to move jobs and staff to eastern Canada it should not leave its nuclear waste behind in Manitoba. Mr. Praznik said that the Manitoba government would like to see the waste moved out of Manitoba as soon as possible. Mr. Praznik said "This plan is not acceptable to Manitoba. If you leave you must take the waste with you. We expect green fields. We serve notice today that the Whiteshell Laboratories Decommissioning Plan will be opposed. We believe Chalk River Laboratories is an excellent location for the Whiteshell Laboratories waste to be shipped to."

Mr. Praznik also said having only 30 people left during the third phase of decommissioning to monitor the site and the waste left behind is not acceptable to the Manitoba government and may not be acceptable under provincial legislation. Mr. Praznik added the Manitoba government accepted the risk of nuclear waste for economic benefits but now that the benefits are leaving the province and the waste is staying behind, the Manitoba government does not see this to be an acceptable situation.

Both Mr. Helbrecht and Doug Champ explained to Mr. Praznik the constraints that AECL faces in terms of lack of space at available alternative waste storage locations in Canada for Whiteshell Laboratories waste and that Canada does not have a nuclear waste disposal facility established.

Mr. Praznik replied "That is your problem. Manitoba gets zero benefits so its AECL's problem to move the waste out of the province." Mr. Praznik added he saw AECL's plan as being only partial decommissioning and he wants all the waste taken out.

Mr. Praznik then asked other reeves and town council members to express their views on Whiteshell Laboratories Decommissioning Plan. Pinawa Mayor Len Simpson, Lac du Bonnet Mayor Glen Hirst, Lac du Bonnet Reeve Dorothy Boznianin, all echoed Mr. Praznik's response that they did not find AECL plan acceptable.

Questions:

Peter Siemens, EDAW
Is Manitoba Legislation subservient to Federal government regulations concerning the storage of nuclear waste in a province?

Member of the Beausejour Town Council (unidentified)
Do you know the cost of your 80 year decommissioning project?

Lorne Kiely, Pinawa Town Council - Comment
AECL occupies the only serviceable land that the Pinawa Town Council has access to. It is not acceptable for the Town Council to get this serviceable land back 75 years from now.

Lac du Bonnet Reeve, Dorothy Boznianin, expressed concern that downsizing of Whiteshell will leave Manitoba without important research and development jobs. She also asked what the impact of Whiteshell decommissioning will have on the Whiteshell Campus of the Deep River Science Academy.

Mr. Praznik asked that the Federal government treat Manitoba fairly as have other communities that have expressed downsizing due to the closure of military bases or crown corporation coal mines.

DECISION REACHED: N/A

FOLLOW-UP REQUIRED:

AECL will continue to answer questions and provide updates on project work.

SUBMITTED BY:

Larry Shewchuk

DATE OF CONTACT: February 26th 1999

NATURE OF CONTACT:

Whiteshell Laboratories Decommissioning Briefing for David Iftody, MP

Meeting Attendees:

David Iftody, Member of Parliament, Provencher
Bob Helbrecht, Program Manager Whiteshell Laboratories Decommissioning
Cliff Zarecki, Site Head Whiteshell Laboratories
Larry Shewchuk, Corporate Media Relations AECL

PURPOSE / OBJECTIVE:

Bob Helbrecht presented Mr. Iftody with his Whiteshell Decommissioning presentation explaining AECL's initial plan, stages of decommissioning, constraints, ALARA, and site overview.

ISSUES / CONCERNS:

Mr. Iftody had the following questions and comments:

- How many people would be employed at Whiteshell during the first phase of decommissioning?
- Will you bring in new staff to help with the decommissioning work during the first phase?
- Mr. Iftody made a comment that he did not think AECL could do its own decommissioning work. What was AECL's view on that?
- What about decommissioning work at Chalk River? Must AECL contract that work out?
- How much is treasury board funding for decommissioning work?

Following the discussion Mr. Iftody was given a tour of Whiteshell Laboratories Waste Management area.

DECISION REACHED: N/A

FOLLOW-UP REACHED:

None. AECL will continue to inform Mr. Iftody on project work.

SUBMITTED BY:
Larry Shewchuk

DATE OF CONTACT - June 24, 1999

NATURE OF CONTACT - AECL Decommissioning briefing and update to the Town of Lac du Bonnet.

Attending the meeting:

Lac du Bonnet Town Council
B. Helbrecht
C. Zarecki

PURPOSE / OBJECTIVE - to update the R.M on the progress on WL decommissioning planning, activity and to explain constraints facing AECL in the decommissioning of WL - i.e. lack of a waste disposal site or alternate waste storage facility in Canada.

ISSUES / CONCERNS

- Why doesn't AECL continue to use the buildings?
- When will buildings be available for other uses?
- Statement from Mayor.
  If you move jobs to Ontario you should take your waste with you.
- What is the design life of the high level waste canisters?
- How will the site be secured? Will people be trained?
- Why did the CNPL deal fall through?

DECISION REACHED - N/A

FOLLOW-UP REQUIRED - None specific. AECL will continue to inform the Town Council on decommissioning project work.

SUBMITTED BY - Cliff Zarecki

DATE OF CONTACT: March 9, 1999

NATURE OF CONTACT:

WL Decommissioning Briefing to the Winnipeg Free Press at Whiteshell Laboratories.

Meeting Attendees:

Gerald Flood, Editorial Writer / Columnist Winnipeg Free Press
Terry Moore, Editorial Writer / Columnist Winnipeg Free Press
Doug Hink, Vice President Strategic Planning AECL
Barbara Gray, Director, Strategic Planning AECL
Bob Helbrecht, Project Manager Whiteshell Laboratories Decommissioning
Cliff Zarecki, Site Head, Whiteshell Laboratories
Larry Shewchuk, Manager, Media Corporate Relations AECL

PURPOSE / OBJECTIVE:

Bob Helbrecht gave a presentation to the Free Press on Whiteshell Decommissioning issues.
Doug Hink and Barbara Gray gave presentations on AECL-EDAW relationship.

ISSUES / CONCERNS:

- Will all equipment at Whiteshell eventually be moved to Chalk River?
- Please elaborate on what kind of nuclear wastes are in the waste management area.
- How much waste is on site from your 30 years of research here?
- What kind of waste can be left on the site in the long term?
- This question to Bob Helbrecht - Have you ever decommissioned sites before? How does this project compare to other decommissioning projects?
- To what extent can you isolate facilities or buildings for future commercialization?
- Is there a single energy source for the site and would that make building isolation difficult for commercialization?
- How do you fully decom a building after many years of nuclear research in it?
- Could a storage area at Whiteshell become a national storage site for all of the country's nuclear waste?
- Was there ever a plan to stay forever at Whiteshell by AECL?
- Could Whiteshell Laboratories have become something else other than a nuclear research facility?
- Elaborate on explaining the choices you face re leaving waste at the site or moving it to other storage facilities?
- How long can you wait for a disposal vault to be built while you store waste at Whiteshell?
- What are your long term liabilities ensuring there is no residual material below ground level long after you have decommissioned Whiteshell Laboratories?
- How do you ensure AECB regulations are in place that will last for the many decades that waste will be here?
- Please explain how decay rates work.
- If AECB is the judge of AECL who is the judge of the AECB?
- Is there a journal of information on decommissioning that could be provided to the Winnipeg Free Press for future reference?

Site Tour

Following the meeting the Free Press was given a tour of the Waste Management area, the Hot Cells, WR-1, SLOWPOKE and the Radioiodine Test Facility.

DECISION REACHED: N/A

FOLLOW-UP REQUIRED:

None. The Free Press subsequently wrote an op-ed article that said AECL's decommissioning approach was reasonable.

SUBMITTED BY:

Larry Shewchuk

Date of Contact - June 22, 1999

Nature of Contact - AECL Decommissioning briefing and update to the RM of Lac du Bonnet

Attending the meeting:

D. Bozninian - Reeve
B. Chudley - Council member
D. Halbert - Council member
T. Howard - Council member
M. Watson - RM office administrator

B. Helbrecht, Project Manager, WL Decommissioning
C. Zarecki, Site Head, WL
L. Shewchuk, Manager, AECL Corporate Media Relations

Purpose/Objective: - to update the RM on the progress on WL decommissioning planning, activity and to explain constraints facing AECL in the decommissioning of WL - i.e. lack of a waste disposal site or alternate waste storage facility in Canada.

Issues/Concerns

- When will non-active buildings be released for alternative business use?
- What kind of businesses will be allowed to operate at the site?
- How much will AECL charge to lease buildings or land?
- Statement - The RM of Lac du Bonnet is losing residential taxpayers because our residents who work at the site are being transferred to Ontario. This concerns us.
- Is developing a permanent nuclear waste disposal facility somewhere in Canada a technical problem or a political problem?
- How do standards for decommissioning work in England compare to standards in Canada?
- We understand that there are two buildings at WL that are so badly contaminated, they will have to be destroyed and the building material moved away. Will that happen?
- How many employees will be at WL for the next 5 years?
- How long will the concrete canisters in the waste management area last?

Decision Reached - N/A

Follow-up Required - None specific. AECL will continue to inform and update the RM on the progress of WL decommissioning planning.

Submitted by – Larry Shewchuk

DATE OF CONTACT - June 23, 1999

NATURE OF CONTACT - AECL Decommissioning briefing and update to the R. M. of Whitemouth

Attending the meeting:

R.M. of Whitemouth Council
B. Halbrecht
C. Zarecki

PURPOSE / OBJECTIVE - to update the R.M on the progress on WL decommissioning planning, activity and to explain constraints facing AECL in the decommissioning of WL - i.e. lack of a waste disposal site or alternate waste storage facility in Canada.

ISSUES / CONCERNS

- Will the URL keep operating?
- Will URL store nuclear wastes?
- Cost for Decommissioning?
- How long is monitoring and surveillance period?
- Who does Decommissioning?
- Will contractors be trained?
- IS CNPL willing to come back?
- Are CRL Hot Cell Facilities being refurbished?
- What CNF - is it being planned?

DECISION REACHED - N/A

FOLLOW-UP REQUIRED - None specific. AECL will continue to inform R.M on decommissioning project work.

SUBMITTED BY - Cliff Zarecki

DATE OF CONTACT - June 24, 1999

NATURE OF CONTACT - AECL Decommissioning briefing and update to the Town of Beausejour.

Attending the meeting:

Beausejour Town Council
B. Helbrecht
C. Zarecki

PURPOSE / OBJECTIVE - to update the Town of Beausejour on the progress on WL decommissioning planning, activity and to explain constraints facing AECL in the decommissioning of WL - i.e. lack of a waste disposal site or alternate waste storage facility in Canada.

ISSUES / CONCERNS

- IS AECL asking for approval of this plan?
- IRUS at CRL, can it used for WL?
- Is the AECB happy to leave waste at WL if safely stored?
- What is the cost of decommissioning?
- Will site wastes be monitored?
- If permanent disposal is earlier, can time frames for WL decommissioning be shortened?
- We are told Decommissioning in England is better planned than in Canada? Is this true?
- Would it be feasible for AECL as a tenant, to have an active building in an industrial park on the WL site or in nearby Pinawa?
- Is an AECB decision required on land and buildings?
- Is AECL willing to give up land and buildings?
- Of the options you have for WL Decommissioning - when will one be chosen?

DECISION REACHED - N/A

FOLLOW-UP REQUIRED - None specific. AECL will continue to inform the Town Council on decommissioning project work.

SUBMITTED BY - Cliff Zarecki

AECL Whiteshell Laboratories Decommissioning
Comprehensive Study Report

CONTACT RECORD

DATE OF CONTACT: Nov 23, 1999
NATURE OF CONTACT (Meeting, interview, telephone call etc.) Meeting / Briefing Attendees: MaryAnn Mihychuk, Manitoba Minister of Industry, Trade and Mines Dennis Cleve, Senior Manager Special Project Development at Industry, Trade and Mines David Markham, Special Assistant to Minister AECL Team: Cliff Zarecki Marvin Ryz Katherine Barker Larry Shewchuk EDAW: Terry Cristall Clive Willis Pat Haney
PURPOSE/OBJECTIVE: Briefing on decommissioning, including information on how decommissioning would affect the availability of surplus lands and buildings on the south side of the WL site.
ISSUE/CONCERN: No major issues raised by Minister. <u>Questions asked:</u> How much decommissioning work can be performed by local residents to survey unaffected lands for release? How long will it take to complete an EA for lands and buildings on the south side of the WL site? What is the total capital building costs that the federal government has invested in Whiteshell Laboratories / Pinawa sites?
DECISION REACHED: N/A
FOLLOW-UP REQUIRED: Nothing specific requested by Manitoba Government. Routine information exchange will continue as necessary.
SUBMITTED BY: Larry Shewchuk

Appendix E.2

Public Consultation on the Comprehensive Study Report

APPENDIX E.2
PUBLIC CONSULTATION SUMMARY

	Date	Format	Groups / Individuals Consulted	Purpose / Objective	Issues Raised	Follow-Up
Government Consultation	**June 9, 1999**	**Meeting**	**TAC**	**TAC review initiated by Manitoba Environment. AECB provided overview of AECB licensing process. Wardrop provided overview of CSR and public participation.**	**Issues raised through Community Leaders' Committee were reported.**	**Issues raised responded to in CSR. TAC meetings at call of Chair.**
	June 23, 1999	**Meeting**	**Edwin Yee, TAC Chairperson, Manitoba Environment (Conservation)**	**To provide briefing on status of decommissioning program and environmental assessment process.**	**None identified.**	**Overview document to be provided to TAC members. TAC meeting to be called in fall.**
	July 8, 1999	**Meeting**	**Dave Wotton, Manitoba Environment (Conservation) and some TAC members, Mayor of Pinawa**	**To provide briefing on status of decommissioning program and environmental assessment process.**	**Timeframe.** **Liability not addressed soon enough.** **Province would like an economic model to deal with liabilities.** **Long-term monitoring guarantees.** **Province would like to see integration with national policy for disposal.** **Province would like collaboration with AECL, NRCan and AECB to establish waste disposal facility in Canada.**	**Issues responded to in CSR.**
	Oct 20, 1999	**Meeting**	**TAC, Mayor of Pinawa**	**Overview presentation by AECL. Update of AECB process and forwarding of Draft Scope document. Community perspective by Mayor.**	**Issues raised by Mayor of Pinawa:** **Concern about loss of local expertise, expenditures at CRL, future generations, economic opportunities, development of local environmental expertise.**	**Issues responded to in CSR.**

	Date	Format	Groups / Individuals Consulted	Purpose / Objective	Issues Raised	Follow-Up
Key-Person Interviews	**July 14, 1999**	**In-person Interview**	**Gary Hanna, Local Administrator, L.G.D. Pinawa**	**To obtain background information and to identify issues to be addressed in CSR.**	**Community image – long-term waste storage. Qualifications of staff for site monitoring. Loss of Grant-in Lieu. Release of buildings for re-development.**	**Advised on Oct. 5, 1999 of newsletter distribution and invited to open house. Advised by phone of information session in Pinawa. Issues addressed in CSR.**
	July 21, 1999	**In-person Interview**	**Mary Greber, President, Pinawa Community Development Corporation**	**To obtain background information and to identify issues to be addressed in CSR.**	**Liability has potential to impact on community development. Information availability. Perception of waste storage site.**	**Notified by letter Oct. 5, 1999 of open house / offer of presentation. Issues addressed in CSR.**
	July 21, 1999	**In-person Interview**	**Len Simpson, Mayor, L.G.D. Pinawa**	**To obtain background information and to identify issues to be addressed in CSR.**	**Concern about loss of hands on knowledge, future safety. External events need to be considered. Contamination under buildings needs to be addressed. Little should be postponed for safety reasons.**	**L.G.D. offered presentation by AECL. Advised of open house in letter of October 5, 1999. Issues addressed in CSR.**
	Sept 8, 1999	**In-person Interview**	**Jane Sargent, Co-ordinator, Pinawa Implementation Committee**	**To obtain background information and to identify issues to be addressed in CSR.**	**Economic impacts more of a concern than environmental.**	**Issues noted. PIC advised of open house and offer of presentation in letter of October 5, 1999.**
	Sept 27, 1999	**In-person Interview**	**Dorothy Boznianin, Reeve, R.M. Lac du Bonnet**	**To obtain background information and to identify issues to be addressed in CSR.**	**Interest in release of land. Potential impacts on tourism. Length of time to decommission. No previous knowledge of environmental monitoring program. Concern about impacts to Winnipeg River.**	**R.M. advised of open house at Whiteshell Laboratories in letter of Oct. 5, 1999 and advised by phone of information session at Lac du Bonnet. Issues addressed in CSR. Ongoing communications with R.M.**

Contact List	Date	Format	Groups/Individuals Consulted	Purpose/Objective	Issues Raised	Follow-Up
Nature & Wildlife Associations and Environmental Organizations	**Oct 5, 1999** **June 5, 2000**	**Letter** **Letter**	• **MB Wildlife Fed.** • **MB Trappers Assoc.** • **MB Recreational Canoeing Association** • **MB Naturalists Society** • **MB Model Forest Inc.** • **MB Eco-Network** • **Canadian Parks & Wilderness Society** • **World Wildlife Fund** • **Heather Game & Fish**	**To forward copy of Newsletter No. 1, advise of environmental assessment/public consultation and invite to open house.** **To forward copy of Newsletter No. 2, advise of follow-up public communication activities and invite to information sessions.**	**N/A** **N/A**	**Will advise of next steps in CSR review.** **Will advise of public review of CSR.**
Industry Associations	**Oct 5, 1999** **June 5, 2000**	**Letter** **Letter**	• **Canadian Nuclear Association**	**To forward copy of Newsletter No. 1, advise of environmental assessment/public consultation and invite to open house.** **To forward copy of Newsletter No. 2, advise of follow-up public communication activities and invite to information sessions.**	**N/A**	**Will advise of next steps in CSR review.** **Will advise of public review of CSR.**
Community And Economic Development Organizations	**Oct 5, 1999** **June 5, 2000**	**Letter** **Letter**	• **Pinawa Chamber of Commerce** • **Lac du Bonnet Chamber of Commerce** • **Economic Development Authority of Whiteshell** • **Winnipeg River Brokenhead Community Futures Development Corp.** • **Pinawa Community Development Corp. Inc.** • **Eastman Regional Development Corp.** • **Pinawa Land Development Group** • **Pinawa Implementation Committee** • **Workforce Adjustment Centre**	**To forward copy of Newsletter No. 1, advise of environmental assessment/public consultation and invite to open house.** **To forward copy of Newsletter No. 2, advise of follow-up public communication activities and invite to information sessions.**	**N/A** **N/A**	**Will advise of next steps in CSR review.** **Will advise of public review of CSR.**

	Date	Format	Groups/Individuals Consulted	Purpose/Objective	Issues Raised	Follow-Up
Whiteshell Laboratories Tenants	**Oct 5, 1999**	**Letter**	• **ACSION Industries Inc.**	**To forward copy of Newsletter No. 1, advise of environmental assessment/public consultation and invite to open house.**	**N/A**	**Will advise of next steps in CSR review.**
	June 5, 2000	**Letter**		**To forward copy of Newsletter No. 2, advise of follow-up public communication activities and invite to information sessions.**		**Will advise of public review of CSR.**
Regional Resource Industries	**Oct 5, 1999**	**Letter**	• **Pine Falls Paper Co. Inc.** • **Tanco**	**To forward copy of Newsletter No. 1, advise of environmental assessment/public consultation and invite to open house.**	**N/A**	**Will advise of next steps in CSR review.**
	June 5,2000	**Letter**		**To forward copy of Newsletter No. 2, advise of follow-up public communication activities and invite to information sessions.**		**Will advise of public review of CSR.**
Health/ Education Associations	**Oct 5, 1999**	**Letter**	• **North Eastman Health Association** • **School District of Whiteshell**	**To forward copy of Newsletter No. 1, advise of environmental assessment/public consultation and invite to open house.**	**N/A**	**Will advise of next steps in CSR review.**
	June 5,2000	**Letter**		**To forward copy of Newsletter No. 2, advise of follow-up public communication activities and invite to information sessions.**		**Will advise of public review of CSR.**
Community Associations	**Oct 5, 1999**	**Letter**	• **Pinawa 50 Plus Club** • **Pinawa Recycling Inc.** • **Pinawa Lion's Club**	**To forward copy of Newsletter No. 1,advise of environmental assessment/public consultation and invite to open house.**	**N/A**	**Presentation - Nov 17 Will advise of next steps in CSR review.**
	June 5, 2000	**Letter**		**To forward copy of Newsletter No. 2, advise of follow-up public communication activities and invite to information sessions.**		**Will advise of public review of CSR.**

	Date	Format	Groups / Individuals Consulted	Purpose / Objective	Issues Raised	Follow-Up
Aboriginal Associations	**Oct 5, 1999**	**Letter**	• **MB Metis Federation**	**To forward copy of Newsletter No. 1, advise of environmental assessment / public consultation and invite to open house.**	**N / A**	**Will advise of next steps in CSR review.**
	June 5, 2000	**Letter**		**To forward copy of Newsletter No. 2, advise of follow-up public communication activities and invite to information sessions.**		**Will advise of public review of CSR.**
Cottage Associations	**Oct 5, 1999**	**Letter**	• **Lorell Cottage Owners Association** • **Black Bear** • **Leisureland** • **Cape Coppermine** • **Bonnet Oaks** • **Fishers Grove** • **Grosdin Point** • **Lee Side Recreation Co-op** • **Wendigo Association** • **Arnold's Campers Co-op** • **Lee River Falls Holdings**	**To forward copy of Newsletter No. 1, advise of environmental assessment / public consultation and invite to open house.**	**N / A**	**Will advise of next steps in CSR review.**
	June 5, 2000	**Letter**		**To forward copy of Newsletter No. 2, advise of follow-up public communication activities and invite to information sessions.**	**N / A**	**Will advise of public review of CSR.**
Elected Federal & Provincial Officials	**Oct 5, 1999**	**Letter**	• **MLA - La Verendrye** • **MLA - Lac du Bonnet** • **Senior Federal Minister (Honourable Lloyd Axworthy)** • **Secretary of State for Western Economic Diversification** • **Member of Parliament - Provencher**	**To forward copy of Newsletter No. 1, advise of environmental assessment / public consultation and invite to open house.**	**N / A**	**Will advise of next steps in CSR review.**
	June 5, 2000	**Letter**		**To forward copy of Newsletter No. 2, advise of follow-up public communication activities and invite to information sessions.**	**N / A**	**Will advise of public review of CSR.**
Government Officials	**Oct 5, 1999**	**Letter**	• **Chairperson - TAC, MB Environment (now Conservation)** • **Assistant Deputy Minister, MB Environment (now Conservation)** • **Director, CEAA Regional Office**	**To forward copy of Newsletter No. 1, advise of environmental assessment / public consultation and invite to open house.**	**N / A**	**Will advise of next steps in CSR review.**
	June 5, 2000	**Letter**		**To forward copy of Newsletter No. 2, advise of follow-up public communication activities and invite to information sessions.**		**Will advise of public review of CSR.**

	Date	Format	Groups/Individuals Consulted	Purpose/Objective	Issues Raised	Follow-Up
Municipal Governments	**Oct 5, 1999**	**Letter**	• **RM of Alexander** • **RM of Whitemouth** • **RM of Brokenhead** • **Town of Beausejour** • **RM of Lac du Bonnet** • **Town of Lac du Bonnet** • **LGD of Pinawa**	**To forward copy of Newsletter No. 1, advise of environmental assessment/public consultation and invite to open house.**	**N/A**	**Will advise of next steps in CSR review.**
	April 28, 2000	**Letter**		**To forward courtesy copy of draft CSR Revision 1 and provide update on status of CSR review.**	**N/A**	**Will advise of next steps in CSR review.**
	June 5, 2000	**Letter**		**To forward copy of Newsletter No. 2, advise of follow-up public communication activities and invite to information sessions.**	**N/A**	**Will advise of public review of CSR.**
Other Organizations	**Nov 12, 1999**	**Letter**	**Whiteshell Laboratories Community/ Provincial Leaders Committee**	**Offer briefing. Advise of AECB scope document.**	**N/A**	**Will advise of next steps in CSR review.**
	Jan 31, 2000	**Letter**		**Advised that responses to 20 recommendations of Community Leaders Committee were included in CSR Appendix. Offer to meet to discuss responses.**	**N/A**	**Meeting April 8, 2000.**
	April 8, 2000	**Meeting**		**To respond to recommendations of Leaders Committee and discuss issues.**	**External events, loss of hands-on knowledge, standpipe waste removal to CRL, status of WMA records.**	**Will advise of next steps in CSR review.**
	April 28, 2000	**Letter**		**To forward courtesy copy of draft CSR Revision 1 and provide update on status of CSR review.**	**N/A**	**Will advise of next steps in CSR review.**
	June 5, 2000	**Letter**		**To forward copy of Newsletter No. 2, advise of follow-up public communication activities and invite to information sessions.**	**N/A**	**Will advise of public review of CSR.**

	Date	Format	Groups / Individuals Consulted	Purpose / Objective	Issues Raised	Follow-Up
Individuals	**Jan. 18, 2000** **June 6, 2000**	**Letter** **Letter**	**B. and D. Hyslop**	**To reply to letter of Dec. 27, 1999 and respond to questions and issues from open house comment sheet.** **To advise them of how their comments were responded to in draft CSR and of availability of draft CSR Rev. 1 for viewing.**	**Issues raised by Hyslop included environmental effects, monitoring of WMA, water from on-site laundry. (Responses provided in letter of June 6, 2000).**	**To advise them of availability of draft CSR.** **N / A**
VECs Interviews	**July 20, 1999**	**Email**	**Reto Zach Ph.D. Professional ecologist with AECL in Pinawa**	**To solicit input on selection of VECs for assessment in CSR.**	**N / A**	**Used suggested VECs**
	July 19, 1999	**Telephone**	**Colin Macdonald, Ph.D. Professional ecologist in Pinawa**	**To solicit input on selection of VECs for assessment in CSR.**	**N / A**	**Used suggested VECs**
	July 19, 31, 1999	**In person, telephone, e-mail**	**Janet Dugle, Ph.D. Professional ecologist in Pinawa**	**To solicit input on selection of VECs for assessment in CSR.**	**N / A**	**Used suggested VECs**
	July 19, 1999	**Telephone**	**Bill Schwartz, Ecology technician in Lac du Bonnet**	**To solicit input on selection of VECs for assessment in CSR.**	**N / A**	**Used suggested VECs**
	July 19, 1999	**Telephone**	**John Kerr, Pinawa trapper, hunter and outdoorsman**	**To solicit input on selection of VECs for assessment in CSR.**	**N / A**	**Used suggested VECs**
	Aug 2, 1999	**Email from France**	**Peter Taylor, Ph.D. Prominent naturalist and author from Pinawa**	**To solicit input on selection of VECs for assessment in CSR.**	**N / A**	**Used suggested VECs**
	July 20, 1999	**In person**	**Alice Chambers, Prominent naturalist and environmental activist**	**To solicit input on selection of VECs for assessment in CSR.**	**N / A**	**Used suggested VECs**
	Oct 8, 1999	**Email**	**Manitoba Natural Resources, via Kelly Leavesley**	**Review by a number of professional and regulatory ecologists in Lac du Bonnet**	**N / A**	**Used suggested VECs**

	Date	Format	Groups / Individuals Consulted	Purpose / Objective	Issues Raised	Follow-Up
Cumulative Effects Contacts	**Oct 4, 1999**	**In person**	**Economic Development Authority of Whiteshell CEO, Pat Haney**	**Determine numbers and types of businesses expected at the new Pinawa Industrial Park.**	**N / A**	**Letter from Pat Haney, Oct 8, filed and faxed to Wardrop for CSR records. Used list provided in CE write-up.**
	Oct 4, 1999	**Telephone**	**Gary Hanna, Resident Administrator for Pinawa**	**Numbers and types of businesses expected in Pinawa.**	**N / A**	**Letter from Gary Hanna, Oct 8, filed and faxed to Wardrop for CSR records. Used list provided in CE write-up.**
	Oct 4, 1999	**Telephone**	**Mary Greber, Ex. Dir. Of Winnipeg River Brokenhead Community Futures Development Corp. and Chair of the Pinawa CDC**	**Numbers and types of businesses expected in region.**	**N / A**	**Letter from Mary Greber on behalf of WRBCDC, Oct 12, filed and faxed to Wardrop for CSR records. Used list provided in CE write-up.**
	Oct 4, 1999	**Telephone**	**Ken Adams - Division Manager of Power Planning & Operations**	**Changes to MB Hydro's facilities on Winnipeg River that may have CE.**	**N / A**	**Letter from Adams, Oct 22, filed in preparation for inclusion in CSR.**
	Oct 4, 1999	**In person**	**Len Simpson - Mayor of Pinawa**	**Confirmed what sent by Gary Hanna.**	**N / A**	**No response. Request again Oct 14 and Nov 10.**
	Oct 4, 1999	**Telephone**	**Glen Hirst - Mayor of Lac du Bonnet**	**Numbers and types of businesses expected in Lac du Bonnet.**	**N / A**	**Letter from Colleen Johnson, Chief Admin. Officer for Town of Lac du Bonnet, Oct 5, filed and faxed to Wardrop.**
	Oct 4, 1999	**Telephone and Fax**	**Jim Linton - Manager Winnipeg Hydro, Point du Bois**	**Changes to Winnipeg Hydro's facilities on Winnipeg River that may have CE.**	**N / A**	**Incorporated telephone interview info into CE write-up for CSR.**
	Oct 4, 1999	**Telephone**	**Dorothy Boznianan - Reeve, RM of Lac du Bonnet**	**Numbers and types of developments expected in RM of Lac du Bonnet.**	**N / A**	**No response.**
	Oct 4, 1999	**Telephone**	**Kevin Lavallee - Reeve of RM of Whitemouth**	**Numbers and types of developments expected in RM.**	**N / A**	**Letter received from RM on Oct 27, included in CE write-up of CSR**
	Oct 10, 1999	**Telephone**	**John Misko - Awanipark**	**Stage of residential development directly South of Whiteshell Laboratories.**	**N / A**	**Telephone follow-up and interview on Oct 12 included in CE write-up for CSR.**
	Oct 4, 1999	**Telephone**	**A. Wingate - CEO Pine Falls Paper Co.**	**PFPC forest activities in the area.**	**N / A**	**Telephone follow-up with B. Kotak - will send brief prepared for ten year Forest Mgmt plan.**
	Oct 4, 1999	**Telephone**	**Mike Waldram - CEO of Manitoba Model Forest**	**MBMF projects in area.**	**N / A**	**Letter of Oct 12, filed and faxed to Wardrop for CSR records. Used list provided in CE write-up.**

	Date	Format	Groups/Individuals Consulted	Purpose/Objective	Issues Raised	Follow-Up
	Oct 4, 1999	Telephone	Bob Enns - Manitoba Conservation	Developments in the active planning stages on lands surrounding Whiteshell Laboratories	N/A	Letter from Kelly Leavesley - Crown Lands Manager, Oct 22, included in CE write-up for CSR.
	Oct 4, 1999	In person	Dave Hnatiw -Chair, Pinawa Chamber of Commerce	Developments in Pinawa and region.	N/A	Letter from Dave Hnatiw, Oct 8, filed and faxed to Wardrop for CSR records. Used list provided in CE write-up.
	Oct 4, 1999	Telephone	Mel Maitowsky - Chair, Lac du Bonnet Chamber of Commerce	Developments in Lac du Bonnet and region.	N/A	No response - follow-up call Oct 12.
	Oct 8, 1999	Telephone	SunGro Peat - Hadashville	New peat developments in the area.	N/A	Phone interview included in CE write-up for CSR.
	Oct 4, 1999	Telephone	Ed Tailleux - Agricultural Rep - MB Agriculture for area	New agricultural developments in area.	N/A	Email response, Oct 4, filed and faxed to Wardrop for CSR records. Used list provided in CE write-up.
	Oct 4, 1999	In person	Elaine Greenfield - RRR Realty	Housing and commercial developments and needs in the area.	N/A	Letter from Greenfield filed and faxed to Wardrop.
	Oct 4, 1999	Telephone	Bill Ferguson - Gen. Mgr. Tantalum Mining Co. of Canada	Expansion of mine or processing facilities.	N/A	Email response of Oct 29, included in CE write-up for CSR.
	Oct 8, 1999	Telephone	Manager, Cold Springs Granite	Expansion of quarry or processing facilities.	N/A	Telephone interview included in CE write-up for CSR.
	Oct 29, 1999	Telephone	City of Winnipeg - Water Engineer	Possible new aqueduct to Natalie Lake to withdraw water for City of Winnipeg.	N/A	Telephone interview included in CE write-up for CSR.
	Nov 5, 1999	Telephone	Alec Warga - Manitoba Hydro Property Division	New residential/retirement village development in Seven Sisters Falls.	N/A	Telephone interview included in CE write-up for CSR.

AECL Whiteshell Laboratories Decommissioning
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CONTACT RECORD

DATE OF CONTACT:
June 23, 1999 2 p.m.

NATURE OF CONTACT (Meeting, interview, telephone call, etc.)
Meeting
Edwin Yee – Senior Consultant, Toxic Chemicals, Manitoba Environment
- Chairman AECL Decommissioning Technical Advisory Committee (TAC)

Bob Helbrecht, Program Manager, WL Decommissioning, AECL
Larry Shewchuk, Manager, Corporate Media Relations, AECL
Barbara Connell, Consultant, Communications and Consultation, Barbara Connell advisory services

PURPOSE/OBJECTIVE:
To brief Edwin Yee on status of decommissioning program and EA.

ISSUE/CONCERN:
None identified.

DECISION REACHED:
Edwin would provide overview document to TAC members when available. A TAC meeting could be called for September.

FOLLOW-UP REQUIRED:
TAC advised of open house and public consultation. TAC members provided copies of newsletter. TAC meeting held October 20 at Pinawa.

SUBMITTED BY:
Barbara Connell

AECL Whiteshell Laboratories Decommissioning
Comprehensive Study Report

CONTACT RECORD

DATE OF CONTACT:
July 8, 1999

NATURE OF CONTACT (Meeting, interview, telephone call, etc.)
Meeting
Dave Wotton, ADM, Operations Division, Manitoba Environment (now Manitoba Conservation)
Some members of provincial TAC
Len Simpson, Mayor, L.G.D. Pinawa
Bob Helbrecht, Program Manager, WL Decommissioning, AECL
Larry Shewchuk, Manager, Corporate Media Relations, AECL
Cliff Zarecki, WL Site Head, AECL
Barbara Connell, Consultant, Communications and Consultation, Barbara Connell advisory services

PURPOSE/OBJECTIVE:
To brief Dave Wotton on status of decommissioning program and EA as part of public process. Other TAC members and Mayor were invited by Dave Wotton.

ISSUE/CONCERN:
- Timeframe is not acceptable
- Concerns that WL program not comparable to UK program
- Liability not being addressed soon enough
- Province will be looking for intrusion-proof and weather proof containment for reactor core
- Province will be looking for an economic model to deal with liabilities
- What guarantees will there be that money will be available for long-term monitoring
- Why not put forward an option that includes a national policy for development of waste disposal facility
- Province would like collaboration with AECL, NRCan and AECB to establish a national waste disposal facility (not in Manitoba)

DECISION REACHED:
Province views process as positive. Province believes that it has to work through the process together with AECL to come up with acceptable solutions. A transparent process is required.

FOLLOW-UP REQUIRED:
Issues noted and addressed in CSR. Issues outside scope responded to in issues table in Appendix. Dave Wotton advised by letter of October 5 of open house.

SUBMITTED BY:
Barbara Connell

AECL Whiteshell Laboratories Decommissioning
Comprehensive Study Report

CONTACT RECORD

DATE OF CONTACT:
July 14, 1999 10:00 a.m.

NATURE OF CONTACT (Meeting, interview, telephone call, etc.)
Key-Person Interview
Gary Hanna – Municipal Administrator, L.G.D. Pinawa

PURPOSE/OBJECTIVE:
To obtain background information on impacts to Pinawa from closure and to identify issues associated with decommissioning to be addressed in CSR.

ISSUE/CONCERN:
- Concern about community image with long-term storage of waste
- Concern about qualifications of staff for site monitoring
- No current concern about safety while site is operational, but concern in future
- Need assurances that there are no adverse environmental impacts from operations
- Money being spent at Chalk River for refurbishment
- Concern about community being able to continue to attract retirees if can't maintain or enhance recreational resources
- Loss of Grant-in-Lieu of taxes would have a significant impact on community
- Community needs an exit agreement with AECL
- Want a clean site and release of buildings for re-development

DECISION REACHED:
N/A

FOLLOW-UP REQUIRED:
Gary Hanna was advised of newsletter distribution on October 5 and invited to open house. Issues within scope of CSR addressed in CSR. Other responses prepared in issues table in Appendix. L.G.D. will continue to be part of AECL's ongoing communications program.

SUBMITTED BY:
Barbara Connell

AECL Whiteshell Laboratories Decommissioning
Comprehensive Study Report

CONTACT RECORD

DATE OF CONTACT:
July 21, 1999 10:30 a.m.

NATURE OF CONTACT (Meeting, interview, telephone call, etc.)
Key-Person Interview
Mary Graber – President, Pinawa Community Development Corporation (PCDC)

PURPOSE/OBJECTIVE:
To obtain background information on PCDC and to identify issues to be addressed in CSR.

ISSUE/CONCERN:
- Perception issue with a waste storage site
- If site was cleaned up now, it would reduce future liability
- Liability has potential to impact on community development
- Important to have all information available to community
- AECL should consider consulting with technical people in community
- Timeframe for site cleanup – sooner the better for economic development opportunities
- Concern about skeletal staff of security people being capable of managing site

DECISION REACHED:
N/A

FOLLOW-UP REQUIRED:
Issues addressed in CSR. Issues outside scope responded to in issues table in Appendix. PCDC advised by letter October 5 of open house and offer of presentation.

SUBMITTED BY:
Barbara Connell

AECL Whiteshell Laboratories Decommissioning
Comprehensive Study Report

CONTACT RECORD

DATE OF CONTACT: July 21, 1999 1:15 p.m.
NATURE OF CONTACT (Meeting, interview, telephone call, etc.) Key-Person Interview Len Simpson – Mayor, L.G.D. Pinawa
PURPOSE/OBJECTIVE: To obtain background information on community impacts and to identify issues to be addressed in CSR.
ISSUE/CONCERN: • Very little that should be postponed for safety reasons • Contamination under buildings needs to be addressed • Concern that AECL doesn't have a good state of the environment of buildings and WMA • Concern about loss of hands on knowledge and safety • Concern that 30 people is not enough to manage the site • What if something goes wrong – can these people address the problem • External events need to be considered e.g. forest fires • Unethical to leave waste for future generations • Would like to see cooperation between NRCan, communities, Province and AECL to address issue of disposal
DECISION REACHED: N/A.
FOLLOW-UP REQUIRED: Issues within scope of CSR addressed in CSR. Issues outside scope responded to in issues table in Appendix. L.G.D. advised of open house. L.G.D. will continue to be part of AECL's ongoing communications program.
SUBMITTED BY: Barbara Connell

AECL Whiteshell Laboratories Decommissioning
Comprehensive Study Report

CONTACT RECORD

DATE OF CONTACT: September 8, 1999 12:30 p.m.
NATURE OF CONTACT (Meeting, interview, telephone call, etc.) Key-Person Interview Jane Sargent – Coordinator, Pinawa Implementation Committee
PURPOSE/OBJECTIVE: To obtain background information on Pinawa Implementation Committee (PIC) and to identify issues to be addressed in CSR.
ISSUE/CONCERN: Views of J. Sargent (not PIC) • Concern about being a host community for low-level waste (what about compensation) • Community supported waste storage while there was a research program, but doesn't necessarily support it now • Economic impacts are more of a concern than environmental
DECISION REACHED: N/A
FOLLOW-UP REQUIRED: Issues noted (not within scope of CSR). PIC contacted by letter October 5 to advise of open house and to offer presentation.
SUBMITTED BY: Barbara Connell

AECL Whiteshell Laboratories Decommissioning
Comprehensive Study Report

CONTACT RECORD

DATE OF CONTACT: September 27, 1999 1 p.m.
NATURE OF CONTACT (Meeting, interview, telephone call, etc.) Key-Person Interview Dorothy Bassinis – Reeve, Rural Municipality Lac du Bonnet
PURPOSE/OBJECTIVE: To obtain background information on concerns of R.M. of Lac du Bonnet and to identify issues to be addressed in CSR.
ISSUE/CONCERN: • Length of time to decommission • Want site to be returned green and clean • Recreational community would not accept long term storage of waste • Concern about impacts to Winnipeg River • Impact on tourism if people knew there were releases to the Winnipeg River • Site characterization – Does AECL know everything about the site? • People have not been informed about environmental monitoring • What have been the impacts on wildlife and what are potential impacts • Could there be impacts on eco-tourism in the area • Transportation of wastes in the future will be a concern • Can the bunkers contain radioactivity • Interest in release of land as RM's land was taken to create LGD
DECISION REACHED: N/A
FOLLOW-UP REQUIRED: Issues addressed in CSR. R.M. advised of open house at WL and information session at Lac du Bonnet. Routine communications are planned for R.M. of Lac du Bonnet.
SUBMITTED BY: Barbara Connell

AECL EACL

FACILITIES & NUCLEAR OPERATIONS
WL Decommissioning

File: 00170
Decom-99-099
1999 November 12

Whiteshell Laboratories Community/Provincial Leaders Committee
P.O. Box 100
Pinawa, MB R0E 1L0

Attention: Co-Chair Mayor Len Simpson, L.G.D. Pinawa
Co-Chair Darren Praznik, MLA Lac du Bonnet

Dear Mr. Simpson and Mr. Praznik:

As you are aware, AECL is conducting its public consultation program for the environmental assessment of the proposed decommissioning program for the Whiteshell Laboratories (WL). As part of this consultation, we are briefing organizations in the region and seeking input into the environmental assessment.

I note that we have not had an opportunity to brief the Community Leaders Committee. I would like to offer the Committee an opportunity to discuss the environmental assessment and to identify issues that Committee members may have related to the decommissioning program. We want to ensure that issues are identified and addressed in the Comprehensive Study environmental assessment.

For your information, the Atomic Energy Control Board (AECB) has released a document for public comment on the scope of the environmental assessment for the WL decommissioning program. The document is available on the AECB's web site at **http://www.aecb-ccea.gc.ca**.

I will follow-up to determine if the Community Leaders Committee would like to have a meeting with AECL and representatives of its environmental assessment team.

Sincerely,

[Original Signed By:]

R.A. (Bob) Helbrecht
Program Manager
WL Decommissioning

AECL EACL

January 18, 2000

Barb & Daryll [illegible]
P.O. Box 1877
Lac du Bonnet, Manitoba
R0E 1A0

Dear Barb & Daryll,

Thank you for your letter of December 27th. The questions raised in your comment sheet have been incorporated into the draft Comprehensive Study Report (CSR). However, there has been a delay in completing the draft CSR with Canada's nuclear regulator, the Atomic Energy Control Board (AECB). We now expect the draft CSR to be completed by the end of February.

The protocol is that the AECB will make the draft CSR public. I will ensure you are sent a copy and I will highlight for you the pages that address your concerns.

As well, we will include as many questions and answers from the public, as space allows, in the next issue of the Whiteshell Laboratories Decommissioning newsletter. We hope to have the next issue out in March or early April.

It wasn't our intent to personally write back to each and every person who completed a comment sheet and I apologize if we left you with that impression.

One concern from your comment sheet does not apply to the decommissioning of Whiteshell Laboratories. You ask how the Underground Research Laboratory (URL) can test containment possibilities without having some radioactive material on site.

As I'm sure you are aware, radioactive waste is not placed in the URL for either storage or research purposes. For research involving containment possibilities in the URL, high-temperature electric heaters have been used to simulate the heat generated by used nuclear fuel waste. The URL is not being decommissioned as part of the Whiteshell Laboratories decommissioning.

The research to investigate if radionuclides could move through rock was conducted at Whiteshell Laboratories itself. Large sections of rock were cut out of the URL, moved to Whiteshell Laboratories, and injected with radionuclides. This allowed researchers to investigate and gather scientific information without contaminating the environment of the URL. I have enclosed an information sheet about this research for your interest.

Sincerely,

Larry [illegible]
Manager, Corporate Relations

FACILITIES & NUCLEAR OPERATIONS
WL Decommissioning

File: 00170
Decom-00-003
2000 January 31

Brokenhead Ojibway Nation
Scanterbury, MB R0E 1W0

Attention: Councillor Deborah Chief

Dear Councillor Chief:

I am writing to reply to your letter of January 12, 2000 in which you advise that Chief and Council of the Brokenhead Ojibway Nation are interested in being informed on the decommissioning project. I note your general concerns as well as specific concerns and wish to advise you that these have been addressed in the draft Comprehensive Study Report which is currently being prepared by AECL's environmental assessment consultant team.

With respect to your question as to why we have included Brokenhead Ojibway Nation in the consultation process, I can respond by saying that the Brokenhead Ojibway Nation is located within the regional study area for the Comprehensive Study environmental assessment and also has indicated potential interest in land within the regional study area. There are three study areas identified for purposes of the environmental assessment: the project study area, local study area and regional study area.

I appreciate your response respecting Brokenhead Ojibway Nation's interest in the decommissioning program and will continue to keep Chief and Council informed. For your information, the draft Comprehensive Study Report will be made available for public review sometime in the spring of 2000.

Sincerely,

R.A. (Bob) Helbrecht
Program Manager
WL Decommissioning

FACILITIES & NUCLEAR OPERATIONS
WL Decommissioning

File: 00170
Decom-00-004
2000 January 31

Whiteshell Laboratories Community/Provincial Leaders Committee
P.O. Box 100
Pinawa, MB R0E 1L0

Attention: Co-Chair Mayor Len Simpson, L.G.D. of Pinawa
Co-Chair Darren Praznik, MLA Lac du Bonnet

Dear Mr. Simpson and Mr. Praznik:

This letter is a follow-up to my letter of November 12, 1999 in which I offered the Community Leaders Committee an opportunity to discuss the environmental assessment of the proposed decommissioning program for the Whiteshell Laboratories. I wish to advise you that AECL's environmental assessment consultant team has given consideration to the 20 recommendations of the Community Leaders Committee in its preparation of the draft Comprehensive Study Report (CSR). A set of responses has been prepared and will be submitted as an appendix to the CSR as part of the issues that have been raised on the proposed decommissioning program.

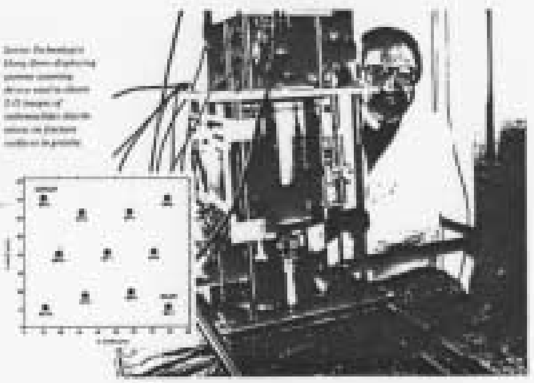
I would be pleased to discuss these responses with the Community Leaders Committee along with representatives of our environmental assessment team. If you are interested in a meeting, please call me at 753-2311 (extension 2295). For your information, the draft CSR will be submitted to the AECB shortly, and following its review, the draft report will be made available for public review.

Sincerely,

R.A. (Bob) Halbrecht
Program Manager
WL Decommissioning

AECL EACL

Large Block Radionuclide Migration Facility



Appendix E.3

Public Information Material

ATOMIC ENERGY OF CANADA LIMITED
WHITESHELL LABORATORY DECOMMISSIONING PROGRAM

The Whiteshell Laboratory (WL), located near Pinawa, Manitoba, was established in the 1960's by Atomic Energy of Canada (AECL) to carry out nuclear research and development activities. All of the facilities are located on a 10,800 acre site.

Funding to AECL was cut back a number of years ago, a result of the Federal Government's Program Review, and the corporation made the business decision to discontinue operations at WL and proceed to closing down the site. In order to shut down and decommission WL, there needs to be an amendment to the existing operating license granted by the Atomic Energy Control Board (a federal agency). As well, this license change triggers application of the *Canadian Environmental Assessment Act*. This *Act* requires that an environmental assessment be carried out before a revised license can be issued. The type of environmental assessment that has been directed under the *Act* is a Comprehensive Study on the decommissioning of WL.

The purpose of the Comprehensive Study is to examine the environmental effects, if any, of activities related to moving the WL from an operational state to a safe and secure monitoring and surveillance state and then to a final decommissioned end state. The environmental assessment is focused on the site cleanup activities, not on the research work carried out at the laboratory over the operating period. The types of activities involved in the Decommissioning Program being proposed by AECL include constructing additional waste storage facilities, moving contaminated materials from laboratory buildings to the waste management area (eg. lab equipment, samples, protective clothing, gloves, etc.), closing down/demolishing buildings, testing for contamination on the site and clean up and, rehabilitation (eg. grading, ditching, re-vegetation).

It should be noted that there is currently no facility in Canada for permanent storage of nuclear waste and therefore nuclear waste currently at the WL must be stored until such time as a permanent facility becomes available. All of the decommissioning activities will occur within the boundaries of the WL site, with the following exceptions. There will be testing of Winnipeg River bed sediments downstream of WL site and at a drainage ditch just north of the site, and non-radioactive materials (eg. demolished building parts) may be transported to local off-site landfill facilities. Finally, once a permanent nuclear waste storage facility is built, nuclear waste from WL will eventually be transported to a new location.

Under the preferred decommissioning program option, the research laboratory facilities and waste management area will be placed in a safe and secure monitoring and surveillance state by the year 2014. Final decommissioning activities related to removal of buildings and infrastructure and continued monitoring and surveillance would occur over the next 45 years (2015-2060).

WHITESHELL LABORATORIES
PROPOSED DECOMMISSIONING PROGRAM - OPEN HOUSE

Welcome

to this Open House on the Environmental Assessment for the proposed Whiteshell Laboratories Decommissioning Program

Whiteshell Laboratories
October 16, 1999
10 a.m. - 4 p.m.

Purpose of the Open House

AECL has assembled a team of environmental assessment experts to prepare a Comprehensive Study environmental assessment under the Canadian Environmental Assessment Act on the Whiteshell Laboratories (WL) proposed decommissioning program.

This Open House is an opportunity for you to:

- learn about the proposed decommissioning program and environmental assessment;
- meet members of the decommissioning and the study teams;
- discuss the proposed program with AECL and its technical advisors; and
- comment on the scope of the environmental assessment.

Your questions and comments are important and we would like to fully address them in the Comprehensive Study Report. Representatives of the team are available to discuss the proposed decommissioning program and environmental assessment.

Atomic Energy of Canada Limited (AECL)
Environmental Assessment Team:
SENES Consultants Limited
Wardrop Engineering Inc.
Connell advisory services

Please review the displays, take the tour, ask questions and give us your comments.

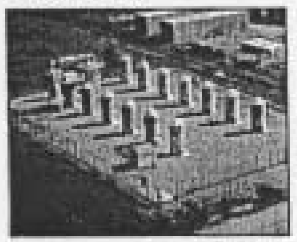
AECL EACL

WHITESHELL LABORATORIES HISTORICAL HIGHLIGHTS

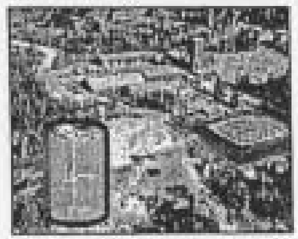
Whiteshell Laboratories - **Past and Present**

Site Construction 1963

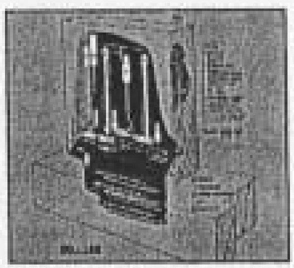
WR-1 Reactor 1965



Concrete Canister Fuel Storage Facilities



Underground Research Laboratory and Schematic



RD - 14M Schematic

1963 The first scientific research employees began arriving at the Whiteshell Laboratories and construction of WR-1, the first nuclear reactor in western Canada began.

1965 Construction of WR-1 completed. WR-1 goes on to provide scientists with 20 years of valuable nuclear science information.

1977 Whiteshell Concrete Canister Fuel Storage Facility is established. The development at Whiteshell Laboratories of dry-storage concrete canisters for used nuclear fuel is eventually used in Canada and throughout the world to safely store highly radioactive used nuclear fuel.

1978 Establishment of the Nuclear Fuel Waste Management Program. This eventually becomes one of the world's leading research programs for the concept of permanent deep geological disposal of used nuclear fuel.

1979 Research into hydrogen combustion at Whiteshell Laboratories begins.

1982 Construction of the Underground Research Laboratory, north of Pinawa, begins. This facility, established to understand geological formations deep below the earth's surface, is the first of its kind in the world. (the Underground Research Laboratory is not included in the decommissioning program)

1988 A full scale thermalhydraulics test facility (RD-14M), that is unique in the world, is constructed to study fluid flow and heat transfer processes that could occur in a CANDU nuclear reactor. RD-14M plays a significant role to validate reactor computer codes, support reactor safety research and licensing of CANDU nuclear power plants. The facility continues to provide valuable research data.

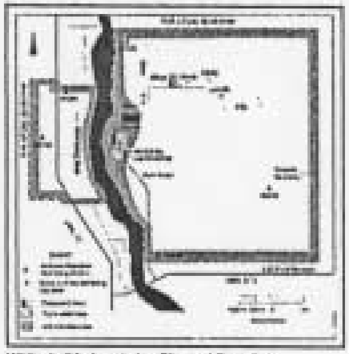
1995-98 The federal government's Program Review process reduces AECL's annual R&D budget from $172 million annually to $100 million. At this level of funding, AECL announces it can no longer afford to operate the Whiteshell Laboratories and research programs will be consolidated to AECL facilities in Ontario.

1998 Decision to terminate nuclear research activities at the site by December, 2001. Options for the privatization of the Nuclear Fuel Waste Management Program are explored. Employment is about 300, down from a peak workforce of over 1,000 in the early 1990s.

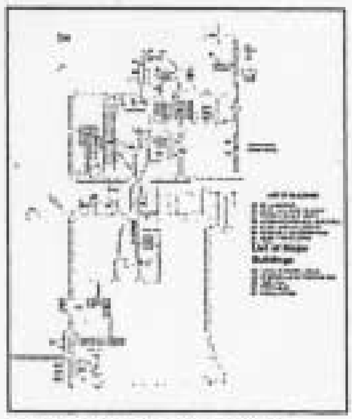
1999 Operational shutdown and planning for decommissioning begins. AECL continues to cooperate with the Economic Development Authority of Whiteshell to find alternate businesses for the surplus site land and buildings.

AECL EACL

WHITESHELL LABORATORIES REGULATORY FRAMEWORK



Whiteshell Laboratories Site and Boundary



Schematic Layout of Whiteshell Laboratories

Regulatory Framework

Current

- the entire Whiteshell Laboratories (WL) site is administered under the Atomic Energy Control Board (AECB) License NRTE 2.2/98
- as the license holder, AECL is responsible to the regulator for all site activities
- nuclear facilities are operated under facility specific authorizations

Decommissioning

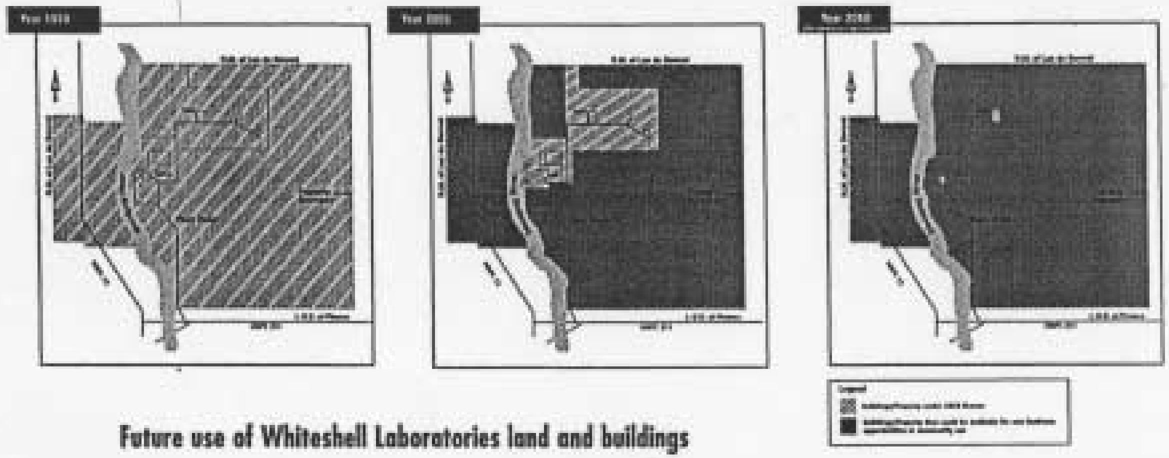
- requires amendment to the site license to effect change from operational to decommissioning state
- prerequisites to decommissioning are:
  - formal notification to the AECB of shutdown and intent to decommission
  - place facilities in a safe shutdown state
  - approved detailed decommissioning plans and environmental assessment secured prior to implementation
- consistent with the AECB Regulatory Policy Statement R-90, the overall objective of the WL Decommissioning Program is to achieve an early, safe and stable state for each facility that can be sustained by a continuing monitoring and surveillance program until decommissioning is completed on a schedule that is optimized and cost-effective

Impact of existing regulatory framework on non-AECL site use

- all changes to site use require comprehensive definition of planned activities and approach to operations e.g., definition of use, management controls, service requirements, access controls etc.
- use of buildings on a tenant basis would not likely require a license amendment
- larger businesses requiring development/construction on existing site lands could require a license amendment and might require an environmental assessment
- since AECL holds the license, AECL must be the licensing proponent for the new activity
- on approval of WL Decommissioning environmental assessment, lands could be de-licensed, transferred to new ownership and the new business would secure any zoning, provincial or local approvals

AECL EACL

WHITESHELL LABORATORIES
FUTURE AVAILABILITY OF LAND



Future use of Whiteshell Laboratories land and buildings

The Whiteshell Laboratories site is 10,800 acres. Once the EA and decommissioning plan is approved, the decommissioning can proceed and except for about 500 acres, the site can be available for new business development in 2001. AECL is working closely with the Economic Development Authority of Whiteshell (EDAW) which has the responsibility to find alternative uses and develop new economic opportunities for the Whiteshell Laboratories site and the surrounding region.

The diagrams above show the licensed site and the availability of land for new development following approval of the EA.

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WHITESHELL LABORATORIES
WHAT IS DECOMMISSIONING?

Decommissioning Defined

- decommissioning is a regulated activity carried out in industrialized countries to retire facilities from service e.g., oil refineries, mining operations, military bases and nuclear facilities
- nuclear decommissioning is the set of actions undertaken to systematically retire licensed nuclear facilities from service ensuring that health and safety of workers and the public and protection of the environment are maintained
- decommissioning steps include characterization, environmental review, decontamination activities, waste storage or disposal and final site restoration

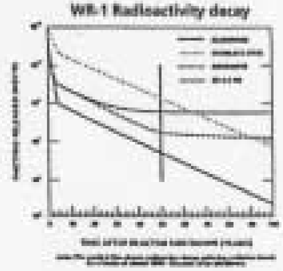
Decommissioning Drivers

- decommissioning required as result of decision to end nuclear R & D at Whiteshell Laboratories
- maintain safety of workers, the public and protection of the environment
- make land and buildings available for other uses
- reduce cost of managing liabilities
- remaining lifetime of infrastructure

Decommissioning Constraints

- to take advantage of reduced radiation fields due to radioactive decay, the timeframe to decommission is often lengthy (e.g., WR-1 reactor)

WR-1 Radioactivity decay



- unavailability of disposal facilities for handling waste from decommissioning is another constraint

Long term management of waste from the site is dependent on finding national solutions consistent with federal government policy.

AECL EACL

WHITESHELL LABORATORIES
DECOMMISSIONING ALTERNATIVES

Decommissioning Planning

Objective:

Maintain a safe, stable state for WL nuclear facilities and infrastructure while systematically decommissioning facilities to enable unrestricted use of site land

What is required to decommission?

Identify and characterize site hazards

Definition of final site conditions

Detailed decommissioning plans and procedures

Complete the regulatory approvals process

Implementation and control of decommissioning project work

Alternative 1: Short Timeframe (20 years)

Phase 1 - Monitoring and Surveillance by 2004
Phase 2 - Waste disposal facilities available in 10 years
Phase 3 - Final decommissioning in last 10 years

Project objectives may not be achievable in such a short timeframe.

Alternative 2: Deferred Decommissioning (100 years)

Phase 1 - Monitoring and Surveillance by 2004
Phase 2 - Waste management facilities closed by 2014 followed by a 45-year deferment
Phase 3 - Final decommissioning by 2100

May require requalification/rebuilding of infrastructure. Creates additional waste. No safety rationale for lengthy deferment.

Alternative 3: End state in Medium Timeframe (60 years)

Phase 1 - Monitoring and Surveillance by 2004
Phase 2 - Waste management facilities closed by 2014
Phase 3 - Final decommissioning by 2050

Optimizes program relative to safety, lifetime of infrastructure, availability of waste disposal facilities, resourcing. This is AECL's preferred approach.

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WHITESHELL LABORATORIES DECOMMISSIONING STRATEGY

AECL's Proposed Decommissioning Strategy

AECL's proposed strategy is to decommission the Whiteshell Laboratories following the phased approach outlined in Alternative 3.

Currently, AECL is in the planning stage and is preparing detailed decommissioning plans. The initial stage of work is called operational shutdown. This has already begun and includes cleanup of facilities that are no longer in use. The environmental assessment is being carried out during the planning stage. The planning is expected to be completed by the summer of 2000.

Once the AECB approves the decommissioning plans, actual decommissioning will be implemented in three phases.

What is operational shutdown?

- removal of process materials and equipment and cleanup of facilities no longer in use
- only work routinely conducted under the operating licence is allowed

What is monitoring and surveillance?

- environmental monitoring and security of the site is maintained
- buildings and services systems are maintained in a minimum heating/ventilation state
- this will maintain the structural integrity of buildings and control any remaining liabilities
- periodic inspection of the buildings is carried out

Whiteshell Laboratories Decommissioning Schedule

Phase 1

Decommissioning – Active Area Research Facilities (2000-2004)

- research facilities will be decommissioned to a state of safe and secure monitoring and surveillance
- buildings will be cleaned up but they will remain in place to manage any residual activity
- environmental monitoring and radiation protection experts will be retained to safely manage the site
- some buildings and most of the site land can be made available for other uses
- waste management facilities remain in operation to accommodate decommissioning actions
- long-term plan for management of wastes developed

Phase 2

Decommissioning – Waste Management Facilities (Concrete Canister Storage Facility, Waste Management Area) (2004-2014)

- research facilities remain in monitoring and surveillance
- closure of waste management facilities with the objective of maintaining continued safe storage until wastes requiring removal are transferred to a disposal site or alternative storage facility
- relocation of HLW from standpipes by 2010
- some empty site buildings may be demolished
- incinerator decommissioned
- bunkers and buildings in monitoring and surveillance

Phase 3

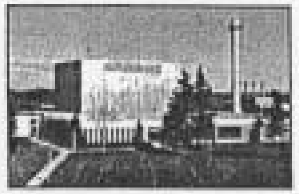
Final WL Site Decommissioning (2014-2060)

- the remaining buildings are demolished
- radioactive waste which cannot be managed at the site, would be transferred to off-site disposal facilities
- end state proposed - free release of entire WL site except for some parts of Waste Management Area and some components of WR-1

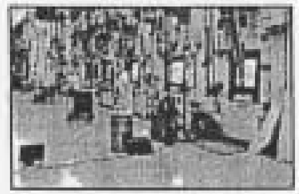
AECL EACL

WHITESHELL LABORATORIES DECOMMISSIONING SCOPE

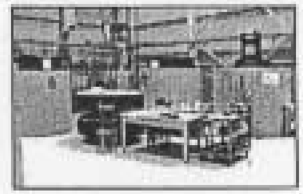
The scope of the WL decommissioning program is the site administered under AECB licence NRTE 2.2/98. These are some of the major facilities to be decommissioned.



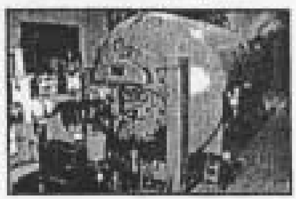
WR-1 Reactor
- demonstration of the organic-cooled reactor concept
- facility for engineering tests on fuels and reactor components
- operated from 1965-1985
- decommissioned to a monitoring and surveillance state in the early 1990's
- final decommissioning target is 2050



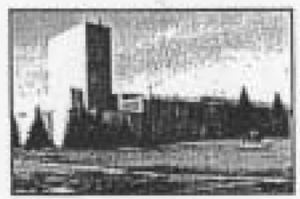
Hot Cells
- remote handling facility to support reactor safety research
- operated from 1966-1998
- decommissioned to monitoring and surveillance state in Phase 1
- final decommissioning target is 2040



Immobilized Fuel Test Facility
- conducted experiments to support Nuclear Fuel Waste Management Program from 1985-1998
- decommissioning to monitoring and surveillance state in Phase 1
- final decommissioning target is 2040



Van de Graaf Accelerator
- operated from 1970-1997
- full decommissioning planned for Phase 1



Building 300
- main research and development laboratory
- operated from 1965 to present (some areas remain in operation)
- decommissioning to monitoring and surveillance state in Phase 1
- final decommissioning target is 2030

Active Liquid Waste Treatment Centre
- began operation in 1963
- received low-level liquid waste effluent from operating nuclear facilities and medium-level waste from the Shielded Facilities
- will be used throughout shutdown operations work and during initial stages of decommissioning
- final decommissioning target is 2025

AECL EACL

Whiteshell Laboratories Decommissioning Activities

Implementation Considerations

End state does not preclude in-situ management of some wastes at Whiteshell Laboratories.

Achieving a final end state is linked to national waste management policy.

A phased approach optimizes the use of current infrastructure to manage liabilities.

A phased approach minimizes overall radiation doses to decontamination staff as a result of radionuclide decay and avoiding double handling of material.

Costs

Planning, Phase 1 and closure of Waste Management Facilities is estimated to cost $35 Million.

Estimates for achieving final end state in Phase 3 are being developed as part of the Detailed Decommissioning Plans for the entire suite of projects.

What kinds of decommissioning activities will be undertaken at Whiteshell Laboratories?

AECL is preparing detailed decommissioning plans that will identify the activities required to decommission the site. Typical activities will include:

- removing fixed surplus materials from buildings
- decontaminating buildings e.g., vacuuming, cleaning, washing, swabbing, sand blasting
- assessing facilities hazards e.g., radiological characterization and sampling, review of historical information
- remediation activities such as excavation/soil replacement, grading, ditching
- demolishing and disposing of building materials to the Waste Management Area
- segregating material that is clean for recycling or disposal at an off-site landfill
- packaging and storing low and intermediate level waste such as protective clothing, shoe coverings, swipes, mops, laboratory equipment from the decontamination process
- processing, packaging and transporting wastes which cannot be managed at Whiteshell Laboratories to off-site disposal or storage facilities (when these are developed in Canada)
- survey and assessment of site land and river sediments
- remediating, stabilizing and rehabilitating the sewage lagoon and the inactive landfill
- environmental monitoring (groundwater, surface water and vegetation)

AECL EACL

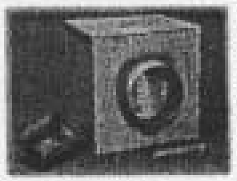
Whiteshell Laboratories Waste Management

What kinds of radioactive wastes exist at Whiteshell Laboratories?

There are three types of radioactive waste safely stored at the site.

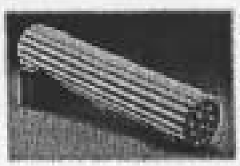
Low-Level Waste

Low-Level Waste (LLW) is typically used laboratory, rubber gloves and shoe covers, wipe paper and mops.



Medium-Level Waste

Medium-Level Waste (MLW) has more radioactivity than LLW. Typically, MLW is scrap metal materials from experiments, filters and radioactive liquid waste that has been solidified.



High-Level Waste

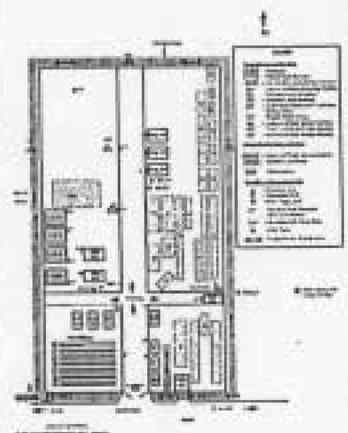
High-Level Waste (HLW) has the highest level of radioactivity. HLW is mostly used nuclear fuel bundles but it can also include tubing from the core of a nuclear reactor. Approximately 40 metric tons of used fuel is in storage in outdoor concrete canisters.

How are radioactive wastes stored at Whiteshell Laboratories?

All radioactive wastes are stored using practices that either met or exceeded international safety standards at the time the waste was placed in storage.

For example, in the 1960s and 70s, packaged LLW waste was stored in underground clay trenches. From the mid-1980s, the practice is to store these wastes in above-ground engineered facilities or storage buildings.

Schematic of the Waste Management Area



The Whiteshell Laboratories Waste Management Area where radioactive wastes are stored. This area is 12 acres in size.

High-level wastes are stored in the concrete canisters (1) in the background. Four above-ground concrete bunkers (2), with low-level waste, are visible to the right, behind the two storage buildings. The below-ground concrete bunkers (3) with medium-level waste have their tops visible in the centre of the photo. The sealed tops of the concrete standpipes (4), with medium-level and some high-level waste are also visible in the centre of the photo just above the road. The grassy area (5) in the foreground is where the clay trenches for low-level waste are located.

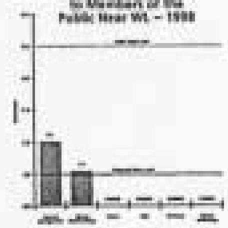
AECL EACL

WHITESHELL LABORATORIES
ENVIRONMENTAL PROTECTION

Commitment to Environmental Protection

- AECL, in all of its current activities and decommissioning programs, is committed to employee and public health and safety, and to protecting and enhancing the environment
- AECL's comprehensive environmental protection programs ensure that radiation exposures, as a result of releases of radioactive material from site activities, remain well below the annual dose limits specified by the *Atomic Energy Control Act and Regulations*
- AECL also complies with other federal and provincial regulatory requirements
- AECL will maintain environmental monitoring for the site for as long as wastes requiring management remain at the site

Radiation Dose Estimates to Members of the Public Near WL – 1998



Environmental Protection Program

- based on recommendations of the International Commission on Radiological Protection (ICRP), the International Atomic Energy Agency (IAEA), the International Organization for Standardization (ISO) and the Canadian Standards Association (CSA)
- encompasses all AECL operations and activities from design to waste management and decommissioning
- implements AECL's Policy 00-004, "Health, Safety and Environment" and is designed to:
  - ensure that all AECL's activities are environmentally responsible,
  - ensure that hazardous emissions to the environment are below regulatory limits and as low as reasonably achievable, taking economic and social factors into account (ALARA), and
- verifies compliance with AECL policy and regulatory requirements

Up-To-Date Knowledge on Radioactivity in the Environment at WL

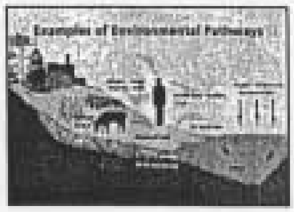
- WL regularly monitors radiological conditions in the environment (for example, tritium, beta activity, alpha activity, cesium-137, strontium-90) at the WL site and surrounding communities at about 30 locations
- results are reported annually to the AECB, and are used to estimate dose impacts from WL operations
- environmental media analyzed regularly for radioactivity include:
  - airborne and liquid effluents
  - rain and snow precipitation
  - Winnipeg River and other surface waters
  - Winnipeg River sediments
  - Winnipeg River fish
  - vegetation and local area garden crops
- monitoring results verify that doses to members of the public are well below the regulatory public dose limits

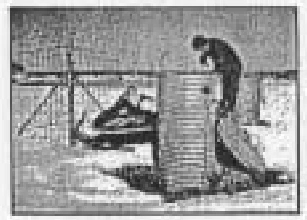
"AECL places health and safety, and protection of the environment among its highest priorities and factors them into our activities at all levels"

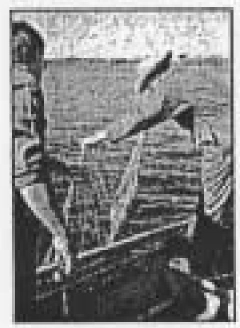
AECL EACL

WHITESHELL LABORATORIES
ENVIRONMENTAL PROTECTION

Environmental Monitoring Activities







Derived Release Limits

- in the nuclear industry, regulatory limits for radioactivity are expressed as "Derived Release Limits" (DRLs)
- DRLs are determined specifically for a nuclear facility, based on local environment and living habits
- when the total of all releases from a nuclear site remains below DRLs, the radiation dose to a member of the public is below the regulatory limit of 5 mSv per year
- calculations take into account all significant pathways that could lead to radiation dose to the most highly exposed member of the public

AECL EACL

Whiteshell Laboratories Health and Safety Programs

Contamination monitor processing laundry in Bldg 411 before cleaning

Contamination monitor in Bldg 411 leak testing a C-4 respirator

Surveyor surveying active waste before disposal

Surveyor doing routine checks on a continuous air monitor in the Hot Cell Facility

AECL has a number of programs in place to protect human health and safety against increased exposure that may result from decommissioning activities, including:

Radiation Protection

AECL's radiation protection program is designed to protect and minimize any impact from working with ionizing radiation. The program complies with or exceeds the safety requirements of the Atomic Energy Control Act.

Environmental Protection

AECL's environmental protection program complies with all applicable environmental laws and regulations, and with AECL's corporate environmental policy. The program includes:

- requirements for protection of the environment,
- assigned responsibilities for implementation of requirements, and
- standards and guidelines for minimizing any discharges into the soil, water or air.

AECL's environmental policy is committed to protection against any changes in the environment resulting from AECL's nuclear and non-nuclear activities.

Occupational Health and Safety

AECL's occupational health and safety program complies with all applicable laws and regulations, and with AECL's corporate health and safety policy. The program includes:

- requirements for protection of worker health and safety,
- assigned responsibilities for the implementation of requirements, and
- standards and guidelines for protecting workers from bodily harm.

The corporate occupational health and safety policy is committed to providing employees with a safe and healthy work environment.

Emergency Response

AECL's emergency response plan provides a mechanism to minimize the effect of an emergency on AECL employees, the public, the site and the environment. In the event of an emergency, the plan covers:

- required actions,
- assigned responsibilities, and
- implementation guidelines.

Environmental Assessment and Health and Safety

The environmental assessment process will also aim to identify processes that will reduce any impact to worker health and safety. Where practical, such processes will be used in decommissioning.

Regulatory Requirements

AECL must also comply with a number of Acts and guidelines:

Atomic Energy Control Board (AECB)

AECB - administered Acts and Regulations, licenses and directives establish nuclear industry regulatory requirements. The AECB provides instruction, assistance and information on these requirements in Regulatory Guidance documents.

Other Federal Acts & Regulations

- Canadian Environmental Assessment Act
- Fisheries Act
- Canadian Environmental Protection Act
- Canada Labour Code
- Health Canada Acts
- Occupational Health and Safety Regulations
- Canadian Council of Ministers of the Environment (CCME)
- Drinking water quality guidelines

Provincial Acts

- Environment Act
- Contaminated Sites Remediation Act
- Public Health Act
- Workplace Safety and Health Act

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WHITESHELL LABORATORIES
AECL's COMMITMENTS

AECL welcomes your ideas on how to continue with dialogue and sharing of information throughout the decommissioning program.

AECL's Commitments

AECL, as the future holder of the WL decommissioning license, is committed to the following undertakings:

- conducting all decommissioning activities to ensure health and safety of workers, the public and protection of the environment
- meeting all regulatory, safety and environmental requirements throughout the decommissioning process
- establishing a reporting mechanism with local and provincial officials to ensure that they are informed and have ongoing opportunities for dialogue and input
- maintaining the environmental monitoring program for as long as waste requiring management remains at the site
- ensuring that well-trained and qualified staff are hired to maintain the monitoring and surveillance activities and to maintain site security
- establishing a long-term communications and consultation program for area residents
- employing local expertise in site characterization and environmental monitoring activities
- continuing to make its environmental monitoring records available to the public
- ensuring that the financial and human resources are in place to undertake the decommissioning activities required under the decommissioning license

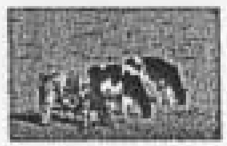
AECL EACL

WHITESHELL LABORATORIES
VALUED ECOSYSTEM AND SOCIAL COMPONENTS

We are seeking your comments and suggestions on Valued Ecosystem and Social Components.

Valued Ecosystem Components (VECs) and Valued Social Components (VSCs) are components of the natural and human environment that are considered valuable. These components may be environmental or there may be economic, social or aesthetic reasons for their value. VECs and VSCs are considered important or valuable because they are:

- legally recognized and afforded specific protection by law;
- recognized by the scientific community as important due to their abundance, scarcity, endangered status, or role in the ecosystem and/or;
- recognized by the public as being important due to their social importance, commercial/economic value, or role in maintaining quality of life within the community.



The environmental assessment team has identified some examples of VECs and VSCs.

Examples of VECs are:

- Clean air, water, land
- Winnipeg River and its riverbanks
- Designated rare, threatened or endangered species and habitats
- Critical habitats such as fish spawning, wildlife overwintering and migration routes
- Important representative undisturbed areas such as gullies, wetlands and forest
- Protected areas such as parks, archaeological sites
- Research Sites (e.g., Field-Irradiator Gamma)

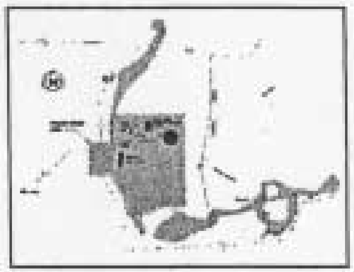
Examples of VSCs are:

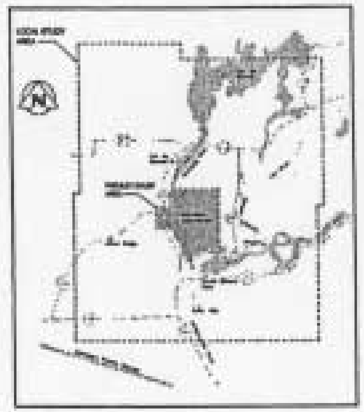
- Archaeological sites
- Traditional land use areas
- Cottage areas
- Recreational areas

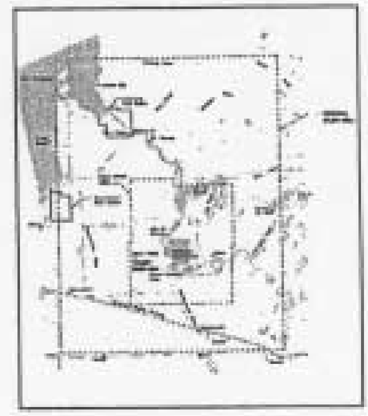
We'd like to know what you think of this preliminary list and what additional suggestions you may have.

AECL EACL

Whiteshell Laboratories Study Areas







Project Study Area

This is the area contained within the Whiteshell Laboratories property boundaries. The area is located north of Highway 211 and includes lands on the east and west side of the Winnipeg River. The project study area will be used to assess direct and indirect biophysical effects.

Local Study Area

This area includes the Rural Municipality of Lac du Bonnet, Local Government District of Pinawa and the north part of the Rural Municipality of Whitemouth. The local study area will be used to assess indirect biophysical and socio-economic effects including cumulative effects.

Regional Study Area

This is the area approximately bounded by highway 15 to the south, Traverse Bay of Lake Winnipeg to the north, Highway 12 north of Anola to Grand Beach in the west and north of Rennie to Point du Bois in the east. The area includes the Sagkeeng and Brokenhead First Nations. The regional study area will be used for the public consultation program.

AECL EACL

WHITESHELL LABORATORIES ENVIRONMENTAL ASSESSMENT PROCESS

What is the Canadian Environmental Assessment Act (CEAA) and why does it apply to the decommissioning project?

- CEAA is Canada's environmental assessment legislation and outlines the process for ensuring that environmental assessments are carried out for projects that come under the Act
- the Act requires that an environmental assessment be carried out when a federal government department is a proponent, provides funds or lands for a project or gives regulatory approval
- a licence amendment, approved by the AECB, must be secured by AECL for decommissioning of the Whiteshell Laboratories, which triggers application of CEAA

Who is responsible for the environmental assessment?

- the AECB is the Responsible Authority for the decommissioning project and for ensuring that an environmental assessment is carried out
- AECL is responsible to the AECB for preparation of the environmental assessment report
- the federal Minister of Environment is responsible for deciding on the environmental assessment since it is a Comprehensive Study under CEAA

What is an environmental assessment?

- it is a process used to identify, evaluate, mitigate and follow-up on the effects of a proposed project on the environment

What is the definition of environment and environmental effect under CEAA?

- environment is defined as land, water and air, organic and inorganic matter and living organisms, and the interacting natural systems
- environmental effect refers to any change the project may cause in the environment, including any effect of any such change on health, socio-economic conditions, etc., and any change to the project caused by the environment

Why is a Comprehensive Study required?

- the project includes decommissioning of the WR-1 reactor and the Waste Management Area which are on the Comprehensive Study List regulations of CEAA

What is a Comprehensive Study environmental assessment?

- a Comprehensive Study environmental assessment involves assessment of alternative means of carrying out the project, need for and requirements of a follow-up program, and effects on renewable resource capacity
- the Comprehensive Study Report is subject to public review prior to a decision by the federal Minister of Environment

What is the scope of the decommissioning project being assessed?

- it includes decommissioning of the Whiteshell Laboratories as licensed by the AECB, including all listed facilities, buildings, infrastructure and lands
- the scope does not include the Underground Research Laboratory or the Whiteshell Irradiator
- the environmental assessment will address:
  - environmental effects of project activities including accidents and malfunctions, cumulative effects, and significance of effects
  - indirect effects of the project on human health, socio-economic conditions, physical and cultural heritage, current use of lands for traditional purposes and effects of the environment on the project
- the assessment will not address:
  - issues associated with the decision to close the Whiteshell Laboratories as these are not within the scope of the CEAA process

What is scoping?

- scoping identifies project activities and environmental issues to be addressed, establishes boundaries of the assessment and focuses the assessment on relevant issues and concerns
- when carried out early in the process, scoping can prevent delays and improve the quality of the assessment
- scoping activities such as this open house are an important first step for obtaining input on issues of concern to the public

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WHITESHELL LABORATORIES ENVIRONMENTAL ASSESSMENT PROCESS

How are environmental effects identified?

- environmental effects or changes in the environment are identified by reviewing actual project activities and applying environmental assessment methods such as overlay mapping, as well as public consultation

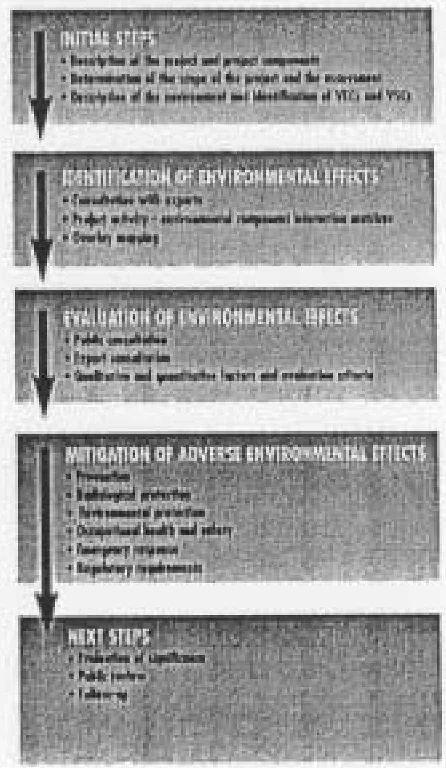
How are environmental effects evaluated?

- by utilizing pre-established evaluation criteria
- by incorporating comments from the public

What opportunities are available for public input?

- there are opportunities for public involvement at each phase of the environmental assessment
  - during the scoping phase (now) and the preparation of the Comprehensive Study Report
  - during the AECB review of the Comprehensive Study Report
  - during the CEAA review of the Comprehensive Study Report
- each public consultation cycle will include:
  - a newsletter
  - an open house
  - displays in area communities
  - opportunities for additional meetings
  - consultation with First Nations
- all comments from the public will be recorded and addressed in the Comprehensive Study Report

Environmental Assessment Procedures



AECL EACL

WHITESHELL LABORATORIES
NEXT STEPS IN THE ENVIRONMENTAL ASSESSMENT PROCESS

Thank you for attending this Open House.

Further information can be obtained at:

AECL website www.aecl.ca

CEAA website: www.ceaa.gc.ca

Manitoba Environment's Public Registry, Pinawa Library, Winnipeg's Centennial Library and at its Winnipeg offices at 123 Main Street

The Atomic Energy Control Board can be reached at 1 800 668-5284

If your organization would like more information or would like a further discussion on the proposed decommissioning program, please call (204)753-2311 (extension 2294) or 1 800 665-0436.

What are the Next Steps?

- the EA consultant team welcomes comments from this Open House and will address your questions and comments in the Comprehensive Study Report
- a follow-up Open House will be held in the winter to respond to all questions and comments and present the findings of the environmental assessment
- the Comprehensive Study Report will be submitted to the AECB for review by federal departments
- the AECB will submit the report to the Canadian Environmental Assessment Agency for national public review
- the federal Minister of Environment will make a decision on the environmental consequences in accordance with the Canadian Environmental Assessment Act
- the AECB will be required to implement the decision through the licensing process

AECL EACL

COMMENT SHEET

Whiteshell Laboratories Decommissioning Program
Open House
October 16, 1999 10 a.m. - 4 p.m.

Thank you for attending this open house. Your comments are important to preparation of the Comprehensive Study Report.

Questions? Do you have any questions that were not answered at this open house?

Comments? Do you have any specific comments that you would like the consultant team to address in the Comprehensive Study environmental assessment? Are there specific issues or valued ecosystem or social components that you want us to know about?

(optional)
Name
Address
Telephone Number

Please leave your comments at the open house or send them to us by November 5, 1999.

mail to:	**fax to:**
AECL	**AECL**
Pinawa, MB R0E 1L0	**(204) 753-2545**

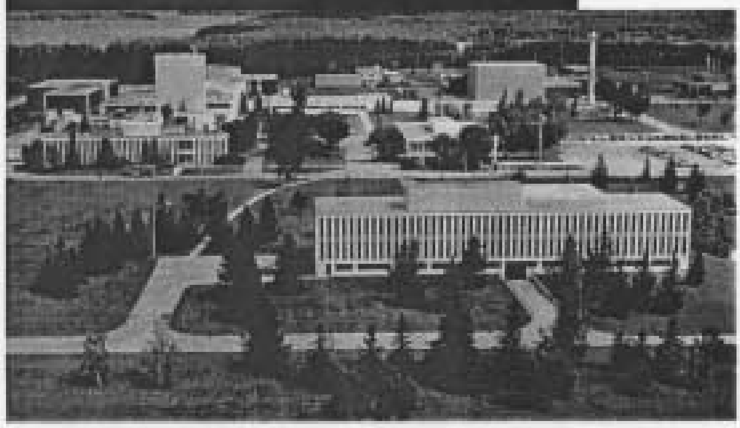
(use the other side if you need more space)

Thank you.

No 1
October
1998

Whiteshell Laboratories

DECOMMISSIONING



What is an Environmental Assessment?

An Environmental Assessment (EA) is a process that is used to identify and evaluate the effects of a proposed project on the environment and human health. It is also used to ensure follow-up analysis of impacts and effects. An EA is commonly used in activities such as highway construction, mining activities, housing and industrial developments to name a few examples. An important component of an EA is that the public has an opportunity to review and comment on the proposed project. Comments and suggestions from the public are vital for an effective EA.

We invite you to attend our Open House.

On Saturday, October 10, 1998, from 10 a.m. to 4 p.m., AECL will host an Open House at Whiteshell Laboratories. We invite you to tour areas of the site to be decommissioned and speak to the decommissioning and EA team. We look forward to receiving your feedback on AECL's initial decommissioning plan. Whiteshell Laboratories is located off Highway 211 (Pinawa Highway). Highway 211 is accessed via Highway 11.

Environmental Assessment of Whiteshell Laboratories Decommissioning Begins

Most residents of the Eastman region are aware that the Whiteshell Laboratories of Atomic Energy of Canada Limited (AECL) will be decommissioned. This means the site and facilities will be systematically retired from use.

Laboratories and support facilities will be cleaned and radioactive waste material will be consolidated at the site's waste management area for safe storage. Decommissioning will prepare most of the site for new business use. The Economic Development Authority of Whiteshell (EDAW) is currently exploring new business opportunities for the site.

The decommissioning plan for Whiteshell Laboratories must be approved by the Atomic Energy Control Board (AECB), the federal government agency that regulates Canada's nuclear industry. A licence change will be required from the AECB to start decommissioning of Whiteshell Laboratories. The licence change triggers an Environmental Assessment (EA) under the Canadian Environmental Assessment Act. The purpose of the EA is to ensure that decommissioning is done in a manner that protects human health and the environment. Before decommissioning work can begin, AECL must have its EA approved by the federal Minister of Environment.

The type of environmental assessment being conducted for Whiteshell Laboratories is a comprehensive study, which includes consideration of comments from the public. A public consultation program is being carried out to inform the public about the decommissioning project and to receive comments to be addressed in the EA. Public comments will be taken into account in the decision by the federal Minister of Environment on the comprehensive study report.

The public consultation program strives to address your questions and comments. We encourage you to learn about AECL's proposed decommissioning plan and provide feedback to us. There will be subsequent Open Houses where responses to your questions and comments will be provided.

Information on how to obtain a copy of the decommissioning plan is on page four.

It is important to note that decommissioning will not prevent EDAW from continuing its ongoing work to find new businesses and tenants for surplus buildings and technology at Whiteshell Laboratories. AECL is working closely with EDAW to help them in their efforts.

For new [illegible] Whiteshell Laboratories to be fully realized the EA must first be approved since this allows decommissioning and [illegible].

The Whiteshell Laboratories site will remain under AECB licence and decommissioning [illegible] AECL, as the licence holder of the site, is committed to meeting all safety, environmental and regulatory requirements throughout the decommissioning process.

Your questions and comments on the Whiteshell Laboratories decommissioning project are important to finalizing the overall decommissioning plan.

AECL EACL

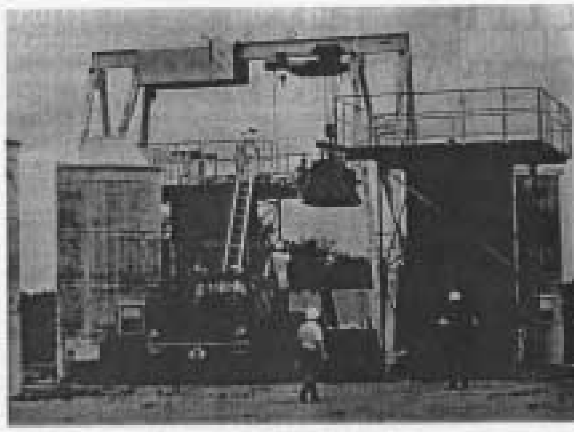


Photo shows Whiteshell Laboratories employees loading used nuclear fuel waste into above ground storage canisters. (photo credit M. Gruman)

Whiteshell Laboratories decommissioning strategy

2

AECL's proposed strategy is to decommission Whiteshell Laboratories using a phased approach. The initial stage of work is operational shutdown. This has already begun and includes cleanup of facilities no longer in use. The planning phase of decommissioning work is expected to be completed by the summer of 2000. Once the AECB approves the decommissioning plan, actual decommissioning work will begin and will be implemented in three phases.

Phase 1 - facilities will be decommissioned to a state of safe and secure monitoring and surveillance. Buildings are cleaned up but remain in place to manage the remaining liabilities. Environmental monitoring and radiation protection experts will be retained to safely manage the site. Some buildings and most of the site land can be made available for other uses. Completion of Phase 1 is planned for March 2004.

Phase 2 - will address the waste management facilities, that were required in operation throughout Phase 1, with the objective of maintaining continued safe storage until wastes requiring removal are transferred to a disposal site or alternate storage facility. Some empty site buildings may be demolished. Phase 2 spans a period of 10 years.

Phase 3 - is the final decommissioning of the site. The remaining buildings are demolished. Radioactive wastes which can not be managed at the site are transferred to off-site disposal facilities. The land remaining under AECB licence and long term controls is reduced to about 10 acres. Phase 3 spans a period of about 45 years.

Time frame of Whiteshell Laboratories decommissioning

Waste management strategy

One of the difficulties that AECL faces in decommissioning Whiteshell Laboratories is that Canada does not have a permanent disposal facility for radioactive wastes. However, wastes stored at Whiteshell Laboratories are safely managed. The radiation from low level waste material will decay, or reduce, to a level equal to radiation that naturally occurs in the environment within 250 to 300 years.

Intermediate and High Level wastes stored at Whiteshell Laboratories waste management area will ultimately require removal to disposal facilities. Existing storage facilities at the site are adequate to safely store these materials for several decades. A long term waste management plan will be developed to schedule the actions required to relocate these wastes when either disposal or alternate storage facilities become available.

As long as radioactive waste is stored at the site, AECL will continue to employ experts in radiation protection, environmental monitoring, building maintenance and security. This will ensure that all wastes remain safely stored until waste disposal or alternate storage is available in Canada, or until the radiation level of the waste decays to the point where it is no longer a concern.

Could contamination from wastes stored underground in the Whiteshell Laboratories waste management area move from the area through groundwater flows?

No. The location of the waste management area was chosen as the result of extensive hydrogeological studies of the area. The properties of the clay soil of the waste management area "locks" the radioactivity within the immediate area. Groundwater monitoring during the years that Whiteshell Laboratories has operated confirms that the waste remains safely managed.

Groundwater monitoring will continue throughout the decommissioning program. Wastes stored in above ground facilities do not come in contact with ground water.

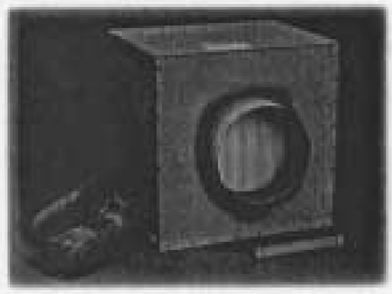
What kinds of radioactive wastes exist at Whiteshell Laboratories?

There are three levels of radioactive waste safely stored at the site. Low-Level Waste (LLW) is typically used labware, rubber gloves and shoe covers, wiper paper and mops.

Low-Level Waste

How are radioactive wastes stored at Whiteshell Laboratories?

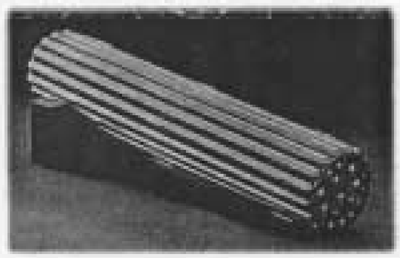
All radioactive wastes are stored using practices that met or exceeded international safety standards at the time the waste was placed in storage. For example, in the 1960s and 70s, packaged LLW waste was stored in underground clay trenches. From the mid-1980s, the practice is to store these wastes in above-ground engineered facilities or [illegible].



Medium-Level Waste

Medium-Level Waste (MLW) has more radioactivity than LLW. Typically, MLW is scrap metal materials from experiments, filters and radioactive liquid waste that has been solidified.

3



High-Level Waste

High-Level Waste (HLW) has the highest level of radioactivity. HLW is usually used nuclear fuel bundles but it can also include tubing from the core of a nuclear reactor. Approximately 40 metric tons of HLW is in storage in outdoor concrete canisters.

Whiteshell Laboratories waste management area

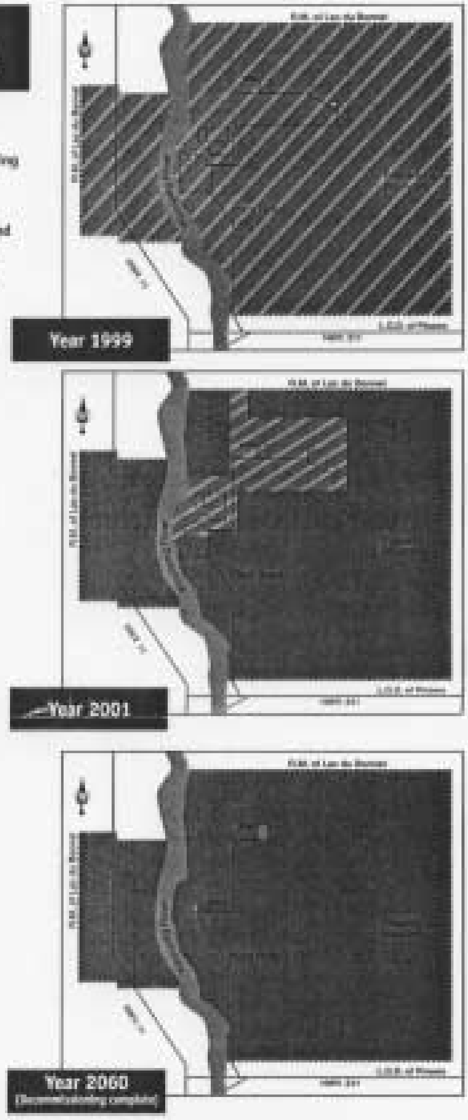
High-level wastes, or used fuel, are stored in the concrete canisters (1) in the background. Four above-ground concrete bunkers (2), with low level waste are visible to the right behind the two storage buildings. The below-ground concrete bunkers (3) with medium-level waste have their tops visible in the centre of the photo. The sealed tops of the concrete standpipes (4), with medium-level and some high-level waste are also visible in the centre of the photo just above the road. The grassy area (5) in the foreground is where the clay trenches for low-level waste are located.

The photo at right shows the Whiteshell Laboratories waste management area where all radioactive wastes are stored. The area is 12 acres in size.

Future use of Whiteshell Laboratories land and buildings

The Whiteshell Laboratories site is 10,800 acres. Once the EA and decommissioning plan is approved, the decommissioning can proceed and except for about 500 acres the site can be available for new business development in 2001. AECL is working closely with EDAW which has the responsibility to find alternative uses and develop new economic opportunities for the Whiteshell Laboratories site and the surrounding region.

The diagrams to the right show the licensed site and the availability of land for new development following approval of the EA.



Legend

- Buildings/Property under AECB license
- Buildings/Property that could be available for new business opportunities or community use

We invite you to our Open House

Join us Saturday October 16 at Whiteshell Laboratories between 10 a.m. and 4 p.m. We'll have tours of the site, displays and information describing the decommissioning plan. Our staff will be at the main entrance to the site to guide you to the displays and tours.

See our displays

We will have displays at Beausejour, Lac du Bonnet, Pinawa and Whitemouth with staff on hand to answer your questions. Phone us for dates and locations of these displays. The displays may also be available for other locations.

Arrange for presentations or informal meetings

If you have a group interested in a presentation or meeting, please contact us. We can arrange for someone from the decommissioning team to meet with your group.

You are welcome to a copy of the decommissioning plan

Copies of the plan and related documents are available from our office. Give us a call or drop by our office for a copy.

Check the Public Registries

As information becomes available on the environmental assessment it will be put on the Canadian Environmental Assessment Agency public registry. The public registry is accessible through their website at http://www.ceaa.gc.ca. Manitoba Environment has also established a public registry for the project with locations at the Pinawa Library, Winnipeg's Centennial Library and at Manitoba Environment's Winnipeg office, 123 Main Street (the VIA Rail station). The Atomic Energy Control Board can be contacted at 1 800 668-5284.

How to contact us

AECL Whiteshell Laboratories
Pinawa, Manitoba R0E 1L0

1-800 665-0436
tel: (204) 753-2311 ext. 2294
fax: 753-2545
e-mail: WLdecomm@aecl.ca
web: www.aecl.ca

On evenings and weekends, ask for extension 2294 and leave a voice mail message.

We welcome your feedback

Appendix E.4

Letter to Potentially Interested Organizations/Persons

AECL EACL

FACILITIES & NUCLEAR OPERATIONS
WL Decommissioning

File 00170
Decom-99-035
1999 October 05

Edwin Yee
Chairman
Whiteshell Laboratories Decommissioning Technical Advisory Committee
Manitoba Environment
123 Main Street
Suite 160
Winnipeg, Manitoba R3C 1A5

Dear Mr. Yee:

This letter is to advise you that Atomic Energy of Canada Limited (AECL) has initiated its public consultation program for the environmental assessment of the proposed decommissioning program for the Whiteshell Laboratories. A newsletter describing the proposed program, the environmental assessment process and ways in which the public can become involved in the process has been widely distributed to residents in the Eastman region.

A major event in initiating the public consultation process is an Open House to be held at the Whiteshell Laboratories on Saturday October 16 from 10:00 a.m. to 4:00 p.m. This will provide an opportunity for interested persons to discuss the decommissioning program with the decommissioning team and the environmental assessment consultants. AECL will also be providing tours of facilities and the Waste Management Area. An important objective of this Open House is to obtain public feedback. Comments and questions from the public will be addressed in the comprehensive study environmental assessment that is being prepared by our external consultant team.

I would like to take this opportunity to invite representatives of the provincial Technical Advisory Committee (TAC) to the Open House. Attached for your information is a brief project description of the proposed decommissioning program that has been sent to other organizations as part of the public notification process. I am also enclosing a copy of the newsletter.

We will continue to keep area residents and organizations informed of our activities and will be setting up displays in area communities, hosting additional Open Houses, and distributing follow-up newsletters that address questions raised in the public consultation. We will also respond to any organization or group that wishes to have a formal presentation or informal discussion.

DECOM-99-035 - 2 - 1999 October 05

We look forward to the attendance of TAC members at the Open House and also look forward to the TAC meeting on October 20.

Sincerely,

[Original Signed By:]

R.A. (Bob) Helbrecht
Program Manager
WL Decommissioning

AECL EACL

FACILITIES & NUCLEAR OPERATIONS
WL Decommissioning

File: 00170
Decom-99-049
1999 October 05

Dave Wotton
Assistant Deputy Minister
Environmental Operations Division
Manitoba Environment
123 Main Street
Suite 160
Winnipeg, Manitoba R3C 1A5

Dear Mr. Wotton:

This letter is to advise you that Atomic Energy of Canada Limited (AECL) has initiated its public consultation program for the environmental assessment of the proposed decommissioning program for the Whiteshell Laboratories. A newsletter describing the proposed program, the environmental assessment process and ways in which the public can become involved in the process has been widely distributed to residents in the Eastman region.

A major event in initiating the public consultation process is an Open House to be held at the Whiteshell Laboratories on Saturday October 16 from 10:00 a.m. to 4:00 p.m. This will provide an opportunity for interested persons to discuss the decommissioning program with the decommissioning team and the environmental assessment consultants. AECL will also be providing tours of facilities and the Waste Management Area. An important objective of this Open House is to obtain public feedback. Comments and questions from the public will be addressed in the comprehensive study environmental assessment that is being prepared by our external consultant team.

We will continue to keep area residents and organizations informed of our activities and will be setting up displays in area communities, hosting additional Open Houses, and distributing follow-up newsletters that address questions raised in the public consultation. We will also respond to any organization or group that wishes to have a formal presentation or informal discussion.

I would like to take this opportunity to invite you to the Open House. Attached for your information is a brief project description of the proposed decommissioning program that has been sent to other organizations as part of the public notification process. I am also enclosing a copy of the newsletter.

Sincerely,

R.A. Helbrecht

R.A. (Bob) Helbrecht
Program Manager
WL Decommissioning

FACILITIES & NUCLEAR OPERATIONS
WL Decommissioning

File: 00170
Decom-99-050
1999 October 05

Darren Praznik
MLA - Lac du Bonnet
Room 227 Legislative Building
Winnipeg Manitoba R3C 0V8

This letter is to advise you that Atomic Energy of Canada Limited (AECL) has initiated its public consultation program for the environmental assessment of the proposed decommissioning program for the Whiteshell Laboratories. A newsletter describing the proposed program, the environmental assessment process and ways in which the public can become involved in the process has been widely distributed to residents in the Eastman region.

A major event in initiating the public consultation process is an Open House to be held at the Whiteshell Laboratories on Saturday October 16 from 10:00 a.m. to 4:00 p.m. This will provide an opportunity for interested persons to discuss the decommissioning program with the decommissioning team and the environmental assessment consultants. AECL will also be providing tours of facilities and the Waste Management Area. An important objective of this Open House is to obtain public feedback. Comments and questions from the public will be addressed in the comprehensive study environmental assessment that is being prepared by our external consultant team. For your information, I am attaching a brief project description of the proposed decommissioning program. I am also enclosing a copy of the newsletter.

I would like to take this opportunity to invite you to the Open House. We will continue to keep area residents and organizations informed of our activities and will be setting up displays in area communities, hosting additional Open Houses, and distributing follow-up newsletters that address questions raised in the public consultation. We will also respond to any organization or group that wishes to have a formal presentation or informal discussion.

We look forward to your involvement.

Sincerely,

[Original Signed By: R.A. Helbrecht]

R.A. (Bob) Helbrecht
Program Manager
WL Decommissioning

FACILITIES & NUCLEAR OPERATIONS
WL Decommissioning

File 00170
Decom-99-053
1999 October 05

Town of Lac du Bonnet
Mayor Glen Hirst
P.O. Box 339
Lac Du Bonnet, MB
R0E 1A0

This letter is to advise you that Atomic Energy of Canada Limited (AECL) has initiated its public consultation program for the environmental assessment of the proposed decommissioning program for the Whiteshell Laboratories. A newsletter describing the proposed program, the environmental assessment process and ways in which the public can become involved in the process has been widely distributed to residents in the Eastman region.

A major event in initiating the public consultation process is an Open House to be held at the Whiteshell Laboratories on Saturday October 16 from 10:00 a.m. to 4:00 p.m. This will provide an opportunity for interested persons to discuss the decommissioning program with the decommissioning team and the environmental assessment consultants. AECL will also be providing tours of facilities and the Waste Management Area. An important objective of this Open House is to obtain public feedback. Comments and questions from the public will be addressed in the comprehensive study environmental assessment that is being prepared by our external consultant team. For your information, I am attaching a brief project description of the proposed decommissioning program. I am also enclosing a copy of the newsletter.

I would like to take this opportunity to invite you and your council to the Open House. We will continue to keep area residents and organizations informed of our activities and will be setting up displays in area communities, hosting additional Open Houses, and distributing follow-up newsletters that address questions raised in the public consultation. We will also respond to any organization or group that wishes to have a formal presentation or informal discussion.

We look forward to your involvement.

Sincerely,

[Original Signed By: R.A. Helbrecht]

R.A. (Bob) Helbrecht
Program Manager
WL Decommissioning

FACILITIES & NUCLEAR OPERATIONS
WL Decommissioning

File 00170
Decom-99-065
1999 October 05

Pinawa Community Development Corporation
Box 234
Pinawa, MB
R0E 1L0

This letter is to advise you that Atomic Energy of Canada Limited (AECL) is undertaking an environmental assessment of the proposed decommissioning program for the Whiteshell Laboratories and is initiating a public consultation program. As the result of federal funding reductions, AECL is discontinuing its operations at Whiteshell Laboratories by the end of 2001. AECL is in the process of completing safe operational shutdown for nuclear facilities and is preparing detailed plans for decommissioning.

In order to proceed with the decommissioning program, AECL is required to undertake a comprehensive study environmental assessment under the Canadian Environmental Assessment Act and to obtain a decommissioning licence from the Atomic Energy Control Board. The comprehensive study will identify and evaluate potential environmental effects from the proposed decommissioning activities. This study is underway and we have initiated our public consultation program.

A newsletter has been widely distributed and an Open House will be held at the Whiteshell Laboratories on Saturday October 16 from 10:00 a.m. to 4:00 p.m. The Open House will provide an opportunity for interested persons to discuss the decommissioning program with the decommissioning team and the environmental assessment consultants. AECL will also be providing tours of facilities and the Waste Management Area. An important objective of this Open House is to obtain public feedback. Comments and questions from the public will be addressed in the comprehensive study environmental assessment that is being prepared by our external consultant team. Attached for your information is a brief project description of the proposed decommissioning program and a copy of the newsletter.

I would like to take this opportunity to invite your organization to the Open House. We are also available, along with our external consultants, to meet with your organization to discuss the proposed program. We will continue to keep area residents and organizations informed of our activities and will be setting up displays in area communities, hosting additional Open Houses, and distributing follow-up newsletters that address questions raised in the public consultation.

We look forward to your involvement. If you have any questions, please do not hesitate to call me at (204) 753-2311.

Sincerely,

[Original Signed By: R.A. Helbrecht]

R.A. (Bob) Helbrecht
Program Manager
WL Decommissioning

AECL EACL

FACILITIES & NUCLEAR OPERATIONS
WL Decommissioning

File: 00170. *-
Decom-99-089
1999 October 06

Dan McNaughton
Regional Director
Canadian Environmental Assessment Agency
Suite 263 - Union Station
123 Main Street
Winnipeg, Manitoba R3C 1A3

Dear Mr. McNaughton:

This letter is to advise you that Atomic Energy of Canada Limited (AECL) has initiated its public consultation program for the environmental assessment of the proposed decommissioning program for the Whiteshell Laboratories. A newsletter describing the proposed program, the environmental assessment process and ways in which the public can become involved in the process has been widely distributed to residents in the Eastman region.

A major event in initiating the public consultation process is an Open House to be held at the Whiteshell Laboratories on Saturday October 16 from 10:00 a.m. to 4:00 p.m. This will provide an opportunity for interested persons to discuss the decommissioning program with the decommissioning team and the environmental assessment consultants. AECL will also be providing tours of facilities and the Waste Management Area. An important objective of this Open House is to obtain public feedback. Comments and questions from the public will be addressed in the comprehensive study environmental assessment that is being prepared by our external consultant team.

We will continue to keep area residents and organizations informed of our activities and will be setting up displays in area communities, hosting additional Open Houses, and distributing follow-up newsletters that address questions raised in the public consultation. We will also respond to any organization or group that wishes to have a formal presentation or informal discussion.

I would like to take this opportunity to invite you to the Open House. Attached for your information is a brief project description of the proposed decommissioning program that has been sent to other organizations as part of the public notification process. I am also enclosing a copy of the newsletter.

Sincerely,

R.A. (Bob) Helbrecht
Program Manager
WL Decommissioning

Appendix E.5

AECL Response to Community/Provincial Leaders Committee Report

APPENDIX E.5
RECOMMENDATIONS OF COMMUNITY LEADERS' COMMITTEE

Recommendations	Addressed in Csr	AECL Response
1. A communication and consultation process should be established by AECL as soon as possible with a commitment to full disclosure of all planning and implementation of decommissioning activities to all interested parties.	A communication and consultation process is underway under CEAA legislation for the preparation of the CSR.	
2. A Community Liaison Committee should be established immediately between the company and the community to ensure participation of the community and to foster trust prior to submission of further decommissioning plans.	Establishing the terms of reference for the Public Advisory Committee was one of the tasks to be addressed in phase 1.	AECL supports the idea of a Community Liaison Committee as part of an ongoing communications program during the implementation of the decommissioning program.
3. All nuclear liabilities created over the life of the site including the activities of the decommissioning process should be dealt with now whenever possible, not deferred to future generations.	Planning for the management of all nuclear liabilities is the focus of the decommissioning planning. The reference plan specifies the timeframes and approaches to mitigate all site liabilities consistent with assumptions on waste disposal availability.	
4. If postponement of action on a nuclear liability is recommended in the decommissioning process, it must be supported by an economic model which clearly demonstrates the benefit of the delay to current and future generations.	AECL believes the preferred alternative of a final end-state by 2060 is advantageous for a variety of reasons. 1. Although there is a national policy for disposal of nuclear waste, permanent disposal space for Whiteshell Laboratories waste is not expected to be available until 2025 for LLW and 2050 for HLW. 2. The proposed plan optimizes the use of existing engineered structures and building envelopes to control nuclear liabilities. 3. The plan takes advantage of the reduction in activity of the key radionuclides. This minimizes the exposure to workers/the environment, and the cost for protection of workers/the environment.	

Recommendations	Addressed in Csr	AECL Response
	4. Double handling is avoided. For example, if a waste storage facility were currently available for HLW, it would have to be handled twice. First, it needs to be handled at Whiteshell Laboratories when being sent to the storage location. Then, it would need to be handled for a second time, when a permanent disposal location becomes available. The cost efficiency of this approach will be assessed and compared to other alternatives.	
5. All documentation pertaining to the research facilities to be decommissioned should be updated and validated in terms of past records including all contaminated facilities, their past use and practices, as well as waters and grounds on site including each bunker, tile hole and trench in the waste management area.	Collection and analysis of historic radiological and environmental information is an integral part of assessing radiological, occupational and environmental hazards. This work is a necessary part of the decommissioning process and is needed to plan: • radiological and environmental surveying/sampling activities, • assessment and mitigation of impact to workers/environment, and • decontamination/remediation activities. Historical and assessment data will be retrievable and stored in a secure location.	
6. A comprehensive environmental site assessment should be initiated as soon as possible following the Manitoba Guideline for Environmental Site Investigations.	This is addressed as part of mitigation measures in the CSR and specifically covered off in facility detailed decommissioning plans.	AECL procedures for decommissioning nuclear facilities follow national and international standards. The procedures include a characterization process specific to nuclear facilities. The Manitoba guidelines are primarily hydrocarbon-based and do not address radioactive contamination. Every effort will be made to ensure that the spirit and intent of Manitoba guidelines are followed and exceeded. The final result is a clean site for unrestricted use with all types of hazards

Recommendations	Addressed in Csr	AECL Response
		mitigated.
7. A comprehensive environmental monitoring program for all stages of decommissioning is required as soon as possible with a clear written commitment to fully disclose all relevant information through regular reporting.	A comprehensive environmental monitoring program will be maintained and will be adapted to the decommissioning program. Regular reporting will be maintained for communications purposes and for maintenance of AECL's decommissioning licence.	
8. Baseline environmental monitoring for characterization of surface water, the Winnipeg River (sediment and aquatic life), as well as groundwater, soils, vegetation and air quality should begin immediately.	The 1998 environmental monitoring report represents the baseline for the decommissioning program. As stated in #7, above, the environmental monitoring program remains in place throughout the decommissioning project.	
9. Experienced staff presently or formerly of the site should be identified and screened for their potential expertise and assistance in the proposed decommissioning of the facilities to the benefit of all interested parties.	The decommissioning program strives to rely on maintaining site nuclear operations knowledge to assist with decommissioning planning and to carry out the decommissioning program, including monitoring and surveillance. Experienced staff (from outside the decommissioning team) are being maintained internally and ex-employees are being contracted back to AECL.	
10. Experienced staff employed presently or formerly of the site should be screened for any potential information on past practices or incidents which may require special decommissioning response (i.e. accidents).	Same as above.	
11. The low, medium and high level radioactive wastes must be addressed as a priority early in the decommissioning process with the clear understanding that trench and tile hole storage are not acceptable practices in the nuclear industry.	Plans are being developed to address the waste inventory stored in Whiteshell Laboratories Waste Management Facilities during Phase 2 and Phase 3 of the decommissioning program. All wastes have been addressed in the CSR and detailed decommissioning plans will be prepared for all facilities document in detail how wastes will be handled.	

Recommendations	Addressed in Csr	AECL Response
	Plans for the management of any waste at Whiteshell Laboratories for the long term will be supported by safety assessments including pathways analysis that demonstrate that any impacts on public safety or the environment are below acceptable regulatory limits. There is no intention to manage intermediate or high-level waste at the site for the long term. Any waste remaining at the site on an interim basis, until waste disposal becomes available, is being managed within the framework of operational and monitoring controls required to meet licensing compliance.	
12. All low-level waste should be secured in an appropriately engineered disposal facility to be constructed for this purpose.	The safety case for in-situ management of low-level waste at the Waste Management Area would not be enhanced by use of an engineered storage structure. Since an engineered structure would not likely endure for the period required for the low-level radioactivity to decay to background levels, the final safety case remains dependent on the local geology/hydrogeology system. The WMA at Whiteshell Laboratories was selected based on favourable hydrogeology. The clay soils retard the migration of radionuclides and water flow through the groundwater system is extremely low. Routine WMA monitoring indicates no measurable movement of radionuclides outside the area. An evaluation of LLW trench in-situ disposal completed in 2000 is presented in Appendix C.	
13. Waste in tile holes (Note that AECL refers to these as standpipes) should be recovered, sorted by classification and receive proper disposal. Fuel waste from tile holes should be packaged and placed in canisters with other fuel waste. Waste storage in leaky bunkers is not acceptable	Addressing fuel waste stored in standpipes at Whiteshell Laboratories will capitalize on remediation planning for similar materials at Chalk River Laboratories. Engineering specifications are currently being developed for retrieval, processing and re-packaging facilities at Chalk River to safely handle the wastes. This project is aggressively in progress at Chalk River Laboratories and the realistic timeframe for implementation is 10 years.	

Recommendations	Addressed in Csr	AECL Response
14. All nuclear fuel waste stored on the site should be removed to canister storage in eastern Canada as soon as canisters can be made available.	The Concrete Canister Storage Facility at Whiteshell Laboratories has a design life, which safely extends to 2050. This date is the planning assumption used by the Whiteshell Laboratories decommissioning project for high-level waste disposal availability. Accordingly, the decommissioning plans propose continued storage in the Whiteshell Laboratories canisters until transfer directly to disposal can be accomplished.	
15. Intermediate level waste should be securely packaged in containers such as the stainless steel drums used in the UK and placed in an engineered storage facility sufficient to last until a permanent disposal system is available in Canada.	There is some fuel waste located in Waste Management Area standpipes, and some intermediate-level waste that will require early retrieval, processing and repackaging. This will be maintained in upgraded interim storage prior to relocation to waste disposal facilities. The specifications of waste containers remain consistent with storage requirements until final waste containers are specified for disposal. The processes for processing this waste are being planned for Phase 2 of the program. One example of such planning is for the fuel stored in standpipes. The technology under development for handling similar waste at CRL will be applied to the processing and interim management of Whiteshell Laboratories waste.	
16. All new radioactive wastes generated from the decommissioning process must be stored in a fully retrievable configuration until such time as a permanent disposal facility is available in Canada.	This has been AECL's policy since use of the low-level trenches was discontinued in 1985. Decommissioning will continue to manage all waste generated in a fully retrievable above-ground configuration.	
17. The WR-1 reactor core should be enclosed in an intrusion and weatherproof containment designed to secure the core for the duration of the safe storage period.	Biological and thermal shields provide a high level of intrusion containment. Maintaining the building structure provides adequate weather protection.	

Recommendations	Addressed in Csr	AECL Response
18. Buildings housing hot cells and active research laboratories should be completely decontaminated without delay for free release, all ventilation an piping within or connected to the buildings should be removed and a complete characterization of grounds under and adjacent to the facilities carried out immediately.	All buildings, including ventilation and piping, will be subjected to a thorough characterization survey to determine the existence of any radioactive contamination. Remediation of contaminated areas will be conducted as part of the Phase 1 decommissioning work with emphasis on potential mobile hazards. These areas will be decontaminated to a level to ensure a safe, secure monitoring and surveillance interim end state condition. Final remediation will be conducted as part of Phase 3 work when waste disposal facilities are available.	
19. If contaminated ground exists beneath formerly active buildings, demolition of those buildings should occur where required to ensure complete clean-up of soil.	Characterization of the soil in the building crawl spaces will be conducted as part of the Phase 1 decommissioning work. Remediation of any contaminated soil will also be conducted in Phase 1 decommissioning work to a level to ensure a safe, secure monitoring and surveillance interim end state condition. Final remediation will be conducted as part of Phase 3 work and will be conducted to ensure that buildings are not contaminated during demolition.	
20. AECL should aggressively market the site to attract new tenants to help offset the cost of operating the site and to encourage the diversification of industries in the Town of Pinawa.		Both the Manitoba government and the federal government have mandated the Economic Development Authority of Whiteshell Laboratories to undertake this activity. AECL supports these initiatives.

Appendix E.6

Issues Outside Scope of Comprehensive Study Report

APPENDIX E.6
ISSUES/COMMENTS RAISED IN PUBLIC CONSULTATION OUTSIDE THE SCOPE OF CSR

Issues/Comments	AECL Response
Community Image	
• Concern about how the community will be viewed by others as nuclear waste site – negative perception.	There is no indication that the presence of Whiteshell Laboratories has had a negative impact on recreational, cottage, industrial development or farming in the area. There is an indication that a significant in-migration of new residents to Pinawa is non-AECL employees.
• Concern that the waste storage site may impact on ability to attract newcomers to community or industry to area.	Same as above.
Land Disposition	
• Return of farmland on west side of Winnipeg River to original owners.	The process for dealing with land falls under the Master Agreement between AECL and the Province of Manitoba. The first opportunity for potential use of the property lies with the Province.
• The R.M. of Lac du Bonnet has a potential interest in land on west side for cottage development.	Same as above.
• There is a desire to have undeveloped land remain as undeveloped.	Same as above.
• Past expropriation of land has meant a loss of income for R.M. of Lac du Bonnet.	Same as above.
Industrial Development	
• It is taking too long to make land available to the private sector and this impacts on jobs in the region.	The removal of site land from the licence is dependent on completion of an environmental assessment process to verify that land meets requirements for unrestricted access. AECL is actively involved in the process of separating unaffected land for release from the licence. Unaffected land could potentially be used for commercial development.
• The sooner the separation of active and inactive sides, the better opportunities for alternate industrial development.	Same as above.
• There is conflicting information on whether buildings are available for re-use e.g. Buildings 100 and 300.	These buildings are not and will not be available for non-AECL use. The use of these buildings for non-nuclear use is not economical and no non-nuclear uses are being considered.
Health	
• It was suggested that current concerns about health impacts could be alleviated if health status information acquired by North Eastman Health Authority (NEHA) for the Whiteshell area was reported to area residents.	NEHA has requested health and safety data from Whiteshell Laboratories. AECL believes that two-way communication and the sharing of information is important.

Issues/Comments	AECL Response
Tourism	
• What are the potential impacts on eco-tourism in area with a waste storage site, e.g. TransCanada Trail?	The Trans Canada Trail is a national development and two local trail planning groups are actively developing components through the Whiteshell area. There is no indication that the presence of Whiteshell Laboratories has had an impact on the development of the trail through this area or on other tourism potential.
• What would be the potential impacts on current and future tourism if people were to learn that releases have been routinely put in the Winnipeg River?	Information on releases to the Winnipeg River has always been available to the public through AECL's annual Environmental Monitoring Report. There has been no apparent impact on tourism in the area.
• Could the storage site be beautified and site be promoted as part of Manitoba's history - could develop education, industry and tourism tours?	AECL acknowledges the historic and educational value of its research operations. It would not be practical to promote the storage site for tourism. It is suggested that development of a museum in Pinawa would be more practical and beneficial to the local and regional tourism industry.
Information Disclosure	
• Future trust and assurances are more difficult because of past lack of information disclosure.	AECL acknowledges that some members of the community may be concerned about future trust. It is AECL's belief that full disclosure of information and community participation through a liaison committee will enhance credibility and trust.
• Open, honest discussion with full disclosure of information on decommissioning program will enhance credibility and trust.	Same as above.
Environmental Effects From Operations	
• There is a concern about the distance that radioactivity has gone from the site.	From a hydrogeological perspective, the location of the WMA was selected to minimize the spread of radioactivity. The environmental monitoring program confirms that there is no migration of radioactivity away from the WMA. The ongoing monitoring program will be used to verify that there are no future impacts.
• Are the environmental effects from operations well documented and should people be concerned?	Environmental effects are well documented. In some areas additional assessments have been done or are planned to address site lands affected by nuclear development. Results of the assessments will be used to manage impacted areas and to achieve a final end-state.
• Have there been any effects on the fishery or wildlife?	Radioactivity levels in fish in the Winnipeg River are typical of values obtained across Canada, including regions very remote from nuclear facilities. These levels are well below Health Canada's guidelines. With respect to wildlife, monitoring results indicate that the impact to wildlife from past operations has been negligible.
• Surrounding communities currently lack knowledge of AECL's environmental monitoring program.	AECL is committed to an ongoing communication program and will ensure that communities are given the appropriate information to understand the current monitoring program and future monitoring program.
• It is only becoming public knowledge that there is contamination under some buildings (does this mean buildings have to be demolished?)	Buildings will be demolished in due course to meet decommissioning goals. Prior to, and/or following building demolition, soil will be remediated, if required, to a level that is safe for the deferment period.

Issues/Comments	AECL Response
Development of National Disposal Facilities	
• AECL, AECB, NRCan and the Province should work collaboratively towards development of national disposal facilities (outside the province).	Under the federal government's framework strategy on nuclear fuel waste, NRCan and the utilities are involved in discussions on these issues.
Grant-in-Lieu of Taxes	
• There is concern about potential effects on LGD of Pinawa with loss of grant-in-lieu of taxes.	AECL is committed to paying the grant-in-lieu of taxes until it is re-negotiated.
• LGD of Pinawa would like an exit agreement.	Same as above.
• There is concern about the ability to attract retirees if LGD doesn't have resources to maintain services or develop others such as recreational services.	Same as above.
Site Licensing	
• Consider transferring the site licence to another entity interested in the future of the site, not in closure (this would open up the site for tenants).	Such a transfer would mean that a new owner would have to assume liabilities associated with a licensed nuclear site and all of the costs associated with addressing these liabilities. To date, no outside entity has agreed to accept or even negotiate on accepting that liability.
Liabilities	
• There is a potential impact on community development if liabilities are deferred to the future.	A key goal of the Whiteshell Laboratories decommissioning program is to ensure that any impact to future generations is limited and over a reasonable timeframe. The implementation of the decommissioning program is cost-optimized relative to the handling and transfer of waste materials. It relies heavily on availability of disposal facilities for high and intermediate-level wastes.
• There is a philosophical argument of not leaving liabilities for future generations.	Same as above.
• An economic model is required to show benefit of delaying decommissioning.	The cost efficiency of AECL's preferred approach will be assessed and compared to other alternatives.

Appendix E.7

Questions / Comments from Open House

APPENDIX E.7

Comments and Questions recorded by AECL and EA consultants at Open House

CSR Issues

What is the exclusion zone around the WMA?
What does E-6 reference?
What are the reasons 60 years is considered to be the best option for the WL decommissioning plan?
Would the liabilities for any contamination permanently belong to AECL?
Is there heavy water around the reactor?
Decommissioning believed to have less impact than continued operation.
Isn't the groundwater from the WMA moving towards the river?
It was noted that the fact that groundwater monitoring had been done since day one was noteworthy.
What does 10 to the minus 6 mean? AECL needs to communicate in a simple manner.
Tour helped people to understand the issues – suggest that AECL is taking a reasonable approach.
What is chance of landfill becoming contaminated with radioactivity?
Will there continue to be a security force when the site is placed in monitoring and surveillance mode?
Have there been any intrusions into the secured area?
Will the reactor core be removed in decommissioning?
Why can't the fuel be moved to CRL?

Non-CSR Issues

We acknowledge AECL is leaving …just give us something to replace the jobs.
There is public opposition to keeping high level waste facilities for so many years.
Why are they shutting down WL and keeping CRL operational? It doesn't make any sense.
The process of making land available for use by the private sector is taking too long.
A person would like to have a radioisotope laboratory made available in B300.
Would AECL continue to pay the grant-in-lieu until 2060?
Concern that if the liability and waste was not completely removed, that a respectable organization wouldn't be willing to move on to the site.
Will the AECB release areas from the site licence before decommissioning has been completed?
Will this be a safe situation?
Concern about economic impact to private businesses e.g restaurant.
When will area along the river be available for development?
Are there commercial groups wanting to set up at WL and will they be able to?
Has all the money that has been spent at WL ever done anything worthwhile?
Is there anything delaying the privatization process?

Appendix E.8

First Nations Consultation Program

APPENDIX E.8
FIRST NATIONS CONSULTATION SUMMARY
SAGKEENG FIRST NATION

Date	Format	Groups / Individuals Consulted	Purpose / Objective	Issues Raised	Follow-Up
Aug. 20, 1999	Meeting	Vince Fontaine, Joe Daniels – Sagkeeng First Nation Environment Dept., AECL's Public Consultation Consultant	Initial introductions and determine how to involve Sagkeeng First Nation in environmental assessment process.	Traditional territory and activities. Water quality. Participation in monitoring.	Letter requesting meeting with Chief and Council.
Sept. 24, 1999	Letter	Chief and Council	To provide background on environmental assessment process and to set up meeting.	N/A	Meeting and tour set up.
Oct. 20, 1999	Letter	Chief and Council	To confirm meeting and propose agenda.	N/A	Meeting and tour.
Oct. 25, 1999	Meeting at Whiteshell Laboratories	Environment Dept. staff, Councillors of Sagkeeng, Dillon Consulting (advisors to Sagkeeng), AECL and public consultation consultant	To provide overview of decommissioning program/EA process and provide tour of facilities.	Extent and frequency of monitoring. Involvement in monitoring. Divestiture of land.	A set of issues to be prepared and forwarded by Chief and Council. A communications protocol to be developed.
Nov. 4, 1999	Letter and attached draft communications process document.	Chief and Council	To provide Sagkeeng with a draft communications and consultation process document to be merged with its proposed process. To set up meeting to discuss.	N/A	Follow-up meeting to discuss communications and consultation process document.

Date	Format	Groups / Individuals Consulted	Purpose / Objective	Issues Raised	Follow-Up
Nov. 18, 1999	Meeting at Dillon Consulting offices	Councillor (Environment Portfolio), Environment Dept. staff, Dillon Consulting, AECL, Public Consultation Consultant	To review communication process documents prepared by AECL and Sagkeeng and begin discussions on issues.	Sagkeeng would like a consultation with elders. Timeframe to review scope document too short.	Dillon to integrate communication process documents. AECL to forward copies of reports requested by Sagkeeng.
Nov. 30, 1999	Meeting at Sagkeeng First Nation	Elders Council (7 elders), Councillor (Environment Portfolio), Environment Dept. staff, Dillon Consulting, AECL, Public Consultation Consultant	To provide overview of decommissioning program and EA process and receive feedback from elders on issues of concern.	Assurances. Safety. Privatization. Future impacts. Worst-case scenario. Involvement of youth through an education component.	AECL awaiting issues paper to be forwarded from Chief and Council.
Feb. 10, 2000	Letter.	Chief and Council	To acknowledge receipt of issues document from Sagkeeng. To acknowledge AECL's commitments to consultation protocol. To follow-up with meeting with Core Group to discuss responses to issues.	N/A	Follow-up meeting April 11, 2000.

Date	Format	Groups / Individuals Consulted	Purpose / Objective	Issues Raised	Follow-Up
April 11, 2000	Meeting at Whiteshell Laboratories	Councillor (Environment portfolio), Environment Dept. staff, Sagkeeng First Nation; AECL; Public Consultation Consultant	To discuss AECL's responses to issues document forwarded by Sagkeeng First Nation. To discuss status of environmental assessment process.	Questions raised by Sagkeeng on emergency response. Sagkeeng notified AECL of new technical consultant – Duncan and Associates. AECL proposed that there be regular communications with Sagkeeng as part of the communications protocol. AECL requested that Sagkeeng advise AECL as to its expectations on training for participation in environmental monitoring program.	AECL's Emergency Plan to be forwarded. AECL to review videos and select appropriate ones to forward to Sagkeeng. Sagkeeng to be forwarded copy of Comprehensive Study Report.
April 28, 2000	Letter	Chief and Council	To forward copy of draft CSR Revision 1.	N/A	To continue to keep Sagkeeng informed on status of review process.

Date	Format	Groups / Individuals Consulted	Purpose / Objective	Issues Raised	Follow-Up
May 3, 2000	Letter	Chief and Council	To forward document entitled *Whiteshell Laboratories Emergency Plan."* To explain that videos on site focus largely on research activities and do not provide concise presentation on site and layout. Accordingly, AECL will prepare a summary of the site layout and forward video when it is available.	N/A	AECL to forward video when it is complete.
June 5, 2000	Letter	Chief and Council	To forward copies of Newsletter No. 2, advise of information sessions in area communities, and advise of status of CSR review.	N/A	AECL to follow-up with Sagkeeng Environment Dept. staff to determine next meeting.

Date	Format	Groups / Individuals Consulted	Purpose / Objective	Issues Raised	Follow-Up
August 28, 2000	Meeting	Environment Department staff, Sagkeeng First Nation; Duncan Associates (technical advisors to Sagkeeng); AECL; Public Consultation Consultant	To provide a status report on CSR technical review. To determine if Sagkeeng had any questions or concerns.	AECL provided overview of significant issues raised in the technical review of the draft CSR. Discussion on Sagkeeng's involvement in environmental monitoring program. Involvement could begin when the project commences.	AECL to forward information / photos on original site conditions and check on status of production of video on Whiteshell Laboratories site. AECL to determine how to initiate a training program for Sagkeeng. Sagkeeng to identify a candidate for training in environmental monitoring program. Summary of status of CSR review to be prepared by AECL. Tour with elders and youth to be arranged by Sagkeeng.
Sept.8, 2000	Fax transmittal	From Public Consultation Consultant to Sagkeeng First Nation and Duncan & Associates	To forward a status summary of the CSR review.	N / A	To continue to keep Sagkeeng informed on status of review process.
Nov. 2, 2000	Telephone conversation	B. Connell (Public Consultation Consultant) and V. Fontaine (Sagkeeng Environment Dept.)	To discuss status of CSR review and determine if there is a need to meet.	N / A	Will meet when CSR technical review is complete and draft CSR is prepared.

AECL Whiteshell Laboratories Decommissioning
Comprehensive Study Report

CONTACT RECORD

DATE OF CONTACT: August 20, 1999
NATURE OF CONTACT (Meeting, interview, telephone call, etc.) Meeting Vince Fontaine, Director Environment Department, Sagkeeng First Nation Joe Daniels, Environment Officer, Sagkeeng First Nation Barbara Connell, Communications and Consultation Consultant to AECL
PURPOSE/OBJECTIVE: To make initial introductions and determine how to involve Sagkeeng First Nation in EA process.
ISSUE/CONCERN: • Traditional territory • Traditional activities • Water quality • Participation in monitoring and access to information
DECISION REACHED: B. Connell provided with name of Chief's scheduler. It was decided that a letter and follow-up phone call would be appropriate for initiating next steps. Sagkeeng advisors recommended that a meeting be held at Whiteshell Laboratories in next short while.
FOLLOW-UP REQUIRED: Letter sent September 24, 1999 to Chief and Council requesting meeting to discuss decommissioning program and to initiate consultation process. Letter sent from AECL October 20 to Chief and Council confirming meeting of October 25 and proposing a format for the meeting.
SUBMITTED BY: Barbara Connell

FACILITIES & NUCLEAR OPERATIONS
WL Decommissioning

File: 00170 -21
Decom-99-026
1999 September 24

Brokenhead Ojibway Nation
Scanterbury, MB R0E 1W0

Attention: Councillor Debbie Chief
Councillor Tina Levesque

Dear Councillor Chief and Councillor Levesque:

I am writing as a follow-up to the telephone conversation between Ms Ardythe Wilson of Winds and Voices Environmental Services Inc. and Councillor Chief regarding the environmental assessment of the proposed decommissioning of the Whiteshell Laboratory near Pinawa. You may be aware that the Whiteshell Laboratory is being closed due to federal funding reductions to Atomic Energy of Canada Limited (AECL). AECL is consolidating all of its research activities at the Chalk River Laboratory in Ontario and will be closing the Whiteshell Laboratory in 2001. We are in the process of undertaking operational shutdown and are preparing for decommissioning. Attached for your information is a description of the proposed decommissioning program and local and regional area maps.

In order to proceed with the decommissioning program, AECL is required to undertake a Comprehensive Study Environmental Assessment under the Canadian Environmental Assessment Act and to obtain a decommissioning licence from the Atomic Energy Control Board. The Comprehensive Study will identify and evaluate potential environmental effects from the proposed decommissioning activities. This study is underway and we are engaging in consultations with different groups and interests in the region. We would like to seek the input of the Brokenhead Ojibway Nation in our Comprehensive Study and determine if your community has concerns regarding the decommissioning program.

As an initial step, Ms Wilson, who is under contract to AECL, and I would like to meet with you and the balance of the Brokenhead Ojibway leadership. Ms Wilson will follow up with a phone call to arrange a mutually convenient time to meet. In the meantime, if you have any questions, please do not hesitate to contact me at (204) 753-2311.

Sincerely,

[Original Signed By: R.A. Helbrecht]

R.A. (Bob) Helbrecht
Program Manager
WL Decommissioning

FACILITIES & NUCLEAR OPERATIONS
WL Decommissioning

File: 00170
Decom-99-027
1999 September 24

Chief Ron Fontaine and Council
Sagkeeng First Nation
P.O. Box 3
Fort Alexander, MB R0E 0P0

Dear Chief Fontaine and Council:

I am writing to follow up on a meeting held August 20, 1999 with Vince Fontaine and Joe Daniels of your Environment Department and Barb Connell, AECL's consultation facilitator for the Whiteshell Laboratories decommissioning environmental assessment. I want to thank you for undertaking to make an initial introduction. I understand that you were unable to attend, but am advised that your staff have recommended that we initiate further discussions in the next short while.

You are probably aware that the Whiteshell Laboratory near Pinawa is being closed due to federal funding reductions to Atomic Energy of Canada Limited (AECL). AECL is consolidating all of its research activities at the Chalk River Laboratory in Ontario and will be closing the Whiteshell Laboratory in 2001. We are in the process of undertaking operational shutdown and are preparing for decommissioning. Attached for your information is a description of the proposed decommissioning program and local and regional area maps.

In order to proceed with the decommissioning program, AECL is required to undertake a Comprehensive Study Environmental Assessment under the Canadian Environmental Assessment Act and to obtain a decommissioning licence from the Atomic Energy Control Board. The Comprehensive Study will identify and evaluate potential environmental effects from the proposed decommissioning activities. This study is underway and we are engaging in consultations with different groups and interests in the region. We would like to seek the input of the Sagkeeng First Nation in our Comprehensive Study and determine if your community has concerns regarding the decommissioning program.

As an initial step, Barb Connell and I would like to meet with you and your Council. We would be pleased to host a meeting at the Whiteshell Laboratory to discuss the decommissioning program and environmental assessment process and initiate a consultation program with Sagkeeng First Nation. We could also provide you with a tour of the facilities to be decommissioned so that you have first hand knowledge of the site and the Waste Management Area.

Your staff provided Barb Connell with the name and phone number of your scheduler and she will be contacting her to arrange a mutually convenient time to meet. In the meantime, if you have any questions, please do not hesitate to contact me at (204) 753-2311.

Sincerely,

[Original Signed By: R.A. Helbrecht]

R.A. (Bob) Helbrecht
Program Manager
WL Decommissioning

FACILITIES & NUCLEAR OPERATIONS
WL Decommissioning

File: 00170
Decom-99-028
1999 September 24

Chief Vern Redsky
Shoal Lake 40 First Nation
Kejick P.O.
Kejick, Ontario P0X 1E0

Dear Chief Redsky:

I am writing to follow up on the telephone conversation that Ms Ardythe Wilson of Winds and Voices Environmental Services Inc. had with you regarding the environmental assessment of the proposed decommissioning of the Whiteshell Laboratory near Pinawa, Manitoba. The Whiteshell Laboratory is being closed due to federal funding reductions to Atomic Energy of Canada Limited (AECL). AECL is consolidating all of its research activities at the Chalk River Laboratory in Ontario and will be closing the Whiteshell Laboratory in 2001. We are in the process of undertaking operational shutdown and are preparing for decommissioning. Attached for your information is a description of the proposed decommissioning program and local and regional area maps.

In order to proceed with the decommissioning program, AECL is required to undertake a Comprehensive Study Environmental Assessment under the Canadian Environmental Assessment Act and to obtain a decommissioning licence from the Atomic Energy Control Board. The Comprehensive Study will identify and evaluate potential environmental effects from the proposed decommissioning activities. This study is underway and we are engaging in consultations with different groups and interests in the region.

We are interested in knowing if members of the Shoal Lake 40 First Nation currently use the local area as identified in the local area map for traditional activities. Ms Wilson, who is under contract to AECL, will follow up with you to discuss this further. In the meantime, if you have any questions, please do not hesitate to contact me at (204) 753-2311.

Sincerely,

[Original Signed By: R.A. Helbrecht]

R.A. (Bob) Helbrecht
Program Manager
WL Decommissioning

FACILITIES & NUCLEAR OPERATIONS
WL Decommissioning

File 00170
Decom-99-030
1999 September 24

Chief Steve Skead
Anishinabe of Wauzhushk Onigum
P.O. Box 1850
Kenora, Ontario P9N 3X8

Dear Chief Skead:

I am writing to follow up on the telephone conversation that Ms Ardythe Wilson of Winds and Voices Environmental Services Inc. had with you regarding the environmental assessment of the proposed decommissioning of the Whiteshell Laboratory near Pinawa, Manitoba. The Whiteshell Laboratory is being closed due to federal funding reductions to Atomic Energy of Canada Limited (AECL). AECL is consolidating all of its research activities at the Chalk River Laboratory in Ontario and will be closing the Whiteshell Laboratory in 2001. We are in the process of undertaking operational shutdown and are preparing for decommissioning. Attached for your information is a description of the proposed decommissioning program and local and regional area maps.

In order to proceed with the decommissioning program, AECL is required to undertake a Comprehensive Study Environmental Assessment under the Canadian Environmental Assessment Act and to obtain a decommissioning licence from the Atomic Energy Control Board. The Comprehensive Study will identify and evaluate potential environmental effects from the proposed decommissioning activities. This study is underway and we are engaging in consultations with different groups and interests in the region.

We are interested in knowing if members of the Anishinabe of Wauzhushk Onigum currently use the local area as identified in the local area map for traditional activities. Ms Wilson, who is under contract to AECL, will follow up with you to discuss this further. In the meantime, if you have any questions, please do not hesitate to contact me at (204) 753-2311.

Sincerely,

[Original Signed By: R.A. Helbrecht]

R.A. (Bob) Helbrecht
Program Manager
WL Decommissioning

FACILITIES & NUCLEAR OPERATIONS
WL Decommissioning

File 00170
Decom-99-029
1999 September 24

Ms Phyllis Jack
Watershed Coordinator
Iskatewizaagegan #39 Independent Nation
Kejick P.O.
Kejick, Ontario P0X 1E0

Dear Ms Jack:

I am writing to follow up on the telephone conversation that Ms Ardythe Wilson of Winds and Voices Environmental Services Inc. had with you regarding the environmental assessment of the proposed decommissioning of the Whiteshell Laboratory near Pinawa, Manitoba. The Whiteshell Laboratory is being closed due to federal funding reductions to Atomic Energy of Canada Limited (AECL). AECL is consolidating all of its research activities at the Chalk River Laboratory in Ontario and will be closing the Whiteshell Laboratory in 2001. We are in the process of undertaking operational shutdown and are preparing for decommissioning. Attached for your information is a description of the proposed decommissioning program and local and regional area maps.

In order to proceed with the decommissioning program, AECL is required to undertake a Comprehensive Study Environmental Assessment under the Canadian Environmental Assessment Act and to obtain a decommissioning licence from the Atomic Energy Control Board. The Comprehensive Study will identify and evaluate potential environmental effects from the proposed decommissioning activities. This study is underway and we are engaging in consultations with different groups and interests in the region.

We are interested in knowing if members of the Iskatewizaagegan #39 Independent Nation currently use the local area as identified in the local area map for traditional activities. Ms Wilson, who is under contract to AECL, will follow up with you to discuss this further. In the meantime, if you have any questions, please do not hesitate to contact me at (204) 753-2311.

Sincerely,

[Original Signed By: R.A. Helbrecht]

R.A. (Bob) Helbrecht
Program Manager
WL Decommissioning

FACILITIES & NUCLEAR OPERATIONS
WL Decommissioning

File: 00170
Decom-99-031
1999 September 24

Chief Joseph P. Seymour
Ochiichagwe'babigo'ining First Nation
P.O. Box 88
Kenora, Ontario P9N 3W7

Dear Chief Seymour:

I am writing to follow up on the telephone conversation that Ms Ardythe Wilson of Winds and Voices Environmental Services Inc. had with you regarding the environmental assessment of the proposed decommissioning of the Whiteshell Laboratory near Pinawa, Manitoba. The Whiteshell Laboratory is being closed due to federal funding reductions to Atomic Energy of Canada Limited (AECL). AECL is consolidating all of its research activities at the Chalk River Laboratory in Ontario and will be closing the Whiteshell Laboratory in 2001. We are in the process of undertaking operational shutdown and are preparing for decommissioning. Attached for your information is a description of the proposed decommissioning program and local and regional area maps.

In order to proceed with the decommissioning program, AECL is required to undertake a Comprehensive Study Environmental Assessment under the Canadian Environmental Assessment Act and to obtain a decommissioning licence from the Atomic Energy Control Board. The Comprehensive Study will identify and evaluate potential environmental effects from the proposed decommissioning activities. This study is underway and we are engaging in consultations with different groups and interests in the region.

We are interested in knowing if members of the Ochiichagwe'babigo'ining First Nation currently use the local area as identified in the local area map for traditional activities. Ms Wilson, who is under contract to AECL, will follow up with you to discuss this further. In the meantime, if you have any questions, please do not hesitate to contact me at (204) 753-2311.

Sincerely,

[Original Signed By: R.A. Helbrecht]

R.A. (Bob) Helbrecht
Program Manager
WL Decommissioning

FACILITIES & NUCLEAR OPERATIONS
WL Decommissioning

File: 00170
Decom-99-032
1999 September 24

Councillor Armand Bingus
Lands and Resources Portfolio
Lac Seul First Nation
P.O. Box 100
Hudson, Ontario P0V 1X0

Dear Councillor Bingus:

I am writing to follow up on the telephone conversation that Ms Patt Larcombe of Winds and Voices Environmental Services Inc. had with George Kenny regarding the environmental assessment of the proposed decommissioning of the Whiteshell Laboratory near Pinawa, Manitoba. The Whiteshell Laboratory is being closed due to federal funding reductions to Atomic Energy of Canada Limited (AECL). AECL is consolidating all of its research activities at the Chalk River Laboratory in Ontario and will be closing the Whiteshell Laboratory in 2001. We are in the process of undertaking operational shutdown and are preparing for decommissioning. Attached for your information is a description of the proposed decommissioning program and local and regional area maps.

In order to proceed with the decommissioning program, AECL is required to undertake a Comprehensive Study Environmental Assessment under the Canadian Environmental Assessment Act and to obtain a decommissioning licence from the Atomic Energy Control Board. The Comprehensive Study will identify and evaluate potential environmental effects from the proposed decommissioning activities. This study is underway and we are engaging in consultations with different groups and interests in the region.

We are interested in knowing if members of the Lac Seul First Nation currently use the local area as identified in the local area map for traditional activities. Ms Ardythe Wilson, of Winds and Voices Environmental Services Inc., who is under contract to AECL, will follow up with you to discuss this further. In the meantime, if you have any questions, please do not hesitate to contact me at (204) 753-2311.

Sincerely,

[Original Signed By: R.A. Helbrecht]

R.A. (Bob) Helbrecht
Program Manager
WL Decommissioning

FACILITIES & NUCLEAR OPERATIONS
WL Decommissioning

File: 00170
Decom-99-033
1999 September 24

Mr. Eric Fisher
Lands and Resources
Wabaseemoong Independent Nations
Whitedog P.O.
Whitedog, Ontario P0X 1P0

Dear Mr. Fisher:

I am writing to follow up on the telephone conversation that Ms Ardythe Wilson of Winds and Voices Environmental Services Inc. had with you regarding the environmental assessment of the proposed decommissioning of the Whiteshell Laboratory near Pinawa, Manitoba. The Whiteshell Laboratory is being closed due to federal funding reductions to Atomic Energy of Canada Limited (AECL). AECL is consolidating all of its research activities at the Chalk River Laboratory in Ontario and will be closing the Whiteshell Laboratory in 2001. We are in the process of undertaking operational shutdown and are preparing for decommissioning. Attached for your information is a description of the proposed decommissioning program and local and regional area maps.

In order to proceed with the decommissioning program, AECL is required to undertake a Comprehensive Study Environmental Assessment under the Canadian Environmental Assessment Act and to obtain a decommissioning licence from the Atomic Energy Control Board. The Comprehensive Study will identify and evaluate potential environmental effects from the proposed decommissioning activities. This study is underway and we are engaging in consultations with different groups and interests in the region.

We are interested in knowing if members of the Wabaseemoong Independent Nations currently use the local area as identified in the local area map for traditional activities. Ms Wilson, who is under contract to AECL, will follow up with you to discuss this further. In the meantime, if you have any questions, please do not hesitate to contact me at (204) 753-2311.

Sincerely,

[Original Signed By: R.A. Helbrecht]

R.A. (Bob) Helbrecht
Program Manager
WL Decommissioning

FACILITIES & NUCLEAR OPERATIONS
WL Decommissioning

File: 00170
Decom-99-034
1999 September 29

Chief Bill Fobister
Grassy Narrows First Nation
General Delivery
Grassy Narrows, Ontario P0X 1B0

Attention: Darryl Fobister
Councillor, Band Government Portfolio

Dear Councillor Fobister:

I am writing to follow up on the telephone conversation that Ms Ardythe Wilson of Winds and Voices Environmental Services Inc. had with you regarding the environmental assessment of the proposed decommissioning of the Whiteshell Laboratory near Pinawa, Manitoba. The Whiteshell Laboratory is being closed due to federal funding reductions to Atomic Energy of Canada Limited (AECL). AECL is consolidating all of its research activities at the Chalk River Laboratory in Ontario and will be closing the Whiteshell Laboratory in 2001. We are in the process of undertaking operational shutdown and are preparing for decommissioning. Attached for your information is a description of the proposed decommissioning program and local and regional area maps.

In order to proceed with the decommissioning program, AECL is required to undertake a Comprehensive Study Environmental Assessment under the Canadian Environmental Assessment Act and to obtain a decommissioning licence from the Atomic Energy Control Board. The Comprehensive Study will identify and evaluate potential environmental effects from the proposed decommissioning activities. This study is underway and we are engaging in consultations with different groups and interests in the region.

We are interested in knowing if members of the Grassy Narrows First Nation currently use the local area as identified in the local area map for traditional activities. Ms Wilson, who is under contract to AECL, will follow up with you to discuss this further. In the meantime, if you have any questions, please do not hesitate to contact me at (204) 753-2311.

Sincerely,

[Original Signed By: R.A. Helbrecht]

R.A. (Bob) Helbrecht
Program Manager
WL Decommissioning

AECL Whiteshell Laboratories Decommissioning
Comprehensive Study Report

CONTACT RECORD

DATE OF CONTACT: 07 OCTOBER 99

PERSON/ORGANIZATION CONTACTED: CHIEF VERN EBSKY
SHOAL LAKE #40

TELEPHONE NUMBER OF CONTACT: 807-733-2315

NATURE OF CONTACT (Meeting, interview, telephone call, etc.)

PURPOSE/OBJECTIVE: FOLLOW-UP TO INITIAL CONTACT LETTER RE: SL40 INTERESTS IN EA

ISSUE/CONCERN: RECEIVED LETTER, AT FIRST GLANCE, IT DOESN'T SEEM TO INCLUDE THEIR AREA OF TRADL INTEREST, HOWEVER, IT WILL BE REVIEWED BRIEFLY WITH COUNCIL & A RESPONSE WILL BE FORWARDED IN WRITING

DECISION REACHED: IF THERE'S A POSSIBILITY OF ANY IMPACT TO SHOAL LAKE WATERSHED, THEN THEIR PRESENCE IS NECESSARY — CONTACT IS NECESSARY

FOLLOW-UP REQUIRED: CONTINUED PHONE CONTACT UNTIL LETTER

SUBMITTED BY: [illegible]

AECL Whiteshell Laboratories Decommissioning
Comprehensive Study Report

CONTACT RECORD

DATE OF CONTACT: 07 OCTOBER 99

PERSON/ORGANIZATION CONTACTED: PHYLLIS JACK, WATERSHED COORD.
SHOAL LAKE 39 FIRST NATION

TELEPHONE NUMBER OF CONTACT: 807-733-2560

NATURE OF CONTACT (Meeting, interview, telephone call, etc.)

PURPOSE/OBJECTIVE: Follow up to AECL initial Contact Letter RE: TH interests in RSA

ISSUE/CONCERN: MS. JACK CONFIRMED RECEIPT OF THE AECL LETTER LATE LAST WEEK. LETTER HAS BEEN FORWARDED TO CHIEF & COUNCIL FOR THEIR REVIEW; WILL PROBABLY REVIEW IT NEXT WEEK.

DECISION REACHED:

FOLLOW-UP REQUIRED: CAC WILL RESPOND IN WRITING ONCE REVIEWED & DISCUSSED. CONTINUE PHONE CONTACT UNTIL LETTER IS RECEIVED

SUBMITTED BY: [illegible]

AECL Whiteshell Laboratories Decommissioning
Comprehensive Study Report

CONTACT RECORD

DATE OF CONTACT: 19 OCT 99

PERSON/ORGANIZATION CONTACTED: ERIC FISHER, LHR
WABASEEMOONG FN
TELEPHONE NUMBER OF CONTACT: 807-927-2068
-2420

NATURE OF CONTACT (Meeting, interview, telephone call, etc.)

PURPOSE/OBJECTIVE:
Follow-up to AECL Letter issued Sept 30.

ISSUE/CONCERN: WABASEEMOONG HAS RECEIVED THE LETTER. IT IS PRESENTLY BEFORE CHIEF & COUNCIL + THEY WILL RESPOND DIRECTLY TO AECL.

DECISION REACHED:

FOLLOW-UP REQUIRED:
Will forward letter of confirmation w/ copies of newsletters. Done

SUBMITTED BY: [illegible]

AECL Whiteshell Laboratories Decommissioning
Comprehensive Study Report

CONTACT RECORD

DATE OF CONTACT: 20 OCT 99

PERSON/ORGANIZATION CONTACTED:
Chief JP Seymour (Dalles) 807-548-5876
TELEPHONE NUMBER OF CONTACT:

NATURE OF CONTACT (Meeting, interview, telephone call, etc.)

PURPOSE/OBJECTIVE: Follow up to AECL letter of Sept 30.

ISSUE/CONCERN: Dalles has not received fax or letter. Refax today to
807-548-2337 And Chief Seymour.

DECISION REACHED:
Chief Seymour indicates new leadership for T3 + wants a letter forwarded to:
Leon Jordaine, Grand Chief of Treaty 3.

FOLLOW-UP REQUIRED:
Barb Cornell / Bob Halbrecht to forward letter to T3 Grand Chief
ARQUINTE RE-FAXED SEPT 24th LETTER, FOLLOW-UP + JAN'S LETTER

SUBMITTED BY: [illegible]

AECL Whiteshell Laboratories Decommissioning
Comprehensive Study Report

CONTACT RECORD

DATE OF CONTACT: 20 OCT 99

PERSON/ORGANIZATION CONTACTED: Judy Da Silva
Grassy Narrows
TELEPHONE NUMBER OF CONTACT: 807-925-2200

NATURE OF CONTACT (Meeting, Interview, telephone call, etc.)

PURPOSE/OBJECTIVE: Follow up to AECL Sept 30 Letter.

ISSUE/CONCERN: Chief & Council in mtg. Have not seen either faxed or original copies

DECISION REACHED: Please re fax to attention of Judy Da Silva @ 807-925-2649.

FOLLOW-UP REQUIRED:
Ardythe re-faxed Sept 24th Letter
(original) letter w/ News letters - Done

SUBMITTED BY: [signature]

AECL Whiteshell Laboratories Decommissioning
Comprehensive Study Report

CONTACT RECORD

DATE OF CONTACT: 20 OCT 99

PERSON/ORGANIZATION CONTACTED: Debbie Chief
Brokenhead First Nation
TELEPHONE NUMBER OF CONTACT: 766-2494

NATURE OF CONTACT (Meeting, Interview, telephone call, etc.)

PURPOSE/OBJECTIVE: Re: Follow-up to AECL Sept 24th Letter.

ISSUE/CONCERN: The letter was received, however, it is unclear whether it has been reviewed by Chief & Council.

DECISION REACHED: Debbie will confirm receipt of letter & if a mtg is required, will contact me. Otherwise, Response will be issued directly to AECL.

FOLLOW-UP REQUIRED:
Drop off Newsletters @ Band Office

SUBMITTED BY: [signature]

Oct 22 - DC phoned back to confirm mtg for Nov 5th @ B/HEAD BAND OFFICE

20 October 1998

COPY

Chief Joseph P. Seymour
Ochiichagwe'babigo'ining First Nation
P.O. Box 68
KENORA, ONTARIO P9N 3W7

Dear Mr. Seymour:

I wish to confirm our conversation this date regarding the September 24th letter issued by AECL regarding the decommissioning process of its Whiteshell Labs in Pinawa, Manitoba. As of this date, you have not received nor seen copies of this letter. As you requested, I faxed you a copy of the original letter to be reviewed by Chief and Council. Ochiichagwe'babigo'ining will be responding, in writing, directly to AECL.

Further, you indicated to me that Treaty 3 is now under new leadership and direct that a letter from AECL be forwarded to Leon Jourdaine, Grand Chief of Treaty 3, detailing its process and contact with the individual First Nations within Treaty 3 area. I have passed your instructions on to the public consultation coordinator who will do the follow-up.

Finally, I enclose several copies of a public information newsletter outlining more details of the decommissioning for distribution to your Council or others in your community.

Thank you for your assistance and please feel free to give me a call regarding any part of the September 24th letter. My direct line is 204-983-2040.

Sincerely,

Ardythe Wilson, Special Projects

enc AECL Newsletters

20 October 1998

COPY

Mr. Eric Fisher, Lands & Resources
Wabaseemoong First Nation
General Delivery
WHITEDOG, ONTARIO P0X 1P0

Dear Eric:

Further to our conversation yesterday, I wish to confirm that Wabaseemoong has received a copy of the September 24th letter from AECL outlining the decommissioning process of its Whiteshell Labs in Pinawa, Manitoba and is presently being reviewed by Chief and Council. Wabaseemoong will be responding, in writing, directly to AECL.

I have enclosed several copies of a public information newsletter outlining more details of the decommissioning for distribution in your community.

Thank you for your assistance and please feel free to give me a call regarding any part of the September 24th letter. My direct line is 204-983-2040.

Sincerely,

Ardythe Wilson, Special Projects

enc AECL Newsletters

COPY

20 October 1998 ?

Chief Vern Redsky
Shoal Lake 40 First Nation
General Delivery
KEJICK, ONTARIO P0X 1E0

Dear Mr. Redsky:

I wish to confirm our conversation of October 7th regarding the September 24th letter issued by AECL on the decommissioning process of its Whiteshell Labs in Pinawa, Manitoba.

You have received a copy of the letter and presently undergoing a review with your council. Specifically, you indicated that if there was the slightest possibility of any impact to the Shoal Lake Watershed, your presence in the process and immediate contact was necessary. You indicated that after concluding a review of the letter and attached information, you would be responding in writing directly to AECL.

Finally, I enclose several copies of a public information newsletter outlining more details of the decommissioning for distribution to your Council or others in your community.

Thank you for your assistance and please feel free to give me a call regarding any part of the September 24th letter. My direct line is 204-992-2940.

Sincerely,

Ardythe Wilson, Special Projects

enc: AECL Newsletters

COPY

20 October 1998

Judy Da Silva, Lands & Environment
Grassy Narrows First Nation
General Delivery
GRASSY NARROWS, ONTARIO P0X 1B0

Dear Judy:

I wish to confirm our conversation this date regarding the September 24th letter issued by AECL regarding the decommissioning process of its Whiteshell Labs in Pinawa, Manitoba. As of this date, Grassy Narrows has not received nor seen copies of this letter and as requested, I faxed a copy of the original letter to be reviewed by Chief and Council.

I enclose several copies of a public information newsletter outlining more details of the decommissioning for distribution to your Council or others in your community.

Thank you for your assistance and please feel free to give me a call to confirm your receipt of the letter or in regard to questions on any part of the September 24th letter. My direct line is 204-992-2940.

Sincerely,

Ardythe Wilson, Special Projects

enc: AECL Newsletters

COPY

20 October 1998

Ms. Phyllis Jack, Watershed Coordinator
Iskatewizaagegan First Nation
General Delivery
KEJICK, ONTARIO P0X 1E0

Dear Phyllis:

I wish to confirm our conversation of October 7th regarding the September 24th letter issued by AECL on the decommissioning process of its Whiteshell Labs in Pinawa, Manitoba.

You have received a copy of the letter and will undergo a review by your Chief and Council. Iskatewizaagegan will respond directly to AECL.

Finally, I enclose several copies of a public information newsletter outlining more details of the decommissioning for distribution to your Council or others in your community.

Thank you for your assistance and please feel free to give me a call regarding any part of the September 24th letter. My direct line is 204-982-2640.

Sincerely,

Ardythe Wilson, Special Projects

enc. AECL Newsletters

AECL EACL

File: 00170
Decom-09-093
1998 October 20

Chief Ron Fontaine and Council
Sagkeeng First Nation
P.O. Box 3
Fort Alexander, MB R0E 0P0

Faxed to: (204) 367-8410

Dear Chief Fontaine and Council:

This confirms our meeting of October 23 at the Whiteshell Laboratories from 11 a.m. to 2 p.m. to discuss AECL's proposed decommissioning program. As I indicated in my letter of September 24, AECL is undertaking a Comprehensive Study environmental assessment on the proposed decommissioning program under the Canadian Environmental Assessment Act and is seeking input in the preparation of the Comprehensive Study Report. I view this meeting as an opportunity to initiate a dialogue with Sagkeeng First Nation and develop a process for further consultation.

I would propose that I make a brief presentation to the Sagkeeng leadership and its advisors followed by discussion, lunch and a tour of facilities to be decommissioned. I understand that the Sagkeeng First Nation may also wish to make a presentation. Other AECL staff, as well as Barb Connell, AECL's public consultation consultant and Ardythe Wilson of Winds and Voices Environmental Services Inc. who is on contract to AECL, will be available to assist with the consultation process.

When your group arrives at the Whiteshell Laboratories, you will be directed from the reception area to the meeting room. Lunch will be provided for the meeting guests. I look forward to meeting with you and your advisors.

Sincerely,

R.A. (Bob) Helbrecht
Program Manager
WL Decommissioning

AECL Whiteshell Laboratories Decommissioning
Comprehensive Study Report

CONTACT RECORD

DATE OF CONTACT:
October 25, 1999

NATURE OF CONTACT (Meeting, interview, telephone call, etc.)
Meeting at Whiteshell Laboratories
Councillor David Swampy, Environment Portfolio, Sagkeeng First Nation
Councillor Claude Guimond, Sagkeeng First Nation
Vince Fontaine, Environment Department, Sagkeeng
Joe Daniels, Environment Department, Sagkeeng
Tom Campbell, Technical Advisor to Sagkeeng, Dillon Consulting
Kurt Sorensen, Technical Advisor to Sagkeeng, Dillon Consulting
Bob Helbrecht, Program Manager, WL Decommissioning
Barbara Connell, Communications and Consultation Consultant to AECL

PURPOSE/OBJECTIVE:
To provide an overview of WL decommissioning program and EA process and provide tour of facilities to be decommissioned.

ISSUE/CONCERN:
- Sagkeeng has not been involved in the past.
- How extensive is monitoring program?
- How frequently is monitoring done?
- Could people from Sagkeeng observe monitoring?
- How secure is project from financial perspective?
- Does AECL contract out any monitoring?
- How is significance of effects determined?
- Is the process defined for divestiture of land?

DECISION REACHED:
A set of issues/questions would be forthcoming from Chief and Council. B. Helbrecht to be main contact for AECL communications. Both parties agree that they want to maintain a longer-term communications process throughout decommissioning program. A communications protocol to be developed.

FOLLOW-UP REQUIRED:
Sagkeeng and AECL to prepare communications process documents to be combined into one. Follow-up discussions between AECL consultant and Dillon Consulting to finalize communications process and arrange next meeting. Letter sent from AECL November 4 to Chief and Council with a proposed consultation and communication process document.

SUBMITTED BY:
Barbara Connell

AECL EACL

File: 00170
Decom-99-095
1999 November 01

Leon Jourdain
Grand Chief
Grand Council of Treaty 3
Kenora, Ontario P9N 3X7

Dear Grand Chief Jourdain:

I am writing to confirm recent contacts with Treaty 3 communities as a result of the Comprehensive Study environmental assessment on the proposed decommissioning program for the Whiteshell Laboratories (WL) near Pinawa, Manitoba. Atomic Energy of Canada Limited (AECL) made the business decision to close WL after funding for its nuclear research programs was cut back. AECL is undertaking operational shutdown of WL and expects to begin decommissioning in late 2000 following completion of the environmental assessment under the Canadian *Environmental Assessment Act* and receipt of a licence amendment by the Atomic Energy Control Board.

On August 23rd, Winds and Voices Environmental Services Inc. (WAVES), who have been sub-contracted to assist and advise us regarding First Nation interests and issues, contacted your offices to determine the proper procedure and identify representatives with whom we would be interacting. Your office referred us to TARR Researcher, Andy Sky who directed Ardythe Wilson of WAVES to contact each of the seven communities directly. Ms. Wilson initiated contact by telephone and by late September, all seven communities had been contacted. The initial contact was then followed by a letter dated September 24th outlining the proposed decommissioning program and attaching maps detailing the local and regional study areas for the environmental assessment.

Except for Lac Seul and Wauzhush Onigum, all communities have confirmed receipt of the letters, indicating they are in the process of reviewing it and further indicating that they will be responding, in writing, directly to AECL. Ms. Wilson is continuing to follow-up with Lac Seul and Wauzhush Onigum.

This brings us up-to-date in terms of our contact with your communities. Please feel free to contact me directly at (204) 753-2311 should you have any questions or require further information. I am enclosing a copy of the September 24th letter with associated area maps and a project description that was sent to the seven communities. Copies of a WL Decommissioning newsletter are also included for your information.

Sincerely,

R.A. (Bob) Helbrecht
Program Manager
WL Decommissioning

ATOMIC ENERGY OF CANADA LIMITED
WHITESHELL LABORATORY DECOMMISSIONING PROGRAM

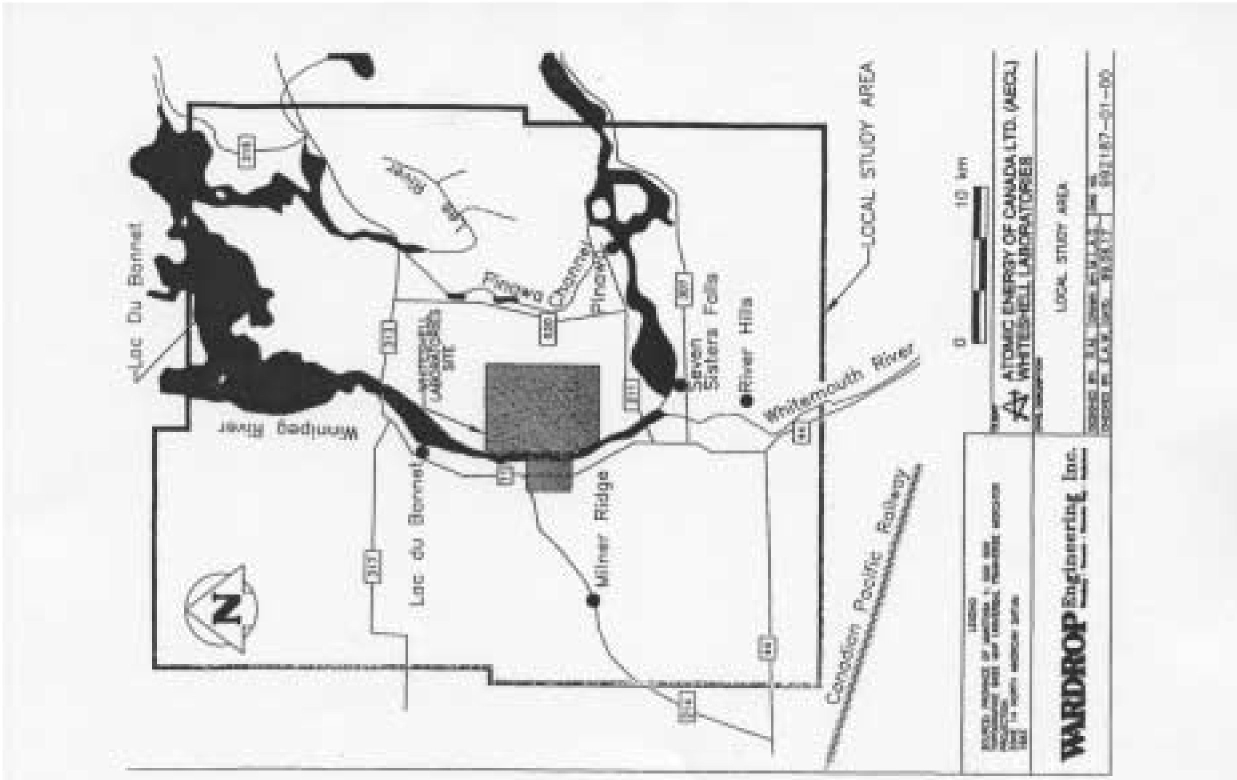
The Whiteshell Laboratory (WL), located near Pinawa, Manitoba, was established in the 1960's by Atomic Energy of Canada (AECL) to carry out nuclear research and development activities. All of the facilities are located on a 10,000 acre site shown on the attached map.

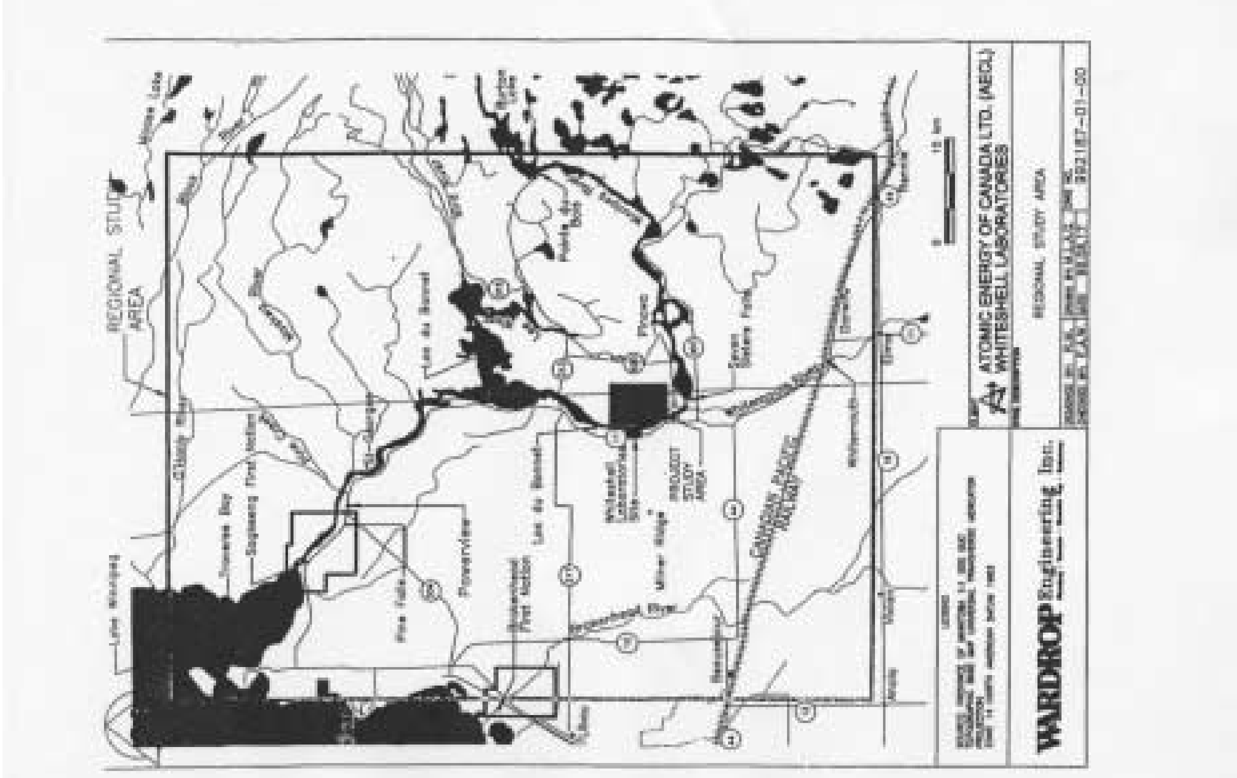
Funding to AECL was cut back a number of years ago, a result of the Federal Government's Program Review, and the corporation made the business decision to discontinue operations at WL and proceed to closing down the site. In order to shut down and decommission WL, there needs to be an amendment to the existing operating license granted by the Atomic Energy Control Board (a federal agency). As well, this license change triggers application of the Canadian *Environmental Assessment Act*. This *Act* requires that an environmental assessment be carried out before a revised license can be issued. The type of environmental assessment that has been directed under the *Act* is a Comprehensive Study on the decommissioning of WL.

The purpose of the Comprehensive Study is to examine the environmental effects, if any, of activities related to moving the WL from an operational state to a safe and secure monitoring and surveillance state and then to a final decommissioned end state. The environmental assessment is focused on the site cleanup activities, not on the research work carried out at the laboratory over the operating period. The types of activities involved in the Decommissioning Program being proposed by AECL include constructing additional waste storage facilities, moving contaminated materials from laboratory buildings to the waste management area (eg. lab equipment, samples, protective clothing, gloves, etc.), closing down/demolishing buildings, testing for contamination on the site and clean up and, rehabilitation (eg. grading, ditching, re-vegetation).

It should be noted that there is currently no facility in Canada for permanent storage of nuclear waste and therefore nuclear waste currently at the WL must be stored until such time as a permanent facility becomes available. All of the decommissioning activities will occur within the boundaries of the WL site, with the following exceptions. There will be testing of Winnipeg River bed sediments downstream of WL site and at a drainage ditch just north of the site, and non-radioactive materials (eg. demolished building parts) may be transported to local off-site landfill facilities. Finally, once a permanent nuclear waste storage facility is built, nuclear waste from WL will eventually be transported to a new location.

Under the preferred decommissioning program option, the research laboratory facilities and waste management area will be placed in a safe and secure monitoring and surveillance state by the year 2014. Final decommissioning activities related to removal of buildings and infrastructure and continued monitoring and surveillance would occur over the next 45 years (2015-2060).


Lac Du Bonnet
Winnipeg River
Pinawa Channel
Whitemouth River
Seven Sisters Falls
River Hills
Milner Ridge
Lac du Bonnet
Canadian Pacific Railway
LOCAL STUDY AREA
ATOMIC ENERGY OF CANADA LTD. (AECL)
WHITESHELL LABORATORIES
LOCAL STUDY AREA
WARDROP Engineering Inc.


REGIONAL STUDY AREA
PROJECT STUDY AREA
ATOMIC ENERGY OF CANADA LTD. (AECL)
WHITESHELL LABORATORIES
REGIONAL STUDY AREA
WARDROP Engineering Inc.

AECL EACL

FACILITIES & NUCLEAR OPERATIONS
WL Decommissioning

File: 00170
Decom-99-097
1999 November 04

Chief Ron Fontaine and Council
Sagkeeng First Nation
P.O. Box 3
Fort Alexander, MB R0E 0P0

Attention: Councillor David Swampy
Environment Portfolio

Dear Councillor Swampy:

Further to our meeting of October 25 at the Whiteshell Laboratories (WL), attached is a proposed consultation and communication process for the participation of the Sagkeeng First Nation in the WL decommissioning program. It is my understanding that the Sagkeeng First Nation has prepared a protocol for its review and assessment of potential issues associated with the decommissioning program and associated consultation activities. I look forward to receiving it and to your input into AECL's proposed process.

I am proposing that we meet on November 18th or 19th to discuss the process and begin discussions on questions and issues that the Sagkeeng First Nation may have. Barb Connell will follow-up with Tom Campbell of Dillon Consulting to arrange a mutually convenient time and place to meet.

Sincerely,

R.A. Helbrecht

R.A (Bob) Helbrecht
Program Manager
WL Decommissioning

cc: Tom Campbell
Dillon Consulting Limited

AECL Whiteshell Laboratories Decommissioning
Comprehensive Study Report

CONTACT RECORD

DATE OF CONTACT: November 3, 1999
NATURE OF CONTACT (Meeting, interview, telephone call, etc.) Meeting at Brokenhead Ojibway Nation's offices, Scanterbury Chief John Bunn Councillor Gary Bear Councillor Debbie Chief Jackie Pownew, Secretary Bob Helbrecht, Program Manager, WL Decommissioning Barbara Connell, Communications and Consultation Consultant to AECL Ardythe Wilson, First Nations Consultant to AECL, Winds and Voices Environmental Services Inc. (WAVES)
PURPOSE/OBJECTIVE: To provide an overview of decommissioning program and EA process and determine how Brokenhead First Nation would like to become involved in process.
ISSUE/CONCERN: • Potential impacts to ground water and surface water and Brokenhead River • Potential air-borne impacts • Potential effects on wildlife and specifically bison herd at Brokenhead • Assessment of lands that might be turned into wildlife management area • Brokenhead has a Treaty Land Entitlement and it is in discussions with Province regarding a petroform site in Whiteshell Provincial Park
DECISION REACHED: Chief and Council indicated they would be interested in a tour of Whiteshell Laboratories which could be arranged through B. Connell or B. Helbrecht. They indicated they needed some time to consider next steps. Environmental monitoring reports from last 15 years to be made available.
FOLLOW-UP REQUIRED: Environmental monitoring reports forwarded November 24.
SUBMITTED BY: Barbara Connell

AECL Whiteshell Laboratories Decommissioning
Comprehensive Study Report

CONTACT RECORD

DATE OF CONTACT: November 18, 1999
NATURE OF CONTACT (Meeting, interview, telephone call, etc.) Meeting at Dillon Consulting offices, Winnipeg Councillor David Swampy, Environment Portfolio, Sagkeeng First Nation Vince Fontaine, Environment Department, Sagkeeng First Nation Joe Daniels, Environment Department, Sagkeeng First Nation Tom Campbell, Technical Advisor to Sagkeeng, Dillon Consulting Kurt Sivertsen, Technical Advisor to Sagkeeng, Dillon Consulting Bob Helbrecht, Program Manager, WL Decommissioning Barbara Connell, Communications and Consultation Consultant to AECL
PURPOSE/OBJECTIVE: To review communication process documents developed by AECL and Sagkeeng First Nation and begin discussions on issues and concerns that Sagkeeng First Nation may have.
ISSUE/CONCERN: • Timeframe to review scope document forwarded by AECB is too short • Would like a consultation with elders • Sagkeeng will want input into future monitoring
DECISION REACHED: Dillon to integrate communication process documents based on discussions at meeting. Documents on environmental monitoring program and decommissioning requested by Sagkeeng to be forwarded to Dillon and Sagkeeng for review in developing issues paper.
FOLLOW-UP REQUIRED: AECL documents forwarded November 29, 30. Follow-up meeting with elders November 30. Joint communications process document finalized by Dillon (*Consultation and Communication Process for the Participation of the Sagkeeng First Nation, November 1999*).
SUBMITTED BY: Barbara Connell

Barbara Connell advisory services

463 Churchill Drive
Winnipeg, Manitoba
R3L 1W3
Tel. (204) 477-4785
Fax (204) 477-0243

November 24, 1999

Brokenhead Ojibway Nation
Scanterbury, MB R0E 1W0

Attention: Councillor Debbie Chief
Councillor Tina Levesque

Dear Councillor Chief and Councillor Levesque:

I am writing as a follow-up to the meeting of November 5th, 1999 between Chief and Council and AECL regarding AECL's proposed decommissioning program and environmental assessment. At that meeting, Councillor Bear requested monitoring reports. I am enclosing copies of annual monitoring reports dating from 1985 that were provided to me from AECL. Please call if you require additional information or if you would like to arrange a tour of the Whiteshell Laboratories.

Sincerely,

Barbara Connell
Communications and Consultation Consultant

CONTACT RECORD

DATE OF CONTACT: 25 NOV 99
PERSON/ORGANIZATION CONTACTED: WABASEEMOONG
TELEPHONE NUMBER OF CONTACT: 807-927-2063
NATURE OF CONTACT (Meeting, interview, telephone call, etc.)
PURPOSE/OBJECTIVE: ON-GOING FOLLOW-UP TO SEPT 24 AECL LETTER. ERIC FISHER, ORIGINAL CONTACT, HAS BEEN UNAVAILABLE.
ISSUE/CONCERN: SPOKE W/ LEONARD FISHER, COUNCILLOR. COUNCIL HAS NOT SEEN DOCUMENTS. CERTAINLY WABASEEMOONG HAS INTERESTS + SITES W/IN WHITESHELL AREA. RESEARCH BEING CONDUCTED. CHIEF + COUNCIL HAS REQUESTED IMMEDIATE REPORT FROM AECL.
DECISION REACHED: C+C WILL MEET W/ ERIC FOR FULL BRIEFING. HIGH CONCERNS RE: THIS SITUATION SINCE WFN has broad, extensive, interests in THE RSA. CULTURAL ACTIVITY IN THE AREA OCCURS FREQUENTLY + REGULARLY.
FOLLOW-UP REQUIRED: WILL PROCEED TO I.D. THEIR INTERESTS AND CONCERNS. WILL CALL WAGES IF THEY NEED FURTHER INFO OR ASSISTANCE (IE MTG W/ AECL). WILL CC WAGES COPY OF CORRESPONDENCE TO AECL.
SUBMITTED BY: ARDYTHE WILSON

AECL Whiteshell Laboratories Decommissioning
Comprehensive Study Report

CONTACT RECORD

DATE OF CONTACT: 29 NOV 99
PERSON/ORGANIZATION CONTACTED: ISKATEWIZAAGEGAN
TELEPHONE NUMBER OF CONTACT: 807-733-2560
NATURE OF CONTACT (Meeting, interview, telephone call, etc.)
PURPOSE/OBJECTIVE: FOLLOW-UP AECL LETTER OF SEPT 24/99.
ISSUE/CONCERN: Spoke with Phyllis Jack, Watershed coordinator re AECL letter and Iskatewizaagegan interests.
DECISION REACHED: BASED ON INFORMATION RECEIVED + REVIEWED BY CHIEF + COUNCIL - ISKAT... HAS NO CONCERNS IN DECOMMISSIONING AT THIS TIME. NO LETTER WILL BE
FOLLOW-UP REQUIRED: FORWARDED TO AECL FROM ISKATE... + MAKE THEIR CONFIRMATION THROUGH THIS TELEPHONE CALL. * WILL Send confirming Letter *
SUBMITTED BY: ARDYTHE WILSON

AECL Whiteshell Laboratories Decommissioning
Comprehensive Study Report

CONTACT RECORD

DATE OF CONTACT:	29 NOV 99
PERSON/ORGANIZATION CONTACTED:	SHOAL LAKE # 40
TELEPHONE NUMBER OF CONTACT:	807 – 733 · 2315
NATURE OF CONTACT (Meeting, interview, telephone call, etc.)	
PURPOSE/OBJECTIVE:	FOLLOW-UP SEPT 24TH AECL letter. SPOKE W/ CHIEF REDSKY BASED ON INFORMATION REC'D, SL#40 HAS NO
ISSUE/CONCERN:	INTERESTS / CONCERNS IN PROPOSED DECOMMISSIONING PROGRAM AT THIS TIME. IF ANYTHING NEW COMES UP, WOULD REQUEST THAT THEY BE
DECISION REACHED:	CONTACTED. SL #40 will not be forwarding letter, instead they're notifying us via this phone call.
FOLLOW-UP REQUIRED:	WAVES will draft follow-up letter.
SUBMITTED BY:	ARDYTHE WILSON

WINDS AND VOICES ENVIRONMENTAL SERVICES, INC.

29 November 1999

COPY

Chief and Council
Iskatewizaagenan Independent Nation
General Delivery
Kejick, Ontario P0X 1E0

Attention: Phyllis Jack, Watershed Coordinator

Dear Ms. Jack:

To follow up on our telephone conversation this morning, I wish to confirm our discussion regarding the September 24th letter from AECL and the proposed decommissioning program of the Whiteshell Laboratory near Pinawa, Manitoba.

Based on the information and attached documents received from AECL and reviewed by your Chief and Council, Iskatewizaagenan Independent Nation has no immediate concerns regarding the proposed decommissioning program at this time, however, if anything new comes up that may be of interest or concern to Iskatewizaagenan Independent Nation, you request that you be contacted again. Iskatewizaagenan Independent Nation is notifying AECL of this position by way of our telephone conversation this morning and will not be forwarding a letter to AECL to this affect.

I trust this properly reflects our conversation and if I've omitted anything, please confirm this by calling me on my direct line at (204) 982-2940 or in writing to the above address.

Thank you for your time and assistance.

Sincerely,

Ardythe Wilson, Special Projects
Winds and Voices Environmental Services
Centre for Indigenous Environmental Resources

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WINDS AND VOICES ENVIRONMENTAL SERVICES, INC.

29 November 1999

COPY

Chief Steve Skead
Anishinabe of Wauzhushk Onigum
P. O. Box 1850
Kenora, Ontario P9N 3X8

By Fax with Original to Follow by Mail

Dear Chief Skead:

Further to our telephone conversation today, I wish to confirm the following discussion regarding the September 24th letter from AECL regarding the proposed decommissioning (shutdown) of the Whiteshell Laboratory near Pinawa, Manitoba:

- You have received the September 24th letter and attached documents
- Due to extremely difficult circumstances and tense situations occurring in your community in the past while, several items requiring the attention of Chief and Council have been held in abeyance to allow the well-being of your members and community to take the highest priority at this point.
- Other matters backed up due to the situation and are being dealt with as the situation and time allows. The AECL September 24th letter is one of them.
- The AECL letter is not being intentionally ignored and that you have verbally requested that the Anishinabe of Wauzhushk Onigum not be discounted as one without issues or concerns in the area or decommissioning project.
- As soon as time allows, the Council will be responding to the letter about any interests or concerns.

I trust this captures the discussion we had. If I have omitted any part of the discussion, please contact me on my direct line at (204) 982-2940 or in writing. Also, should you require further information or assistance regarding the AECL decommissioning program, please do not hesitate to contact me.

In the meantime, I extend my prayers and good wishes to you in your struggles to protect and improve your community.

Sincerely,

Ardythe Wilson, Special Projects
Winds and Voices Environmental Services

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WINDS AND VOICES ENVIRONMENTAL SERVICES, INC.

29 November 1999

Chief Vern Redsky
Shoal Lake (40) First Nation
General Delivery
Kejick, Ontario P0X 1E0

Dear Chief Redsky:

To follow up on our telephone conversation this morning, I wish to confirm our discussion regarding the September 24th letter from AECL and the proposed decommissioning program of the Whiteshell Laboratory near Pinawa, Manitoba.

Based on the information and attached documents received from AECL, Shoal Lake 40 has no immediate concerns regarding the proposed decommissioning program at this time, however, if anything new comes up that may be of interest or concern to Shoal Lake 40, you request that you be contacted again. Further, Shoal Lake 40 is notifying AECL of this position by way of our telephone conversation this morning and will not be forwarding a letter to AECL to this effect.

I trust this properly reflects our conversation and if I've omitted anything, please confirm this by calling me on my direct line at (204) 982-2940 or in writing to the above address.

Thank you for your time and assistance.

Sincerely,

Ardythe Wilson, Special Projects
Winds and Voices Environmental Services
Centre for Indigenous Environmental Resources

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AECL Whiteshell Laboratories Decommissioning
Comprehensive Study Report

CONTACT RECORD

DATE OF CONTACT:
November 30, 1999

NATURE OF CONTACT (Meeting, interview, telephone call, etc.)
Meeting at Sagkeeng First Nation
Elders Council (7 elders)
Councillor David Swampy, Environment Portfolio, Sagkeeng First Nation
Vince Fontaine, Environment Department, Sagkeeng First Nation
Joe Daniels, Environment Department, Sagkeeng First Nation
Tom Campbell, Technical Advisor to Sagkeeng, Dillon Consulting
Kurt Simonsen, Technical Advisor to Sagkeeng, Dillon Consulting
Bob Helbrecht, Program Manager, WL Decommissioning
Marv Ryz, WL Decommissioning Operations Manager
Barbara Connell, Communications and Consultation Consultant to AECL

PURPOSE/OBJECTIVE:
To provide an overview of decommissioning program and EA process to Elders Council and receive feedback on issues of concern.

ISSUE/CONCERN:
A number of questions were raised and responded to at the meeting:

- Do they have assurances that waste will be moved?
- Is waste safely stored now?
- Is AECL going to privatize buildings?
- Where does radiation go when it goes into the river?
- Are there reports on fishery and wildlife?
- Doesn't radioactivity accumulate in environment?
- What is being covered in EA?
- Could there be impacts to future generations of people?
- Is there an organization that monitors?
- Would URL be used for disposal?
- If there was a leak at the WMA, would it go into the river?
- What would a worst-case scenario look like and how would people be notified?
- How can anyone trust government?
- Want assurances that wastes would not be imported.
- Is there any heavy water at WL?
- Is it possible to have a chain reaction?
- How long will containers last?
- What guarantees can be given to Sagkeeng for security?
- What kind of warning would you give communities if off-site concern?

AECL Whiteshell Laboratories Decommissioning
Comprehensive Study Report

November 30, 1999 meeting with Sagkeeng (con't)

Other issues raised:

- Sagkeeng lost benefits when WL was built as this was a traditional land use area.
- Elders suggest that AECL meet with other members of community.
- Can only say that AECL met with some members of community in this consultation and not the community.
- An education component should be developed and provide information to high school students.

DECISION REACHED:
AECL reiterated its commitment to involving Sagkeeng First Nation in environmental monitoring program. An education component could be developed for high school.

FOLLOW-UP REQUIRED:
An issues paper to be developed by Sagkeeng First Nation and forwarded for review and discussion with AECL.

SUBMITTED BY:
Barbara Connell

WINDS AND VOICES ENVIRONMENTAL SERVICES, INC.

01 December 1999

Chief J.P. Seymour
Ochiichagwe'babigo'ining First Nation
P. O. Box 88
Kenora, Ontario P9N 3W7

By Fax Only

Dear Chief Seymour:

re: Decommissioning of Whiteshell Laboratory
near Pinawa, Manitoba; AECL

I'm writing to continue my follow-up to the September 24th AECL letter and my October 20th letter to you regarding the above. I've attempted to reach you several times by telephone since then, however I have been unable to reach you. Understandably, you've been extremely busy.

As outlined in the AECL letter, the Whiteshell Laboratory is being decommissioned (shut down) and undergoing a comprehensive study environmental assessment to determine if there will be any impacts or effects from the decommissioning. Once the assessment is completed, a Comprehensive Study Report will be drafted identifying all interests, concerns and potential impacts. All those who may be potentially impacted must be notified of the proposed decommissioning.

My initial telephone contact to you in August and the AECL letter in September are attempts to determine if your community has:

- any interests (i.e. traditional lands, cultural activities) in the regional study area (identified in the maps attached to the AECL letter)
- any concerns regarding the proposed decommissioning program
- any other concerns regarding the area or proposed decommissioning program

which should be reflected in the Comprehensive Study Report.

As you requested, the recently elected Grand Chief of Treaty 3 has also been formally notified of the contacts and discussions with the individual First Nations affiliated with Treaty 3. If you have identified any interests and/or concerns or require more information, please confirm in writing to AECL or give me a call on my direct line: (204) 982-2940. I Look forward to your response at your earliest convenience.

Sincerely,

Ardythe Wilson

Ardythe Wilson, Special Projects
Winds and Voices Environmental Services
Centre for Indigenous Environmental Resources

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[illegible]

WINDS AND VOICES ENVIRONMENTAL SERVICES, INC.

11 January 2000

Mr. Leon Jourdain, Grand Chief
Grand Council of Treaty 3
P.O. Box 1720
Kenora, Ontario P9N 3X7

Grand Chief Jourdain:

re: Whiteshell Laboratories Decommissioning

Further to the letter from Bob Helbrecht of AECL in November 1999 regarding the above-cited, the following is an up-date of contacts and discussions with several communities within the Grand Council of Treaty 3 jurisdiction.

Communities contacted include Wabaseemoong Independent Nation, Iskatewizaagegan Independent Nation, Ochiichagwe'babigo'ining First Nation, Anishinabe of Wauzhushk Onigum, Shoal Lake #40 First Nation, Grassy Narrows First Nation and Lac Seul First Nation. Contact has been by letter, fax and telephone.

Of the seven communities:

- one has verbally expressed the existence of traditional lands and cultural/ spiritual sites and interests within the study area;
- two have identified no immediate interests/concerns in the study area and decommissioning process but require re-notification for any new activity;
- four have not issued any statements regarding interests or concerns in the regional study area or the decommissioning process.

The most recent update on the decommissioning schedule is that a draft Comprehensive Study Report will be submitted to the Atomic Energy Control Board (AECB) by the end of February and will be available for public review and feedback by Spring 2000.

Those First Nations which have not expressed or stated any interests/concerns in the study area have been notified that under the guidelines of the Canadian Environmental Assessment Act, they will also be able to review and comment on the report, including interests and concerns, during the public review process.

...2

W A V E S

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the Centre for Indigenous Environmental Resources

Head Office

WINDS AND VOICES ENVIRONMENTAL SERVICES, INC.

COPY
Letter to
Treaty 3 First Nations

11 January 2000

Wabaseemoong First Nation
General Delivery
Whitedog, On P0X 1P0

Attention: Leonard Fisher, Counsellor

Dear Mr. Fisher:

re: Whiteshell Laboratories Decommissioning

Further to our correspondence of November 26th and telephone discussion on December 9th, please be advised that the most recent update on the above indicates that a draft Comprehensive Study Report is scheduled to be submitted to the Atomic Energy Control Board (AECB) by the end of February and will be available to the public for review and feedback by Spring 2000.

Should you be unable to state your interests in the Regional Study Area prior to the release of the public review copy, under the guidelines of the Canadian Environmental Assessment Act, you will be able to review the draft report and submit your interests during that review process.

If you have already submitted your interests directly to AECL, please excuse my oversight and request that a copy be forwarded to me for inclusion in my contact report.

We are now moved into our new premises, which address and numbers are listed below. Please feel free to give me a call if you require any further assistance or information.

Sincerely,

Ardythe Wilson, Special Projects

W A V E S

All communities have been notified that I will remain available for assistance or further information until such time as our contract is completed with AECL. I extend the same to you.

Sincerely,

Ardythe Wilson, Special Projects
WINDS AND VOICES ENVIRONMENTAL SERVICES

FACILITIES & NUCLEAR OPERATIONS
WL Decommissioning

File: 00170
Decom-00-005
2000 February 10

Chief Ron Fontaine and Council
Sagkeeng First Nation
P.O. Box 3
Fort Alexander, MB R0E 0P0

Attention: Councillor David Swampy
Environment Portfolio

Dear Councillor Swampy:

I would like to acknowledge receipt of the document prepared by the Sagkeeng First Nation on issues for AECL to consider in preparation of the Comprehensive Study Report (CSR) for the proposed decommissioning program of Whiteshell Laboratories (WL). I have reviewed the issues of concern and can indicate that the comments are similar to and consistent with the public feedback on the WL project.

For your information, a draft CSR has been submitted to an internal review committee of AECL. While the issues identified by Sagkeeng have not been specifically identified in this report, AECL is committed to including them in the revised draft CSR prior to submission to the Atomic Energy Control Board.

I would also like to acknowledge AECL's commitment to the November 1999 consultation and communication protocol which sets out an agreed approach for exchanging information and establishing a process for the ongoing participation of Sagkeeng in the decommissioning program. As part of this ongoing dialogue, it has been suggested by Tom Campbell that a meeting be held shortly to bring the parties up to date on decommissioning activities. I have advised Barb Connell of my availability and she will coordinate the next meeting with Tom. In the meantime, AECL will respond to the issues list.

Thank you for bringing your issues forward to AECL. I look forward to discussing them with the Core Group at our next meeting.

Sincerely,

[Original Signed By:]

R.A. (Bob) Helbrecht
Program Manager
WL Decommissioning

cc: Tom Campbell
Dillon Consulting

Whiteshell Laboratories Decommissioning Program

Consultation and Communication Process for the Participation of the Sagkeeng First Nation

November 1999

Whiteshell Laboratories
Decommissioning Program
Consultation and Communications Process for the Participation of the Sagkeeng First Nation

Atomic Energy of Canada Limited

99-4979-0101

Submitted by

Dillon Consulting Limited

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1.0 BACKGROUND

Funding to Atomic Energy of Canada Limited (AECL) was cut back several years ago as a result of the federal government's program review. Subsequently, AECL made the business decision to discontinue operations at the Whiteshell Laboratories (WL) and proceed to close down the site. In order to shut down and decommission WL, there needs to be an amendment to the existing operating licence issued by the Atomic Energy Control Board (AECB) (a federal agency). This licence change triggers application of the *Canadian Environmental Assessment Act*. This *Act* requires that an environmental assessment be carried out before an amended licence can be issued. The type of environmental assessment that has been directed under the *Act* is a Comprehensive Study on the decommissioning of WL.

The purpose of the Comprehensive Study is to examine potential environmental effects of activities related to moving the WL from the operational state to a safe and secure monitoring and surveillance state and then to a final decommissioned end state. The environmental assessment is focussed on the site cleanup activities, not on the research work and other activities carried out at the laboratory over the operating period. The types of activities involved in the decommissioning program being proposed by AECL include constructing additional on-site waste storage facilities, moving contaminated materials from laboratory buildings to the waste management area (e.g., laboratory equipment, samples, protective clothing, gloves, etc.), closing down and demolishing buildings, testing for contamination on the site and remediation to required standards, and rehabilitation (e.g., grading, landscaping, excavation, etc.).

WL is currently undergoing operational shutdown. Decommissioning activities are scheduled to start in late 2000 and extend over a 60-year period.

The purpose of the First Nation addressing this project is based on the Aboriginal and Treaty rights flowing from the traditional land use which encompasses the regional study area of the project. The First Nation also lies adjacent to Winnipeg River downstream of the Whiteshell Laboratories and as such, may have issues with respect to impacts to the watershed from the proposed project. The protocol of this traditional land use area must respect the Aboriginal rights of the First Nation and their significant connection to the land and relationship to all matters effecting the traditional territory. The First Nation has the Anishenabe teachings and understandings of the traditional and cultural practices to adhere with for the Anishenabe protocol. These must be in harmony with the contemporary protocol agreements. In all cases and all phases of the project, there must be an understanding that respects the Anishenabe way of life with respect to Aboriginal and treaty rights.

2.0 FUNDAMENTAL PRINCIPLES AND OBJECTIVES

2.1 Principles

AECL recognizes that the Whiteshell Laboratories is located on lands that are considered to be traditional territory by the Sagkeeng First Nation. AECL also understands that as downstream users of the Winnipeg River system, the Sagkeeng First Nation has an interest in the decommissioning program. AECL is committed to a consultation process to ensure that the areas of interest and issues of importance to the Sagkeeng First Nation are identified and addressed in a meaningful manner.

AECL understands that the Sagkeeng First Nation is interested in a long-term relationship. AECL is committed to this relationship and views the communication activities related to the Comprehensive Study as initial steps in the development of a long-term relationship.

2.2 Objectives

The objectives of this consultation and communication process are to:

- Develop a mechanism for the exchange of information between AECL and the Sagkeeng First Nation on the decommissioning program and environmental assessment.
- Establish a process for identifying and addressing areas of interest and issues of concern.
- Establish a process for the ongoing participation of the Sagkeeng First Nation in the decommissioning process.

3.0 DECISION-MAKING STRUCTURE

3.1 AECL Management Structure

AECL is the proponent of the proposed decommissioning program for the environmental assessment. AECL holds the licence for the entire site and is responsible to the AECB for complying with the licence terms and conditions. AECL will be responsible for undertaking decommissioning activities and satisfying requirements of the Comprehensive Study environmental assessment.

The WL Decommissioning Team is comprised of a group of experts in radiation safety, environmental protection, health and safety, nuclear operations, and decommissioning. The team is headed by Bob Helbrecht, Program Manager, WL Decommissioning Program.

The environmental assessment is being conducted by a team of external consultants from SENES Consultants Limited, Wardrop Engineering, ECOMatters Inc., Winds and Voices Environmental Services Inc., and Barbara Connell advisory services.

3.2 The AECB

The AECB will grant an amendment to the site licence to reflect transition from an operation to a decommissioned state and to permit other activities such as changes in use of lands and buildings at WL. The AECB is the Responsible Authority for the environmental assessment under the *Canadian Environmental Assessment Act* and is responsible for implementation of mitigation measures and follow-up requirements. The Federal Minister of Environment makes the decision on the environmental assessment.

Matters that fall within the scope of the Decommissioning Program can be addressed by the Program Manager for the Decommissioning Program, e.g., environmental monitoring program.

Matters that fall outside the scope of the Decommissioning Program will be referred by the Decommissioning Program Manager to others with responsibility for those matters, e.g., future use of buildings and land.

3.3 Sagkeeng Management Structure

The First Nation is governed by the Chief and Council. Each council member carries a portfolio of responsibilities. In Sagkeeng's case, the environmental portfolio is managed by Councillor Dave Swampy. In all cases, correspondence should be addressed to the Chief and Council with the attention to the Councillor Portfolio Designate. The Council will have a subcommittee of councillors, David Swampy, and Claude Guimond. The Chief is always ex-officio member to the subcommittee. The environment and natural resources portfolio is supported by the directors and technical support personnel to carry out the communications and briefings for the Councillor in charge who in turn briefs the Chief and Council.

The Sagkeeng First Nation is an independent organization operating outside of the regional tribal council. However, the First Nation from time to time collaborates with other First Nations in the Southeast Tribal Council Region when there is an issue or interest of mutual concern.

From time to time, the First Nation may address the issue with the provincial and/or national political organizations of Assembly of Manitoba Chiefs and the National Assembly of First Nations.

to the Councillor Portfolio Designate. The Council will have a subcommittee of councillors, David Swampy, and Claude Guimond. The Chief is always ex-officio member to the subcommittee. The environment and natural resources portfolio is supported by the directors and technical support personnel to carry out the communications and briefings for the Councillor in charge who in turn briefs the Chief and Council.

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From time to time, the First Nation may address the issue with the provincial and/or national political organizations of Assembly of Manitoba Chiefs and the National Assembly of First Nations.

4.0 CORE GROUP

A Core Group will be established for purposes of implementing this consultation and communication process. The Core Group will work towards joint resolution of issues and will engage in consultations with the broader community under the direction of Chief and Council.

The Core Group will be comprised of:

- Bob Helbrecht - Program Manager, WL Decommissioning Program
- Marv Ryz - WL Decommissioning Operations Manager
- Barb Connell - Consultant to AECL, Communications and Consultation
- David Swampy - Councillor, Environment Portfolio, Sagkeeng First Nation
- Vince Fontaine - Director, Environment Department, Sagkeeng First Nation
- Joe Daniels - Environment Officer, Sagkeeng First Nation
- Tom Campbell - Consultant to Sagkeeng First Nation, Dillon Consulting Limited
- Kurt Simonsen - Consultant to Sagkeeng First Nation, Dillon Consulting Limited

5.0 CONSULTATION AND COMMUNICATION PROCESS FOR THE ENVIRONMENTAL ASSESSMENT

The communication protocol of the First Nation for the purpose of this project is designed to maintain a high level of knowledge for the Chief and Council and First Nation members. The communication protocol is outlined below:

- Correspondence from AECL or Dillon Consulting will be filed with the Chief and Council to the attention of Councillor Dave Swampy.
- Minutes of all AECL and Sagkeeng communication meetings to be maintained and circulated to the First Nation through the Chief and Council to the attention of Dave Swampy.
- The decisions of the First Nation will be signed off by a quorum of the Chief and Council.
- Public information for the project will be maintained on file with the First Nation including the notices of any changes to the program; band members may review this information at any time.
- The correspondence filed by the First Nation to AECL of any issues or concerns will be in writing and should be verified by AECL acknowledgement.

The protocol for meeting notification should follow the communication procedure previously outlined.

Likewise, the First Nation will provide AECL with a written request for any meetings to discuss the project. A one week notice for meetings will be considered.

A process will be established to exchange information and identify and address issues of concern to the Sagkeeng First Nation. An issues and questions list will be prepared by the Sagkeeng First Nation and presented to AECL for review and discussion. Copies may be sent to the Canadian Environmental Assessment Agency and Indian and Northern Affairs Canada. AECL will make available members of its decommissioning team and environmental assessment team to address issues and questions. It is expected that a series of meetings with the Core Group will take place over a period of several months. Issues identified through this process will be addressed in the Comprehensive Study Report (CSR). A reasonable course of action will be presented for issues that cannot be resolved.

A process for a long-term relationship between AECL and Sagkeeng First Nation that ensures Sagkeeng's ongoing involvement in its areas of interest in the Decommissioning Program, e.g., environmental monitoring, will be established. In the spirit of partnership and capacity-building, AECL will endeavour to provide opportunities for the Sagkeeng First Nation to build on skills at the community level.

6.0 SCHEDULE

AECL is preparing a draft CSR. In the short-term, AECL will be seeking the Sagkeeng First Nation's input into this draft report through the identification of issues. AECL is seeking input into the draft report by the end of November 1999. The process established for the resolution of issues and identification of issues remaining to be addressed, will be used for input into the final report. The target date for the final report is April 2000.

SAGKEENG FIRST NATION

IDENTIFIED ISSUES FOR ATOMIC ENERGY OF CANADA FOR THE PREPARATION OF A COMPREHENSIVE STUDY REPORT FOR THE WHITESHELL LABORATORIES DECOMMISSIONING PROGRAM

1.0 INTRODUCTION

Atomic Energy of Canada Ltd (AECL) has made the business decision to discontinue operations at the Whiteshell Laboratories (WL) and proceed to close down the site. As part of the requirements of the Canadian Environmental Assessment Act, a Comprehensive Study Report (CSR) must be prepared by AECL of the potential environmental impacts of the proposed project. The purpose of the CSR is to examine potential environmental effects of activities related to moving the WL from the operational state to a safe and secure monitoring and surveillance state and then to a final decommissioned end state.

The scope of the CSR, as defined by the Atomic Energy Control Board, requires AECL to consult with potential stakeholders, including First Nations communities. This included the Sagkeeng First Nation. The purpose of the consultation process was to identify issues of concern and valued ecosystem components which may be impacted by the project. The scope of the assessment also requires AECL to assess the environmental effects on the current use of lands and resources for traditional purposes by aboriginal persons.

AECL met with the Sagkeeng First Nation on October 25, 199 at the Whiteshell Laboratories. At this meeting, the AECL project management team briefed the representatives of Sagkeeng (and their consultant Dillon Consulting) as to the nature of the project and provided a tour of the site. This was followed by a meeting at Fort Alexander on November 19 with the AECL project management team and the Sagkeeng elders to explain the project and answer questions.

The output of the consultation exercise has been the production of a formal consultation and communication protocol document entitled "Whiteshell Laboratories Decommissioning Program-Consultation and Communication Process for the Participation of the Sagkeeng First Nation." This was released on December 8, 1999. The Sagkeeng First Nation has also identified specific issues of concern for analysis in the CSR document. These are provided below.

2.0 ISSUES OF CONCERN

The following issues of concern have been highlighted by the Sagkeeng First Nation as it pertains to the environmental assessment currently being conducted by AECL of the WL Decommissioning Program:

- The people of the Sagkeeng First Nation rely on the natural resources within their Traditional Land Use Area for their livelihood; as such, the health of the flora and fauna within this area are of a concern to the people of Sagkeeng. The CSR should therefore address the possible impacts to flora and fauna within the regional study area as it pertains to AECL historic activities, as well as the proposed decommissioning activities by AECL. The study should address possible impacts to migratory species as they move in and out of the licenced study area and how these impacts will be mitigated. The Sagkeeng are specifically concerned about possible impacts to wildlife as they move in and out of the Waste Management Area, which will remain on-site for an indefinite period of time.

- Since the Waste Management Area will potentially be used indefinitely, the Sagkeeng are concerned about how accidental releases will be mitigated and monitored and what sort of institutional controls will be provided around the facility. AECL are asked to clarify how intentional intrusion into the Waste Management Area will be mitigated. The Sagkeeng would also ask that a risk assessment report be prepared for the Waste Management Area that looks at receptor pathways and quantifies risks to the environment and human health from material stored in the Waste Management Area, and the material ultimately slated for disposal in the Waste Management Area that currently lies in the trench facility.

- The Sagkeeng regularly fish in the Winnipeg River and are concerned about contaminated sediment and water downstream of the WL. AECL are asked to describe background sediment and water quality conditions prior to WL operations and describe the nature and extent of impacts to the sediment and water quality from intentional or unintentional releases from the WL. The Sagkeeng would also like to understand any impacts to fish species from AECL activities and the potential for further impacts as a result of the decommissioning proposal.

- Since decommissioning nuclear facilities is relatively new to AECL, the Sagkeeng are concerned about possible accidents that may occur during the decommissioning process and the potential impacts to human health and the land and water resources that may result from an accident. AECL is asked to describe the safeguards that will be implemented during decommissioning and what contingency plan will be developed in case of an accident. The Sagkeeng needs to be aware of any accident that may impact the resources in their Traditional Land Use Area and request a communication program to notify Sagkeeng in the event of an incident.

- As the decommissioning of the site will proceed over a number of years, the Sagkeeng would ask that a decommissioning "closure" or "status" report be prepared by AECL for each site for each phase of the decommissioning process. The Sagkeeng would ask that these reports be submitted to a public registry so all stakeholders can follow the work as it is completed and any residual impacts are reported and understood.

- The monitoring of land and water resources will be required throughout the decommissioning process and during the time the Waste Management Area remains active. The Sagkeeng requested that they be involved in the development of a long-term monitoring program and the people of Sagkeeng be trained and employed in the collection of monitoring data. The Sagkeeng people feel if they are part of AECL's monitoring team, they would have more confidence in the monitoring data and the Sagkeeng community would have a better understanding of the impacts to the Traditional Land Use Area from the project. The Sagkeeng would like to partner with AECL in the monitoring of resources within the regional study area.

Appendix E.9

Contacts Regarding VECs

ECOMatters Technical Issues Questionnaire

WL Decommissioning Technical Interviews - VECs

Name: Dr Colin Macdonald, professional ecologist

Address: 24 Dufferin Ave

Phone Number: 753-2244

Position(s) held at WL: 1) Research Scientist in
Date(s)
2) Environmental Res. Br.
3) 1974 1998

Recollections Valued Ecosystem Components:

Type, Location, Importance, Potential Impacts?

1) bald eagles (possibly osprey) along river
2) sport fish - walleye, pike, sucker, burbot
3) amphibians in wetlands, linkage to Lagoons
4) small mammals as keystone species for
5) birds of prey, foxes, wolves, etc
6) sturgeon (agreed with interviewer, not brought up by CM)
7)
8)

Any other Comments or Issues you would like to discuss/share with an Independent Decommissioning Team?

interviewed July 19/99
~11 am
Steve Sheppard

ECOMatters Inc.

ECOMatters Technical Issues Questionnaire

WL Decommissioning Technical Interviews - VECs

Name: Bill Schwartz

Address: Lac du Bonnet

Phone Number: 345-8056

Position(s) held at WL: 1) start ESB 1968 - 1998 retired
Date(s)
2) environmental research technologist
3)

Recollections Valued Ecosystem Components:

Type, Location, Importance, Potential Impacts?

1) EIGs - lady slippers, Indian Pipes in Pinawa
2) river bank Maples, Grapes (vine, wood bank jump in ...)
3) - eastern edge of range
4) much of site is similar to rest of region
5) sturgeon - white and Red enough - dams ... dates
6) beaver - lots ongoing - pest
7)
8)

Any other Comments or Issues you would like to discuss/share with an Independent Decommissioning Team?

July 19/99
Steve Sheppard

ECOMatters Inc.

ECOMatters Technical Issues Questionnaire

WL Decommissioning Technical Interviews - VECs

Name: Dr. Janet Dugle

Address: Pinawa

Phone Number: ____________

Position(s) held at WL: Date(s)
1) Research Scientist
2) ~1960's to 1986
3) ____________

Recollections Valued Ecosystem Components:

Type, Location, Importance, Potential Impacts?

1) FIG - the area is very extensively documented
2) and therefore is a resource of value
3) a study was done by A Rip of a similar FIG
4) cattail hybridization may no longer be evident at FIG
5) lot of orchids
6) ____________
7) ____________
8) ____________

Any other Comments or Issues you would like to discuss/share with an Independent Decommissioning Team?

July 17/99

Steve Sheppard

ECOMatters Inc.

Sheppard Environmental
To: [illegible]
Subject: Valued Ecosystem Components (VECs)

Jan ...

Thanks for your time in the mall.

As I described, we are part of the decommissioning consulting group working on the Whiteshell site. A rather bitter sweet task. One of our tasks is to define VECs. VECs are supposed to be determined through a combination of expert judgement and interviews with knowledgeable public.

I have listed FIG as a VEC.

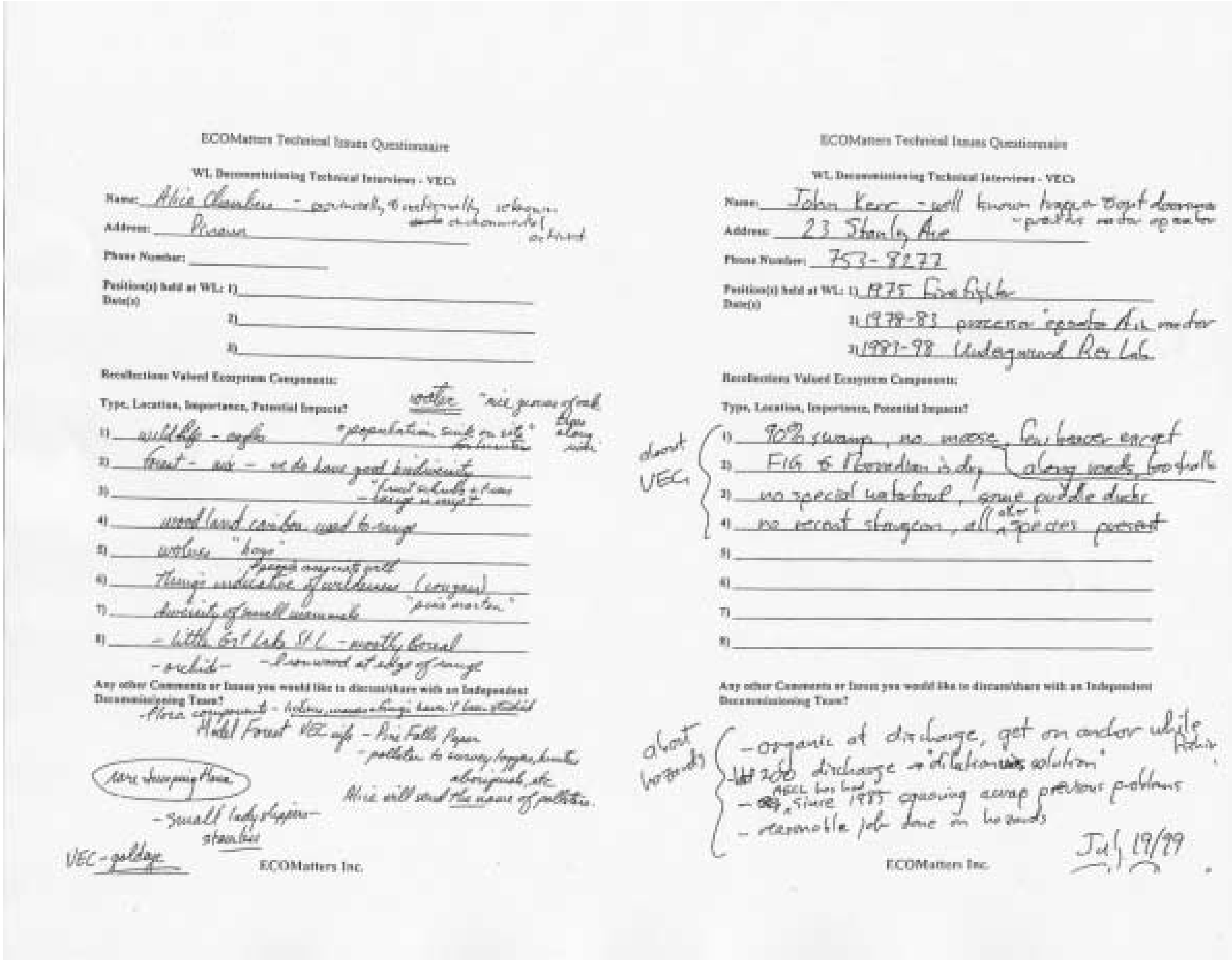
If you think of other features of the site (or affected by operations on the site) that need to be protected, I'll be happy to include them on the list. Examples of ideas brought forward so far are the river as an eagle migratory route, the river for sturgeon, and the ravines for small mammal and locusts.

Any comments you have most welcome.

Thanks

Steve S.

S.C. (Steve) Sheppard Ph.D. P.Ag.
ECOMatters Inc.
Suite 104A, W.B. Lewis Business Centre
24 Aberdeen Ave., Pinawa, MB, Canada, R0E 1L0
Ph: 204-753-2747
Fax: 204-753-2176
Email: sheppards@ecomatters.com
WWW: http://www.ecomatters.com



ECOMatters Technical Issues Questionnaire

WL Decommissioning Technical Interviews - VECs

Name: Alice Chambers [illegible]

Address: Pinawa

Phone Number:

Position(s) held at WL: 1)
Date(s)

2)

3)

Recollections Valued Ecosystem Components:

Type, Location, Importance, Potential Impacts?

1) wildlife - eagle "population sink on site" [illegible]
2) forest - [illegible] we do have good biodiversity
3) [illegible]
4) woodland caribou used to range
5) wolves "bogs"
6) Things indicative of wilderness (cougars)
7) diversity of small mammals "pine marten"
8) - little [illegible] - mostly boreal
- orchids - ironwood at edge of range

Any other Comments or Issues you would like to discuss/share with an Independent Decommissioning Team?

[illegible]

Alice will send the names of [illegible]

- small lady slipper -

VEC - [illegible]

ECOMatters Inc.

ECOMatters Technical Issues Questionnaire

WL Decommissioning Technical Interviews - VECs

Name: John Kerr - well known trapper [illegible]

Address: 23 Stanley Ave

Phone Number: 753-8277

Position(s) held at WL: 1) 1975 Fire Fighter
Date(s)

2) 1978-83 process operator [illegible]

3) 1993-98 Underground Res Lab

Recollections Valued Ecosystem Components:

Type, Location, Importance, Potential Impacts?

about VEC

1) 90% swamp, no moose, few beaver except
2) FIG [illegible] along [illegible]
3) no special waterfowl, some puddle ducks
4) no recent sturgeon, all other species present
5)
6)
7)
8)

Any other Comments or Issues you would like to discuss/share with an Independent Decommissioning Team?

about lagoons

- organic at discharge, get on and/or white [illegible]
- [illegible] discharge [illegible] solution
- AECL has had, since 1985 [illegible] previous problems
- reasonable job done on lagoons

July 19/99

ECOMatters Inc.

Sheppard Environmental
From: Zach, Reto [zachr@aecl.ca]
Sent: Tuesday, July 20, 1999 12:59 PM
To: 'Sheppard Environmental'
Subject: RE: thanks, and now for my reason

Hi Steve,
VECs are valued by somebody and in this case by me. Because ERI assessment endpoints need not be valued by anybody, I find them actually more useful than VECs, although VECs can be important in the selection of assessment endpoints. (Actually, ERI does not use the concept of VEC, which seems to have become outdated.)
My point of view comes from conservation and habitat preservation is tops. If sufficient habitat is maintained in a suitable state, everything else will follow. Often aquatic habitat is more important than terrestrial habitat, but around WL, terrestrial habitat (with pockets of wetland) would seem more important. This is mainly related to the fact that the upstream seven Sisters forebay provides very important aquatic habit, more so than the river at WL and even Lac du Bonnet.
So the 1st VEC is maintenance of mixed boreal forest habitat around WL. For me this means no lumbering, no new roads, no additional habitat fragmentation, rehabilitation of some areas cleared and used by AECL, and no contamination.
The second VEC is maintenance of aquatic habitat in the Winnipeg river. For me this means leaving things pretty well as they are or improving them, if possible, and no contamination.
For both of these VECs there can be a number of indicators (or measurement endpoints) related to carefully selected plant and animal species, populations or communities.
Greetings from SP, Reto

From: Sheppard Environmental[SMTP:sheppards@granite.mb.ca]
Sent: Tuesday, July 20, 1999 11:38 AM
To: Zach, Reto
Subject: thanks, and now for my reason

Thanks. And now for my reason, which also includes you!
As you know we are part of the decommissioning consulting crew. One of our
tasks is to define VECs. VECs are supposed to be determined through a
combination of expert judgement and interviews with knowledgeable public.
You have the potential for a triple role, as an expert, as a member of the
knowledgeable public, and as an employee of the client.
I was hoping to ask you here as a member of the knowledgeable public.
Obviously we are both conscious of your other roles.
What features of the site (or affected by operations on the site) need to be
protected from your perspective as a member of the public? Examples of
ideas brought forward so far are the river as an eagle migratory route, the
river for sturgeon, and the ravines for small mammal and beaver.
Any comments you have most welcome. If you are uncomfortable with this,
that's fine. I have lots of input already. However, you clearly know the
ecology of the site as well or better than anyone.
Thanks
Steve S.

Sheppard Environmental
To: taylorp@aecl.ca
Subject: greetings, and some questions

Peter ...

Hope this finds you.

Haven't heard anything about you stay in France. I'm sure its been wonderful. We will go to a conference in Montpellier in October. Looking forward to that because France is one of my favorite countries to visit.

My question is about the ecology of the WL site. ECOMatters (our company) is involved with a few other firms in doing the decommissioning assessment for the site. A bitter sweet job. One of the tasks is to define 'Valued Ecosystem Components (VECs)', things that need to be protected. Often they are populations of organisms, but can be habitat. VECs are determined through a combination of expert judgement and interviews with knowledgeable public. I was hoping to count you as a member of the knowledgeable public.

Are there features on the site (or affected by operations on the site) that need to be protected? Examples of ideas brought forward so far are the river as an eagle migratory route, the river for sturgeon, and the ravines for small mammal and beaver.

Any comments you have most welcome. Please acknowledge if you receive this, so I know if email worked.

Thanks

Steve S.

S.C. (Steve) Sheppard Ph.D. P.Ag.
ECOMatters Inc.
Suite 104A, W.B. Lewis Business Centre
24 Aberdeen Ave., Pinawa, MB, Canada, R0E 1L0
Ph: 204-753-2747
Fax: 204-753-2178
Email: sheppards@ecomatters.com
WWW: http://www.ecomatters.com

Sheppard Environmental [illegible]
From: Peter or Sharon Taylor [peter.taylor@[illegible]]
Sent: Monday, August 02, 1999 11:24 AM
To: Sheppard Environmental
Subject: Re: greetings, and some questions

Dear Steve

Here is a preliminary reply to your request. A couple of items come to mind. I assume your brief covers the whole AECL property.

The coniferous forest off PR 211 east of the plant road is an excellent area for Great Gray Owls, mostly (or at least most conspicuously) in winter, but it is likely at least a semi-regular nesting area (the species is nomadic, and hence does not use the same nest sites every year, but does have traditional feeding and nesting areas that are used when small mammal populations are high). Perhaps more important, it is a good area to find a variety of boreal bird species (Spruce Grouse, Boreal Chickadee, Black-backed & Three-toed Woodpeckers, Gray Jay, Yellow-bellied Flycatcher, plus many commoner species... and irregularly White-winged Crossbill and Boreal Owl). None of these is especially rare, but most are inconspicuous and are high on the "want list" for visiting bird-watchers. Thus, one might make a case that the area has value for eco-tourism by providing ready access to a number of relatively hard-to-find species. There are also some interesting orchids in the area, notably Malaxis unifolia (south of the Highway) and Arethusa bulbosa (in more open bog towards FKD). I suggest this would be a good area to focus inventory studies to make any case for preservation. There was extensive cutting in the area 15 years or so ago (I think mainly for aspen), and I don't have a good feel for its impact on bird populations, or on the site's desirability as a reserve.

Incidentally, are you aware of Alice Chambers' efforts to have AECL property declared a reserve? I sent her some ruminations along the same lines as the above some time ago, and unfortunately have deleted it.

Another area that comes to mind is the plant sewage lagoon. It attracts a substantial number of migratory and breeding water birds. If it does not remain in use after plant decommissioning, a case might be made to convert it to a waterfowl reserve, especially if it will remain relatively secluded.

A third area that I don't know well, but may have some special value, is the riparian deciduous forest strip. Possibly important for preventing river-bank erosion as well as intrinsic biological value. It is also a habitat that is getting nickel-and-dimed away by cottage development, and a case might be made to retain a representative section.

Regarding eagle migration, yes, the Winnipeg River is a significant migration route. The most important resting/feeding areas seem to be between the 211 bridge and Seven Sisters dam, hence off the AECL property, but the stretch downstream from the bridge is used as well. Also, there is probably an eagle nest somewhere in or near the coniferous area I described above. The open water below Seven Sisters dam, which extends onto AECL property in milder winters, is also one of the few regular wintering areas for Bald Eagles in Manitoba (usually just a couple of birds, likely the local nesting pair). I suspect the number of eagles feeding or resting along the river there is a small fraction of the birds passing through.

Snapping Turtle may be worth a mention. I don't have a very good feel for its abundance in Manitoba, but most of my sightings have been on plant property, including the lagoons. Not an easy beast to census!

One more personal note, but possibly significant if your report has an ecotourism spin: the FKD road and other trails in partly cleared areas are excellent for butterflies (but mostly common species) in summer.

Unfortunately, all my detailed records are back in Pinawa. However, I would be pleased to flesh out the above suggestions as much as possible, if they are along the right lines. I could probably come up with a briefly annotated bird species list for either site from memory, if that is any use. It would be easier to provide an opinion on specific birds or beasts that are of interest. Of course, a large fraction of the plant site is inaccessible, and there may well be many hidden treasures! If there are any plans for field studies, I'll be available next spring!

Please confirm that you've received this, and let me know if anything is useful and/or needs elaboration.

Best wishes,

Peter

APPENDIX F

PROPOSED AECL RESPONSE TO TECHNICAL REVIEW COMMENTS ON WHITESHELL DECOMMISSIONING PROGRAM CSR REV. 1

APPENDIX F
RESPONSES TO TECHNICAL REVIEW COMMENTS ON THE DRAFT COMPREHENSIVE STUDY REPORT ON THE WHITESHELL LABORATORIES DECOMMISSIONING PROJECT, REV. 1, APRIL 2000

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
1	Western Economic Diversification Canada	AECL should provide additional information on the historical economic impact of Whiteshell Laboratories on the local community, and the severe decline that will culminate with the decommissioning of the site.	Sections 5.5.1 and 5.5.2, Pages 5-38, 5-39	This is a matter that falls outside the scope of this environmental assessment. The CEAA requires that the responsible authorities assess the environmental effects of the project; that is, the effects of the proposed decommissioning project on land, water and air, organic and inorganic matter, living organisms, and interacting natural systems that include the above components. The consideration of socio-economic effects that are within the scope of the assessment includes only those that may result from the changes that the project may cause in the above biophysical components of the environment. The decision to close the Whiteshell Laboratories facility has already been made by the Government of Canada and AECL, and is not a decision that the RAs must now consider.	
2	Western Economic Diversification Canada	Describe the federal government initiatives that have been put into place in an effort to offset the withdrawal of AECL from the local economy.		See comment 1.	
3	Western Economic Diversification Canada	CSR should include information about AECL's expectation for the continuation of the grant-in-lieu into the future, along with any mitigation measures that the corporation will implement.	Section 5.5.5, Page 5-44	Any measures to mitigate the economic impact of the earlier decision by the Government of Canada and AECL to cease operations at AECL are outside the scope of this environmental assessment. The CSR will consider measures designed to mitigate the biophysical effects of the proposed decommissioning activities and any socio-economic effect directly resulting from any changes to that biophysical environment that are likely to be caused by the decommissioning activities.	
4-30	Local Government District of Pinawa	Comments from local government district.		These comments were not part of the technical review by Federal authorities. Accordingly, the comments have been documented and addressed in the public consultation section of the CSR.	Section 10.0 Table 10.4

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
31	Canadian Environmental Assessment Agency	It is necessary that the assessment of environmental effects address the overall potential effects of the project, rather than the incremental effects of various project components.		The CSR has been restructured to better describe the overall effects of the project on the various components of the environment, including VECs.	Section 6.0
32	Canadian Environmental Assessment Agency	The discussion on noise and vibration assessment on Page 6-5 would benefit from some further description.	Page 6-5	New section on air quality and vibration provided.	Sections 6.3.1 and 6.3.2
33	Canadian Environmental Assessment Agency	Where the VECs have several components, the changes to the individual components were documented, rather than to the VEC as a whole." This would seem to potentially neglect the true environmental effect on a VEC. VECs are selected in order to focus the effects assessment to areas of both social and ecological importance; this assessment may be missing that focus for some of the VECs selected. There needs to be more discussion around how these activities will impact directly on the VECs.		See comment 31.	Section 6.0
34	Canadian Environmental Assessment Agency	On Page 6-12 rehabilitation practices are outlined. These discussions would benefit from more detail in order to identify which species are going to be used in re-vegetating the area, such as native or non-native species.	Page 6-12	Re-vegetation plans will be part of the DDPs. Vegetation species will be selected to provide for a stable and self-sustainable cover that is compatible with surrounding vegetation and/or proposed land-uses at the time.	An outline of a DDP is given in Section 4.4.2

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
35	Canadian Environmental Assessment Agency	On Page 6-38, the statement "Although some leakage from the WMA is expected, the facility has been designed to minimize the transfer of contaminants outside the WMA" needs to be expanded, in terms of the amount of possible leakage and any possibilities of exceeding acceptable levels.	Page 6-38	Addressed as part of WMA groundwater flow/contaminant transport assessment.	Appendix C.1
36	Canadian Environmental Assessment Agency	On Page 6-49, the statement "Space within this building is currently being marketed to privatization interests. Note that this building was only used for low-level radioactive work. As a result the radionuclide inventory is very small " would also benefit from further explanation or even a comparison to other situations in order to put into perspective what 'low-level radioactive' means in a way that the general public could understand.	Page 6-49	Suitable for low-level radioactive work, and is designated as Zone 1 (considered a 'clean zone', dose levels do not exceed 1 mSv/a) for use as routine laboratory space. This has been clarified in the revised CSR.	Section 4.3.2
37	Canadian Environmental Assessment Agency	On Page 6-58, comments in the Soil and Groundwater section indicate that "levels of heavy metals in the leachate should be low and consequently, contamination of soil and groundwater should be low provided items containing heavy metals have not routinely been added to the landfill". There should be more certainty surrounding these statements, and if there is no certainty, sampling programs should be outlined to identify contaminant levels.	Page 6-58	Operating procedures for the landfill outline acceptable wastes only as material certified free of radioactivity and hazardous industrial wastes. Data on groundwater in the vicinity of the landfill site has been added to Section 5.4.4 and indicates that there are no radioactive contaminants. Proposed enhancements to the groundwater monitoring program for the landfill have been added to Section 9.5.	Sections 5.4.4 and 9.5.3

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
38	Canadian Environmental Assessment Agency	On Page 6-63, it says "Given the nature of the effluent, it is unlikely that there has been much release of contaminants to groundwater." What is the "nature" of the effluent? How much is "much", how "unlikely" is it?	Page 6-63	Lagoon effluent characterization data has been included in Section 5.2.3. There is no evidence of downward migration into the underlying clays. The text has been revised accordingly.	Section 5.2.2
39	Canadian Environmental Assessment Agency	Within Section 6.22 the discussion of effects and mitigation should note the reference to the *Fisheries Act* in Section 6.0, and the possibility of a further, more specific CEAA assessment.	Section 6.22	Agreed	Addressed as part of sediments. Description in Sections 4.3.3, 5.3.3 and in Appendix B.
40	Canadian Environmental Assessment Agency	On Page 6-78, consideration should be give to adding a specific reference to the *Fisheries Act*, and then adding the following reference in the last sentence, "it should be noted that the environmental effects and mitigation measures will be evaluated, including a separate evaluation as part of an environmental assessment under CEAA if required, as part of the implementation plan, should the rivers sediments assessment conclude that remediation is required".	Page 6-78	Agreed	Addressed as part of sediments. Description in Sections 4.3.3 and 5.3.3. See also Appendix B. Role of DFO is clarified in Section 1.0

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
41	Canadian Environmental Assessment Agency	The effects of malfunctions and accidents are considered in Section 6.25. On Page 6-91, examples of potential equipment failure are provided. If there are other types of equipment failure, these should be noted as well. If such a list is considered too comprehensive for inclusion in the CSR, then a reference should be provided as to where this information can be found.	Page 6-91	The list of possible equipment failures has been reviewed and minor revisions have been incorporated.	Section 6.4
42	Canadian Environmental Assessment Agency	The analysis of cumulative effects (Section 8.0) requires a greater level of detail. The analysis provided does not indicate how or why it was determined that none of the projects identified in 8.2 affect the site or any of the VECs on it. Similarly, it does not provide any information to substantiate the claim that none of the activities/physical works impact on the designated stretch of the Winnipeg River.	Section 8.0, 8.2	Section 8.3 has been revised to better show interaction between the residual effects of the decommissioning project and other projects in the area.	Section 8.3

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
43	Canadian Environmental Assessment Agency	The overall comments that are provided in Section 7.1 could be elaborated, particularly in the case of the first bullet, which says "releases during decommissioning will not be continuous. The decommissioning process is spread over many years and activities will occur sporadically." If the staggered timing of the activities is considered to be central to the effects being insignificant, then it would appropriate to include a chart or graph that illustrates when these activities are anticipated to happen.	Section 7.1	A summary schedule of the principal decommissioning activities (i.e. those that have the potential to significantly interact with the environment) has been added to the CSR. There will not be continuous activity; nor will all activities occur at the same time. This means, for example, in the case of dust from demolition, that there will not be a continuous source of material potentially affecting vegetation.	Figure 4.4
44	Canadian Environmental Assessment Agency	Detailed definitions are needed for the Step 2 criteria. For example, how is "loss of function" defined? With respect to duration, how many years does each "phase" encompass?		Revisions have been made to Section 7.2. Definition of "significance" criteria are provided in the Glossary.	Section 7.2 and Glossary
45	Canadian Environmental Assessment Agency	How were the thresholds for occurrence and reversibility determined? Also, based on the definition provided in Table 7.2, it is difficult to tell the distinction between duration and occurrence - perhaps the distinction could be better explained? 'It should also be noted how the definitions may necessarily vary from VEC to VEC.	Table 7.2	Thresholds were determined on the basis of risk to human and ecological health; these vary from VEC to VEC. Duration refers to length of time; occurrence to frequency.	Section 7.2 and Glossary

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
46	Canadian Environmental Assessment Agency	We also note that magnitude was deemed to be the most important of the criteria. Some explanation is warranted as to why this was chosen, and how the "requirement for effect to be significant" were derived. This also highlights the need to provide a clear definition of magnitude.		Magnitude is the “effect” descriptor most likely to affect function. Magnitude is the size or degree of impact compared to existing environmental conditions.	Section 7.2 and Glossary
47	Canadian Environmental Assessment Agency	On Page 7-7 a set of rules were outlined to establish significance based on the magnitude rating. It is unclear if these are the only combinations of ratings which will result in a significant effect. If this is not the case, other combinations need to be outlined and justified.	Page 7-7	These were the only two combinations used to establish significance.	
48	Allison Stoddart Canadian Environmental Assessment Agency	In Section 7.3, it would be useful to provide a more detailed analysis that shows why or how all of the activities met the criteria outlined in Step 1. 'For example, what applicable legal standards were applied?	Section 7.3	Standards included federal drinking water objectives CNSC regulations etc. No legal requirement or standard was violated.	Phrase added to Section 7.2

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
49	Canadian Environmental Assessment Agency Canadian Environmental Assessment Agency	The significance analysis in Table 7.3 is very helpful, but would benefit from a greater measure of certainty. For instance, the comment for nuisance dust says "a number of factors will limit the transport of nuisance dust …"What factors? For surface water quality, the comment says "Decontamination is normally done indoors." Will that be done in this case? If so, it should say "decontamination will be done indoors". Similarly, it says that "drainage plans can avoid problems". Will they?	Table 7.3	In general, decontamination will be done indoors. In some cases it may not be necessary The DDPs will determine that precisely. For that reason, words like "normally" must be used. Where there are possibilities that contaminants may be washed into surface waters, drainage around the facility will be controlled to collect and process aqueous contamination through the ALWTC. The revised CSR provides further clarification on these factors and possible mitigation measures.	Section 4.2.2 provides a description of a DDP.
50	Canadian Environmental Assessment Agency	Also, under socio-economic effects, it says "adherence to AECL's radiation protection and occupational health and safety programs should ensure …", rather than will ensure. This is particularly important to address, since adherence to these programs are frequently cited as a mitigation measure for potential effects to worker health and safety.		Agreed; should has been changed to will.	Text changed in Table 7.3
51	Canadian Environmental Assessment Agency	The mitigation measures that were identified were integrated with the environmental effects analysis in Section 6.0. Careful consideration will have to be given to the level of detail that is necessary for the purpose of the comprehensive study report.	Section 6.0	Level of detail considered adequate for environmental assessment analysis purposes.	

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
52	Canadian Environmental Assessment Agency	It would be useful to include a short explanation as to why the issues raised by the Local Government District of Pinawa (in Table 10.5) was singled out from the other public concerns. It would also be useful to note what additional measures were taken to include the Treaty 3 First Nations in the consultation process.	Table 10.5	Table 10.5 has been reincorporated into Table 10.4. An update on the consultation with Treaty 3 first nations is included in Section 10.5.4.	Section 10.5.4
53	Canadian Environmental Assessment Agency	There were many references to the concept of establishing a Public Advisory Committee. This is an opportunity that could be explored in the CSR in further detail.		Agreed; AECL supports the formation of a PAC. The terms of reference for formation of the PAC require consultation with the local community and will be undertaken early in Phase 1.	Section 9.9
54	Canadian Environmental Assessment Agency	The analysis provided in Section 3.0 does not give a clear explanation as to why the time frame for the project was the only type of "alternative means" to be examined. The proponent may also want to consider further analysis of alternative means, other than the time frames of the project.	Section 3.0	Rationale for approaches to WMA trenches, Sediments and WR-1 is addressed in Sections 3.3, 3.5 and 4.3. The criteria considered for the selection of the preferred alternative included economic and technical feasibility as well as environmental considerations.	Sections 3.3, 3.5 and 4.3
55	Canadian Environmental Assessment Agency	A general scheduling of decommissioning could be considered, and various alternative schedules could be outlined which may identify the most environmentally sound way of proceeding (i.e. minimizing impacts by scheduling decommissioning activities to avoid overlapping effects).		A general statement/paragraph has been added to Section 4.3.4 stating, "there is a logical flow of decommissioning work commencing with nuclear research facilities and nuclear support facilities to handle the most significant hazards while maintaining the site infrastructure. Service systems are addressed subsequent to nuclear facilities decommissioning. This also tends to avoid overlapping or conflicting effects between individual project components. A table and figures outlining the scheduling of key decommissioning activities over the three phases has been added to Section 4.3.4.	Section 4.3.4

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
56	Canadian Environmental Assessment Agency	Consideration could be given to addressing all issues pertaining to alternative means in Section 3.0 of the report.	Section 3.0	Section 3.5 on alternative methods has been added.	Section 3.5
57	Canadian Environmental Assessment Agency	Cessation of a monitoring activity will occur once it can be shown that an effect has stabilized or has been reduced to a level where it is no longer considered significant by regulatory or other standards such as community concerns." 'It may be more appropriate to avoid the use of the term "significant". Monitoring and follow-up should be done to verify the environmental assessment, and determine the effectiveness of mitigation measures.		Agree. The monitoring and follow-up is conducted to verify the predictions of the assessment and determine the effectiveness of mitigation measures.	Factors affecting the scope of monitoring are outlined in Section 9.6.
58	Canadian Environmental Assessment Agency	The effects of the project on the capacity of renewable resources are addressed in Section 6.26. This section would benefit from a more detailed description of the range of renewable resources that could be affected by the project, and a matrix that identifies the project-resource interactions. This level of analysis is still required, even if the effects are considered to be positive.	Section 6.26	A new table addressing effects on renewable resources has been added to Section 6.6.	Section 6.6
59	Canadian Environmental Assessment Agency	The description provided in Section 5.4.11 on Valued Ecosystem Components would benefit from a more complete explanation of the methodology used to select the VECs.	Section 5.4.11	Information on the methodology used has been included in Section 5.6.	Section 5.6

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
60	Canadian Environmental Assessment Agency	The second bulleted list in Section 5.4.11 provides some information on how the VECs and VSCs were initially identified, it would be helpful if more detailed information was provided as to exactly who provided the input, and the basis for their position.	Section 5.4.11	A list of people consulted is provided in Appendix E.	Appendix E
61	Canadian Environmental Assessment Agency	The list provided in Table 5.18 does not reflect some of the species identified in the preceding pages as being endangered, such as the peregrine falcon, burrowing owl, piping clover, and loggerhead shrike. As well, the highest rated (13 ‘points') is not discussed at all in the discussion section that immediately follows the table.	Table 5.18	These were not identified as VECs because they were not specifically found on site even though it was possible that were there. Habitats, such as gullies were specifically mentioned and became a more relevant VEC.	Section 5.6
62	Canadian Environmental Assessment Agency	A more thorough description or definition of the five criteria (Section 5.4.11) would be useful. For instance, what is the difference between "ecological or social importance" and "extent of ecological or social importance"? Without some further explanation, the impression is left that this particular criterion was double-counted. Also, what does "specificity of effects" refer to?	Section 5.4.11	This section has been revised in the CSR. The table has been removed and additional analysis of the VECs has been added.	Section 5.6 and Glossary

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
63	Canadian Environmental Assessment Agency	There needs to be greater explanation of the difference between "availability of information" and "ability to assess". On the surface, these criteria create the impression that some environmental effects will be excluded from consideration or analysis, simply because we lack certain information or skills. This would be inappropriate. In situations where data availability or scientific knowledge favour the use of one VEC over another, it is necessary to explain how and why this was done.		See comment 62.	Section 5.6 and Glossary
64	Canadian Environmental Assessment Agency	The rating system used in Table 5.18 is not accompanied by a legend that explains the values assigned to each VEC. It is necessary to explain the numerical score, and the rating system on which it is based. For instance, if the rating system is based on a scale of 0 to 3, what is meant by each value?	Table 5.18	Table 5.18 has been removed from the CSR. The rating system is no longer based on values, but on ecological importance of the species, spatial extent and abundance.	Section 5.6 and Glossary
65	Canadian Environmental Assessment Agency	An explanation is necessary as to why 10 was chosen as a cut-off for the selection of VECs for further analysis. While it is sometimes necessary to provide focus for an environmental assessment, the selection of what to include must not be arbitrary.		Table 5.18 has been removed from the CSR. Best professional judgements was used to rate the most significant components among those identified during the consultation.	Section 5.6 and Glossary

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
66	Canadian Environmental Assessment Agency	Based on the level of consultation that appears to have taken place with First Nation and Aboriginal organizations, Section 5.5.7 could provide more detailed (and certain) information.	Section 5.5.7	Additional information is included in revised Section 5.5.7.	Section 5.5.7
67	Canadian Nuclear Safety Commission	Detailed hydrogeological characterization is necessary in order to assess the potential for contamination of groundwater, aquifer materials and soils, and possibly receiving surface waters at the main waste management area (WMA) which has stored low, medium and high level radioactive waste since 1963.		Addressed as part of WMA groundwater flow/contaminant transport assessment in Appendix C and in Section 6.3.4.	
68	Canadian Nuclear Safety Commission	Detailed hydrogeological characterization is necessary in order to assess the potential for contamination of groundwater, aquifer materials and soils, and possibly receiving surface waters at the sewage lagoon which is reported in the CSR to contain radioactive sludge.		The approach to decommissioning is outlined in Section 4.3.3. A preliminary evaluation and assessment of the effluent has been carried out for the purpose of making EA decisions on the likelihood and significance of potential environmental effects. . It should be noted that the level of radioactivity in the bottom sludge is minor. See additional characterization data for lagoon in Section 5.4.4. The detailed assessment requested here is planned for Phase 2 of the CNSC licensed decommissioning program. The assessment will refine the understanding of the effects and mitigations measures as necessary	Sections 4.3.3 and 5.4.4

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
69	Canadian Nuclear Safety Commission	Detailed hydrogeological characterization is necessary in order to assess the potential for contamination of groundwater, aquifer materials and soils, and possibly receiving surface waters at the inactive landfill which may still contain some radioactivity associated with previously disposed industrial waste.		The approach to decommissioning is outlined in Section 4.3.3. A preliminary evaluation and assessment of the landfill environment has been carried out for the purpose of making EA decisions on the likelihood and significance of potential environmental effects. The effects section has been revised to reference the controls placed on landfill operation which prohibited the disposal of hazardous wastes. See additional characterization data for landfill in Section 5.4.4. The detailed assessment requested here is planned for Phase 2 of the CNSC licensed decommissioning program. The assessment will refine the understanding of the effects and mitigations measures as necessary	Sections 4.3.3 and 5.4.4
70	Canadian Nuclear Safety Commission	There are potentially "affected" lands where radioisotope experiments were carried out, specifically tritium injection test sites north and northwest of the WMA and cesium-137 experimental ponds about 500m east of the WMA. The potential exists for residual contamination of groundwater and soils at these sites; the draft CSR does not describe the purpose and scope of these tests, the activity of the isotopes released to the environment at the time of the tests, current levels of activity etc.		Data on experiments and incidents for 'affected lands' have been summarized in Table 5.9 and added to Section 5.3.3 describing the releases and current status.	Section 5.3.3

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
71	Canadian Nuclear Safety Commission	The existing groundwater quality including concentrations of potential contaminants in the vicinity of the WMA is neither reported nor referenced. Although it is stated in Table 10.4 of the CSR that environmental monitoring shows that waste in the WMA is safely stored, none of the hydrochemical data collected over the last 3 decades from the extensive WMA groundwater monitoring network is reported or even summarized to support this conclusion.	Table 10.4	Addressed as part of WMA groundwater flow/contaminant transport assessment in Appendix C and in Section 6.3.4. Groundwater quality data has been added to Section 5.4.4.	Appendix C and Sections 5.4.4 and 6.3.4
72	Canadian Nuclear Safety Commission	AECL states that characterization of the waste inventory will be carried out during Phase 1 of decommissioning as well as identification of any contaminant plumes originating from the WMA.		Addressed as part of WMA groundwater flow/contaminant transport assessment in Appendix C and in Section 6.3.4. Groundwater quality data has been added to Section 5.4.4.	Appendix C and Sections 5.4.4 and 6.3.4
73	Canadian Nuclear Safety Commission	There is no mention in the CSR of any hydrogeological monitoring in the vicinity of the sewage lagoon or the inactive landfill.		There is one monitoring well near the inactive landfill and information from that is provided. In developing the follow up program (including monitoring) reference will also be made to the closure policies of the Manitoba government with respect to sewage lagoons and landfills See summary of lagoon monitoring data added to Section 5.2.2. See comments 37 and 38.	Section 5.2.2
74	Canadian Nuclear Safety Commission	It is therefore important to determine whether contaminants from the landfill have leached into the groundwater and the extent of any contaminant migration in the groundwater flow system around the site. Accordingly, a hydrogeological monitoring system should be established around the landfill.		See reply to comment 73.	

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
75	Canadian Nuclear Safety Commission	The major hydrogeological deficiency in the CSR is the absence of hydrogeochemical information on the existing groundwater quality in the vicinity of the WMA. This information should be provided as an addendum to the CSR.		Addressed as part of WMA groundwater flow/contaminant transport assessment (Appendix C).	Appendix C and Section 6.3.4
76	Canadian Nuclear Safety Commission	The revised CSR should also contain a commitment to hydrogeological/hydrogeochemical monitoring of the sewage lagoon and inactive landfill during Phase 1 of decommissioning.		See reply to comment 73. Follow up monitoring programs are outlined in Sections 9.5.3 and 9.5.4.	Sections 9.5.3 and 9.5.4
77	Canadian Nuclear Safety Commission	A more detailed description is required of the levels of radioactive contamination on potentially "affected" lands at sites where various radioisotope tracer experiments were conducted.		Summary data on 'affected lands' impacts is included in Table 5.9, Section 5.3.3. See also comment 70.	Section 5.3.3
78	Health Canada	Decommissioning should take place in a shorter period than the preferred alternative 3, e.g. specifically closer to the timing of Alternative 1 (20-year period).		The basis for the timing of the decommissioning program is driven by two factors; the availability of a national disposal facility and the safety of dealing with high level wastes such as those in WR1. The risks of early decommissioning of WR-1 are outlined in Section 3.3. Additional information on the trenches and the river sediments has been provided in Appendix B and C and in Section 6.	Appendix B and C and Sections 3.3 and 6.0
79	Health Canada	Disposal in 60 years greatly increases the risk that the public as well as workers may be inadvertently exposed to radiation at the WMA or nuclear facilities.		See comment 78.	
80	Health Canada	The Executive Summary requires a bit of reorganization.		The Executive summary has been revised to reflect changes in the CSR text.	Executive Summary

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
81	Health Canada	Section 5.0 describes the existing environment. The gross measurements are only qualitative and do not show the actual radionuclides. It would be more meaningful if actually measured radionuclides are shown.	Section 5.0	Summary information on radionuclides sufficient for environmental assessment purposes has been enhanced for project components such as River Sediments and the WMA. However, source term contamination is not restricted to these two components but will be described wherever present or suspect. Complete information is available from AECL's annual monitoring reports.	New information is provided in Section 5.0.
82	Health Canada	Environmental effects are shown in Section 6.0. Most of the impacts shown are qualitative in nature; radiation doses to workers are undertaking decommissioning are not indicated.	Section 6.0	The description of environmental effects is quantitative where appropriate. Estimates of worker dose are included in the revised CSR and will be specified in the DDPs in accordance with the radiation protection program.	Section 6.0
83	Health Canada	The Proponent is advised to use a modelling approach to predict radiation to workers and the public at large.		See comment 82.	
84	Health Canada	The sediments at the outfall in the Winnipeg River are definitely contaminated. The radioactivity (Cs-137) in fish is enhanced near the outfall. This fact should be reflected into AECL's conclusions for transparency.		New information is provided in Appendix B.	Appendix B
85	Manitoba Conservation, Technical Advisory Committee	60 years is a long period of time when viewed in a human context, important that there is continuity in the administration of the program, maintenance of an adequate level of funding and the presence of trained personnel throughout the 60-year period.		AECL has clearly committed to maintaining the resources required to carry out the monitoring and surveillance activities to the end of the decommissioning program including, security, fire fighting, environmental monitoring, radiation protection and buildings maintenance. A new Section 9.5 has been added outlining the disciplines required and stating that resources levels will be structured to be consistent with carrying out the M&S plan. Note that the decommissioning project will be completed under a CNSC licence which also ensures formal regulation of the project.	Section 9.5

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
86	Manitoba Conservation, Technical Advisory Committee,	Of particular concern is the off-site contamination of the Winnipeg River sediments with radioactive cesium - any future dredging plans for the Winnipeg River should be closely reviewed not only with DFO but also with Manitoba Conservation-Fisheries.		New information is provided in Appendix B.	Appendix B
87	Manitoba Conservation, Technical Advisory Committee	It appears that there may be a biomagnification of Cesium in the food chain - conduct further testing to determine whether or not there may be an accumulation of cesium in the food chain.		New information is provided in Appendix B.	Appendix B
88	Manitoba Conservation, Technical Advisory Committee,	Monitoring should be maintained until downstream radioactivity levels are equivalent to those upstream.		The nature and duration of the monitoring program will be established by the responsible authorities in the follow-up program and by the CNSC in the licensing process. Factors affecting the scope of monitoring are outlined in Section 9.6. It is anticipated that monitoring will continue until the absence of significant adverse effects has been adequately demonstrated.	Section 9.6
89	Manitoba Conservation, Technical Advisory Committee	Buildings and infrastructure facilities that are contaminated or store contaminated wastes will not be shut down permanently until the latter stages of decommissioning - numerous areas where accidents could occur and cause off-site contamination.		These buildings will remain under CNSC license and are therefore subject to normal CNSC safety requirements. The risk of accidents and malfunctions therefore will be within acceptable limits set by the CNSC.	
90	Manitoba Conservation, Technical Advisory Committee,	Radioactive industrial wastes were inadvertently deposited in the landfill.		As outlined in text (Section 4.3.3), the contaminated materials inadvertently placed in the landfill were retrieved and transferred to the WMA. The paragraph referring to the possibility of radioactive waste in the landfill has been revised to reflect the operational practices and will indicate ‘actual anomalies’ rather than ‘possibilities’.	Section 4.3.3

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
91	Manitoba Conservation, Technical Advisory Committee	The cesium spill that outsiders were not aware of until it was revealed in sediment core testing on Lake Winnipeg.		This statement is not supported. There were no unrecorded spill events resulting from AECL's operations.	
92	Manitoba Conservation, Technical Advisory Committee	Public consultation program tabled in the decommissioning report should be maintained throughout the decommissioning process.		A public consultation program will be maintained throughout the process. A major vehicle for this aspect of the program could be a Public Advisory Committee.	Section 9.9
93	Manitoba Conservation, Technical Advisory Committee	Report structure and writing style are difficult for a non-technical reader to follow.		Edits have made where appropriate.	
94	Manitoba Conservation, Technical Advisory Committee,	Difficult to match text and tables in Section 4.0 - appears to be an implied contradiction.	Section 4.0	Edits have been made to enhance clarity.	
95	Manitoba Conservation, Technical Advisory Committee	AECL should provide a report summary with greater clarity.		Edits have made within the Executive Summary where appropriate.	
96	Manitoba Conservation, Technical Advisory Committee	Identification of individual wastes, their origin and management strategy would be helpful.		Appropriate summaries of the waste streams are provided in Figure 4.5. More detailed information will be contained in the Detailed Decommissioning Plans for each facility prepared for subsequent CNSC licensing approvals. That level of detail is not considered necessary to draw the overall conclusions on the significance of effects in the environmental assessment.	Section 4.5
97	Manitoba Conservation, Technical Advisory Committee	A number of terms in the report are not defined. Clarification of the terminology would be helpful (mostly in Section 4 and Section 6).	Sections 4 and 6	Agreed; a Glossary has been added.	Glossary

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
98	Manitoba Conservation, Technical Advisory Committee	Section 1.6.2 states operational shutdown activities are expected to extend through June 2000, while p 4-4 states they are planned for completion by June 2000.	Section 1.6.2, Page 4-4	Agreed; the text has been changed to reflect the longer period for shutdown (S/D) operations.	
99	Manitoba Conservation, Technical Advisory Committee	Greater clarity is needed to differentiate what operational shutdown means in the context of continued operation of the Reactor Safety Research program, NFWMP and Whiteshell Laboratories WMAs.		Operational S/D is the activity conducted to place a facility in a safe S/D state when the facility is no longer required. Accordingly, for facilities that continue to operate in parallel with commencement of decommissioning in redundant facilities, S/D operations occur further in the future. Operational Shutdown has been added to the Glossary.	Glossary
100	Manitoba Conservation, Technical Advisory Committee	The CSR seems to contradict the statement on p 2-1 that it does not address historic contamination, when it discusses delineation and remediation of sewage lagoon and landfill contamination.	Page 2-1	The CSR addresses all environmental issues consistent with the scope of the assessment provided by CNSC. It does not however, address the effects of investigative processes.	Clarification provided in Section 2.1
101	Manitoba Conservation, Technical Advisory Committee	TAC should have input to scope of detailed decommissioning plans to provide necessary assurances required for Province of Manitoba to accept transfer of these lands.		If the CNSC proceeds to the licensing stages (i.e. if there is a positive referral from the Minister on the CSR), Detailed Decommissioning Plans for the various components of the facility will need to be approved by the CNSC. Interested parties will have the opportunity to participate in the CNSC licensing process, which is a fully public process. As such, the province of Manitoba will have the opportunity to comment on the details and acceptability of the proposed decommissioning end state conditions.	Section 4.2.2
102	Manitoba Conservation, Technical Advisory Committee	The alternatives discussed in Section 3 do not mention environmental monitoring programs for each, and Section 9.0 discussions of environmental monitoring program does not address modification of the program for different alternatives.	Sections 3 and 9.0	The comparison of alternative methods of carrying out the project needs to consider the technical and economical feasibility and the relative environmental effects of each alternative. The requirement for the follow-up program relates only to the proposed project.	

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
103	Manitoba Conservation, Technical Advisory Committee	No detailed cost estimates for each alternative.		Cost comparisons have been re-evaluated and are at a level appropriate for environmental assessment analysis. Costs are discussed in Section 3.3.	Section 3.3
104	Manitoba Conservation, Technical Advisory Committee	Not clear if costs of environmental and safety monitoring programs are included in the general cost comparisons between alternatives.		The relative costs of the alternatives are discussed in Section 3.3.	Section 3.3
105	Manitoba Conservation, Technical Advisory Committee	Concerns about double handling of waste and cost of interim facilities on p3-5 appear to be contradicted on p4-6 and 4-28, where decommissioning the incinerator and relocating irradiated fuel and HLW from the WMA are discussed.	Pages 3-5, 4-6, 4-28	As outlined in the text of the CSR, a certain amount of double handling is inevitable as facilities approach the end of their safe and useful life. The general goal is to reduce double handling as much as possible, but safe storage is the overriding principle.	
106	Manitoba Conservation, Technical Advisory Committee,	Institutional controls should be defined or described (Section 4.0) and whether they vary between each of the areas discussed. More elaboration is required.	Section 4.0	Institutional control refers to a form of regulatory control consistent with control of remaining hazard potential at the site until all hazards are reduced to an acceptable public release condition. Added to Glossary. See also addition to Section 3.2.2 on the institutional control period.	Glossary and Section 3.2.2
107	Manitoba Conservation, Technical Advisory Committee	On p 4-6 it is stated that if in-situ disposal is selected, there will be a need for a longer period of institutional controls at both WR-1 and WMA. This should be clarified as to what time frame is being compared.	Page 4-6	The project proposed by AECL includes the complete removal of the WR-1 reactor and the in-situ disposal of selected low-level waste management area trenches. The long-term institutional controls for the waste disposal component are described in Section 3.2.2.	Section 3.2.2
108	Manitoba Conservation, Technical Advisory Committee,	WMA storage facilities which are not required should be identified on p 4-14.	Page 4-14	The WMA remains fully operational during Phase 1. All storage facilities are placed in a passive operational state (receive no additional waste) during Phase 2. New facilities required to support the decommissioning program are listed in Sections 4.3.1 and 4.5.3.	Sections 4.3.1 and 4.5.3

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
109	Manitoba Conservation, Technical Advisory Committee	Section 4.3.3 should also include discussion of the bulk fuel oil storage tank, which will remain operational but it final disposition is not clear.	Section 4.3.3	The removal of fuel oil storage tanks will be carried out in accordance with CCME-EPC-LST-71E. The removal work will be detailed in plans associated with final disposition of the powerhouse.	
110	Manitoba Conservation, Technical Advisory Committee	Section 4.4.1.1 does not provide any details as to the description and origin of these decommissioning wastes.	Section 4.4.1.1	Details on waste production are a component of DDPs for individual facilities. For the purposes of the environmental assessment, categorization by waste type, volume and proposed final disposal location are given in Section 4.5. Waste flow paths are shown in Figure 4.5 and total waste inventories are listed in Table 4.6.	Section 4.5
111	Manitoba Conservation, Technical Advisory Committee	The term De Minimis is not defined.		Agreed; added to Glossary.	Glossary
112	Manitoba Conservation, Technical Advisory Committee,	50,000 cubic meters of de minimis waste is a significant volume and should be more clearly identified.		Although the volume is large, de minimis waste consists primarily of clean construction rubble and is different from the low-level waste identified in the CSR. Section 4.5 differentiates between LLW and de minimis derived from Whiteshell facilities.	Section 4.5
113	Manitoba Conservation, Technical Advisory Committee	No details are provided as to what type of additional assessments will be carried out in Phase 1 to estimate the contaminated soil that need to be decommissioned.		Methodology similar to that applied to estimating the river sediment inventory is envisioned (core sampling and analysis) to define the impacted zone. The detailed approach will be included in individual facility DDPs.	

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
114	Manitoba Conservation, Technical Advisory Committee,	Considering future assessments of contaminated soil appears to be contradictory to statements made on p 2-1 re scope and historic waste.	Page 2-1	To clarify, it is important to distinguish between the investigative work that forms part of the decommissioning project itself, the investigative work necessary to prepare this environmental assessment and the decommissioning plans in support of the decommissioning licence application. The CNSC considers the latter activities to be authorized under the present facility licence; those field sampling programs may continue without a prior environmental assessment or specific CNSC approvals. However, the CNSC also recognizes that ongoing detailed investigations often form part of an active decommissioning project; such as to systematically confirm, and permit the adaptation to conditions found in previously inaccessible locations as a facility is progressively dismantled. Where relevant, the potential for those project-related investigations to impact adversely on the environment are within the scope of the project and this environmental assessment.	Clarification provided in Section 2.1
115	Manitoba Conservation, Technical Advisory Committee	Statement p5-23 that the WMA will not act as a transmission zone for contaminants is misleading - should discuss potential for gw flow pattern to change over the long time frames considered, and DNAPLS to move downward against the hydraulic gradient.	Page 5-23	New information is provided in Section 5.3 and the assessment is provided in Section 6.3. In regard to DNAPLS, only small quantities of organics were placed in the WMA. The use of chlorinated solvents at Whiteshell Laboratories was particularly avoided because chlorine caused fouling of the cooling system in WR-1. Consequently, the use of chlorinated solvents in the WR-1 building was prohibited. This practice also resulted in close control of solvents in laboratories. As a result, any solvents placed in the trenches were in large part volatile, and lighter than water (not DNAPLS).	Sections 5.3 and 6.3
116	Manitoba Conservation, Technical Advisory Committee,	On p 6-9, it would be useful to provide an estimate of the timeframe for the facilities that will remain operational during decommissioning and what are the requirements for their decommissioning.	Page 6-9	Agreed; Figures 4.4 and 4.5 summarize the timeframe for the operation of the waste management facilities. See also comment 43.	
117	Manitoba Conservation, Technical Advisory Committee	There should be some indication of the maintenance, monitoring and safety programs needed to maintain any non-decommissioned facilities.		Operational facilities continue to be managed under the Site licence in accordance with CNSC authorizations. Section 6.2 describes the programs and control systems that will remain in effect during the decommissioning project.	Section 6.2

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
118	Manitoba Conservation, Technical Advisory Committee,	It is not specified if environmental monitoring will be conducted and sampling for dusts generated by decommissioning will be undertaken, on p6-22, 6-27, Table 6-25.	Pages 6-22, 6-27, Table 6-25	Revisions to the monitoring program, including revisions related to dust etc. are presented in Section 9.5.	Section 9.5
119	Manitoba Conservation, Technical Advisory Committee	On p 6-28 it is stated that the hydrogeological regime of the area is not well enough understood to determine whether leakage could reach the Winnipeg River - a full risk assessment should be conducted to support Option A.	Page 6-28	The in-situ option is no longer proposed for WR-1 and the text has been revised accordingly.	Section 4.3.1
120	Manitoba Conservation, Technical Advisory Committee,	On p 6-28 it is not clear if the current environmental program will be maintained or upgraded to monitor both soil and groundwater - the scale and duration of the monitoring program should be identified.	Page 6-28	The monitoring plan has been updated and changes have been made to Section 9.0.	Section 9.0
121	Manitoba Conservation, Technical Advisory Committee	On p6-29, "before any waste could be managed in-situ, AECL's proposal would be subject to regulatory review and approval" - would this include CEAA and public hearings?	Page 6-29	The in-situ management of the low-level trench waste will be considered in this environmental assessment as part of the decommissioning project. Further detailed regulatory assessments will be required prior to any final decision to release any waste areas from CNSC licence control and into some other form of long-term institutional control. Such a licensing decision may not occur for several years or decades in the future. Although a CEAA assessment and hearing may not be required for those future decisions, the CNSC licensing process will take into account environmental protection issues and will be subject to a hearing by CNSC under the Nuclear Safety Control Act.	
122	Manitoba Conservation, Technical Advisory Committee	Page 6-36 does not include the 270 L of HLLW decommissioning waste identified in Table 4.3 and the total 450 L HLLW identified on p.4-28	Page 6-36, Table 4.3, Page 4-28	The discrepancy has been corrected in the text. The CSR has considered the environmental effects of handling and interim storage of these wastes at a level suitable for the environmental assessment.	Section 4.3.1

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
123	Manitoba Conservation, Technical Advisory Committee	No details of how acceptability of in-situ disposed LLW will be demonstrated prior to release of land for unconditional use and of the mechanism for approval - will include CEAA and public hearings?		Further assessment of the proposed in-situ disposal of low-level trench wastes will be included in the revised draft of the CSR. It is currently envisioned that the land will remain under some form of institutional control and that unconditional use will not be permitted. Any future CNSC decision to remove its licence from the site, and release the site to some other form of long-term institutional control will likely involve a hearing pursuant to the NSCA.	
124	Manitoba Conservation, Technical Advisory Committee,	The decommissioning time frame of the incinerator has not been addressed.	Page 6-37	Agreed. Decommissioning of the incinerator is listed as an activity under Phase 2.	
125	Technical Advisory Committee	Environmental monitoring, dust and/or water sampling programs should be identified where dust and water contamination concerns have been raised.	Pages 6-37, 6-38, 6-48, 6-51, 6-58, 6-67, 6-71, 6-83	Agreed; revisions to the monitoring program, including revisions related to dust etc. are presented in Section 9.5.	Section 9.5
126	Manitoba Conservation, Technical Advisory Committee,	Who determines appropriateness of long-term land- and resource-use restrictions and what is the review and approvals process?	Page 6-40	This is a CNSC control issue. No building, facility or land area will have outright release for uncontrolled access and use without the approval of the CNSC. Institutional controls, other than CNSC licensing, may be appropriate for the longer term for some parts of the site (e.g. in-situ waste trench disposal). The details of what form those controls will take will be established in consultation with the relevant authorities prior to any release of areas from CNSC licence control.	The approval process is summarized in Section 1.7
127	Manitoba Conservation, Technical Advisory Committee	Use of enclosures to mitigate impacts from dust generation may not be practical for remediation of roadways. Clarification is needed.	Page 6-71	Mobile or portable enclosures can and are being used to control dust in road repair and removal. It can be done on either a small scale (about 800 square feet at a time) or by using modern road repair equipment. The need for such enclosures will be identified in the DDPs.	

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128	Manitoba Conservation, Technical Advisory Committee	A full assessment of environmental monitoring data and original documentation of the spill should be supplemented by current site investigations, as contaminants may have migrated since previous monitoring was conducted.	Page 6-74	Agreed; the required investigative work will be carried out as part of the DDP preparation process. There is adequate knowledge of the residual contamination at the site to draw environmental assessment conclusions on the overall likelihood and significance of adverse effects from that contamination. See also Section 4.3.3 on the north ditch.	Section 4.3.3
129	Manitoba Conservation, Technical Advisory Committee	There needs to be a risk assessment that addresses both in-situ and sediment removal scenarios.	Section 6.22.4	Sediment removal no longer forms part of the proposed project. This decision was based on a detailed assessment of the sediments in the fall of 2000 which indicated that leaving the sediments in-situ would not pose a significant risk to the environment. Therefore it is not necessary to undertake a formal comparative risk assessment with the removal option. New information is provided in Appendix B	Appendix B
130	Manitoba Conservation, Technical Advisory Committee	More details are required for the sediment removal scenario including costs and timeframes.		See comment 129	Appendix B and C
131	Manitoba Conservation, Technical Advisory Committee	The more significant public health effects associated with early off-site transport of highly radioactive waste should be explained in greater detail (not enough information to make the comparison).	Page 6-38	A discussion on public health is given in Section 6.3.8.	Section 6.3.8
132	Manitoba Conservation, Technical Advisory Committee	Not clear how the conclusion in Table 7.3 of no significant contamination during remediation of active sediments was reached - a risk assessment is needed to qualify this conclusion.	Table 7.3	See comment 129.	

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
133	Manitoba Conservation, Technical Advisory Committee	Not clear how the conclusion on p8-3 of no cumulative environmental effects can be made based on possible decommissioning alternatives over the course of 60 years or more - needs clarification of underlying assumptions.	Page 8-3	Only that which is known or ongoing can be considered in the cumulative effect discussion. Thus by definition activities occurring later may interact with activities at Whiteshell Laboratories. That said there are few off site effects so Whiteshell Laboratories' role will be minimal and declining over time.	
134	Manitoba Conservation, Technical Advisory Committee	Table 9.1 does not indicate if there will be specific modifications to the environmental monitoring program to address the concerns raised in Section 6.0.	Table 9.1	A revised monitoring and follow-up program has been prepared to verify the accuracy of the predictions of effects and determine the effectiveness of the mitigation measures. Factors affecting the scope of monitoring are outlined in Section 9.5 and 9.6. See also comment 57.	Sections 9.5 and 9.6
135	Manitoba Conservation, Technical Advisory Committee	Table 9.5 does not indicate groundwater monitoring near the inactive landfill, which the assessment on p6-58 indicates should be conducted.	Table 9.5, Page 6-58	Proposed enhancements to the ground water monitoring program for the landfill have been added to Section 9.5.	Section 9.5
136	Manitoba Conservation, Technical Advisory Committee	Asbestos, PCB's and petroleum hydrocarbons should be considered with the non-radiological parameters identified on p9-8.	Page 9-8	No pathways identified for any of these contaminants into the liquid effluent system.	
137	Manitoba Conservation, Technical Advisory Committee	On p9-11, details of the monitoring and surveillance program and post-decommissioning programs (particularly the extent and duration of post-decommissioning) should be identified.	Page 9-11	The follow-up program described in the CSR outlines the general scope of the monitoring programs. The specific details of the parameters, frequencies, sampling locations and protocols will be developed under the CNSC licensing process.	Section 9.5
138	Manitoba Conservation, Technical Advisory Committee	The process (including the regulatory authority and process) to determine the frequency and type of monitoring, and the cessation of monitoring should be described.		See comment 137.	

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
139	Manitoba Conservation, Technical Advisory Committee	Total decommissioning costs should be estimated and the mechanism for securing the funding should be identified.		The issue of financial guarantees will be addressed as part of the CNSC licensing process. The principle followed by CNSC is to ensure secure funding instruments are used.	
140	Manitoba Conservation, Technical Advisory Committee	Conclusions appear to be premature based on the need to fully develop and assess the implications of the DDP's for each facility - risk assessments should be undertaken to support these conclusions.		The analysis is adequate for environmental assessment purposes There is enough information available to determine if there is likelihood that environmental effect will be significant. That is the purpose of the environmental assessment. The DDP's follow-up and monitoring programs are executing procedures to ensure that this conclusion remains valid.	
141	Manitoba Conservation, Technical Advisory Committee	Determination of provincial protected area status for portions of the "unaffected land" will have to be done by Manitoba Conservation.		Agreed.	
142	Manitoba Conservation, Technical Advisory Committee,	No clear indication of what AECL will do with the plant access road from Hwy 211 - Manitoba Highways should review this matter.		This is a licensing and ownership issue and is a subject handled under the Manitoba/AECL agreement and not a consideration for the environmental assessment.	
143	Manitoba Conservation, Technical Advisory Committee	Sixty years is far too long a period of time for high-level nuclear waster to remain in-situ - the long-term potential risk to the local population and the environment favours the 20-year time frame.		The basis for the timing of the decommissioning program is driven by two factors; the availability of a national disposal facility and the safety of dealing with high level wastes such as those in WR1. A 20-year time frame for the decommissioning of WR-1 increases safety risks and is extremely costly especially given the unavailability of a national waste disposal facility. Safety, costs and especially the lack of a national waste disposal facility militate against a 20-year completion. The risks of early decommissioning of WR-1 are outlined in section in Section 3.3. Additional information on the waste inventory, the LLW trenches and the river sediments are provided in Section 5.0.	Sections 3.3 and 5.0
144	Manitoba Conservation, Technical Advisory Committee	Moral imperative that this issue not be passed down to subsequent generations to resolve.		Costs and benefits are spread across a number of generations. Many of the costs are being borne by this generation. Note also, that the benefits of the Whiteshell Laboratories research projects apply to more than one generation.	

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
145	Manitoba Conservation, Technical Advisory Committee	General level of detail for each of the three phases of decommissioning is insufficient.		Information is adequate for environmental assessment purposes but additional information has been added to the revised CSR to better support key decisions. See reply to comment 140.	
146	Manitoba Conservation, Technical Advisory Committee	Concerned whether sufficient staff, both in numbers and training, will be provided for long-term environmental monitoring.		AECL has clearly committed to maintaining the resources required to carry out the monitoring and surveillance activities to the end of the decommissioning program including, security, firefighting, environmental monitoring, radiation protection and buildings maintenance. Information has been be added to Section 9. Outlining the disciplines required and stating that resources levels will be structured to be consistent with carrying out the M&S plan.	Section 9.0
147	Manitoba Conservation, Technical Advisory Committee	Would like to see cost breakdown for the 20 and 60-year options, in sufficient detail to disclose the nature of the incremental costs associated with the 20-year option.		Cost comparisons have been re-evaluated and are at a level appropriate for environmental assessment analysis.	Costs are discussed in Section 3.3
148	Manitoba Conservation, Technical Advisory Committee	What is the end-state of decommissioning? The CSR is not clear as to the outcome of the decommissioning process with respect to the utilization of the Whiteshell Laboratories land in the near term.		End state is the final condition of the decommissioned site for which release from regulatory control or establishment of continuing controls is approved. This term has been added to the glossary. Near term use of Whiteshell Laboratories unaffected lands is not within the scope of the CSR. See comment 150 below regarding the use of Whiteshell Laboratories lands and buildings.	Glossary
149	Manitoba Conservation, Technical Advisory Committee	The offering of the unaffected area to the Province is not apparent in the document.		Unaffected lands are not part of the CSR scope and disposition is governed by the Manitoba/AECL agreement.	
150	Manitoba Conservation, Technical Advisory Committee	The use of the buildings not located in the "active area" is not described in the manner discussed in the verbal presentation.		The long-term use of site infrastructure is entirely dependent on economic development activity in the area. Buildings can be transferred to new owners for commercialization purposes. However, buildings, which are not commercialized within a time frame of 5 to 10 years, will be demolished.	Clarification added to Section 4.3.3

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
151	Manitoba Conservation, Technical Advisory Committee	The term "assumption" as applied to future waste management strategies needs clarification. The authority base for the assumptions needs to be made clear to the reader.		The provision of a national radioactive waste disposal facility is a federal responsibility. The assumptions on availability are based on best professional judgment.	
152	Manitoba Conservation, Technical Advisory Committee	That the decommissioning and operational wastes stored at Whiteshell Laboratories will be in place for a very long time has an impact on the expectations associated with the rigor required in the technical work to secure the wastes and the funding to accomplish their tasks.		Agreed; AECL has clearly committed to maintaining the resources required to carry out the monitoring and surveillance activities to the end of the decommissioning program including, security, fire fighting, environmental monitoring, radiation protection and buildings maintenance. The CNSC will maintain the nuclear substances and facilities under licence until it is demonstrated that they no longer pose a significant risk to people or the environment. The release from CNSC licensing may also be contingent on some other form of reliable long-term institutional control being in place.	
153	Manitoba Conservation, Technical Advisory Committee	Must have assurance that there is a commitment to fund the cash flow required to meet the time line for the project.		The issue of financial guarantees will be addressed as part of the CNSC licensing process. The principle followed by CNSC is to ensure secure funding instruments are used.	
154	Manitoba Conservation, Technical Advisory Committee	Statements like the second one in Section 9-10 "monitoring responsibility" should be given greater visibility in the document, to give the public a strong assurance that the project will not become forgotten or derailed by alternate priorities over such a long project time.	Section 9-10	See response to above two comments and note AECL commitments.	AECL's commitments are documented in Section 1.5
155	Manitoba Conservation, Technical Advisory Committee	Section 5-43 does not address the approach of the Corporation to the grants-in-lieu. Some statement about the continued existence of and respect for the Manitoba-AECL Agreement seems required.	Section 5-43	The terms of the Manitoba-AECL agreement for grants in lieu are outside the scope of this environmental assessment.	

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
156	Manitoba Conservation, Technical Advisory Committee	The report does not specify the source of the radiation field or the manner in which the measurements were obtained.		The radiation fields in the WR-1 reactor vault emanate from the activated components made up of the fuel channels, the calandria vessel and the thermal shield. The radiation levels were estimated through the activation calculations based on the irradiation history of the reactor core and were verified through direct measurements in several representative fuel channels. References for the WR-1 radionuclide assessments have been added to the text.	Section 3.3
157	Manitoba Conservation, Technical Advisory Committee	Why can't the WR-1 fuel channels be moved to alternate storage in order to reduce the radiation field? This should be addressed in a detailed discussion of the WR-1 core.		There are no storage structures available in Canada that provide the level of safety provided by the existing reactor vault shielding structure. Even if the channels were removed, the radiation field from the calandria and thermal shield contribute to radiation fields at levels which prohibit any direct handling. There is a significant reduction in worker dose from radioactivity decay and by handling the material only once from the reactor to final disposal.	Section 3.3
158	Manitoba Conservation, Technical Advisory Committee	Assurance is needed in the document that the AECL Criticality Committee will analyze the processing of fissile material and reconfiguration of storage of fissile material and has the authority to approve or disapprove the criticality safety of these tasks.		As long as fissile material accountability is required at Whiteshell Laboratories, the role of the Criticality Committee will be maintained. The operations of Whiteshell Laboratories will remain governed by the NSCA and its regulations and through appropriate site licence conditions.	
159	Manitoba Conservation, Technical Advisory Committee	Auditing of the progression of the decommissioning plan, including the orderly flow of funding, seems required - insufficient to be done solely by the AECL Safety Committee - external public auditing needed.		Note that the site will remain under CNSC license throughout the process. The license provides an auditing mechanism. AECL supports the formation of a public advisory committee - one of whose activities could relate to the audit/monitoring program.	Section 9.9

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
160	Manitoba Conservation, Technical Advisory Committee,	Consequences for the decommissioning plan of diminished size of security and fire-fighting force leaving the site dependent on municipal policing and firefighting are not apparent in CSR.		AECL has clearly committed to maintaining the resources required to carry out the monitoring and surveillance activities to the end of the decommissioning program including, security, firefighting, environmental monitoring, radiation protection and buildings maintenance. Information has been added to Section 9.5 outlining the disciplines required and stating that resource levels will be structured to be consistent with carrying out the M&S plan. See also AECL commitments outlined in Section 1.5.	Sections 1.5 and 9.5
161	Manitoba Conservation, Technical Advisory Committee	The storage plan should provide a mechanism for the detection of and response to unauthorized removal of contaminated material.		This will be a continuing aspect of the site security program which will be maintained throughout the decommissioning project. Disciplines maintained at the Site to meet monitoring and surveillance needs are outlined in Section 9.5.	Section 9.5
162	Manitoba Conservation, Technical Advisory Committee	Are the two demonstration canisters (p4-12) that remain in the active area to be demolished? When?	Page 4-12	The demonstration canisters are part of the Concrete Canister Storage Facility and demolition will be implemented in Phase 3 after all Whiteshell Laboratories irradiated fuel has been transferred to disposal facilities.	
163	Manitoba Conservation, Technical Advisory Committee	Unclear as to the final decommissioning plan for the drain line from Building 200 to the Outfall station. Is this to be excavated and removed after decommissioning of Active Liquid Waste Treatment Centre?		The line is included in the evaluation of Buried Services in Section 4.3.3 under storm drains. Remediation will follow final demolition of Site nuclear facilities as part of final active area remediation to an end state condition that meets criteria for release from licensing conditions.	Section 4.3.3
164	Natural Resources Canada	Sections 4 to 9 of the report focus on hydrogeological issues. There is very little technical material in this report upon which to comment.	Sections 4 to 9	Agree that WMA is most significant hydrogeology issue and is addressed as part of the WMA groundwater flow/contaminant transport assessment in Section 6.3.4. Technical information on hydrogeological issues has been supplemented in Appendix C.	Section 6.3.4 and Appendix C
165	Natural Resources Canada	Long-term "residual" impacts are briefly mentioned only to state that these facilities will be the object of later Detailed Decommissioning Plans (DDP) subject to regulatory approval.		The text has been revised to include the effects of hydrogeology on the VECs.	Section 6.3.4

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
166	Natural Resources Canada	Of particular concern from a groundwater perspective are residual impacts of the Waste Management Area (WMA) and the reactor (WR-1) decommissioning, expected will be addressed, in detail, in later applications to the CNSC for permits to manage radioactive waste.		Addressed as part of WMA groundwater flow/contaminant transport assessment in Appendix C and in Section 6.3.4. In-situ management of WR-1 has been ruled out and the assessment will focus on full decommissioning and disposal.	Appendix C and Section 6.3.4
167	Natural Resources Canada	Recommend that AECL consider a detailed airborne gamma-ray spectrometer survey over the Whiteshell site and extending out over the surrounding areas to determine the regional natural background radiation levels on and off the site.		Aerial surveys supported by soil sampling and analyses have been conducted to justify releasing unaffected lands from the Whiteshell Laboratories site licence.	Section 5.3.3
168	Natural Resources Canada	Executive Summary section under the title 'Soils and Ground Water' contains no information on soils.		Information on soils has been added to the revised CSR.	Executive Summary
169	Natural Resources Canada	p. 5-27 should also state that Lockhart et al. (2000) found elevated levels of 137Cs in Lake Winnipeg sediments deposited in the 1970s and 1980s that they attribute to releases from the Whiteshell Labs.	Page 5-27	AECL's monitoring activities have also revealed higher than background Cs-137 concentrations in sediment upstream of Whiteshell Laboratories site. Note that the Cs-137 levels in those sediments are not likely to cause significant adverse environmental effects and are well below-levels that require CNSC licensing.	
170	Environment Canada, Environmental Protection	Scientific and/or technical data that were used in assessing potential impacts were not presented, or are not yet available, which makes it difficult to conduct a thorough review of several sections of the Comprehensive Study Report (CSR).		This is a generic comment. See the proposed resolution for the specific comments made in 171 and 172.	

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
171	Environment Canada, Environmental Protection	Does not allow our department to provide specialist advice on possible remediation of the contaminated sediments in the Winnipeg River, as discussed in Section 6.22.	Section 6.22.	New information is provided in Appendix B..	Appendix B
172	Environment Canada, Environmental Protection	Does not allow our department to provide specialist advice on decommissioning of ALWTC, WR-1, WMA, inactive landfill, sewage lagoon, North Ditch.		As noted by the reviewer, AECL is committed to further studies as required. For example, additional assessments were conducted with regard to river sediments (see comment 84) and low-level waste in the WMA (see comment 67). The reviewer also acknowledged that additional details will be provided in DDPs.	
173	Environment Canada, Environmental Protection	We recommend that any activities conducted in areas where migratory birds are likely to be nesting are conducted outside the breeding period.		No nesting sites have been identified where activities will occur with the possible exception of the lagoon. The DDP's will note such sites and provide a program for protection.	Section 4.2.2
174	Environment Canada, Environmental Protection	A national, off-site waste disposal facility may not be available for many years. It would be helpful to include additional information on the status of work or studies being done to develop a national waste disposal site in order to further substantiate the chosen alternative.		The provision of a national radioactive waste disposal facility is a federal responsibility. The assumptions on availability are based on best professional judgment.	
175	Environment Canada, Environmental Protection	Section 4.3.3, Page 4-25 the reference should be provided as to where in the report the available monitoring data on sediment contamination can be found.	Section 4.3.3, Page 4-25	New information is provided in Appendix B.	Appendix B
176	Environment Canada, Environmental Protection	In Section 4.4.1.1 (p4-26) and Section 6.5.1 (p 6-10) it should be stated that PCB materials taken out of service will be stored in accordance with the federal "Storage of PCB Materials Regulations" under the Canadian Environmental Protection Act (CEPA).	Section 4.4.1.1 (Page 4-26) and Section 6.5.1 (Page 6-10)	Agreed.	Referenced to footnote 6 in Table 4.6

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
177	Environment Canada, Environmental Protection	AECL should also consider sending any PCB wastes for destruction as soon as practical, rather than maintaining these wastes in storage, since proposed amendments to the federal PCB regulations may limit allowable storage time.		Agreed; Whiteshell Laboratories routinely sends PCB material for destruction and will continue to do so as required. See comment 176.	
178	Environment Canada, Environmental Protection	We also note that 3,014 kg of Freon were identified as being present at the facility, but specific types were not identified, and remedial measures have not been included in the report.	Table 4.3	Ozone depleting substances are Whiteshell include: HFCs, Halons, CFCs and HCFCs. These will be vented in accordance with Environmental Code of Practice for Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems, Federal Halocarbon Regulations SOR/99/255, Environmental Code of Practice on Halons Code of Practice EPS 1/RA/3E. See new footnote to Table 4.6.	
179	Environment Canada, Environmental Protection	More specific information should be provided on the types of ozone-depleting substances present and how these will be handled.	Section 4.5	See comment 178.	
180	Environment Canada, Environmental Protection	Section 5.5.8 (p5-47) additional information should be provided on the purpose, operation, impacts on the environment, possible contamination issues, mitigation required, etc. of the Field Irradiator Gamma [FIG].	Section 5.5.8 (Page 5-47)	Additional information on the activities carried out in the affected lands was provided in section 5.3.3. A sealed source, which has since been removed, was used at the FIG. Thus, no contamination of the land resulted from the research activities. Also, the removal of the FIG will not result in any physical disruptions that could affect the environment. As such, no special mitigation measures are expected to be required.	See Table in Section 5.3.3

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
181	Environment Canada, Environmental Protection	Section 6.3.4 (p6-4) The proponent assessed air quality issues based on "professional judgment", not empirical data or modelling, as is usually the case. They submitted a qualitative description of effects with comments attached, rather than any methodology, any input or output data, or an analysis of the results. This information is insufficient for a scientific evaluation of the quality of the assessment.	Section 6.3.4 (Page 6-4)	Modelling possible but will be done selectively It is possible to predict emissions from the demolition in a general way through modelling using broad-based emission factors. Such predictions tend to overstate the amount of emissions. The downward impact of dust emission can be simulated using an air quality dispersion model and an upper bound provided for the ground level concentration estimated for an average meteorological days well as a day that is not conducive to good dispersion. The analysis could also help identify conditions to avoid during construction. Such analysis, which is best done during actual conditions, will be carried out during early demolition projects to guide mitigation for subsequent project work.	
182	Environment Canada, Environmental Protection	Section 6.3.4 (p6-4) fine particulate matter (PM10) was declared CEPA toxic in May 2000 and further regulatory actions may be contemplated under CEPA during the course of the project. This may influence the type of mitigation strategies chosen.	Section 6.3.4 (Page 6-4)	Agreed; it is important to monitor fine particulate dust and such dust will be monitored as per air quality monitoring protocols.	Section 9.0
183	Environment Canada, Environmental Protection	Section 6.25 (p6-91 to 6-94) Will AECL be maintaining sufficient resources on site to effectively implement their contingency and emergency preparedness plans related to malfunctions, fires, etc.	Section 6.25 (Page 6-91 to 6-94)	AECL has clearly committed to maintaining the resources required to carry out the monitoring and surveillance activities to the end of the decommissioning program including, security, firefighting, environmental monitoring, radiation protection and buildings maintenance. Information has been added to Section 9.5 outlining the disciplines required and stating that resource levels will be structured to be consistent with carrying out the M&S plan. See also AECL commitments outlined in Section 1.5. It should be noted that the decommissioning project would remain under CNSC licence, the conditions of which will require the provision of adequate controls and contingencies.	Section 1.5 and 9.5

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
184	Environment Canada, Environmental Protection	There is no discussion of the potential for climate change over the next 60 years to influence (i.e., increase or decrease) the probability, magnitude or duration of possible extreme events. How will possible climate change issues be factored into mitigation plans and/or contingency plans that may be in place for a long period of time?		Climate change may change the absolute frequency of adverse conditions. Currently there is no way of predicting what those changes may be. It is specific and day-to-day meteorological conditions that are important. To that end it is the general monitoring and mitigation procedures that are important. The identification of change will be assisted by the maintenance of the meteorological station at Whiteshell Laboratories.	Section 9.0
185	Environment Canada, Environmental Protection	In Section 4.3.3, we did not notice any reference to underground or aboveground petroleum product storage tanks on the site. Are any such tanks (and associated piping) present?	Section 4.3.3	There are no underground fuel storage tanks at Whiteshell. All underground fuel lines are in double contained piping. Dismantling of petroleum product storage tanks will be carried out considering the applicable federal regulations.	
186	Radiation and Environmental Protection Division, Canadian Nuclear Safety Commission	A glossary is very much needed.		Agreed.	Glossary
187	Radiation and Environmental Protection Division	Report should refer to CNSC and its current regulatory requirements, not the AECB.		Agreed.	Changes made throughout CSR
188	Radiation and Environmental Protection Division	References to the specific timing of future environmental assessment steps should be removed or statements added that clearly state that this could vary.		Agreed.	Changes made in 1.6

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
189	Radiation and Environmental Protection Division	Remove the statement on the anticipated issuance of the decommissioning licence. This prejudges the outcome of the environmental assessment and decision by the CNSC.		Agreed.	Changes made in 1.6
190	Radiation and Environmental Protection Division	Define what is meant by a "natural" end-state. For example, what will be the remaining levels of contamination in soils, sediments and remaining structures? This is the source term information needed to predict long-term effects. Also, it is unclear how the proposed in-situ disposal of the WR-1 reactor, contaminated sediments and waste will meet with this end-state objective.		Agreed. The rationale for alternative methods of achieving the end state are found in Section 3.5	Section 3.5 and Glossary
191	Radiation and Environmental Protection Division	Now that the NSCA is in force, the triggering of the CEAA is somewhat different and requires consideration of the Interpretation Act until the CEA Agency can complete the consequential amendments to their regulations.	Section 1.4.1.2	Under Section 5 Trigger: The amendment to the Whiteshell Laboratories licence to allow for decommissioning of the Whiteshell Laboratories will be made under subsection 24(2) of the Nuclear Safety and Control Act (NCSA). With the advent of the NSCA, consequential amendments to the regulations under the CEAA will be needed to replace references to the Atomic Energy Control Act and its regulations by appropriate references to the provisions of the NSCA. Until these amendments are put in place, Section 44 of the Interpretation Act deems references to the former legislation to be references to the analogous provisions of the NSCA. In this case, the former provision authorizing the licence amendment was subsection 27(1) of the Atomic Energy Control Regulations, which was listed as a CEAA trigger under the Law List Regulations.	Section 1.4.1.2

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192	Radiation and Environmental Protection Division	Under the subheading "Responsible Authority" the Department of Fisheries and Oceans should be added.	Section 1.4.1.2	DFO has been added as a responsible authority.	Section 1.4.1.2
193	Radiation and Environmental Protection Division	It should be clarified that the 20 to 100 year time frames are the time frames that define the "project". They do not necessarily coincide with the time frames for the effects assessment.	Section 2.3.2	Agreed. The assessment timeframes is not limited by the project.	
194	Radiation and Environmental Protection Division	The discussion of why "alternatives to" was not considered should be removed, including references to AECB Policy R-104. It is sufficient to state that the scope of assessment requires that only "alternative methods" be considered.	Section 3.1	AECL believes that there is a need to explain the difference between alternatives to and alternative means and why, at Whiteshell Laboratories, only alternative means need to be discussed. 'Alternatives to' is not a matter within the scope of the EA (see Appendix A) and does not need to be further discussed in the body of the CSR.	Section 3.5
195	Radiation and Environmental Protection Division	It should be clarified that, in the event that a national repository for the disposal of radioactive waste is not available in the assumed time frames for the alternatives, the wastes would continue to remain in CNSC licensed waste storage facilities.		Agreed. Contingencies with regard to waste storage are described in section 4.2.2.	Section 4.2.2
196	Radiation and Environmental Protection Division	This section should explain that the alternative methods assessment did not go to the level of assessing alternative methods to dismantle and decontaminate each of the facility components or parts thereof.	Section 3.2	A new section was added to provide a discussion of alternative methods within the preferred timing option.	Sections 3.5

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
197	Radiation and Environmental Protection Division	The alternative methods assessment should be expanded to include an evaluation of the options identified for decommissioning the outfall sediments, WR-1 reactor and certain waste management areas. The examination of those options should consider information on the inventories of radiological and non-radiological contamination present and on projections concerning the fate of those contaminants in the environment.	Section 3.2	See comment 196.	Section 3.5
198	Radiation and Environmental Protection Division	Presently, it is not clear why all decommissioning, except WR-1, could not be performed within 20 years or less.	Section 3.2	The rationale for Whiteshell Laboratories decommissioning is to achieve a final end state for the site. This achievement is dependent on the transfer of most of the waste to a national waste disposal facility. Since it is unlikely that such a facility will be available within the next twenty years, the twenty-year option has unacceptably schedule risks. It should also be noted that ILW produced by WR-1 programs and currently stored in the waste management area also benefits from a deferment period which optimizes radioactivity decay.	Section 3.3
199	Radiation and Environmental Protection Division	On Page 3-2 it is stated that "Twenty years would allow time to assess wastes and to differentiate the wastes that can be managed in-situ at the site from those that will require removal to disposal or alternate storage". This does not provide a suitable basis for judging the environmental acceptability of such options today.	Section 3.2	Agreed. The in-situ options for sediments and the low-level waste trenches have been evaluated and documented in Appendix Band C.	Appendix B and C

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
200	Radiation and Environmental Protection Division	More information on the present radiation inventory at the WR-1 reactor site and Waste Management Areas (including their radioactive decay characteristics) is needed to support the stated benefits of the deferred 60 and 100 year dismantling strategies in Alternatives 2 and 3.	Section 3.2	The radiation fields in the WR-1 reactor vault emanate from the activated components made up of the fuel channels, the calandria vessel and the thermal shield. The radiation levels were estimated through the activation calculations based on the irradiation history of the reactor core and were verified through direct measurements in several representative fuel channels. References for the WR-1 radionuclide assessments have been added to the text. These same arguments apply to the ILW stored in the waste management area,	Section 3.3
201	Radiation and Environmental Protection Division	The radioactive decay that has occurred to date since shutdown should be taken into account.	Section 3.2	The impacts/benefits of radioactivity decay are discussed in more detail in the revised Section 3.3.	Section 3.3
202	Radiation and Environmental Protection Division	It is not clear why the high level waste management program only requires 10 years for radioactive decay for the safe handling of the spent fuel bundles, whereas a much longer time-frame is required here (Page 3-4, Table 3.2).	Section 3.2	The cooling period for irradiated fuel is related to the reduction in decay heat to allow dry storage rather than for radioactive decay. In addition, equipment already exists to remove and transfer fuel and all WR-1 fuel has been placed in dry storage at the Whiteshell Laboratories CCSF. The removal of the activated reactor components requires new technology since all materials require segmentation and many must be segmented in the reactor vault prior to allowing removal. Consequently the radiation field level of reactor components is critical to safe and economic decommissioning.	Section 3.23
203	Radiation and Environmental Protection Division	In support of the alternative phasing strategies identified, data is required on the current inventories and projected changes over time for the WR-1 and the WMA.	Section 3.2	See comment 202.	Section 3.3
204	Radiation and Environmental Protection Division	It is not clear why providing the public with an opportunity to provide input to the decommissioning program is an "operational constraint". This should be explained or deleted.	Section 4.2.1	It is a constraint only in the sense that the project cannot proceed without having given the public an opportunity to comment.	

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205	Radiation and Environmental Protection Division	The sentence in the fifth paragraph should read, "...Neutron Generator and the Van de Graaff Accelerator would be carried out shortly after the conclusion of this environmental assessment and issuance of a decommissioning licence by the CNSC".	Section 4.2.2	Agreed.	Changes made to text in Section 4.2.2
206	Radiation and Environmental Protection Division	The project description does not give a clear enough picture of present conditions at Whiteshell Laboratories to allow a reasonable assessment of potential decommissioning effects. It is not possible to assess environmental effects when no data or estimates are given on present levels of environmental contamination and the likelihood of future contamination.	Section 4.3	New data has been added to Sections 5 particularly for river sediment, low-level trenches, the landfill, sewage lagoons and affected lands.	Sections 5.0
207	Radiation and Environmental Protection Division	For example, the CSR must contain data on, or reasoned estimates of, the extent and concentrations of radionuclides in soil, groundwater, vegetation, terrestrial invertebrates, etc., from: past spills and leaks at the ALWTC and adjacent lines.	Section 4.3	See comment 206. A new section on affected lands has been added.	Section 5.3.3
208	Radiation and Environmental Protection Division	It may be necessary to exclude from the "project" those options that cannot be reasonably supported with currently available or attainable information of this kind.	Section 4.3	The environmental assessment must address all items in the CNSC scope of work Clarifications on the proposed decommissioning strategies of key project components were provided in section 4.3. Also, a new section was added to provide a discussion of alternative methods within the preferred timing option.	Section 3.5 and 4.3
209	Radiation and Environmental Protection Division	The options of in-situ disposal vs. dismantlement should be addressed as "alternative means of carrying out the project".	Section 4.3.1	Agree. See comment 208.	Section 3.5

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
210	Radiation and Environmental Protection Division	The options of in-situ disposal vs. removal of the contaminated sediments at the outfall should be addressed as "alternative means of carrying out the project".	Section 4.3.3	See comment 208.	Section 3.5
211	Radiation and Environmental Protection Division	The CSR mentions contamination of river sediments because of routine releases and some spill incidents but provides little data to evaluate the level of contamination or spatial distribution of the contamination. More information must be given on these incidents and the extent of contamination.	Section 4.3.3	Addressed as part of river sediments (section 5.4.7 and Appendix B)	Section 5.4.7 and Appendix B
212	Radiation and Environmental Protection Division	On Page 4-23, it is noted that 1450 kg of coolant oil was released to the river in the 1970s. The bulk of the coolant spread over a total area of 21 ha to a distance of 1 km downstream from the outfall. No information is given on the present status of this organic coolant spill and its fate	Section 4.3.3	The issue of organic coolant contamination is addressed as part of the river sediment assessments. Sampling at the outfall and some distance downstream indicates that the organic coolant has been dispersed. There is no visible organic on the river bottom or in core samples. Core sample analysis shows low-levels of organics in the sediments (Appendix B).	Appendix B
213	Radiation and Environmental Protection Division	The potential effect of WR-1 organic coolant on aquatic biota should be determined	Section 4.3.3	Earlier work at Whiteshell Laboratories documents effects of organic coolant on aquatic biota. Based on the low residual levels of organic indicated no additional work on effluents will be conducted.	Appendix B
214	Radiation and Environmental Protection Division	The potential for higher contaminant concentrations in nearby depositional areas must be determined.	Section 4.3.3	Addressed as part of river sediments.	Appendix B
215	Radiation and Environmental Protection Division	In describing the project and its past performance, annual releases of radionuclides, estimated dose to members of public and releases of other contaminants over the operation life of the facility must be included in the CSR.	Section 5.2	Airborne and liquid effluent data is provided for the period 1995-98. Estimated dose to the public is added. AECL's operational performance is the object of a continued assessment by the regulator.	Section 5.3

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216	Radiation and Environmental Protection Division	The relevance of historical effluent data to the assessment of effects from the project must be clarified.	Section 5.2	The relevance of monitoring data is to illustrate that routine releases were always controlled to a small fraction of the applicable limits and therefore represent an acceptable level of in environmental impact. The decommissioning project objective is to manage releases to comparably low-levels.	Section 5.4.7 and 5.2.2
217	Radiation and Environmental Protection Division	A clear distinction between source term data and the projected decommissioning effluents must be made and included in the Description of the Project (Section 4), rather than the Description of the Existing Environment in Section 5.	Section 5.2	Agreed: Clarification made.	Section 4.0
218	Radiation and Environmental Protection Division	The CSR should include a summary of the non-radiological contaminant release data presented in AECL-MISC-390.	Section 5.2	A table summarizing the data has been added to Section 5.2.2.	Section 5.2.2
219	Radiation and Environmental Protection Division	The CSR should present AECL's actual non-radiological effluent guidelines, the rationale for the choice of non-radiological parameters monitored for comparison to the guidelines (e.g., effluent characterization data generated during the design of the program) and effluent monitoring results (Page 5.5).	Section 5.2	Information on radiological and non-radiological effluent guidelines, types of effluents present at Whiteshell and environmental monitoring results, including incremental dose levels, have been included in the revised CSR.	Guidelines referenced in Section 5.2
220	Radiation and Environmental Protection Division	Table 5.10 shows elevated gross beta concentrations in vegetation near the WMA and canisters. The radiation dose to biota and the potential for radiation effects from these exposures should be estimated.	Section 5.3.4	An evaluation of vegetation sampling as well as a discussion of exposure to the public by food-chain pathways is given in Appendix C.1.	Appendix C.1

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221	Radiation and Environmental Protection Division	A statement should be added indicating that the condition of the unaffected lands will be verified through detailed radiological survey and that the lands will remain under CNSC licensed control until authorized by the CNSC for release.	Section 5.3.5	Agreed; added following sentence. This was verified through detailed radiological survey in the summer of 2000. Until the release of the unaffected lands is authorized by the CNSC, the lands will remain under CNSC licensed control.	
222	Radiation and Environmental Protection Division	Soonawala (1998) concluded that Whiteshell Laboratories could not have contributed to 137Cs deeper in the sediment profiles. This should be substantiated with 210Pb dating of the cores and temporal estimates of the inventory of 137Cs in the sediment. The occurrence of 134Cs in Lake Winnipeg does not suggest this is the case.	Section 5.4.7	The decommissioning program work scope and the environmental assessment focus only on areas with contamination levels with the potential for significant environmental impact. The potential impact zone is relatively localized to the Whiteshell Laboratories outfall area. Core sampling and analyses have been conducted for this area.	Section 5.3.3
223	Radiation and Environmental Protection Division	The CSR must give concentrations of radionuclides and other contaminants in fish over the operational period of Whiteshell Laboratories so trends can be evaluated or substantiated. Data on radionuclide concentrations and uncertainty in invertebrates must be given.	Section 5.4.8	This information is provided in Appendix B.	Appendix B
224	Radiation and Environmental Protection Division	Table 5.17 showing data for 137Cs concentrations in road kills could be improved by providing information on uncertainty in the measurements, temporal trends, number of samples and dates.	Section 5.4.9	A revised table has been added to Section 5.4.9.	Section 5.4.9
225	Radiation and Environmental Protection Division	The assessment of effects on the VECs needs to be made more transparent.	Section 5.4.11	Agreed. New section in Section 6 summarizes effects on VECs and VSCs.	Section 6.7

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
226	Radiation and Environmental Protection Division	An eighth step should be added in the process; that is "determination of the significance of the residual effects".	Section 6.2	Agreed.	Section 6.1
227	Radiation and Environmental Protection Division	The initial matrices in Section 6 could also indicate in a cell if the effect is primary (direct) or secondary (indirect). For example, "demolition" may have a direct impact on "air" quality (e.g., dust) that, in turn, could have a secondary effect on vegetation.	Section 6.3	All matrices have been put in Appendix D and are included for reference purposes. The assessment now focuses on the impact on environmental components. A summary of residual effects by component is given in Table 7.1.	Appendix D
228	Radiation and Environmental Protection Division	Project Activities should be described (perhaps in a separate list or appendix) to ensure a clear understanding of what could be released in the way of noise, dust, contaminants, wastes, etc.; that is, the mechanism and nature of interaction with the environmental component should be clear.	Section 6.3	Agreed. Decommissioning activities are described in Section 4.	Section 4.4
229	Radiation and Environmental Protection Division	The consumption of vegetation (crops) and wild meat should be considered.	Section 6.3.4	Pathway reviewed. No effect identified.	Section 6.3.8.2
230	Radiation and Environmental Protection Division	Some of the more recent CNSC documents and the AECL Radiation Protection Procedures and Manual are not listed and may be relevant.	Section 6.4	Added: • AECL Policy, 'Health, Safety and Environment', Policy 00-004. • RC-2000-633-1, 'AECL Radiation Protection Manual' (Draft). • WNRE-659, 'Radiation Protection Manual' (being replaced by RC-2000-633-1). • AECB R-85, Radiation Protection -Requisites for the Exemption of Certain Radioactive Materials from Further Licensing Upon Transferral for Disposal. Corrected AECB C-219 to CNSC G-219.	Section 6.2

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231	Radiation and Environmental Protection Division	The impact matrices should be redesigned to show the final results of the environmental assessment team's assessment of how each major component of the project could affect each major component of the environment or VEC. The matrices should not be used to document the evolution of the decision making process. That can be done separately or in an appendix, if desired.	Section 6.6.3	See comment 227.	Appendix D
232	Radiation and Environmental Protection Division	Air Quality" and "Noise Environment" should be treated as separate environmental components. Although it can be argued that noise propagates in the air medium, the effects are of quite a different nature than those associated with the release of contaminants.	Section 6.6.3	Agreed: Air Quality and Noise have been treated separately.	Sections 6.3.1 and 6.3.2
233	Radiation and Environmental Protection Division	It is not accurate to state that a "component" or "activity" was "eliminated". It is preferred to state that the effects of the interaction were determined to either be nil or fully mitigated and, therefore, not carried forward to the assessment of significance.	Section 6.6.3	Agreed. Text modified accordingly. See Appendix D.	Appendix D
234	Radiation and Environmental Protection Division	Table 5.8-units (e.g. Bq/L) are missing.	Table 5.8	Agreed.	
235	Radiation and Environmental Protection Division	Table 10.6, (Page 10-19) - Impacts to Sediment and Water Quality - STATUS, Outstanding Issues. The citation should be Appendix C, not Appendix D.	Table 10.6	Agreed.	

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
236	Radiation and Environmental Protection Division	The summary of effects tables needs to be revised to ensure clear traceability back to the initial impact matrices and also forward to the assessment of residual effects.	Section 6.6.4	To improve clarity the analysis has focused on the effects on environmental components. To maintain traceability between project activities and environmental components the original matrices have been included in Appendix D. Table 7.1 summarizes the residual effects by environmental component and project facility.	
237	Radiation and Environmental Protection Division	Wherever possible, effort should be made to estimate the source term and quantity, timing and duration of the releases.	Section 6.6.4	Additional source term information has been provided in Section 5 particularly for river sediments, low-level waste trenches and affected lands.	Sections 5.4.7 and 5.3.3 and Appendix C
238	Radiation and Environmental Protection Division	It appears that there is no anticipated effect on air quality from the continued operation of the ALWTC as part of the decommissioning project. However, this operational effect is addressed to some extent in Section 6.9.4 (Table 6.9.1).	Section 6.9.3	Agreed; will be made consistent with text.	
239	Radiation and Environmental Protection Division	In Section 6.9.3, and in several locations in the assessment, it is stated that vibration will likely be a concern to adjacent buildings and structures. This statement suggests that the adjacent buildings and structures could be threatened by this vibration.	Section 6.9.3	Very little effect is expected from vibration.	Section 6.3.2
240	Radiation and Environmental Protection Division	There is insufficient detail with which to assess whether the effects associated with non-radiological contaminants are adverse and significant.	Section 6.9.3	Non-radiological contaminants are monitored at the outfall as well as at the various facilities themselves and documented in AECL MISC-390 series. No exceedances of AECL guidelines have occurred at the outfall, sewage lagoon outlets or facilities. Current operational control levels will be maintained throughout the decommissioning program and because operations will decline, even lower emissions will result.	Section 5.2.2
241	Radiation and Environmental Protection Division	The difference between "site remediation" and "site restoration" is not clear. These terms also do not link back to an initial impact matrix.	Section 6.9.4, Table 6.9.1	Agreed; new definitions provided in glossary. Initial impact matrices superseded.	Glossary

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242	Radiation and Environmental Protection Division	The decommissioning options should be evaluated separately and then compared as part of the "Alternative Methods" section of the environmental assessment.	Section 6.10.3	See comment 196.	Section 3.5
243	Radiation and Environmental Protection Division	The natural reduction in noise energy over the long distances to the nearest human receptors should also be acknowledged as a factor. A quantitative projection of the noise levels at the off-site residences and social VECs should be added.	Section 6.10.3	Our professional judgement indicates that noise impacts on residences and VECs and VSCs will be insignificant. Modelling requires too many assumptions to be useful. Residences will rarely be affected because there will be little or no blasting and distances are substantial. No other VECs will be affected.	Section 6.3.2
244	Radiation and Environmental Protection Division	It is not clear why only the in-situ option has the potential to impact on soil and groundwater. Presumably, the decontamination, dismantling, and waste management activities of Option B could also have an effect on these components, albeit at different times and locations and by different mechanisms.	Section 6.10.3	The in-situ option has been removed. The rationale supporting removal is provided in section 3.3. It is anticipated that normal and proven mitigation measures will be applied to the removal of the WR-1. The effects of dismantling WR-1 are described in section 6.3 of the CSR	Section 3.3 and 6.3
245	Radiation and Environmental Protection Division	Although it is acknowledged in the environmental assessment that both options for decommissioning the WR-1 reactor could affect surface water, it is not clear how or why the effects could occur under each option. Only exterior washing of the building is identified. This would not seem to be the most important activity affecting surface water from decommissioning this major component of the site.	Section 6.10.3	Any anticipated effects are from accidental long-term releases due to structural deterioration associated with the in-situ option - an option that has been abandoned.	

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246	Radiation and Environmental Protection Division	There is no mention of the effects from the handling, storage and disposal of wastes arising from the dismantling option. Only the potential radiation effects on workers is mentioned.	Section 6.10.4, Table 6.10.1	The key effect identified was on worker health and safety. Section 6 has been rewritten to assess the potential environmental effects and their interaction with various facilities, including WR-1. Residual effects are identified when appropriate.	
247	Radiation and Environmental Protection Division	If Option A is to be retained as part of the "project", the identified residual effects to groundwater will need to be elaborated. Specifically, the extent of ground water contamination should be quantified using assessment models. The subsequent potential for contamination of vegetation and soil organisms and possible food chain transfer to higher tropic levels should also be addressed.	Section 6.10.4, Table 6.10.1	Comment no longer relevant as this option has been abandoned.	
248	Radiation and Environmental Protection Division	It is stated that demolition of the canisters will take place in enclosed facilities using HEPA filters to control the release of radioactive dust. It is not clear why this would be necessary given that the canisters should not be contaminated unless there has been a serious malfunction of the storage system when in operation. If there has been such a malfunction, it would seem prudent to only decontaminate under controlled conditions. See also Table 7.1.	Section 6.11.3	Agreed; there will be no radioactivity from the destruction of the canisters themselves and it is unlikely that therefore enclosures will be required for the destruction of the concrete canisters.	

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249	Radiation and Environmental Protection Division	It is noted that groundwater contamination is considered unlikely due to the fact that the waste management areas are located in a groundwater discharge area; however, there is no mention of how significant the effects on surface water quality from site runoff may be, or what sort of containment barriers could be used and how they would function.	Section 6.12.3	Addressed as part of WMA groundwater flow/contaminant transport assessment.	Section 6.3.4 and Appendix C
250	Radiation and Environmental Protection Division	Data must be presented demonstrating there are no contaminant plumes and that the contaminants are sorbed to the clay.	Section 6.12.3	Addressed as part of WMA groundwater flow/contaminant transport assessment in Section 6.3.4 and Appendix C	Section 6.3.4 and Appendix C
251	Radiation and Environmental Protection Division	The effect of non-radiological wastes on the environment must also be addressed.	Section 6.12.3	Addressed as part of WMA groundwater flow/contaminant transport assessment.	Appendix C
252	Radiation and Environmental Protection Division	It is not clear why airborne radioactive emissions would be expected from construction of new facilities. Also why would there be the need for such facilities in Phase 3 of the decommissioning project?	Section 6.12.4, Table 6.12.2	Agreed; new construction will not generate radioactive dust. Some facilities may be required for sorting and packaging during Phase 3 and will, as a result require storage.	
253	Radiation and Environmental Protection Division	The nature and extent of contamination of exterior building surfaces should be described in support of that prediction.	Section 6.13.3	The incidence of exterior decontamination will be unusual and only in trace quantities because releases from buildings are tightly controlled during operations. Detail to this level will be provided in the DDPs.	
254	Radiation and Environmental Protection Division	What is meant by "surveying to commercialize or retain"?; how can "transferring ownership" affect air quality?; and what does "rehabilitating" involve?	Section 6.13.3	Agreed; there is no effect from these activities from air quality.	Glossary

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
255	Radiation and Environmental Protection Division	It is stated that the demolition of Building 300 would be done under some type of ventilated enclosure, presumably due to the radioactive contamination that would remain following the earlier "decontamination" stage. It is not clear how this could be done or why it is necessary.	Section 6.13.4	Where needed (high-risk areas) and as determined in the DDPs, ventilated enclosures will be constructed.	
256	Radiation and Environmental Protection Division	In this and several other locations in the CSR, it is stated that "Recent work (Watson and Chow 1999) suggests that the fine fraction … will reduce the amount transported beyond 50 metres by over 90%". It is not clear whether other work has found that dispersal will be greater than this or whether dispersal studies have been performed at Whiteshell Laboratories. It is not demonstrated that the cited findings are relevant to the Whiteshell Laboratories area.	Section 6.13.4	This condition has not been specifically identified at the Whiteshell Laboratories site. Watson and Chow's evidence is a compilation of a great deal of research which corroborates the probability of AECL's conclusion. That is, as long as there is shrubbery and other obstacles on the site, fugitive dust will be retained on-site. The monitoring program described in Section 9 will confirm this at the time of activity.	Section 9.5.1
257	Radiation and Environmental Protection Division	More information is needed on the quantity, nature and characteristics of contaminants in the inactive landfill and leachate in order to assess the effects of its decommissioning.	Section 6.17	The approach to decommissioning is outlined in Section 4.0The effects section has been revised to reference the controls placed on landfill operation, which prohibited the disposal of hazardous wastes. An examination of the groundwater quality data confirms no significant quantities of contaminants were transported from the landfill. The detailed assessment requested here is planned for Phase 2. The assessment will refine the understanding of the effects and mitigations measures as necessary	Section 4.0

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
258	Radiation and Environmental Protection Division	As with the inactive landfill, more information on the levels of contamination (radiological and non-radiological) in the water, sludge and along the existing ground and surface water pathways is required in order to evaluate the appropriateness and potential effects of the proposed decommissioning activities.	Section 6.18	The approach to decommissioning is outlined in Section 4.0. The detailed assessment requested here is planned for Phase 2. However, additional information has been provided in Section 5.4.4. The level of radioactivity in the bottom sludge is at trace levels.	Section 5.4.4
259	Radiation and Environmental Protection Division	It difficult to envision how there could be artifacts under the lagoons, given that these are presumably dug facilities. Even if this is possible, how will this be assessed and a conclusion drawn?	Section 6.18.3	Agree: Word “underneath” has been removed.	
260	Radiation and Environmental Protection Division	A map showing the location and approximate area of contaminated lands should be added.	Section 6.2	Agree.	Figures 4.3, 5.3, 5.4 and 5.5
261	Radiation and Environmental Protection Division	What sort of soil processing is envisioned?	Section 6.20.4	Only sorting and packaging will occur; there will no processing or treating.	
262	Radiation and Environmental Protection Division	How is it envisioned that soil remediation can be accomplished under ventilated containment?	Section 6.20.4	Where needed (high-risk areas) and as determined in the DDPs, ventilated enclosures will be constructed.	
263	Radiation and Environmental Protection Division	More general information is needed on the proposed "effluent containment procedures" and "storm drainage plan".	Section 6.21.4	No further remediation of the North Ditch is anticipated. Monitoring will continue.	Section 4.3.3

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
264	Radiation and Environmental Protection Division	Considerably more quantitative information about the source, type, form, nature and extent of radiological and non-radiological contamination in the sediments (and its current effect on the River) is required before either the in-situ or removal options can be adequately assessed.	Section 6.22	New information is provided in Appendix B.	Appendix B
265	Radiation and Environmental Protection Division	Reference is made to "dry" removal of sediments. Is this actually "dry", or simply isolated from the rest of the river? Presumably some type of slurry pumping or dredging of the sediments from behind the dam would be required.	Section 6.22	Data presented in Appendix B concludes that no remediation will be required.	Appendix B
266	Radiation and Environmental Protection Division	Add, under mitigation, the suspension of outdoor decommissioning/remediation activities that could lead to contamination of runoff.	Section 6.24	Agreed.	
267	Radiation and Environmental Protection Division	The important aspects of the existing fire, explosion and spill procedures should be elaborated upon to explain how they will curtail and contain the spread of contamination.	Section 6.25	The effects and mitigation measures of each of the aforementioned events are presented in Section 6.4. Also, as indicated in Section 6.2, Whiteshell Laboratories already has site wide and facility-specific emergency preparedness plans to address accident and malfunction events. The decommissioning work will be carried out in accordance with these plans and the plans will remain in effect until the hazards associated with each facility and/or activity are removed or mitigated.	Sections 6.2 and 6.4
268	Radiation and Environmental Protection Division	It should be made clear that the ratings of "High", "Medium" and "Low" are relative and that a rating of "High" does not necessarily mean an unacceptable effect.	Section 7.2	Agreed: clarification provided.	Section 7.2

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
269	Radiation and Environmental Protection Division	It is not adequate to state only that wildlife can go to other areas if disturbed by noise. This implies a permanent loss of habitat.	Section 7	Due to the nature of the decommissioning generated noises, (dismantling using little if any blasting) none of the wildlife species affected will experience habitat loss as a result of noise. Even if noise causes wildlife to leave an area, the effect is likely temporary and reversible once the noise ceases.	Section 6.3.2
270	Radiation and Environmental Protection Division	It is stated that an effect is "short term" if occurring in one decommissioning phase only. However, some of the phases will occur over several decades. This cannot be reasonably considered short term.	Section 7.2	Duration is now defined in absolute terms instead of by phase.	Section 7.2 and Glossary
271	Radiation and Environmental Protection Division	It may be useful to illustrate the magnitude and duration of effects on a time line.	Section 7.2	Given the short duration and generally small magnitude of effects, a timeline is not practical. However, a generalized timeline for major project components is presented in Figure 4.4	Figure 4.4
272	Radiation and Environmental Protection Division	Some quantification of effects is necessary to understand their relative significance and thus preferences, i.e., if proper precautions are taken as stated in the CSR then there should be little or no difference in the amount of radionuclide activity released to the river with the three alternatives.	Section 6.23	The only significant difference among the alternatives concerns worker health and safety. Releases from any of the three alternatives will be well within regulatory limits and are expected to be lower than when WL was operating.	Section 3.3
273	Radiation and Environmental Protection Division	The purpose of the follow-up program should be clearly stated. The follow-up program for an environmental assessment and that required for licensing, although related, are not necessarily the same thing.	Section 9	Agree.	Section 9.0

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274	Radiation and Environmental Protection Division	The monitoring programs presented appear to be those used in the current operations for CNSC licensing and contain little on how those programs are relevant to, or would be modified to, focus on the predicted environmental effects of the decommissioning project.	Section 9	Section 9.5 identifies areas where the monitoring activities will be modified or augmented. Factors affecting the scope of monitoring are identified in Section 9.6. The follow-up program will provide confirmatory evidence that the decommissioning activities will not result in significant adverse effects.	Sections 9.5 and 9.6
275	Radiation and Environmental Protection Division	The proposed environmental monitoring program focuses exclusively on radiological parameters.	Section 9	Existing monitoring program shown in Section 9.3 includes non-radiological contaminants. Follow up monitoring will address all contaminants that have a potential to cause adverse environmental effects.	Section 9.3
276	Radiation and Environmental Protection Division	The proposed follow-up does not appear to address the amount, quality and distribution of dust.	Section 9	A new air quality monitoring protocol is presented in Section 9.5.1.	Section 9.5.1
277	Radiation and Environmental Protection Division	The proposed follow-up does not appear to address the effects of things such as noise, vibration, odours, wildlife disruption, etc.	Section 9	See comment 274.	Sections 9.5 and 9.6
278	Radiation and Environmental Protection Division	The proposed follow-up does not appear to address the identified issues related to the landfill, sewage lagoons and contaminated sediments.	Section 9	The revised monitoring program addresses landfill and sewage lagoons Environmental monitoring of sediments will take place throughout Phase2 and most of Phase 3 to determine if contaminants deposited as a result of the decommissioning project require remediation to achieve the final end-state objectives. The monitoring requirements will reflect the nature of the releases from decommissioning activities.	Sections 9.5.3, 9.5.4 and 9.5.6
279	Radiation and Environmental Protection Division	The data provided is over 20 years old. More recent data and information on potential effects of past discharges is required.	Appendix C	New information is provided in Appendix B.	Appendix B

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280	Wastes and Decommissioning Division, Canadian Nuclear Safety Commission	The purpose of the project is stated here and includes that the end-state is supposed to meet the regulatory requirements for a licensed nuclear site. What will the site be licensed for after the decommissioning project is completed? This statement should be reviewed to ensure that it captures the essence of the decommissioning project.	Page 1-2, Section 1.3.2	The purpose is to achieve unrestricted release from licensed condition.	Section 1.3.2
281	Wastes and Decommissioning Division	At the bottom of this page, it states that there are no other Responsible Authorities for this project. It is not clear if this is correct. This should be reviewed and revised.	Page 1-3, Section 1.4.1.2	DFO has been added as a responsible authority. The text was revised accordingly.	
282	Wastes and Decommissioning Division	One of AECL's stated commitments is to ensure staffing to meet security requirements. Does this include fire protection? If not, how will this be managed?	Page 1-5, Section 1.5	The decommissioning project will be conducted under CNSC licence that ensures adequate emergency response measures. AECL is clearly committed to maintaining the resources required to carry out the monitoring and surveillance activities to the end of the decommissioning program including, security, fire fighting, environmental monitoring, radiation protection and buildings maintenance. The disciplines and expertise required along with necessary resources levels will be structured to be consistent with carrying out the M&S plan.	Section 9.5
283	Wastes and Decommissioning Division	The schedules listed at the top of this page should be revised to reflect the current situation.	Page 1-6, Section 1.6.1	Agreed: Schedules revised.	Section 1.6.1
284	Wastes and Decommissioning Division	The reference in this section should be updated to reflect the fact that G-219 is the document for decommissioning planning. Furthermore, the reference to the licence may also be revised to update it in light of the pending licence renewal.	Page 1-6, Section 1.7	Agreed: R-90 is changed to G-219.	Section 1.7

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
285	Wastes and Decommissioning Division	Alternative decommissioning strategy No. 3 seems to exclude the potential for some decommissioning to be delayed beyond the structural life of the building. Some contingency planning should be provided to ensure that the buildings will be sound and capable of being decommissioned at the required time. This may add to the costs cited and decrease the financial benefit of this option.	Page 3-3, Section 3.2.3	Contingencies outlined.	Sections 3.3 and 4.2.2
286	Wastes and Decommissioning Division	The radiation fields in and around WR-1 are cited as being up to 500 Gy/h. What is the basis for this statement? A reference should be cited for this and further information provided on the nature and extent of such fields.	Page 3-4, Section 3.2.4	See comments 156 and 157.	Section 3.3
287	Wastes and Decommissioning Division	Secondly, the third paragraph in this section (top of Page 3-5) also states that remote handling and shielding would increase decommissioning costs by $40 M to $80 M. What are the annual monitoring and surveillance costs for the time that this facility will be in storage with surveillance mode? How do these compare? This information should be provided to ensure that a proper comparison can be made.	Page 3-4, Section 3.2.4	Cost comparisons have been re-evaluated and are at a level appropriate for environmental assessment analysis.	Section 3.3

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
288	Wastes and Decommissioning Division	The second last paragraph on Page 3-5 refers to the advantage of radioactive decay to reduce the radionuclide inventories. To support this assertion, further information should be provided on the radionuclide composition of the activity so the decrease can be properly assessed. Alternatively, a proper reference should be provided. This paragraph also refers to the additional building costs that would be incurred by deferring to Alternative No. 2.	Page 3-5	Cost comparisons have been re-evaluated and are at a level appropriate for environmental assessment analysis. See reply to comment 156.	Section 3.3
289	Wastes and Decommissioning Division	The description of the Waste Management Area facilities would benefit from having these structures identified on Figure 4.2. As it stands, it is not possible to correlate this list with that figure.	Page 4-13, Section 4.3.1	Security considerations for fissile material storage make it inappropriate to identify precise locations. Colour coding provides adequate definition of storage areas.	
290	Wastes and Decommissioning Division	There are several concerns with figure 4.2. Firstly, the diagram is inconsistent with the photo on the facing page. It would appear that the photo is more recent than the drawing. These should be the same.	Figure 4.2	Figure 4.2 has been updated.	
291	Wastes and Decommissioning Division	Under the section regarding the decommissioning approach for the WMA, the last sentence makes reference to the identification of "appropriate institutional controls" to manage any remaining wastes in the WMA. This statement is vague and this section requires clarification.		The decommissioning approach has been revised in Section 4.3.1 and institutional controls are defined in Section 3.2.	Sections 4.3.1 and 3.2

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292	Wastes and Decommissioning Division	The discussion on the decommissioning of the inactive landfill seems to exclude mention of the metal scrap area in the vicinity of this landfill. Information on the decommissioning approach for this significant area should also be provided.	Page 4-19, Section 4.3.3	The metal scrap is being removed as part of the general clean up associated with operational shutdown.	
293	Wastes and Decommissioning Division	The description of the "Affected" Lands contains only superficial descriptions of some significant facilities, including those used for environmental monitoring of released contamination. Further information on the nature and extent of potential contamination from these activities should be provided to assess the proposed decommissioning approach.	Page 4-22, Section 4.3.3	Data on 'affected lands' facilities and/or incidents is summarized in Table 5.9; Section 5.3.3 describes inventory released/emplaced and current status.	Section 5.3.3
294	Wastes and Decommissioning Division	Furthermore, the tritium injection site in the WMA is mentioned here but not in the section on that facility. It would be more effective to include it in the description of the WMA.	Page 4-22, Section 4.3.3	Agreed; description of tritium injection well has been moved to the project description.	Section 4
295	Wastes and Decommissioning Division	The decommissioning approach for the "Affected" Lands seems to be only concerned with the radiological contamination. There are facilities, particularly in and around the FIG site, that should be described and a decommissioning approach for these should be included.	Page 4-23, Section 4.3.3	Agreed; these are non-nuclear facilities (except for FIG and ZEUS) and are addressed in Section 4.3.3, General Infrastructure.	Section 4.3.3

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
297	Fisheries and Oceans Canada	The Waste Management area is located in an area of groundwater discharge. Consideration needs to be given to the advisability of repositioning materials within this area to decrease the likelihood of contaminant mobilization over time.	Page ES-6	New information is provided in Appendix C.	Appendix C
298	Fisheries and Oceans Canada	The spectrum of contaminants associated with the outfall that are contained in the river sediments should be delineated along with the geographic extent of their distribution. Ongoing sources of emissions and anticipated quantities to be discharged during, and subsequent to decommissioning actions should be quantified.		New information is provided in Appendix B and the assessment is provided in Section 6.3.	Section 6.3 and Appendix B
299	Fisheries and Oceans Canada	The leakage of organic coolant in 1977 is not indicated on Page C-1 as a source of contamination in downstream river sediments yet it is highlighted here as the area that may also be representative of the 1979 "accidental release". Clarification needs to be provided concerning the extent of the organic coolant contamination in the sediments as well as the radioactive contamination.	Appendix C-3	New information is provided in Appendix B.	Appendix B
300	Fisheries and Oceans Canada	It is stated that "A residual effect on the resource use of the Winnipeg River could result from remediation of river sediments." Details of the potential extent of such effects need to be quantified.	Page ES-9	No remediation of river sediments are proposed.	Appendix B

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
301	Fisheries and Oceans Canada	It would appear that the geographic extent of the Winnipeg River sediments that may require remediation has as yet not been quantified.	Page ES-12	See comment 300.	
302	Fisheries and Oceans Canada	The reference to the Section 5 trigger should be updated to reflect the appropriate section of the Nuclear Safety and Control Act now in effect.	Page 1-3	Agree; text has been updated.	
303	Fisheries and Oceans Canada	The last line on Page 3 should be amended to read "Fisheries and Oceans Canada is also a responsible authority for this project."	Page 1-3	Agree.	Section 1.4.1.2
304	Fisheries and Oceans Canada	It is understood that the underground research laboratory is not being included in the decommissioning proposal. This should be clearly stated to avoid any misunderstanding, and clear reasons for its exclusion from the decommissioning project should be provided.	Page 2-1	The URL is not within the CSR scope as stated in Section 2 and in Appendix A.	Appendix A and Section 2
305	Fisheries and Oceans Canada	Designation of an "off-site" disposal facility needs to be addressed in advance of a decision concerning the duration of the decommissioning actions. AECL needs to address the course of action to be followed for each of the "Alternatives" if no "off-site" disposal facility exists at the conclusion of the scheduled decommissioning period.	Page 3-1	Contingencies are described in Section 3.3. All waste will remain under CNSC license until final disposition.	Section 3.3

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
306	Fisheries and Oceans Canada	AECL needs to address the course of action to be followed for each of the alternatives if no off-site disposal facility exists at the conclusion of the scheduled decommissioning period.	Page 3-1	The uncertainties associated with the availability of an off-site disposal facility are recognized in the CSR. To address further those uncertainties, the project description has been expanded to include a description of the types of contingencies available for longer-term storage of radioactive wastes arising from the decommissioning activities. Any such interim contingency waste storage facilities will be under full regulatory control of the CNSC, and can be designed, operated and monitored using proven technologies and methods to ensure no unreasonable risk to human health or the environment. The assessment of likely environmental effects considers the potential effects of those contingency activities, should they become necessary to implement. The same types of contingencies are assumed to apply to all of the alternatives evaluated.	Section 3.3
307	Fisheries and Oceans Canada	On Page 3-3 it is stated that "The approach assumes that a radioactive waste disposal repository will be available within 10 years". Then on page 3-5 it is stated that "with disposal availability unlikely within the 20-year time frame, the highly radioactive wastes … would have to be accommodated in interim storage facilities."	Page 3-5	Alternative 1 was developed to identify the shortest time frame possible for the completion of the decommissioning of Whiteshell Laboratories assuming appropriate national waste disposal facilities would be available. This approach has high risks because it is unlikely that such facilities will be available in the required time frame.	
308	Fisheries and Oceans Canada	The supporting documents to the CSR referred to here (Helbrecht (1999), and Ridgway (1999), do not appear to be part of the documentation provided. The finalized CSR should include these supporting documents.	Page 4-2	Reference documents are not normally made available within the CSR. Relevant information has been reproduced in the CSR where appropriate. Source documents are available on request.	
309	Fisheries and Oceans Canada	The quality of the effluent released from the sewage lagoon to the Winnipeg River should be provided. The source(s) and nature of the backfill to be used to decommission the lagoon should be provided.	Page 4-20	Effluent quality information is provided in Section 5.2. The closure plan will provide details on closure procedures. Reference is also made to Manitoba Environment Act Regulation 163/88, which apply to the closure of sewage lagoons. See also comment 38 and lagoon monitoring summary added to Section 5.2.	Section 5.2 and section 4.3.3.

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310	Fisheries and Oceans Canada	The reference to the work by Guthrie and Acres (1979) should be provided in the list of references.	Page 4-24	Organic coolant in Winnipeg River Sediments, AECL—06317 (Mar 01, 1979) Guthrie, J.E., Acres, O.E.	Reference
311	Fisheries and Oceans Canada	A detailed list of the annual contaminant loadings to the Winnipeg River from the sewage lagoons should be provided.		Information is provided in AECL annual reports, MISC 362 and 390.	Section 5.2.2
312	Fisheries and Oceans Canada	Sediment data at the outfall and downstream to Lac Du Bonnet should be provided as part of the CSR along with details of the "additional studies" and monitoring proposed. There would be merit in soliciting input from regulatory agencies on the study design, prior to implementation.	Page 4-25	New information is provided in Appendix B. Collaboration with CNSC/DFO will be ongoing.	Appendix B
313	Fisheries and Oceans Canada	This figure indicates that radioactive liquids from the sewage lagoon go to the ALWTC for interim processing prior to discharge to the Winnipeg River. Previous statements on page 4-20 indicated that water from the sewage lagoon was discharged to the Winnipeg River in the spring and the fall each year, but did not indicate that there was any treatment of the effluent. This discrepancy should be clarified and the quantities of contaminants in the flows from the sewage lagoon provided.	Figure 4.3	Agree; Figure 4.5 refers to waste removed from sewage lagoon during decommissioning not to routinely discharged effluent. Sewage lagoon effluent data is included in Section 5.2.	Section 5.2

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314	Fisheries and Oceans Canada	Standards for radiological effluents are based on dose limits for the public rather than dose limits for aquatic biota. It should be acknowledged that dose limits acceptable for the public are not necessarily protective for aquatic biota.	Page 5-2	Agree; risk based approaches have been applied to the sediment assessments.	Appendix B
315	Fisheries and Oceans Canada	With respect to "non-radiological effluents", Canadian Water quality guidelines for the protection of aquatic life should be followed for "determining acceptable concentrations of various elements" in all AECL effluent discharges.	Page 5-3	Discharges are compared to AECL’s guidelines for the emissions in liquid effluents. The guidelines are based on the guidelines for effluent quality at federal establishments and are supplemented with other provincial quality objectives.	Section 5.2
316	Fisheries and Oceans Canada	The annual contaminant loadings to the Winnipeg River from AECL site drainage ditch discharges should be quantified, even though it is considered "insignificant compared to the outfall and the lagoon".	Page 5-5	Environmental monitoring of surface water indicates that no measurable quantities have been released.	
317	Fisheries and Oceans Canada	The information presented is very misleading since the sewage lagoon discharges are averaged over twelve months even though discharge occurs only twice per year. When the data are presented as pulse discharges, a much different picture representative of actual discharge conditions emerges.	Table 5.4	AECL reporting practices have been approved by the CNSC. Note that applying the data to a six-month term, i.e. dividing it by 2 instead of by 12, which take account of the “pulse”, still shows an insignificant percentage of the allowable release limit.	

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318	Fisheries and Oceans Canada	Details of the collection methodology and the sample horizon for which data are reported should be provided and the data restated after application of the "revised efficiency factor" to all of the data. In 1998, gross beta values 13 km downstream from the outfall were greater than at the outfall. A map depicting the location of the sample points should be included in the CSR.	Page 5-11, Table 5.9	Addressed as part of river sediments assessment. The impact zone at the outfall and downstream has been identified by direct gamma sampling and sediment core sampling. Only zones identified as having contamination levels which could have an adverse environmental impact are evaluated as part of the decommissioning program.	
319	Fisheries and Oceans Canada	The information presented only details the most recent record of water chemistry. To place observations in the sediments, fishes and benthos in perspective, a more complete understanding of the history of water quality is needed. AECL data from 1962 to 1993 should be incorporated in the tabulated summary in Table 5.15. This would illustrate that at Great Falls, 28 km downstream, 137Cs concentrations reached 0.025Bq/L in the mid 1970's.	Page 5-25	Summary information on the location and levels of downstream radiological contamination (below the outfall and at more distant locations), and its likely linkage to historical operations of the Whiteshell Laboratories, has been added to the revised CSR (see section 5.4.7 and Appendix B). That information is for the purpose of further detailing the conditions of the existing environment and for assessing the cumulative effects of the effluents likely to arise from the proposed decommissioning project together with the residual contamination from past Whiteshell Laboratories' operations. The river sediments themselves are no longer considered to fall within the scope of the decommissioning project. There is presently no proposal to conduct any decommissioning activities in the river.	

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320	Fisheries and Oceans Canada	The sediment values should be provided from stations in the vicinity of the water quality data reported in Table 5.15 for comparative purposes. The sediment data provided only extend 13.06 km downstream, whereas the water data extend 28 km downstream. Hence, there is no way in the CSR to compare the sediment quality to the water quality at Great Falls.	Page 5-27	See comment 319.	
321	Fisheries and Oceans Canada	Reference to the data on radioactivity in fish is given as Neimi and Soonawala 1999, but Appendix B cites the reference as Graham et al 1998. Clarification should be provided concerning the source of the data in Tables B.1-1 to B.1-3.	Page 5-29	Authorship different in 1998 and 1999.	
322	Fisheries and Oceans Canada	The table should be revised. There are duplicate entries for "grouse" and "red fox". No sample sizes are indicated and no dates or distances from the Whiteshell Lab site are provided for the road kills analyzed.	Page 5-32, Table 5.17	Data refers to individual animals. Data was collected in 1999. Locations have been added to the text and distances from the site provided. Additional data has been provided.	Section 5.4.9
323	Fisheries and Oceans Canada	Mitigation measure(s) should also include monitoring of sediments in the Winnipeg River.	Page 6-24	Monitoring and follow-up are presented in Section 9.0. Mitigation is part of the assessment of environmental effects and is found in Section 6.0.	

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
324	Fisheries and Oceans Canada	It is acknowledged that the hydrogeological regime in the area is not well enough understood to determine whether leakage of contamination from WR-1 could reach the Winnipeg River in the long-term. Additional knowledge needs to be acquired to adequately address potential decommissioning issues in a balanced manner. Studies to fill existing knowledge voids as they relate to groundwater flow paths to the Winnipeg River that may become contaminated should be initiated so that impacts may be accurately modeled.	Page 6-28	The in-situ disposal option for WR-1 has been abandoned. Facility monitoring under final decommissioning will verify that contaminants do not reach the aquifer.	Section 4.3.1
325	Fisheries and Oceans Canada	The anticipated leakages from the WMA should be quantified.	Page 6-38	New information is included in Appendix C.	Appendix C
326	Fisheries and Oceans Canada	As part of the decommissioning work, all flow paths on the decommissioned site should be reinstated to resemble pre-operational conditions insofar as possible. All flows through roadways should be restored and culverts removed, where such roads are not needed for post-decommissioning monitoring access. Decommissioning activities that result in disruption of flow paths and drainage patterns should be avoided insofar as possible.	Page 6-55	Final decommissioning will return site to a natural condition as defined in the glossary and address these concerns.	Glossary
327	Fisheries and Oceans Canada	The monitoring proposed to establish that the landfill "is fully stabilized" should be provided.	Page 6-56	The criteria for the modification of the monitoring program are provided in Section 9.6. Monitoring will continue until the absence of environmental effects has been adequately demonstrated.	Section 9.6

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
328	Fisheries and Oceans Canada	Elaboration is needed concerning what is associated with "rearranging surface water drainage pathways". The volume of flows being contemplated for redirection should be stated.	Page 6-58	The approach to decommissioning is outlined in Section 4.3.3. A preliminary evaluation and assessment of the landfill environment has been carried out for the purpose of making EA decisions on the likelihood and significance of potential environmental effects. The effects section has been revised to reference the controls placed on landfill operation which prohibited the disposal of hazardous wastes. See additional characterization data for landfill in Section 5.4.4. The detailed assessment requested here is planned for Phase 2 of the CNSC licensed decommissioning program. The assessment will refine the understanding of the effects and mitigations measures as necessary.	Section 4.3.3
329	Fisheries and Oceans Canada	The anticipated leachate migration to the Winnipeg River from the landfill should be modeled.	Page 6-59	The approach to decommissioning is outlined in Section 4.3.3 and an analysis of environmental effects is found in Section 6. The effects section has been revised to reference the controls and source term measurements placed on landfill operation which prohibit the disposal of hazardous wastes. The groundwater quality data confirms the absence of any significant transport of contaminants from the landfill. Also see 329.	Section 4.3.3
330	Fisheries and Oceans Canada	Clarification is needed as to what is meant by "rehabilitated to a natural condition".	Page 6-61	Clarification provided in Glossary.	Glossary
331	Fisheries and Oceans Canada	The extent of the radioactive contamination associated with the sewage lagoon should be quantified. There is a need to address methods of reducing the potential for contaminant movement from the lagoon to the groundwater, and to the Winnipeg River.	Page 6-62	The approach to decommissioning is outlined in Section 4.3.3Additional information has been provided in Section 5.3. The level of radioactivity in the bottom sludge is at trace levels. There has been no movement of contaminants into the underlying clay material. Given the low hydraulic conductivity of the clay and the decay of the radioactive contaminants, quantities of contaminants that may eventually reach the river are expected to be very small. The detailed assessment requested here is planned for Phase 2 of the CNSC licensed decommissioning program. The assessment will refine the understanding of the effects and mitigations measures as necessary.	Section 4.3.3

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
332	Fisheries and Oceans Canada	The wind velocities that the reactor and the concrete canisters are able to withstand needs to be stated for comparison to those winds encountered in a tornado.	Page 6-89	Safety information is provided in the CNSC approved Safety Analyses for individual buildings.	
333	Fisheries and Oceans Canada	Promoting access to the Winnipeg River to encourage fishing opportunities in the vicinity of contaminated sediments is not considered advisable at this point, given uncertainties relating to the extent and magnitude of contamination in the sediments arising from operations of the Whiteshell Labs and the likely condition of the sediments upon completion of decommissioning.	Page 6-95	There is no need to consider controls on fishing in the Winnipeg River since effluent releases will be reduced even further as a result of the shutdown of operations.	
334	Fisheries and Oceans Canada	Reference is made to the "currently immobilized contaminated sediments" in the Winnipeg River, but no documentation appears to have been provided to illustrate the static nature of these sediments. The criteria to determine when any "significant adverse effects from removal activities" arise need to be clearly delineated.	Page 7.0	New information is provided in Appendix B.	Appendix B

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
335	Fisheries and Oceans Canada	The conclusion is reached that the effects on aquatic biota associated with contamination arising during the removal of sediments from the Winnipeg River is "not significant". Then it is stated that at a later date a study and plan will be prepared to address the issue of contaminated sediments in the Winnipeg River. The conclusion of "not significant" should be reserved until such time as the assessment of the extent of sediment contamination has been completed.	Page 7-9	New information is provided in Appendix B.	Appendix B
336	Fisheries and Oceans Canada	The consideration of cumulative effects is stated as being "conservative", but at the same time the rationale for the geographical extent of the analysis is not stated. Restricting the analysis to one kilometre "upstream of the outfall" is not considered a conservative approach to assessment of cumulative impacts.	Page 8.3	Review included all projects of Whiteshell Laboratories within the Regional Study Area. The 1 km restriction has been removed.	Section 8.0
337	Fisheries and Oceans Canada	It is questionable whether annual sediment sampling of the top 1 cm of sediments in the Winnipeg River would yield useful data for monitoring trends over time. Given the dynamics of the river and sediment depositional processes, sampling every year is unlikely to yield information that will reflect year to year changes in the sediment chemistry of the top 1 cm of sediment... less frequent sampling of sediment cores to determine changes in the sediment chemistry of core profiles is warranted.	Table 9.4	Initially, the routine monitoring activities will be retained during the implementation of the decommissioning project. Later, the monitoring requirements may be modified to reflect the nature of the releases during the decommissioning activities to determine if the contaminants deposited as the result of the decommissioning require remediation to achieve the final end-state objectives.	Section 9.6

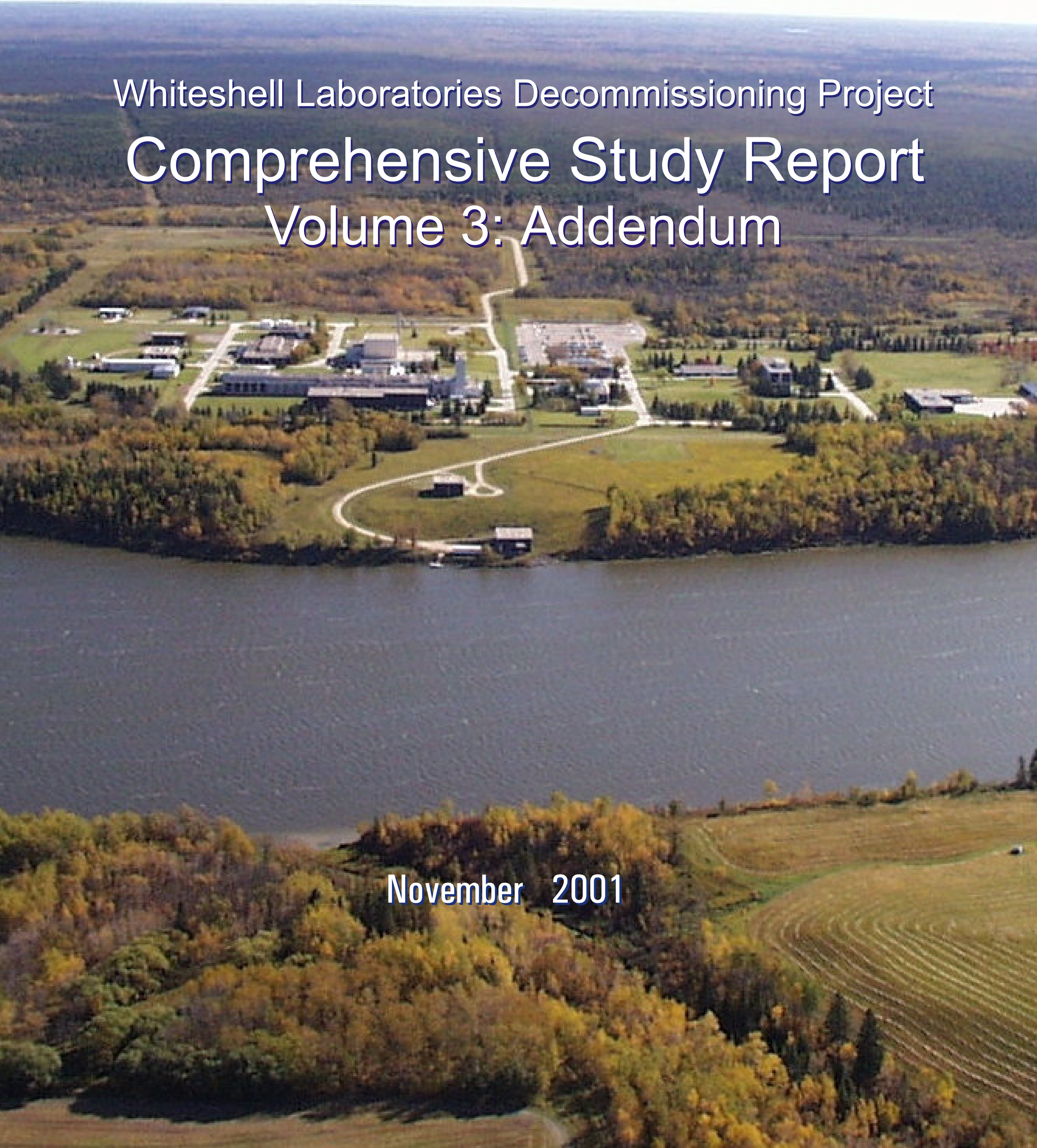
Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
338	Fisheries and Oceans Canada	The information provided on page 9-11 points to the fact that the environmental monitoring of sediments that has been undertaken to date is not suitable to provide a baseline that will enable the design of "follow up activities". This shortcoming needs to be addressed in a timely fashion through a carefully designed program that involves input from the regulatory agencies.	Page 9-11	New information is provided in Appendix B.	Appendix B
339	Fisheries and Oceans Canada	Clarification should be provided concerning the independent monitoring that has been conducted in the past by Fisheries and Oceans Canada, and a specific reference to the work cited.	Page 10-13	Refer to data on coliform levels collected by DFO in 1993 and cited in the November 1995 Winnipeg River Task Force Report, Section 4.3.2.	
340	Fisheries and Oceans Canada	The conclusions reached in the draft CSR are premature, given the need for resolution of the outstanding issues relating to actions to be taken in connection with decommissioning of the Winnipeg River sediments.	Page 11-1	New information is provided in Appendix B.	Appendix B
341	Fisheries and Oceans Canada	The reference to Cherry and Robertson 1988 (page 5-23) is not cited in the reference list.	Reference R-2	Agreed, reference added.	
342	Fisheries and Oceans Canada	The reference to Guthrie and Scott 1988 indicates that this information represents "proportional data". Does this infer the data was acquired in the early 1960's prior to the establishment of the site, or is there another reference that documents pre-development conditions?	Reference R-3	Yes, the data was acquired prior to the establishment of the site.	

Comment Number	Comment By	CNSC Summarized Comment	Rev. 1 Reference	Response	Rev. 2 Reference
343	Fisheries and Oceans Canada	The reference to Lockhart et al 1994 should be provided in full and updated to reflect the reference to the publication in 2000.	Reference R-3	1994 paper referenced in full. Still awaiting 2000 version.	
344	Fisheries and Oceans Canada	The reference by Soonawala 1998 is not provided.	Reference R-5	Reference is now listed as Soonawala 2000.	
345	Fisheries and Oceans Canada	It is stated in Appendix C that the release from the sewage lagoon is not contaminated with radioactive contaminants, yet on Page 6-60 it is indicated that the lagoon sludges are contaminated with radioactive contaminants with higher levels in the primary pond than in the secondary pond. The extent of contamination needs to be quantified and the statements in the CSR harmonized for consistency.	Page C-1	Effluent data on the sewage lagoon has been added to Section 5.2.2. The level of radioactivity in the bottom sludge is at trace levels.	Section 5.2.2
346	Fisheries and Oceans Canada	No reference to the paper by Pollock (1979) is provided. There would also be merit in including the references to Appendix C in the main reference list for the CSR.	Appendix C	1979 reference is no longer applicable. New information is provided in Appendix C.	Appendix C
347	Fisheries and Oceans Canada	It is indicated that some of the sediment samples collected in the vicinity of the outfall "have been well above levels that might be considered acceptable in the public domain". These data should be summarized and presented as part of the CSR.	Appendix C	New information is provided in Appendix B.	Appendix B

AECL EACL

Whiteshell Laboratories Decommissioning Project

Comprehensive Study Report
Volume 3: Addendum



November 2001

Addendum to the Comprehensive Study Report for the Whiteshell Laboratories Decommissioning Project

November 2001

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Addendum to the Comprehensive Study Report for the Whiteshell Laboratories Decommissioning Project

1.0 INTRODUCTION

The information in this addendum is intended to update or supplement the comprehensive study report (Rev.2) for the decommissioning of the Whiteshell Laboratories. The principal objective of the addendum is to address the comments received during the responsible authorities' public and technical review.

The addendum consists of several sections. Section 2 contains errata whereas section 3 provides points of clarification. Additional information is provided in section 4. To the extent possible, cross-references to the main report are provided to assist the reader.

Finally, the Appendix provides a listing of all the comments along with responses from AECL and/or the responsible authorities. Where applicable, cross-references to the main report and/or the relevant section of the addendum are offered.

A global table of contents is presented in section 1.1. It duplicates the content structure of revision 2 of the comprehensive study report in both the headings and numbering sequence. The table includes a series of columns that indicate where errata, clarifications or additions were made. The four columns are:

None:	indicating that the section of the CSR Rev. 2 remains unaffected by the addendum;
Errata:	indicating that the section has minor corrections provided in section 2 of the addendum;
Clarify:	indicating that a point of clarification provided in section 3 of the addendum applies to the section; and
Add:	indicating that the section is supplemented by new information presented in section 4 of the addendum.

It is important to note that the information provided in the addendum does not alter the conclusions drawn in the comprehensive study report, namely:

- The decommissioning project is not likely to cause significant adverse environmental effects taking into account the mitigation measures proposed in the CSR;
- The cumulative effects analysis indicates that there are not likely to be any cumulative effects associated with the project; and
- The public has had opportunities to become informed and to raise issues of concern. Responses have been provided for all concerns related to the decommissioning project.

2.0 ERRATA

2.1 COMPREHENSIVE STUDY REPORT, VOLUME 1: MAIN REPORT

Executive Summary:

- p. ES-1, 2nd paragraph, 5th line: 'Responsible Authorities' should be replaced with 'CNSC'.
- Figure ES-2: The institutional control period should extend to year 260 (see revised Figure 4.4 below).

Glossary: TLD – 'Thermoluminescence' should be replace with 'Thermoluminescent'.

Section 1.4.1.2: under Responsible Authorities: 'Department of Fisheries and Oceans' should be replaced with 'Fisheries and Oceans Canada'.

Section 1.4.1.3: 3rd sentence: The sentence should read: 'Harmful alteration, disruption or destruction of…'

Section 4.3.4, Figure 4.4: The institutional control period should extend to year 260.

Figure 4.4
Whiteshell Laboratories Decommissioning Project Component Timelines

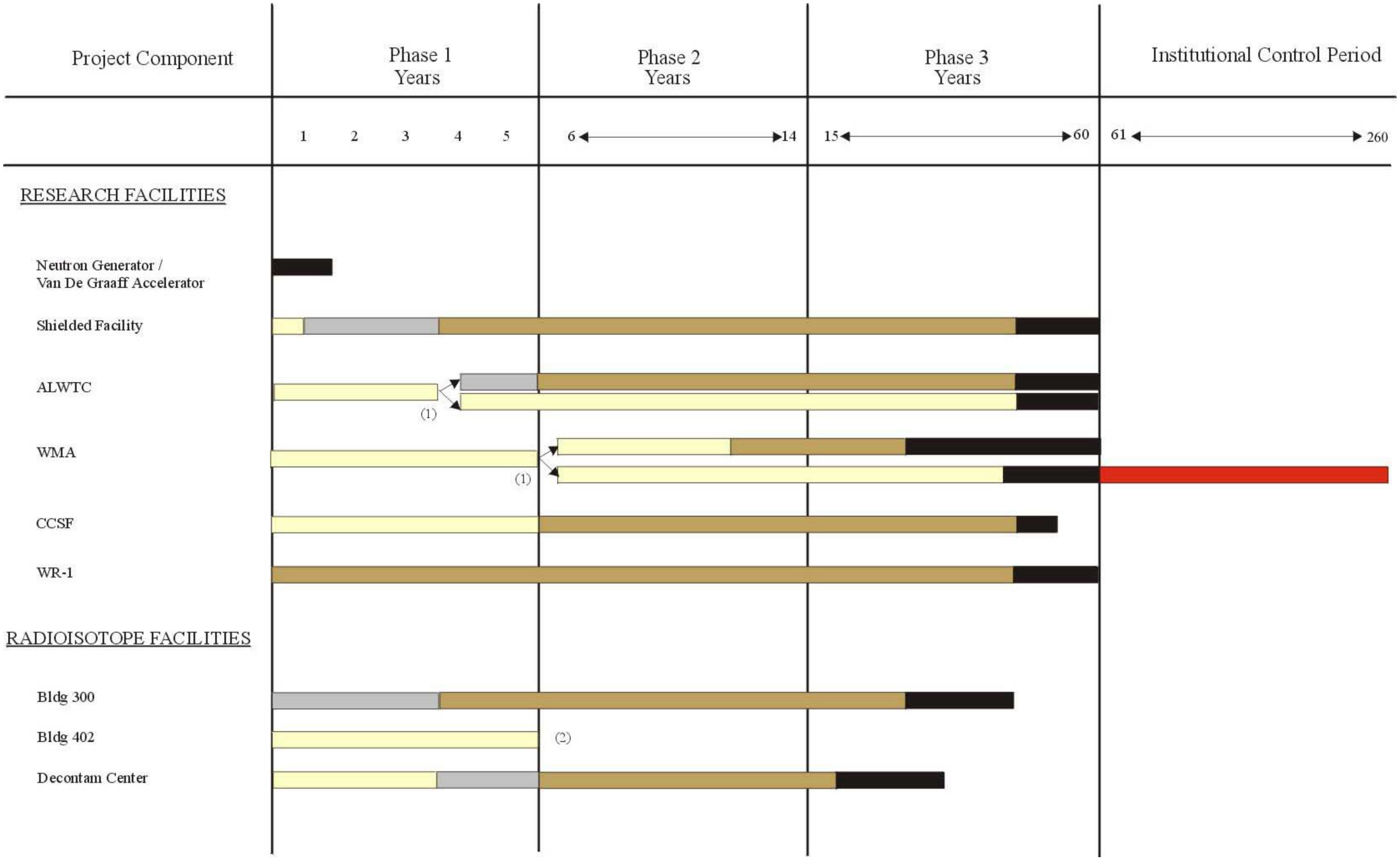
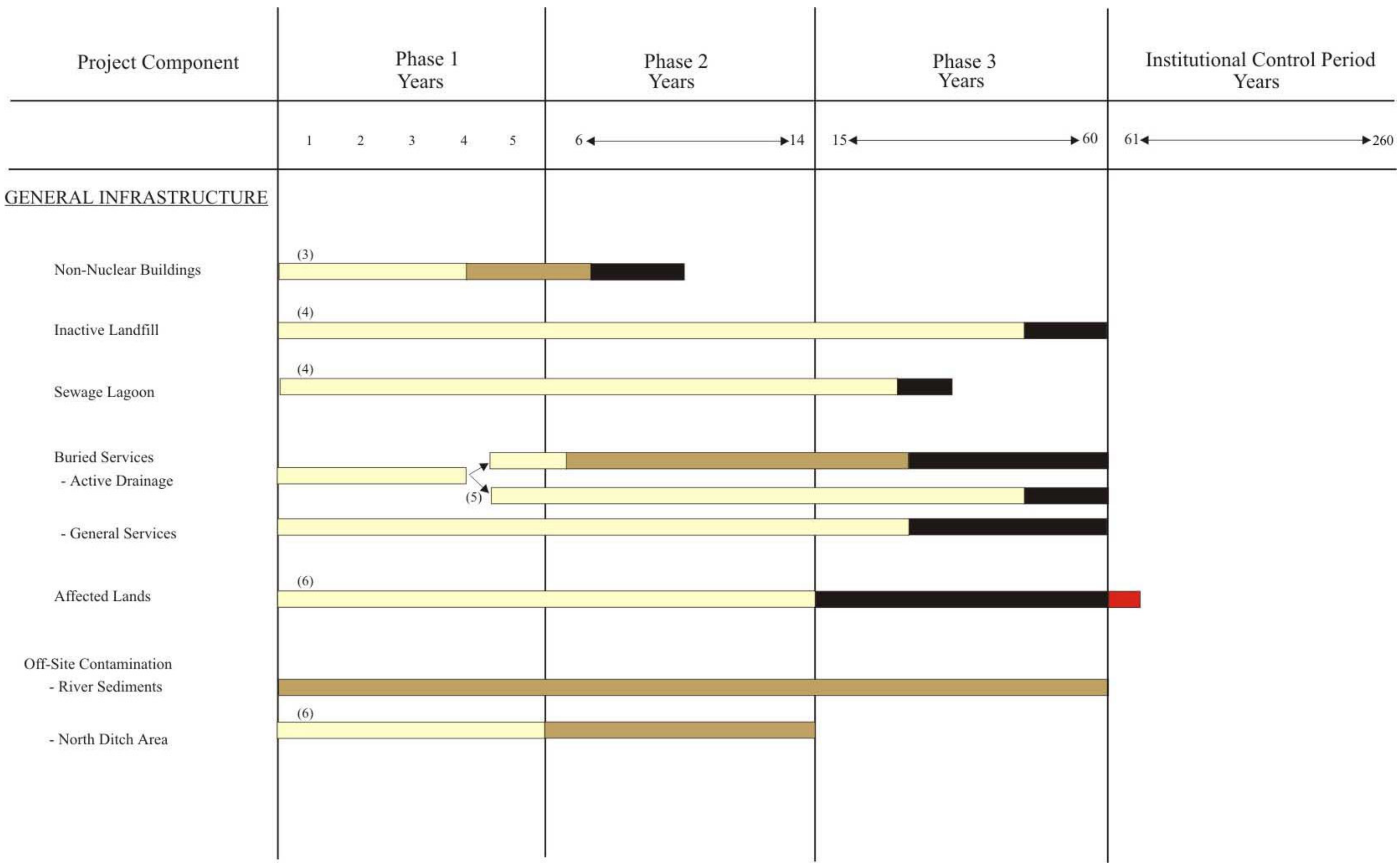


Figure 4.4 (continued)

Whiteshell Laboratories Decommissioning Project Component Timelines



Section 5.4.2: The following corrections should be made:

- Figures 5.8 and 5.10: the acronym 'AES' should be deleted from the caption.

- Figure 5.9: the caption should read 'Environment Canada/Whiteshell Laboratories wind rose, 1998 for 10 m height'.

- Page 5-15, the 2nd line of the 1st paragraph should be replaced with: 'Figures 5.7 to 5.10 show wind roses measured at 61, 25,10 and 6 m respectively. The data show an increasing percentage of calms and a shift to lower wind speeds as the surface is approached'.

- Page 5-15, in the last line of the second paragraph, the words 'coriolis forces' should be replaced with 'decreasing effect from friction'.

- Page 5-15, 3rd paragraph, 1st line: it should read 'Figure 5.9 …'

Section 5.4.3, the legend of Figure 5.12 should read 'carbonate rich clay till'.

Section 5.4.4,

- page 5-27, 1st paragraph under Project Study Area –WMA: The first sentence should read:

'Radioactivity of deep wells and water-table wells at the Waste Management Area (WMA) is monitored semi-annually'.

- The second sentence should be deleted.

Section 5.4.7, Figure 5.24: The unit cps should appear beside the isopleth bar on the right.

Section 5.5.2, page 5-51, under Sports Fishing, last line of 3rd paragraph: The word 'in' should be added between 'sport fishing has' and 'the general area'.

Section 5.5.2, Table 5.33, 2nd column beside Non-residents (Continued): the second item should read 'Expenditures related in whole or in part to sports fishing – Manitoba'.

Section 5.5.3, under Roads, 1st paragraph, 5th line: 'de' should be replaced with 'du' in Lac du Bonnet'.

Section 6.1.2, first sentence: the words 'the project on' should be added at the end of the sentence.

Section 6.3.4.2, 5th paragraph on page 6-17, the word 'confirmed' should be changed to 'supported'.

Section 7.3, Table 7.3: The word 'Criterion' should appear above the headings M, D, O, G and R.

Section 8.4, 2nd line: the word 'is' appearing between 'that there' and 'no measurable interactions' should be replaced with 'are'.

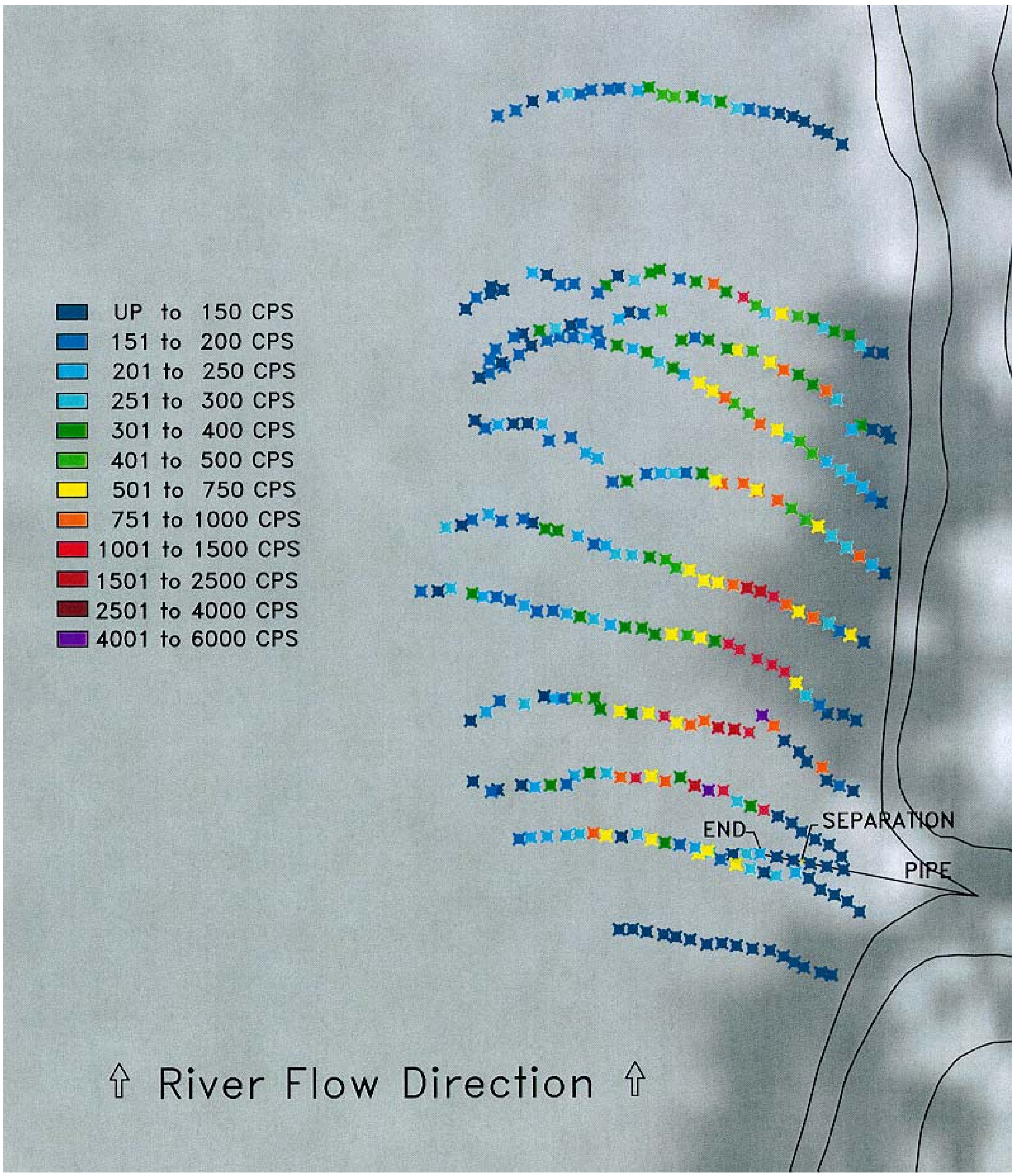
Section 9.3, the following changes should be made:

- Table 9.3: The column labeled 'tritium' should be deleted.
- Table 9.4: The column labeled 'gross alpha' should be deleted.
- Table 9.10, last footnote: 'Cloakroom' should be replaced with 'Coliform'.

2.2 COMPREHENSIVE STUDY REPORT, VOLUME 2: APPENDICES

<u>Appendix B-1</u>: A number of changes should be made, including:

- Figure 1 should be replaced with the following figure (North is to the top of page):



- Table 1: units of time for the half-lives appearing at the bottom of the table should be years for Cs-137, Sr-90, Cs-134, Co-60, and days for Ce-144 and Ru-106Table 6: The table caption should read: 'Activities are shown as Bq/g, with the corresponding 2 sigma error if the level was considered detectable. Shaded cells indicate non-detectable. The other radionuclides reported, Sr-90, Mn-54, Co-57, Co-58, Zn-65, Nb-94, Ag-110m, I-131, Cs-134, Ce-144, Eu-152, Pb-210, U-235, Np-237 and Am-241 were all non-detectable with 14-hour counts'.

- Table 7: The following words should be added to the table caption: 'The shaded cells highlight elevated levels with respect to background values'.

<u>Appendix B-3</u>: the following changes should be made:

- <u>Section B3.1</u>, last line of 1st paragraph: the word 'Safety' should be replaced with 'Study'.

- Figures 7 and 8: the unit 'cps' should appear beside the count bar to the right of the figures.

<u>Appendix C-1</u>: the following changes should be made:

- <u>Section C1.4.5.2</u>, 14th line: the dose should read 0.056 <u>m</u>Sv·a^{-1}

- <u>Section C1.4.4</u>, Table 4: For ^{137}Cs, the time to peak concentration at ditch should read 'Decays' instead of >200.

<u>Appendix F</u>

- Comment #178: In the response, the word 'vented' should be replaced with 'handled'.

- Comment #221: Rev. 1 Reference should be Section 5.3.<u>4.</u>

3.0 CLARIFICATIONS

3.1 COMPREHENSIVE STUDY REPORT, VOLUME 1: MAIN REPORT

Executive Summary: A numbers of clarifications should be made:

- page ES-4, 8th line of 3rd paragraph: The words 'more benign' should be replaced with 'fewer'.
- page ES-8, 1st bullet (Radioactive Emissions): add '(2.2 mSv/a)' at the end of the sentence.
- page ES-8, the last 2 lines under 'Soils and Groundwater' should be replaced with:

  'The site is underlain by soils, formed in discontinuous organic deposits, silt, silty clay, fine sand and clay till, overlying Precambrian bedrock'.

- page ES-16, Conclusions, 1st bullet: add: '(see section 6.3 to 6.5)' at the end of the sentence.

Glossary: Air Kerma: the definition should read: 'Kinetic Energy Release per unit mass' is approximation of dose from gamma radiation.

Section 1.4.1.3, 1st paragraph should read:

'The Fisheries Act is administered by the Ministers of Fisheries and Oceans Canada and Environment Canada'.

Section 2.3.1.3: The following sentence should be added to the end of the paragraph:

'While the URL lies within the local study area it is not part of the scope of the decommissioning project'.

Section 2.3.2, last paragraph should be corrected to:

'In addition to the time frame of the project as described above, the temporal boundaries of the assessment were considered to be flexible to ensure that the duration of any effects beyond the project time frame would be fully characterized'.

Section 3.2.2, under 'Institutional Control Period', the following sentence should be added to the end of the paragraph:

'As stated in section 1.5, AECL commits to maintaining an environmental monitoring program for as long as waste requiring management remains at the WL site. Where alternative management responsibility for WL becomes necessary, AECL will ensure that the responsibility for monitoring or controls, that extend into the institutional control period, be transferred to another suitable government organization before relinquishing responsibility for the site'.

Section 4.2.2, under Institutional Control Period, the following information is added to clarify the rationale for the 200-year institutional control period:

'The rationale for the 200-year institutional control period following the 60-year project period is based on both benchmarking with other programs and an analysis of Cs-137 and Sr-90 inventories. Because of radioactivity decay, the concentrations decrease with time. Taking the trench with the highest inventory of Cs-137 and Sr-90, and computing the concentrations in these trenches, it would take 267 years from emplacement to reach the IAEA clearance levels for Cs-137 (IAEA 1996, Clearance levels for radionuclides in solid materials, Application of exemption principles, Interim report for comment. IAEA-TECDOC-855, Vienna, Austria). The Sr-90 reaches clearance levels much sooner. This analysis is conservative because these clearance levels are established for any use of the trench contents (gardening, recycling, etc), and no dilution by migration away from the trench is assumed.

Consequently, the planned institutional control period is 200 years following the 60-year project period'.

Section 4.3.1: Additional information regarding the enhanced monitoring program and future assessments is provided below under section 9.5.2. The proposed enhanced monitoring program and assessments for the WMA results in adjustments in the decommissioning approach for this component of the project.

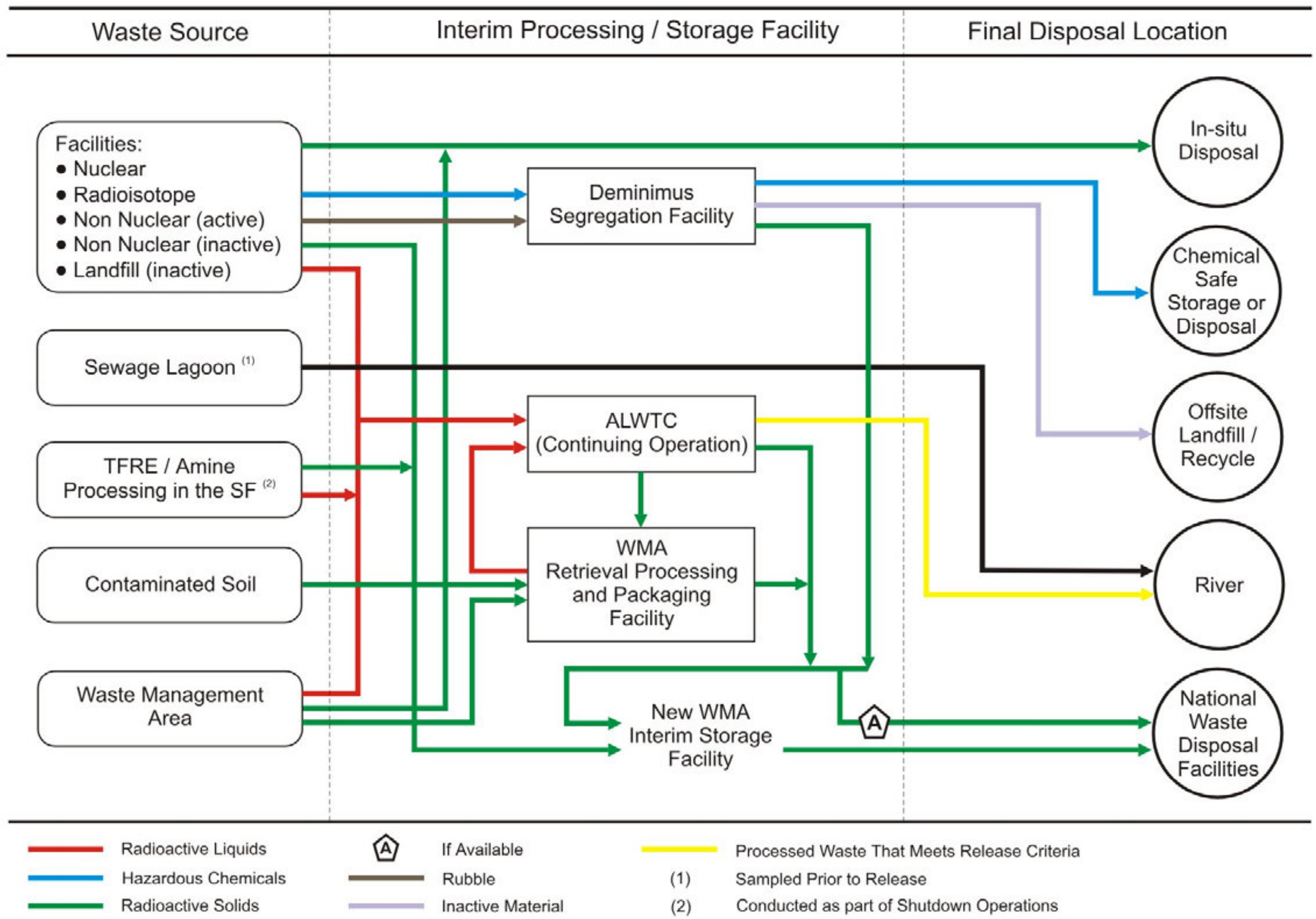
Section 4.3.3: under Sewage Lagoon, a) Description: add after the second sentence of the 1st paragraph:

'The primary settling lagoon is located west of the secondary lagoon'.

Section 4.5.4: Figure 4.5 should be replaced with the following figure. The figure was modified to show a link from the waste management area to in-situ disposal. The in-situ disposal option will apply to selected low-level waste trenches.

FIGURE 4.5

PROJECT WASTE STREAM AND INTERIM HANDLING FACILITIES



Section 6.3, the following lead-in paragraph should be added immediately before section 6.3.1:

'This section provides a systematic assessment of the potential effects of the project on biophysical components, workers and public health and socio-economic components. The section follows the outline provided in section 6.1.2'.

Section 6.3.6.2, last sentence of page 6-21: The sentence should be re-phrased to: 'Benthic species are important but many are short-lived'.

Section 6.3.8, 1st paragraph, the 2nd and 3rd sentences should read:

'Activities that could potentially affect public health were reviewed to determine if it was possible for contaminants to reach off-site human receptors via the air, water or the food chain. Further analysis, such as estimation of radiation dose and other measures of exposure, was carried out to estimate the risk of significant health effects where such processes were deemed possible'.

Section 6.3.9, 1st paragraph should read:

'The Canadian Environmental Assessment Act requires consideration of the environmental effects from the project. The environmental effects include any change that the project may cause in the environment, including any effect of such change on health and socio-economic conditions. With respect to socio-economic conditions, only the effects caused by a change in the environment due to the decommissioning project can be considered in the CSR'.

Section 6.3.9.3, 1st paragraph should read:

'As mentioned above, the economic impacts were assessed in the context of the federal environmental assessment regime. The economic impacts considered were those caused by a change in the environment due to the decommissioning project. Therefore, the economic effects resulting from the closure of the Whiteshell Laboratories were not considered here'.

Section 6.7.1.1: the first sentence of the 3rd paragraph under 'Winnipeg River and Shoreline' should be deleted.

Section 7.1, under Aquatic Biota, last line: The sentence should be re-worded to:

'Based upon present understanding, existing contamination in Winnipeg River sediments, and anticipated contamination associated with future activities, is unlikely to affect aquatic biota (section 6.3.6)'.

Section 9.5.2: Additional details on the commitments for the enhanced monitoring program and future assessments for the Waste Management Area are presented below in response to CSR Rev. 2 review questions/comments:

'AECL's general strategy for the WMA is to manage wastes within existing storage structures until off-site disposal becomes available. An exception to this approach that is noted in the CSR is the early retrieval (within ~ 10 years) of irradiated fuel from the standpipes (Section 4.3.1). In addition, as noted in the CSR, AECL has committed to the retrieval of certain wastes from the trenches, not considered suitable for in-situ disposal (Sections 4.3.1 and 6.3.4.2 and Appendix C). Retrieval of this waste has been planned for Phase 3 of the project, consistent with assumptions on LLW disposal availability (within 25 years) as follows:

- Arsenic from trench 1;
- Irradiated reactor components from trench 6
- Soil and waste contaminated by WR-1 waste water in trench 10, and
- Waste containing Tc-99 from trench 16.

In response to comments received on Rev. 2 of the CSR and to clarify AECL's plans with regard to the WMA, AECL commits to the development and implementation of an enhanced monitoring program to confirm and build on the understanding of the hydrogeological system at and in the immediate vicinity of the WMA. Also, AECL further commits to carrying out assessments of the fitness-for-service of the waste storage structures that AECL plans to continue to use for storage during the decommissioning project, and the recoverability of certain non-radioactive wastes from the trenches. The purpose of these activities is to confirm and build on the understanding of the site, to assist in determining the timing of WMA remedial work, and to contribute to the final safety assessment for planned in-situ disposal of LLW trenches. The three activities are described in greater detail below.

Enhanced monitoring program

The continued use of existing in-ground storage structures until off-site disposal facilities become available and the plan to convert most of the LLW trenches to in-situ disposal are based to a large degree on the understanding that ground water flow at the WMA is generally directed upward, and that the surficial geology provides for significant containment of any contaminants that leak from the structures or are leached from the trenches. As such, an enhanced monitoring program will be implemented to confirm the hydrogeological flow model for the WMA that is described in the CSR. This will involve drilling new monitoring wells and, where possible, using or refurbishing existing monitoring wells to provide a sufficient understanding of the ground water flow regime at the WMA and in the immediate vicinity of the WMA, including the spatial distribution of hydraulic head and flow directions, patterns and rates. Siting of new, monitoring wells will be designed to assess the extent of any contaminant migration around the structures and trenches. The existence of contamination would provide indications of areas where the integrity of storage facilities may have been breached.

The data collected and findings from the enhanced monitoring program will also be used in the development of safety assessment models in support of the safety case for converting the LLW trenches into in-situ disposal facilities.

Fitness-for-service assessment for existing waste storage structures

In addition to the monitoring work around the storage structures described above, AECL will compile and assess the various waste types, characteristics, forms, and containers and the various storage structures and conditions to evaluate whether the existing storage methods can be expected to provide adequate protection of health, safety and the environment until disposal facilities become available. This will include a detailed analysis of the available inventory records and information on the MLW and HLW stored in WMA facilities to better define the inventory of these wastes, and an assessment of the impacts of continued storage in the existing structures on the ease of waste retrievability. Also, the monitoring requirements to verify that the storage structures continue to provide adequate containment will be identified. The results of the enhanced monitoring program and the fitness-for-service assessment will be used to determine the priorities and timing of remedial work for the WMA, and whether any of the existing storage structures will need to be upgraded or replaced.

Assessment of the recovery potential of non-radioactive wastes in the trenches

As documented in Appendix C.1 and C.2 of Rev. 2 of the CSR, lead and drums of several organic contaminants are known to have been buried in the LLW trenches. The argument that it is acceptable to leave these contaminants in place is based on the assumption that the drums no longer provide for the containment of the organic wastes, and the assumption that the wastes either have low mobility (concentrated organic residue and lead) or would have degraded and dispersed by the end of Phase 3 such that appropriate clean-up criteria will be satisfied (DDT, glycol and solvents). To confirm these assumptions, AECL will assess the recovery potential of the drums (i.e.; assess whether the drums are intact) and other wastes (e.g.; lead) that are listed in Schedule 1 of the Canadian Environmental Protection Act (CEPA) through the use of techniques such as ground penetrating radar and terrain electrical conductivity measurements. The need for recovery of the lead and drums of organic wastes or further monitoring or remediation of these trenches will depend on the results of the investigations. If the drums have in fact been breached, AECL will conduct monitoring to confirm that contaminant concentrations are within acceptable ranges as part of the safety case for converting the trenches to in-situ disposal. Similarly, if wastes such as lead that are listed in Schedule 1 of the CEPA are to be left in place, AECL will need to perform monitoring to confirm that contaminant concentrations are within acceptable ranges.

Schedule

AECL commits to implementing the enhanced monitoring program for the WMA in the first two years of Phase 1. Furthermore, AECL commits to carrying out the assessments of the fitness-for-service of waste storage structures and the recoverability of non-radioactive wastes from the trenches in the first three years of Phase 1. AECL will report on the results of the assessments when they are completed, and a suitable frequency will be determined for reporting the findings and analytical results from the enhanced monitoring program. AECL further commits to collecting and analyzing the data to confirm a schedule for WMA remedial work by the end of Phase 1 (~ 6 years)'.

<u>Section 9.6</u>, the 2nd paragraph requires the following changes:

2nd sentence should read:

'With the exception of sediment monitoring, cessation of a monitoring activity will occur once it can be shown that an effect has stabilized or has been reduced to a level below regulatory concern or below other standards such as community concerns'.

The last sentence should read:

'Modifications to the monitoring program will be submitted to the CNSC for approval prior to implementation'.

3.2 COMPREHENSIVE STUDY REPORT, VOLUME 2: APPENDICES

Appendix C-1: page C1-30: The following paragraphs should be inserted immediately after the bullets:

'Most fission products (i.e., Sr-90, Cs-134, Cs-137, Fe-55, Co-60, Sb-125, Pm-147) will have decayed to background levels by the time the institutional control period ends, and thus these radionuclides will not be of concern during the post-institutional control period. Further, the trench containing Tc-99 (trench 16) will be remediated, and thus this long-lived radionuclide will not be of concern during the post-institutional control period.

The long-term impacts of the actinides (see Table 9 of Appendix C2) and other long-lived radionuclides (C-14, Ni-59, Ni-63, Nb-94 and Ra-226) will need to be rigorously assessed against the requirements in Regulatory Policy Statement R-104 in the final safety case for in-situ disposal. Because the transport of most of these radionuclides in clay soil is limited, it is expected that intrusion scenarios into the trench environment will be the most important with regard to the assessment of long-term safety. The actinide inventory used in the preliminary assessment in the CSR is an upper-bound estimate, and thus it will be important to refine the inventory data for the actinides and long-lived radionuclides for the final safety case calculations for in-situ disposal. AECL will fully utilize the 60-year project period, and particularly the remediation of trenches 1, 6, 10 and 16, to:

- collect additional information to better characterize the inventory of actinides and other long-lived radionuclides in the trenches,
- further assess the potential impacts of these radionuclides on human health and the environment for the period of time after institutional controls end, and,
- confirm that $^{14}CO_2$ in soil pore water does in fact diffuse to the atmosphere (remediation of trench 1, which contains 55% of the documented C-14 inventory, will provide key data)'.

Appendix C-2: page C2-12. The following text should be added after the first paragraph:

'Appendix C2 Table 2 summarizes the data contained in the WMA log monthly reports. Radionuclide specific data were only recorded for non-routine waste shipments, most of which originated in laboratories where specific contaminants were used for experiments. Approximately 85% of the recorded total trench activity was from routine waste shipments, which were reported simply as fission, corrosion or activation products. Standard radionuclide mixtures were developed to convert the recorded activity levels for these generic classifications to radionuclide specific estimates.

The derivation of the original dose rate to activity conversion formula, and the methodology used to perform the waste characterization, were assessed to identify any potential errors with the original activity estimates and to determine an upper bound value for the screening assessment. The

Microshield simulation was performed to assess the accuracy of the original formula by modeling a standard waste package geometry with the reference radionuclide mixtures.

The fission product mixture was based on a reference burn-up CANDU fuel bundle decayed to 500 days to be consistent with the original assumption on the age of typical routine waste contaminants. The corrosion/activation product mixture was based on analysis results from the WR-1 decommissioning project corrected to the date when the reactor was shut down. These reference mixtures include significant radionuclides not identified in the original documentation, such as Fe-55, Ni-59, Ni-63, Nb-94, Sb-125, Cs-134 and Pm-147. The resulting ratio of each contaminant was then multiplied by the recorded activity levels for each general classification and decay corrected to January 2001. An upper bound correction factor of 10 times the recorded inventory was used to provide the final upper bound inventory estimate'.

Appendix C-2: References

The reference list in this section needs revision. The revised reference list, which correctly organizes the references in the order they appear in Appendix C2, follows. Although this corrects most of the deficiencies, it is acknowledged that some references in the text are listed by author rather than by number. The references do however appear in the correct order.

References

1. J.M. White, "Radiation and Industrial Safety Manual, Part 1 – Health Physics," Chalk River Nuclear Laboratories Manual, CRNL-356 (1971, 1977 & 1982).

2. H.M. Johnson, "Revision of Active Waste Disposal Procedures," Memorandum, RIS-78-125 (1978) (includes revision to WEP-75-123 "Whiteshell Nuclear Research Laboratories Procedures for Active Waste Disposals from Research Laboratories").

3. E.J.K. Cowdrey, "Principles and Practices for the Safe Handling of Radioactive Materials in WNRE Laboratories," Whiteshell Nuclear Research Establishment Report, WNRE-490 (1980).

4. A.L. Powaschuk, "Waste Management Area Guidelines for Surveyors," Whiteshell Nuclear Research Establishment Report, WNRE-617 (1985).

5. R.A. Helbrecht, "WNRE Waste Management Area Safety Analysis Report," Whiteshell Nuclear Research Establishment Report, WNRE-327 (1985).

6. J.W. Barnard, E.J.K. Cowdrey, C.P. Brown and W.P. Brown, "Radiation Protection Manual – Whiteshell Nuclear Research Establishment," Whiteshell Nuclear Research Establishment Report, WNRE-659 (1985).

7. P.C. Jay to C.A. Mawson, "Technical Memorandum – Practical Measurement of Radioactive Content of Low-Level Waste Packages," (circulated 1 November, 1973), Attachment 9 of CRNL-974-4, "Minutes of the Fourth Meeting of the Chalk River Environmental Panel Held in the Conference Room of Building 513 at 0830 Hours January 3, 1974"

8. C.A. Mawson, "Standardisation of Low-Level Waste Bag Activity Measurement," Memorandum to J.A. Morrison, 20 February, 1973, AECL Biology and Health Physics Division Environmental Research Branch.

9. B. Kowalchuk and S. Carter, "WR-1 Radiation Contamination And Air Sample Results," Memorandum to M. Berry, RIS-91-318 (1991).

10. J. Bedford, "WR-1 Waste Categorization," Memorandum to B. Helbrecht, RIS-92-251 (1992).

11. J. Bedford, "WR-1 Waste Categorization Fields at 30 cm and Small Crates," Memorandum to B. Helbrecht, RIS-92-382 (1992).

12. J. Bedford, "WR-1 Process Drain Line Contamination Activity Estimate," Memorandum to B. Helbrecht, RIS-94-86 (1994).

13. J. Bedford, "WR-1 Radionuclide Inventory," Memorandum to B. Helbrecht, RIS-94-303 (1994).

14. H. McIlwain, "Total Radioactive Inventory of the Remaining Core Components for the WR-1 Reactor," Technical Note, SAB-TN-443 (1992).

4.0 ADDITIONAL INFORMATION

4.1 COMPREHENSIVE STUDY REPORT, VOLUME 1: MAIN REPORT

Glossary: The following definition should be added:

'Beta radiation: Ionizing radiation with a medium penetrating ability. Beta particles can be stopped by aluminum foil or several centimeters of wood'.

Section 4.1: The following text and figure should be added to the end of the section.

'Figure 4.1(a) shows the location of the Concrete Canister Storage Facility in relation to the Waste Management Area and the Laboratory Site'.

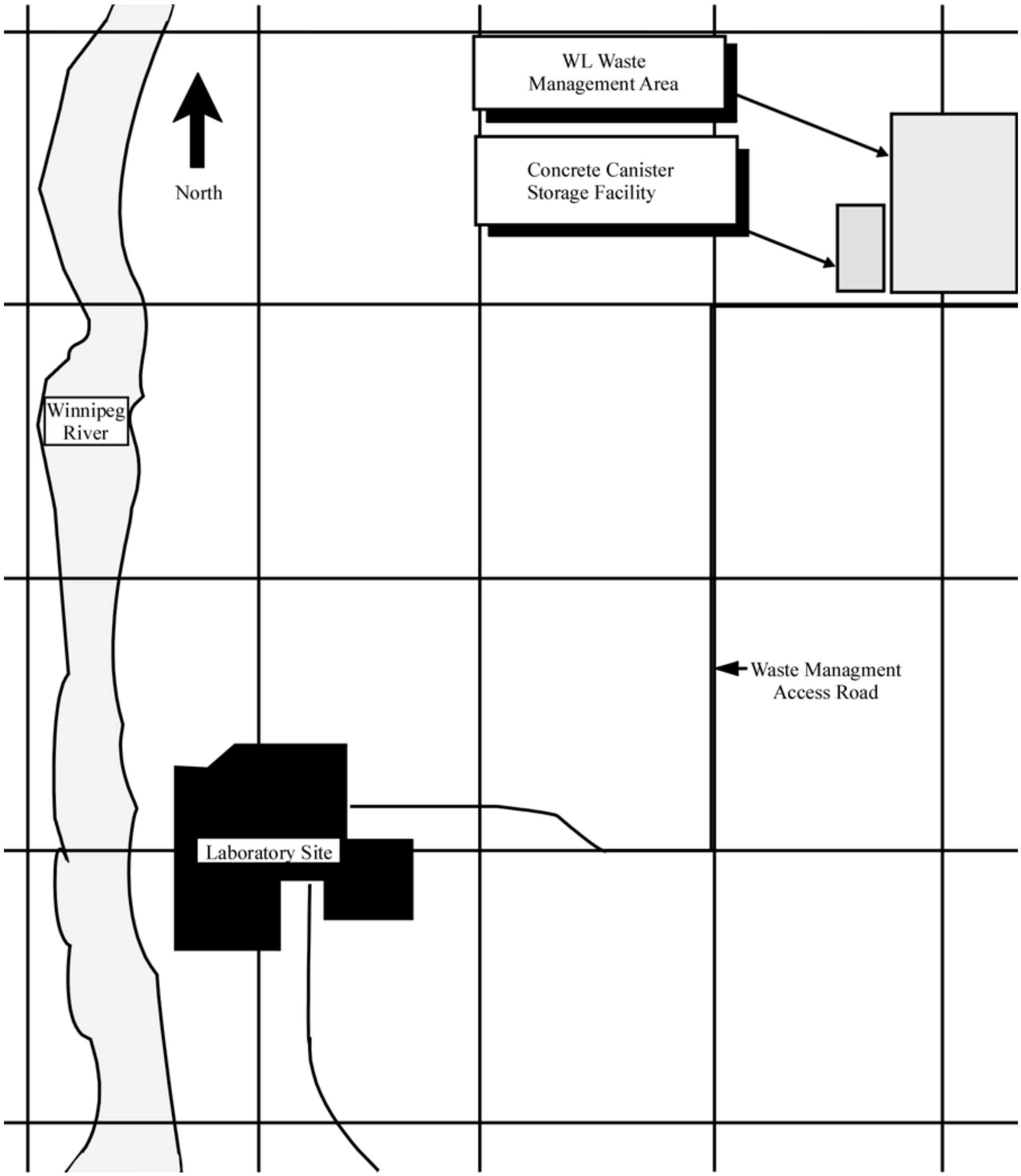


Figure 4.1(a) Location of the Concrete Canister Storage Facility

Section 4.3.3, Buried Services, 1st paragraph on page 4-24 following the bullet. Add the following sentence before the last sentence:

'The Cs-137 levels measured in grasses and alfalfa between 1988 and 1991 varied between 0.33 to 13.9 Bq/g, while the Sr-90 levels ranged from 14 to 120 Bq/g (fresh weight)'.

Section 4.5.2: In addition to the information provided in that section, AECL commits to analyze the waste recovered from the low-level waste trenches identified for remediation. The information will be applied to refining the accuracy of the remaining waste inventory.

Section 5.4.4: Tables 5.16 and 5.17 were revised to add gross alpha and background radioactivity data for wells in the WMA. Wells listed in Table 9.6 are monitored for gross beta and gross alpha contents semi-annually. If a given well is dry at the time of sampling, a suitable alternative would be identified and sampled to ensure that the monitoring requirements stipulated in AECL's environmental protection program are met.

Table 5.16
Total Beta and Total Alpha Activity in Wells at the WMA, 1999

	Number	Gross Beta (Bq/L)			Gross Alpha (Bq/L)		
	of Tests	**Maximum**	**Minimum**	**Average**	**Maximum**	**Minimum**	**Average**
Waste Management Area							
Water-Table Wells	16	0.70	0.13	0.34	0.19	0.08	0.16
Deep Wells	32	0.73	0.04	0.26	1.54	0.10	0.46
Background							
Water-Table Wells	4	0.95	0.27	0.61+	< 1.7*	< 0.18*	< 0.94*
Deep Wells	18	1.32	0.17	0.36+	0.87	0.13	0.40

+ When comparing WMA samples to background samples, it should be noted that the gross beta values are near the limit of detection and therefore, have an inherent relatively high uncertainty. The lower precision in these sample results was attributed to a new supply of plastic that generated an unusually high amount of ash in the samples. * This increased both the detection limit and the uncertainty in the results.

Table 5.17
Average Total Beta and Total Alpha Activity in Wells at WMA

	Gross Beta (Bq/L)					Gross Alpha (Bq/L)				
	1995	1996	1997	1998	1999	1995	1996	1997	1998	1999
Waste Management Area										
Water-Table Wells[1]	0.52	0.43	0.35	0.41	0.34	0.16	0.26	0.13	0.43	0.16
Deep Wells[2]	0.28	0.24	0.38	0.20	0.26	0.12	0.07	0.08	0.23	0.46
Background										
Water-Table Wells[3]	0.34	0.10	0.69*	0.54*	0.61*	0.06	0.03	0.10	0.12	< 0.94[+]
Deep Wells[4]	0.18	0.14	0.14	0.32*	0.36*	0.05	0.05	0.03	0.16	0.40

* When comparing WMA samples to background samples, it should be noted that the gross beta values are near the limit of detection and therefore, have an inherent relatively high uncertainty.
[+] The lower precision in these sample results was attributed to a new supply of plastic that generated an unusually high amount of ash in the samples. This increased both the detection limit and the uncertainty in the results.

[1]The WMA water-table wells monitored include:

T01, T03, T04, T05, P61-1, P62-2, P63-3, P64-1.

[2]The WMA Deep wells monitored include:

S01, S03, S04, S05, S10, S12, P61-2, P61-3, P62-3, P62-1, P63-1, P63-2, P64-2, P64-3, P23,
P6-5, P6-13.

Those WMA wells are shown on figure 9.0 (c) (see below).

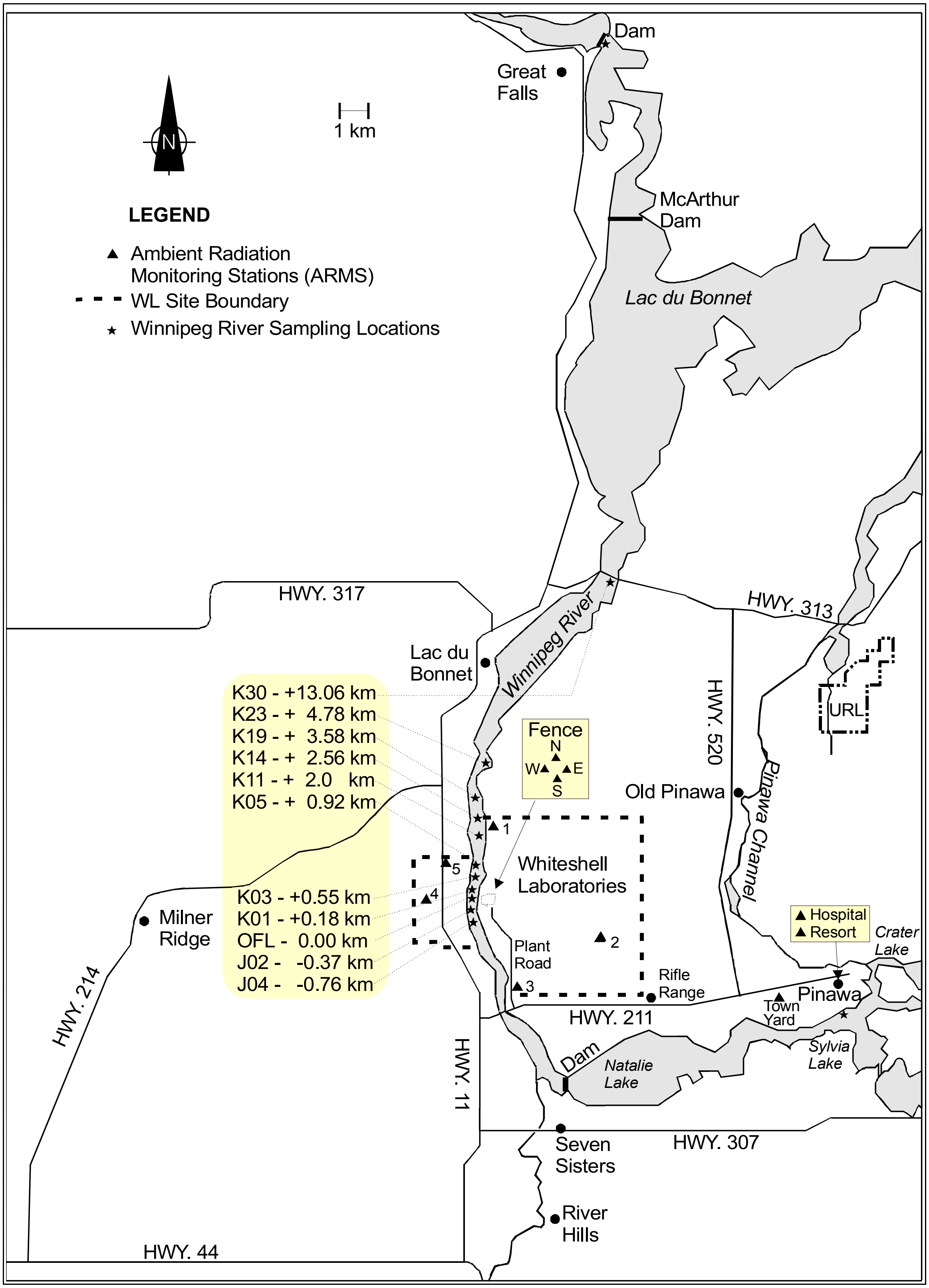
[3]The background water-table wells are located in the FIG Area (see Figure 2.1 of the CSR).

[4]The background deep wells are also located east of the WMA in the upland recharge area. Most of those wells are located in FIG and ZEUS area (Figure 5.13 of the CSR).

Section 6.3.4.2, the following sentence should be added on page 6-18 following the bullets:

'During the follow-up program, further work will be required to confirm the understanding of the groundwater flow regime at the WMA that was developed in the 1980s (Cherry and Robertson, 1988)'.

Sections 9.3 and 9.4: A number of maps showing river sampling locations as well as surface water and groundwater sampling locations near the Waste Management Area need be added to this section.



Figures 9.0 (a) Whiteshell Laboratories and Surrounding Area Monitoring Stations

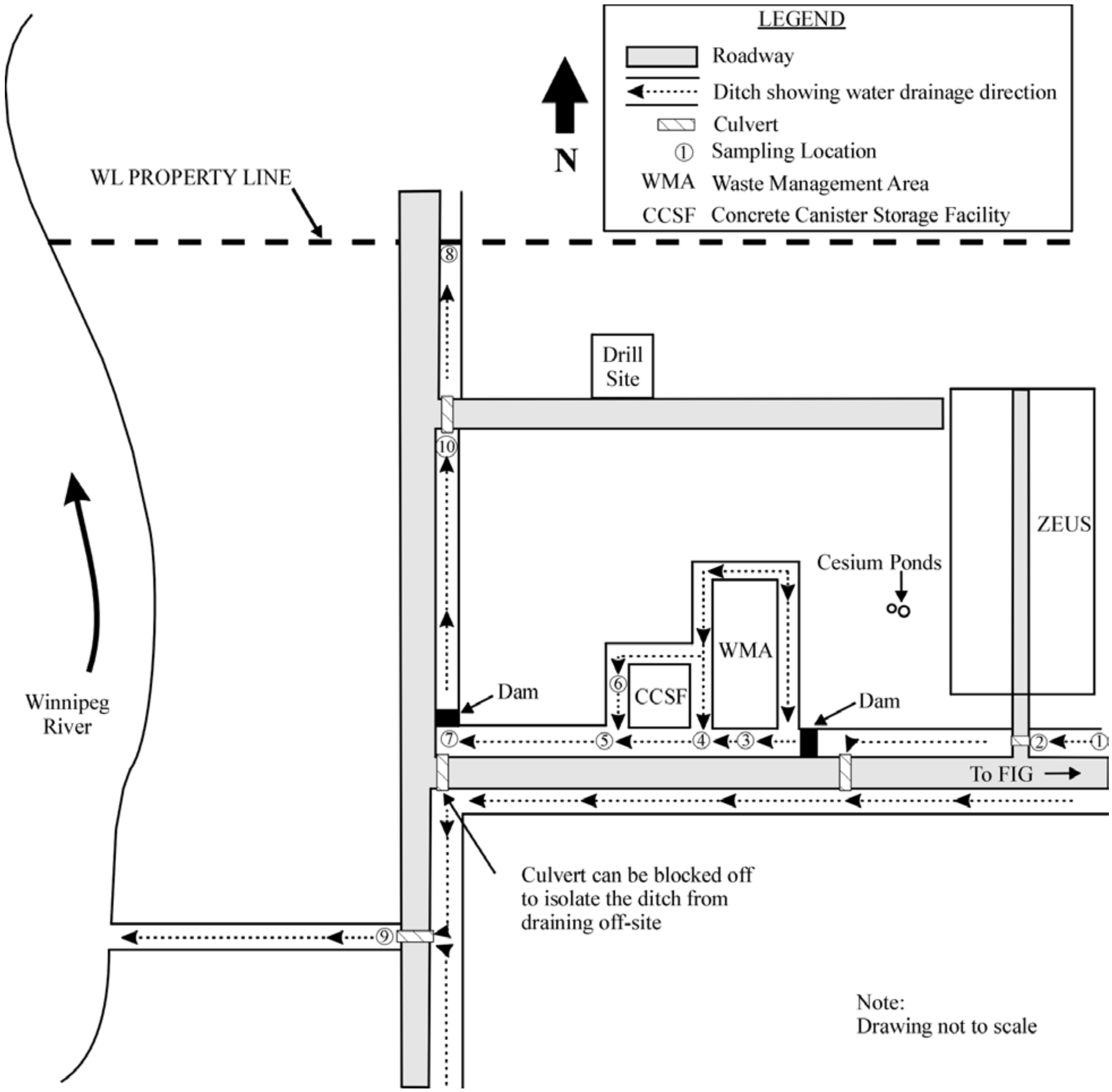


Figure 9.0 (b) WMA Surface Water Run-Off Sampling Locations

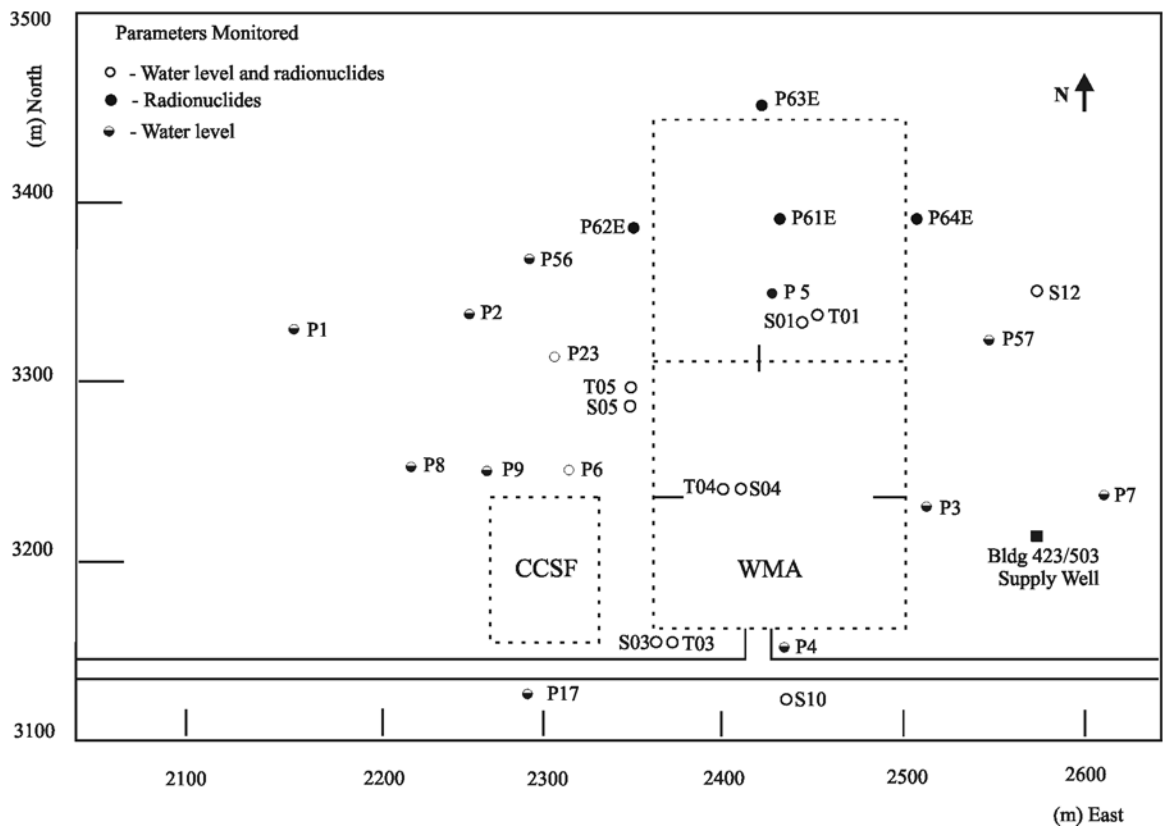


Figure 9.0 (c) WMA Groundwater Monitoring Locations

<u>Section 9.5</u> Follow-up Monitoring and Surveillance for Decommissioning

The following sub-section should be added:

Section 9.5.5 Follow-up Monitoring for the Winnipeg River Sediments

Also in the fall of 2000, a detailed assessment of the potential impact of the contaminated sediments at and below the outfall was conducted. The objective of the assessment was to determine the potential impact on aquatic biota and humans. Details on the assessment are provided in Appendix B and the main results summarized in section 6.3.6.

It was concluded that the sediments were unlikely to cause any significant adverse effects even when considering the anticipated releases to the river during the decommissioning of the laboratories.

However, to provide assurance that the conclusion remains valid over the life of the decommissioning project, additional follow-up monitoring activities are proposed.

In addition to the routine monitoring of the sediments described in section 9.3 and summarized in Table 9.5 of the main report, the following sampling and analysis will be carried out:

- Sediment cores will be obtained in depositional areas upstream of the following dams: Powerview (see Figure 2.3 of CSR), Great Falls McArthur Falls and Seven Sisters Falls (see Figure 9.0 (a),
- Effort will be made to collect cores long enough to capture ^{137}Cs bomb-fallout,
- Cores will be sliced in short sections and analyzed for radiological and non-radiological contaminants
- Initial sampling above those dams will be undertaken during Phase 1 of the project and repeated at the same locations 20, 40 and 60 years later.

The details of the sediment follow-up monitoring program must be approved by the CNSC and DFO prior to implementation.

<u>Section 10.3</u> CEAA-Related Public Consultation Activities

Consultation activities continued after the submission of Revision 2 of the Comprehensive Study Report in March 2001.

The main activities included a presentation to the Technical Advisory Committee (TAC) of Manitoba Conservation on March 16, 2001 and an open house held in Pinawa on April 4, 2001. The main goal of those activities was to highlight the changes to the CSR and initiate the review of the revised document. Attendance at the open house was about 25 persons.

“Comments received subsequent to the presentation and open house are incorporated in the appendix of this addendum.”

4.2 COMPREHENSIVE STUDY REPORT, VOLUME 2: APPENDICES

Section C1.4.2.3: The following should be added at the end of the section:

In the screening calculations, it should be noted that a flow path capacity factor, K*p*, rather than a retardation factor, R, is employed. In this approach, the average linear velocity, retardation factor and dispersion coefficient are multiplied by the porosity so the variables used are the Darcy velocity, the capacity factor and the product of the dispersion coefficient and the porosity. This is called the intrinsic dispersion coefficient.

Using capacity factors and Darcy velocities has advantages. The Darcy velocity comes directly from the application of Darcy's law and is a more direct way of determining velocity. Capacity factor gives the ratio between the total amount stored in the water plus sorbed per unit volume to the concentration in water. It can be obtained more directly from in-diffusion and through diffusion experimental results without relying on notoriously inaccurate batch Kd results. Further, the bulk dry density of the material is used. This term is independent of the volume of the flow path. The Kd was adjusted in some of the sensitivity calculations to take into account that only a fraction of the clay might be participating in the sorption along the flow path.

The solution to the equations for the concentration in the trench as a function of time, *t*, is:

$$C = \frac{M_o}{VK_t} \exp\left[-\left(\lambda + \frac{Aq}{VK_t} \right) t \right]$$

To obtain the concentration of the radionuclide at a distance x in the flow path from the trench to a discharge point, the concentration within the trench as a function of time was incorporated into the response function of Heinrich and Andres (1985):

$$C(x,t) = \frac{M_o}{VK_t} \exp(-bt) \int_0^t \exp(bt')G(x,t')dt'$$

Where:

$$G(x,t) = \frac{x\sqrt{K_p}}{2\sqrt{D\pi t^3}} \exp\left[\frac{qx}{2D} - \left(\frac{q^2}{4DK_p} + \lambda \right) t - \frac{x^2 K_p}{4Dt} \right]$$

and

$$b = \lambda + \frac{Aq}{VK_t}$$

$$K_p = \varepsilon_p + \rho_p P_p$$

$$D = D_o \varepsilon_p \tau + \alpha_L q$$

Here:

ε_p is the porosity along the flow path,

D_o is the free water radionuclide diffusion coefficient,

τ is the tortuosity factor for the flow path,

α_L is the longitudinal dispersion length for the flow path,

ρ_p is the dry bulk density for the flow path, and
P_p is the distribution coefficient for the flow path,

The model described above, and used for this assessment was formulated and parameterized to ensure that both transport and sorption occurred primarily in the clay fractures as opposed to the bulk media. To achieve this, an effective hydraulic conductivity that represents the fractures of 6.3 x 10^{-2} m a^{-1} (2 x 10^{-7} cm s^{-1}, Grisak and Cherry, 1975) was used to compute the water flux. This was the hydraulic conductivity used by Grisak et al. (1980) in preparing their dual-porosity model for application to actual WNRE clay till block tracer test (Grisak and Pickens 1980). Also, a fracture porosity of 2 x 10^{-5} m^3 m^{-3} was used to calculate both the flow path capacity factor, *Kp*, and the intrinsic dispersion coefficient, *D*. If we had assumed that flow was primarily within the bulk media, then the bulk porosity selected would have been 0.49 m^3 m^{-3}, in keeping with a bulk density of 1350 kg m^{-3}. Depending on which porosity is used, a calculated retardation factor of 675 (fracture) or 675,000 (bulk media) would be found. Similarly, a sorption coefficient should be chosen to represent the bulk clay loam till. The value used in this assessment may be more representative of the bulk sorption coefficient than a true fracture sorption situation and may be too large, however we used the same Kd value (10 to 27 L/kg from Mills and Zwarich (1980)) used by Grisak et al. (1980) in their model validation on the WNRE clay block.

In actual fact, as has been pointed out already, both sorption and transport are probably occurring in both the fractures and the bulk media of this subsoil clay, making this a dual porosity system. Although fractures can increase the velocity of water flow through the media, it is important to account for matrix diffusion and its role in contaminant transport. Matrix diffusion slows the arrival of the solute at any point along the fracture.

It must be noted that this analysis assumes that fractures are horizontal, not vertical as observed in the field and assumes a degree of continuity that does not exist, making this assessment very conservative. It must also be noted that as the transport slows and the sorption increases, the effect of the 30-year half-life (using Sr-90 as an example) becomes the important driver in determining the final concentration at any location.

The next appropriate step would be to determine the proportion of the sorption and flow in each media type, fracture and bulk soil, properly measure and/or estimate the site-specific parameter values and then revise the model appropriately or choose a new model and recompute the travel times and final subsoil radionuclide concentrations. If flow and sorption in fractures are confirmed to be the most important paths through a thorough site investigation, then it would be appropriate to determine Ka's, sorption coefficients based on surface area as opposed to mass and use this in the present model. This step is reserved for a more detailed assessment to be based on additional site data collected as part of the follow-up monitoring program.

<u>Section C1.7</u>: the following references should be added to the list:

Grisak, G.E. and J.F. Pickens. 1980. *Solute transport through fractured media 1. The effect of matrix diffusion.* Water Resources Research 16:719-730.

Grisak, G.E., J.F. Pickens and J.A. Cherry. 1980. *Solute transport through fractured media 2. Column study of fractured till.* Water Resources Research 16:731-739.

Appendix

Responses to Public and Technical Review Comments on the Draft Comprehensive Study Report on the Whiteshell Laboratories Decommissioning Project, Rev.2, March 2001.

APPENDIX
RESPONSES TO PUBLIC AND TECHNICAL REVIEW COMMENTS ON THE DRAFT COMPREHENSIVE STUDY REPORT ON THE WHITESHELL LABORATORIES DECOMMISSIONING PROJECT, REV.2, MARCH 2001.

Comment Number	Comment By	Summarized CNSC Comment	CSR Rev.2 Reference	Response	Addendum Reference
1	Pinawa Professional Fire Fighters Association Local F-160	The Lac du Bonnet Fire Department has indicated it will not provide fire protection service to AECL at Whiteshell	Sec. 1.5 See 6.2.1, 6.2.2	AECL is committed to maintaining site monitoring and security, including fire protection throughout the decommissioning project and will maintain the capability to provide fire protection at WL. Shared community services will continue to be considered as an option in providing fire protection.	
2	The Local Government District of Pinawa	AECL must maintain round the clock adequate fire protection for their licensed facilities for as long as they are under CNSC licence.	Same as 1.	AECL is committed to maintaining site monitoring and security, including fire protection throughout the decommissioning project and will maintain the capability to provide fire protection at WL. Shared community services will continue to be considered as an option in providing fire protection.	
3	Pinawa Land Development Group	We request that the Pinawa Land Development Group continue to play a positive role in the ongoing process of decommissioning and mechanisms are continued for this involvement.		AECL supports an on-going communications program and the development of a Public Advisory Committee. This could provide the mechanism for involvement of the Pinawa Land Development Group in the decommissioning process. AECL will also continue to communicate with local interest groups on an ad hoc basis.	
4	Pinawa Land Development Group	The Group wishes to see the expeditious transfer of unaffected lands from the licence.		AECL continues to support business development initiatives for the WL site. Planning includes opportunities for early use of site land and buildings in the inactive area for commercial activity, within the constraints of the site licence conditions. Examples include the businesses already operating in Building 402 (ACSION, ECOMatters, Channel, etc) and the lease agreement under development for non-AECL tenant use of inactive area buildings generally.	
5	Pinawa Land Development Group	There is confusion as to what parts of the site and what buildings will eventually be turned over for use by other businesses and what ones will be demolished and returned to a green-field state.	Sec. 4	As outlined in section 4 of the CSR, active area buildings will be demolished and the lands brought to a condition suitable for unrestricted use. Inactive area buildings will be available for privatization/business use and demolition will be dependent on the success or failure of commercialization activities.	
6	Concerned Citizens of Manitoba	Concerned Citizens of Manitoba was not included in the "Identification of Interest, as an environmental organization".	10-2	Concerned Citizens of Manitoba (CCM) was not contacted by AECL in June 2000 because an address for the organization could not be found at that time. AECL believed that the CCM was continuing to remain informed through direct communication through the Manitoba Eco-Network. The CNSC directly sought input from CCM at the scoping stage and on the draft environmental assessment.	

Comment Number	Comment By	Summarized CNSC Comment	CSR Rev.2 Reference	Response	Addendum Reference
7	Concerned Citizens of Manitoba	AECL failed to contact CCM on issues raised on the scope and has not acknowledged public concern		CNSC considered the comments raised by CCM on the scope of the assessment in the preparation of the final scope document.	
8	Concerned Citizens of Manitoba	AECL consistently dismisses the concerns of CCM because they question AECL's integrity		AECL has routinely responded to issues raised by Dave Taylor. In accordance with its communications policy (Policy 00-006). AECL endeavours to respond to all enquiries in an open, professional and sensitive manner. Enquiries from the CCM have been treated in accordance with the same principles.	
9	Concerned Citizens of Manitoba	Our major concern is that releases will continue to the Winnipeg River as part of the decommissioning activities. There is no safe level of radiation and AECL has already discharged over 7 tonnes of radioactive oil to the river as a result of an accident with the WR1 reactor. CCM believes decommissioning should eliminate releases of radioactivity into the environment.	6-13,14	Radioactivity releases to the Winnipeg River have been in accordance with regulatory limits. Unplanned releases have been duly assessed and formally reported. Characterization of impacted river bottom has been conducted and concludes that there is no impact on aquatic life in the river. The decommissioning project does provide for a systematic decrease in releases to the river over the project timeframe. Shutdown of research operations has already reduced annual releases to a small fraction (<2%) of the level released during the operating period.	
10	Concerned Citizens of Manitoba	The report on the WR1 reactor failure and the discharges in the 70s continue to be shrouded in mystery as AECL has refused to release the report concerning this accident to the public after repeated requests from our organization. Although the accident occurred over 20 years ago, AECL continues to conceal the report for proprietary reasons. We feel the release of this document is imperative to the understanding of the reason for the contaminated sediment at the outfall, data for which is not provided for years prior to 94. AECL discusses "the possibility of leaks from the WR1," but fail to provide any documentation of these leaks. The Federal Radiation and Environmental Protection Division also raised concerns regarding these releases. (F-38 Appendix 2). AECL's response to their concern is inadequate. The confidential report needs to be released.		The CSR includes a detailed characterization and assessment of the area at the outfall to the river from the site. Only trace quantities of organic coolant were detected and the residue from past spills has been dispersed. There is no identified impact on the aquatic environment. The report referred to here was withheld because of proprietary information relating to the facility, not because of sensitive organic coolant release information. Since there is no evidence of accumulated coolant at the outfall, reporting documentation for the original incident is not particularly relevant. Pertinent information is documented in Appendix B of the CSR. CNSC staff are satisfied that the residual effects of the organic coolant spill on the Winnipeg River were adequately reviewed in the additional field studies carried out by AECL in the summer and fall of 2000 and as reported in the CSR Appendix B.	

Comment Number	Comment By	Summarized CNSC Comment	CSR Rev.2 Reference	Response	Addendum Reference
11	Concerned Citizens of Manitoba	Regarding the statement, "We feel the source of elevated levels in the 1970s and 80's is less clear." (5-33) Sediment sampling graphs are only included for 94-98, and we would like to see the data pertaining to sediment during the entire operation especially since reference is made to these figures. We would also like to receive a copy of Soonawala's report of 2000, which concludes WL could not have contributed to the Cs-137 in the deeper sediment. AECL continues to deny its responsibilities for statistically significant increases in radiation levels at its own outfall, blaming nuclear bomb testing and global fallout.	5-33	A copy of the Soonawala report has been supplied directly to Mr. Taylor through AECL/CNSC. Since sedimentation in proximity to the outfall is at an extremely slow rate (the river bottom is a highly scoured environment) the deeper core samples secured during the 2000 field evaluations and documented in Appendix B provide the most current information relative to deeper sediment contamination. AECL acknowledges that the elevated radiation levels at the outfall are directly attributable to the operations of WL. Contamination observed in sediments downstream during earlier studies may also be attributable to WL operations, but at levels that do not pose a significant risk to people or the environment.	
12	Concerned Citizens of Manitoba	Recent sediment data of 94 and 96 (Table 5.21), indicate significant releases which are not adequately explained in this document. (75,500 Bq/Kg of CS137 found in the outfall sediment in 94, indicates significant environmental pollution compared to the IAEA clearance levels of 300 Bq/Kg).	Table 5.21	Consistent with the current study data, documented in Appendix B, data in Table 5.21 shows some elevated samples immediately adjacent to the outfall. Sample data acquired in 2000 indicates a similar pattern but at reduced levels. The entire inventory in the assessment zone at the outfall is estimated at 1.3 GBq which represents a very small fraction of the operational releases. This fact demonstrates that the outfall operated exactly as intended. Routine emissions were maintained below regulatory limits. The concentrations in recent sample data do not pose a significant risk to people or the environment.	
13	Concerned Citizens of Manitoba	AECL must follow tighter guidelines than the vague ALARA principle for radioactive pollution.		The CNSC requires AECL, through limits specified in the licence, to keep its emissions at levels that do not pose a significant risk to people or the environment. The ALARA principle is applied in addition to those licence limits to ensure resulting exposures are as low as reasonably achievable, and well below the regulatory limits.	

Comment Number	Comment By	Summarized CNSC Comment	CSR Rev.2 Reference	Response	Addendum Reference
14	Concerned Citizens of Manitoba	It is well known that the Sagkeeng people regularly eat the Sturgeon of this river and by AECL's own accounts (5-38), "an area favoured by sturgeon is located at the outfall of the Whiteshell Laboratories. Radioactivity in Sturgeon has never been adequately addressed by AECL. The document is lacking in this data, and in data pertaining to the ingestion of Sturgeon and its correlation to cancers on the Sagkeeng Reserve. Several years ago Concerned Citizens of Manitoba raised the issue of an epidemiological study of the people in the area. This should be part of the cumulative effects of any decommissioning plan.	5-38	The 1995 Winnipeg River Task Force report concluded that it is unlikely that Whiteshell Laboratories has ever posed a significant threat to the health of downstream residents. With respect to fishery impacts, radioactivity levels in fishes in the Winnipeg River are typical of values obtained across Canada, including regions very remote from nuclear facilities. These levels are well below Health Canada's guidelines. AECL records show that routine discharges are currently maintained within acceptable standards and discharges will gradually diminish to virtually zero by the time decommissioning is complete. The likelihood of a major leak is low because all site and facilities protection systems and work controls are maintained during the decommissioning project. CNSC staff believes that the likely direct and cumulative effects of the decommissioning project on human health have been adequately assessed in the CSR without the need to conduct specific health studies.	
15	Concerned Citizens of Manitoba	Dr. Lockhart of the Freshwater Institute, (Lockhart et al 1994), indicated to our group in a letter that Cesium in the northern sediments of Lake Winnipeg could have come from no other source than AECL's Whiteshell facility. Concerned Citizens of Manitoba want the flushing of nuclear materials into the Winnipeg River to stop immediately.	6-13, 14	Radioactivity releases to the Winnipeg River have been in accordance with regulatory limits. Unplanned releases have been duly assessed and formally reported. Characterization of impacted river bottom has been conducted and concludes that there is no impact on aquatic life in the river. The decommissioning project does provide for a systematic decrease in releases to the river over the project. Shutdown of research operations has already reduced annual releases to a small fraction (<2%) of the level released during the operating period.	
16	Concerned Citizens of Manitoba	We would like the Cumulative Effects of the continued releases to the Winnipeg River to be adequately considered in this report.	Sec. 6/3/3	The environmental effects on surface water and on the Winnipeg River are evaluated under Site Hydrology, Sec. 6.3.3 of the CSR. Cumulative effects were assessed in section 8.	

Comment Number	Comment By	Summarized CNSC Comment	CSR Rev.2 Reference	Response	Addendum Reference
17	Concerned Citizens of Manitoba	Non-radiological releases to the Winnipeg River are a concern. In the most recent WL licensing document AECL was presented with a number of deficiencies related to their releases of hazardous substances. Many of these deficiencies are not dealt with in the CSR. Releases include oil/grease, phosphorus, chromium, copper, iron, lead, mercury, nickel, zinc. The CNSC expressed concerns with AECL re: monitoring, no scientific basis for their guidelines, unavailability of monitoring results and a lack of toxicity testing. These were found in Section 4.5.3 of the licensing document Effluent and Environmental Monitoring of Hazardous Substances. The flushing of wastes at the outfall and are consistent with Aces haphazard approach to releases. Based upon this new license it is clear that releases to the Winnipeg River must be discontinued as part of the decommissioning process.		The assessment of contaminants in the river sediments at the outfall carried out in the summer and fall of 2000 (Appendix B) addressed both radiological and non-radiological contaminants. Although the resident inventory of non-radiological contaminants at the outfall were shown to not pose a significant risk to the environment, AECL will continue to be required, under its CNSC licence, to monitor all relevant hazardous substances at all significant points of release to the environment. This is discussed further in Section 9.3 (Environmental Monitoring Program).	
18	Concerned Citizens of Manitoba	AECL states that it supports the establishment of a "Public Advisory Committee" (6-28), but has made no mention of how it will be established, what its responsibilities will be, or who the members of this committee will be. Mitigation or compensation activities are mentioned as well, in a general and vague manner. The PAC should be able to gain access to all documentation and to set the standards for emissions for the site. This should be an independent committee, which includes members of the community, members of Sagkeeng First Nation, and other interested parties.	6-28	The development of the PAC is expected to be a collaborative activity with the local communities and interest groups. AECL supports formation of the PAC as a valuable communications activity and is open to suggestions on the structure and mandate of such a committee. The CNSC establishes the limits for environmental releases from the site as part of its licensing authority.	

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19	Concerned Citizens of Manitoba	It is clear that contamination of the river water or fish is a potential residual effect (6-29), and yet AECL plans to flush radioactive waste into the waterway.	6-29	The 1995 Winnipeg River Task Force report concluded that it is unlikely that Whiteshell Laboratories has ever posed a significant threat to the health of downstream residents. With respect to fishery impacts, radioactivity levels in fish in the Winnipeg River are typical of values obtained across Canada, including regions very remote from nuclear facilities. These levels are well below Health Canada's guidelines. AECL records show that routine discharges are currently maintained within acceptable standards and discharges will gradually diminish to virtually zero by the time decommissioning is complete. The likelihood of a major leak is low because all site and facilities protection systems and work controls are maintained during the decommissioning project Note that the residual effect identified on pg. 6-29 is a socio-economic effect (presumably arising from a perception of risk from the minor contamination predicted), rather than a significant health risk from the contamination.	
20	Concerned Citizens of Manitoba	It is clear from the comments (10-19) that the LGD of Pinawa, and also Mayors and Reeves of surrounding communities are not satisfied with the decommissioning plan.	10-19	Noted.	
21	Concerned Citizens of Manitoba	AECL has not adequately considered public opinion, and judging from the turn out at its public consultation meetings has not encouraged input.		AECL has carried out an extensive public consultation program since commencing the EA in 1999. The program activities and public comments are well documented in CSR Sec. 10 and Appendices E and F.	
22	Concerned Citizens of Manitoba	No outstanding issues are identified by AECL in considering the public's input. Many of these issues are dismissed without sufficient scientific evidence.		Noted. Public concerns about the health and safety of the environment have not been dismissed. The assessment of those effects in the CSR is based on scientific evidence and appropriate professional judgement.	
23	Concerned Citizens of Manitoba	Prior to AECL's plan to decommission the site, a number of spent fuel bundles from Ontario and U.S. reactors were brought into Manitoba for "research purposes." This additional waste appeared to be brought in to "fill up" the WMA before the decommissioning process had begun. Storage of nuclear waste from outside the province is illegal under Manitoba's High-Level Radioactive Waste Act and documentation of what was imported or for what purpose, remains confidential.		No fuel has been transferred to Whiteshell as waste material. Fuel requiring post irradiation examination has been received for research work and the residues have been stored in the Concrete Canister Storage Facilities. This fuel represents a very small fraction of the total fuel inventory stored at WL. Since termination of research activities began at WL in 1995, 116 kg of irradiated fuel has been received for post-irradiation examination. In the same period, 400 kg of irradiated fuel has been transferred back to CRL for retention in research programs. Therefore, there has been a net decrease in the amount of non-WL fuel.	

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24	Concerned Citizens of Manitoba	Concerned Citizens of Manitoba want a complete inventory of radioactive waste which has been brought in from outside the province. We also want the WMA to be closed to any future shipments of waste. The ongoing license to import waste for "research" purposes was not dealt with in this document.		Post irradiation examination work was terminated at WL in March 1998 and consequently no future transfers of fuel are planned. See also comment #23.	
25	Concerned Citizens of Manitoba	Considering the WMA is the largest potential source for leachate, it is imperative that records are made available to the public and that future importing of waste must stop. These topics must be addressed in the decommissioning plan.		There has been no 'importation' of waste to the WL site. With the termination of research activities, the receipt of research materials has vastly decreased and will ultimately cease (approximately 2003). The potential for impacts associated with leaching from the WMA is indeed addressed in the DDP.	
26	Concerned Citizens of Manitoba	We are opposed to the fact that AECL is not planning to decommission the WL in the near future. We believe that decommissioning should be commencing immediately.		Decommissioning will commence following completion of the EA process and establishment of the regulatory/licensing structure required to implement the project.	
27	Concerned Citizens of Manitoba	AECL is proposing to hire and monitor the site with unqualified personnel. Due to the unchallenging nature of guarding the site, the watch crew will likely not be comprised of highly skilled employees that are able to properly monitor the site and initiate action in the event of a serious emergency.	Sec. 1.5	AECL is committed to maintaining, at the site, a staff that has the training and resources necessary to maintain security and protect people and the environment during both normal and emergency situations that may arise. This is presently, and will continue to be, a requirement of the CNSC licence	
28	Concerned Citizens of Manitoba	We believe that the site decommissioning should have public and private sector experts from outside influence of AECL in order to give an unbiased survey of the site facilities and waste management areas that are contaminated and are currently leaking into the environment. The CCM should have input into the selection of private/public experts.		The responsible authorities for this assessment (CNSC and DFO) are independent federal regulators. The CNSC and DFO have, during the course of this assessment, consulted with disciplinary experts in their departments, and in other federal departments, including Environment Canada, Health Canada, Natural Resources Canada, and Western Economic Diversification. As well, the RAs have consulted with experts in various provincial government departments in Manitoba. The CNSC presently conducts, and will continue to conduct during the decommissioning project, regular inspections and audits of AECL's activities to verify compliance with the Nuclear Safety and Control Act, its regulations, and the conditions of the licence.	
29	Concerned Citizens of Manitoba	The concrete storage canisters containing high level radioactive nuclear waste must be removed from the site, from the province.		Noted.	

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30	Concerned Citizens of Manitoba	We have deep concerns that the Underground Research Laboratory (URL) not be considered in any way as storage / disposal facility for the radioactive nuclear waste found at the WL site. If a demonstration vault is started with the decommissioning process of the WL, we feel that this will lead to a privatized commercial: nuclear vault" operation. This is not based on fiction: many federal politicians have promoted this idea.		Noted. AECL has no plans to use the URL as a waste disposal facility.	
31	Pinawa Chamber of Commerce	We request that the Pinawa Chamber of Commerce continue to play a positive role in the ongoing process of decommissioning and mechanisms are put in place for this involvement.		AECL supports an on-going communications program and the development of a Public Advisory Committee. This could provide the mechanism for involvement of the Pinawa Chamber of Commerce in the decommissioning process. AECL will also continue to communicate with interest groups on an ad hoc basis.	
32	Pinawa Chamber of Commerce	CNSC will make sure that enough money is in place to decommission the site." This is a very large responsibility. A complete set of Detailed Decommissioning Plans, building by building, has not been published, and the only cost estimates in this document for the three decommissioning alternatives have been done in a relative manner. How can you correctly estimate the cost of this decommissioning and therefore ensure the funds have been or will be set aside? It would seem that the approval to proceed would have to be granted prior to any detailed cost estimates. Do we have any precedent of similar magnitude that has been carried out successfully to show this project will proceed over these long time frames with proper funding?		Under the new Nuclear Safety and Control Act, the CNSC has the authority to require financial guarantees for the decommissioning of the Whiteshell Laboratories. The cost estimates in support of those guarantees will be based on a cost-engineering analysis of a detailed decommissioning plan for the entire project. That plan and costing will be required by the CNSC prior to, or shortly after the initial issuance of a decommissioning licence for the site. The financial guarantee may be refined as facility specific plans are produced and decommissioning work is completed. The discussion of the relative costs of the project phasing alternatives in the CSR will not be used as the basis for the financial guarantees. As the ability to require financial guarantees is a new regulatory authority, there are currently no precedents in Canada of guaranteed funding of projects of this type and duration.	
33	Pinawa Chamber of Commerce	The interim and final end states should be described more fully.		The endstate detail is considered adequate to evaluate the environmental impacts of the decommissioning project. Additional definition of project work and endstates will be documented in the Detailed Decommissioning Plans for each facility. All buildings and lands will ultimately be brought to a condition acceptable to the CNSC for unrestricted use by the public, except where specifically designated for other types of control to protect people and the environment.	

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34	Pinawa Chamber of Commerce	It should be clarified which buildings because of their contamination or design nature that are either a liability and/or not generally useful and should be outright demolished and those buildings that are more generically useful and can be decontaminated. Will the Industrial Park operators then have access to put tenants in those buildings in time?		As outlined in section 4 of the CSR, controlled area buildings will be demolished and returned to a green-field state. Supervised area buildings will be available for privatization/business use and demolition will be dependent on the success or failure of commercialization activities.	
35	Pinawa Chamber of Commerce	We ask that a monthly update on activities at the site should appear in all local newspapers and there should be a local contact person identified so that information can be obtained first-hand. This person has to be a member of the Decommissioning Team and know what is technically occurring - not a Public Affairs individual.		Routine reporting in the media is not considered to be appropriate. The media is welcome to gather information of interest and report as they see fit. AECL supports an on-going communications program and the development of a Public Advisory Committee. This could provide the mechanism for communicating project activities and for local involvement in the decommissioning process.	
36	Pinawa Chamber of Commerce	AECL needs to ensure and use the local business community as their preferred source for goods and services for this decommissioning. Local involvement means we still have a critical mass of knowledgeable people in the community that are familiar with the site and its operation and provide a level of comfort knowing that high quality planning and work is being put into the decommissioning. This may also lead to business opportunities. It is important to be involved to ensure opportunities that are positive for both local businesses and AECL are captured.		Noted. AECL intends to use local businesses and to employ local people, where they are economically competitive and have the requisite skills and qualifications.	

Comment Number	Comment By	Summarized CNSC Comment	CSR Rev.2 Reference	Response	Addendum Reference
37	Pinawa Chamber of Commerce	It is mentioned that a "PAC will be considered". This is absolutely essential. It is imperative that dialogue with local citizens and the local media be very effective. Information such as staffing levels, ability to react to emergencies and decommissioning plan progress and specific details of work being carried out at the site should be delivered monthly (for some issues) and quarterly for everything. This PAC should be made up of local Pinawa experts (former radiation workers) and have access to other specialists (CNSC, DFO, Health Canada, etc.). The role of this PAC should be better described prior to instigation and the nomination for local community groups and members needs to be well advertised.		AECL does support the formation of a PAC. This is expected to be a collaborative process with the initial activity to establish membership and the role of the PAC.	
38	Pinawa Chamber of Commerce	What environmental indicator will be used in the environmental monitoring program; how will they be determined and by whom? More information as to how this MP will be determined, carried out and publicized must be known.	Sec. 9.3 Sec. 9.6	The existing monitoring program including parameters monitored is detailed in Sec. 9.3. The drivers for adapting the program to address the decommissioning period with emphasis on key areas of change is documented in Sec. 9.6. The final details of the environmental monitoring program, and related evaluation criteria, will be established in the CNSC licensing process. The monitoring will be a mandatory requirement of the CNSC licence. The monitoring requirements will be reviewed periodically by CNSC staff during the decommissioning project and are likely to evolve over time.	Sec. 3.1
39	Pinawa Chamber of Commerce	This Monitoring Plan and its monthly/quarterly results must be made public.		AECL supports an on-going communications program and reporting of monitoring results is expected to be a component. The monitoring reports submitted regularly to the CNSC as a requirement of the decommissioning licence will be public documents, and will be available from the CNSC on request.	
40	Pinawa Chamber of Commerce	There is no discussion of how AECL plans to preserve the Valued Ecosystem Components, VECs, mentioned in this report during Decommissioning (i.e. scheduling of work to ensure bird migration is not affected by excessive dust or noise). We believe local experts should be consulted for advice in these matters.		Likely environmental effects are documented in Sec. 6. For any parameters where a potential effect is identified, mitigation methods are listed. Implementation of the mitigation measures is designed to protect all VEC’s. AECL will engage external expertise where necessary to evaluate potential risks and to propose mitigation where warranted.	

Comment Number	Comment By	Summarized CNSC Comment	CSR Rev.2 Reference	Response	Addendum Reference
41	Pinawa Chamber of Commerce	For the Waste Management Areas, plans to better characterize the wastes and monitoring plans to assure they are indeed not moving via groundwater need to be better defined.		Additional detail on the process for designing and implementing an enhanced monitoring program at the WMA, assessing the fitness for service of existing storage facilities and for establishing remediation schedules has been added to the Addendum.	Sec. 3.1
42	Pinawa Chamber of Commerce	The Sagkeeng have been mentioned as being part of the Monitoring future for the WL, the town of Pinawa also needs to be part of that Plan.		Sagkeeng interest comes from two sources; 1) interest in potential impacts on the river because they are downstream and the river transects the reserve land, and 2) to provide "capacity building" – increase their knowledge of the monitoring program and methodology. Pinawa remains one of the primary sources of trained monitoring program staff. Many environmental monitoring program employees live in Pinawa. The PAC also could provide an opportunity for Pinawa input and information exchange.	
43	Pinawa Chamber of Commerce	A baseline for air quality (particulate and concentration of other contaminants) must be started as part of the pre-decommissioning planning and work.		The strategy for air quality monitoring documentation in Sec. 5.4.2 outlines a program which establishes baseline during the remaining shutdown operations and during the planned intermittent periods of storage with surveillance during the decommissioning project.	
44	Pinawa Chamber of Commerce	The report states that AECL's Waste Management Area will continue to be closely monitored for any change in current conditions. What are these changes that are expected. The Appendix shows that some contaminants, for example Tc, could be reaching the ditch soon. Are they monitoring to ensure that what they think is happening is actually happening or are they calibrating or planning to calibrate their models using the monitoring data.		Monitoring data indicates that there is no near term impact (20 years) from the Tc^{99}. Since Tc^{99} will eventually migrate and has a long half-life, trenches containing Tc^{99} waste are planned for remediation. No changes in current WMA groundwater flow are anticipated Additional detail on the process for designing and implementing an enhanced monitoring program at the WMA, assessing the fitness for service of existing storage facilities and for establishing remediation schedules has been added to the Addendum.	Sec. 3.1
45	Pinawa Chamber of Commerce	In the past, the evacuation plan for the site included bringing people to Pinawa. Will this still be the case?		Evacuation is still included in the WL Emergency Plan. The Emergency Plan also defines roles for the LGD of Pinawa and Province of Manitoba emergency organizations in the event of an emergency at WL.	
46	Pinawa Chamber of Commerce	Since there is no longer any medical personnel on site, are the appropriately trained medical people available in Pinawa? How does AECL plan to ensure the needed infrastructure for decontamination or medical attention is in place?		Medical personnel in Pinawa, other local communities and the Manitoba Emergency Measures Organization are relied on in the event of an emergency. Trained Protective Services personnel provide emergency first aid response at WL. Trained radiation protection staff also provides expertise in the event of an emergency. Maintaining the capability to deal with emergencies is also a licence requirement of the CNSC.	

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47	Pinawa Chamber of Commerce	Has the "worst case" accident been described somewhere (chemical explosion at WMA?, fire in Building 300?) and the required people/assistance been put in place. What is the emergency and how should the people of Pinawa react?		The largest credible radiological release from WL (an airborne release from the Shielded Facility or an aqueous release from the ALWTC) has been analyzed in Report RC-654 (Rev 2) published in December 1998. The WL Emergency Plan takes into consideration the analysis done in RC-654. RC-654 concludes that there is no credible scenario, which will result in significant dose to off-site individuals. The consequences of the worst-case accident during the decommissioning project are much lower and the likelihood of an off-site threat is minimal. AECL is committed to maintaining the capability to respond to an emergency. This is also a licensing requirement of the CNSC.	
48	Pinawa Chamber of Commerce	The comment that AECL should not use the lack of a waste repository as an excuse for not building required engineered storage was responded to with. "No issue". This is not a useful answer, we believe that the answer is in the text that "it is expected that engineered storage facilities would be built as and when needed". The defensive answers to these questions raise concerns for future "good relations" between the local residents and the Decommissioning Team. We need to work together for a successful Project and local economy outcome.		Noted. The earlier response was not intended to be defensive, and AECL looks forward to working with the community in ensuring a successful project.	
49	Pinawa Chamber of Commerce	The Pinawa Chamber would like to have closer direct communication links with the Decommissioning Team. We believe that it can be achieved by: 1) placing a representative of our Chamber on the Public Advisory Committee, 2) identifying a member of AECL's WL Decommissioning Team that is our contact point, 3) providing tours during decommissioning. It is also important that any and all local communities be informed of all mitigation measures that are planned or prescribed for use.		AECL supports an on-going communications program and the development of a Public Advisory Committee. This could provide the mechanism for involvement in the decommissioning process. The development of the PAC is expected to be a collaborative activity with the local communities and interest groups. AECL supports formation of the PAC as a valuable communications activity and is open to suggestions on the structure and mandate of such a committee.	

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50	Pinawa Chamber of Commerce	It is important that as AECL downsizes, they continue to be responsible corporate citizens. They must be actively engaged in assistance to other businesses and the community of Pinawa as well as other small towns.		AECL continues to support business development initiatives for the WL site. Planning includes opportunities for early use of site land and buildings in the inactive area for commercial activity, within the constraints of the site licence conditions. Examples include the businesses already operating in Building 402 (ACSION, ECOMatters, Channel, etc) and the lease agreement under development for non-AECL tenant use of inactive area buildings generally.	
51	Pinawa Chamber of Commerce	AECL can assist local businesses by: 1) becoming a corporate member of the Pinawa Chamber of Commerce, 2) using local businesses to provide goods and services, 3) Establishing a fund to promote local business health. and 4) notifying the Pinawa Chamber of any surplus, goods, equipment or buildings, as they are decommissioned and become available.		AECL intends to use local businesses and to employ local people, where they are economically competitive and have the requisite skills and qualifications. AECL intends to continue to foster good corporate relationships with local communities.	
52	Pinawa Chamber of Commerce	We wish to ensure that AECL's corporate sponsorship of our cultural and recreational events be continued and heightened until significant new businesses move in to fill this sponsorship void.		Noted. AECL intends to continue to foster good corporate relationships with local communities.	
53	Pinawa Chamber of Commerce	We believe AECL should 1) provide funds and artifacts for an "energy" museum that could combine the nuclear history and the water-power history (Old Pinawa Dam) for the region.		This suggestion falls outside the scope of this environmental assessment; however, the comment has been noted for further discussion with the Pinawa Chamber of Commerce.	
54	Local Government District of Pinawa	We have as yet had no response from CNSC as to the status of our objections to the previous edition of the CSR. The AECL response in CSR rev. 2 is to dismiss our concerns with statements that are not correct, answer a different issue from the one we are addressing or simply note our objections but do nothing to deal with them.	App. F	In completing the CSR, the responsible authorities (CNSC and DFO) will consider all comments received on the earlier drafts of the CSR. It is not the normal practice to provide individual responses to commenters outside the EA documentation. CNSC and DFO staff consider that the responses to the comments documented in Table 10.4 are reasonable and have been adequately addressed by AECL, where appropriate, in the revised EA documentation.	

Comment Number	Comment By	Summarized CNSC Comment	CSR Rev.2 Reference	Response	Addendum Reference
55	Local Government District of Pinawa	AECL is asking us to accept a plan that defers any real decommissioning for 60 years, and proposes institutional control of the lands for 200 years. There are no firm schedules provided for the completion of the various stages of the decommissioning activity and no guarantees that anything will ever be done. No budget is presented for taking the project to completion and no guarantees are given that sufficient funding will be available to complete the work. Indeed, AECL is in no position to make any guarantees as they are an agency of the federal government and dependent on annual appropriations for their activities. Only the federal government can guarantee that funding will be available on schedule (if indeed a schedule is ever established).		The schedule for the initial phase of decommissioning to place the facilities in a secure monitoring and surveillance state is relatively firm (expected to be complete within 6 years following EA approval). The schedules for the remaining work are more conceptual but provide a reasonable framework for completing the project based on assumptions for waste disposal availability. Detailed schedules for delivery of the project are subjects of the Detailed Decommissioning Plans and Work Plans which will be administered by the CNSC under the site decommissioning licence conditions. With the exception of the longer-term institutional control for selected low-level trenches, the decommissioning is anticipated to “end” at year 60 (not begin at year 60 as implied in the comment). Furthermore, the only areas that are presently envisioned for institutional control are associated with the selected low-level trenches. In fact, much of the land is already being prepared for release from the licence, and more land is expected to be released as the decommissioning progresses. Detailed cost-engineering estimates of the decommissioning program will be based on a detailed decommissioning plan that the CNSC will require for the initial decommissioning licence. The financial guarantees for the project will be required of the Government of Canada.	
56	Local Government District of Pinawa	In the CSR, page10-18, AECL states that they will be required to maintain compliance with the decommissioning plan once approved. Only the federal government can make this pledge and it should be made clear that ultimate responsibility for the decommissioning must lie with the federal government. We would expect that any directives made by the regulator on the decommissioning should be made directly to the federal government as, given the long time frames, it is unlikely that AECL will even exist when the decommissioning is currently scheduled to be completed.		The CNSC will be continually verifying compliance with the NSCA, the regulations, and the decommissioning licence conditions. AECL will continue for the foreseeable future as the licensee, and will be directly accountable for compliance with the CNSC’s legal requirements for safety, security and protection of the environment. In the event that AECL is no longer available to complete the decommissioning project, the financial guarantees required by the CNSC will be used to provide for the ongoing, competent and safe completion of the project.	

Comment Number	Comment By	Summarized CNSC Comment	CSR Rev.2 Reference	Response	Addendum Reference
57	Local Government District of Pinawa	In the early years, nuclear waste disposal schemes at WL would not meet modern day standards and have left waste, including spent nuclear fuel, buried in the ground in a state that will make remediation very difficult and expensive.	Sec. 4.3.1	Additional detail on the process for designing and implementing an enhanced monitoring program at the WMA, assessing the fitness for service of existing storage facilities and for establishing remediation schedules has been added to the Addendum. The cost estimates and financial guarantees will be reviewed and adjusted, as necessary, on the basis of the results of that assessment. Regardless of the findings of the assessment, the remediation can be completed using proven technologies for containing the wastes and contaminants such that the workers, the public and the environment will be protected.	Sec. 3.1
58	Local Government District of Pinawa	At Chalk River redundant buildings have been sealed up rather than decontaminated and decommissioned. This is what they are proposing to do with the Whiteshell structures but it is not a safe practice.		A detailed decommissioning plan, indicating when and how the different facilities at WL will be decommissioned will be prepared. This plan, supplemented with more detailed facility-specific plans during the course of the project, will form the basis of the decommissioning licence issued by the CNSC. The CNSC will not permit buildings to remain in conditions that pose an unreasonable risk to human health or the environment.	
59	Local Government District of Pinawa	Throughout their history AECL has been reluctant to spend money on properly dealing with the residue of their operations. As the government agency promoting nuclear energy, it is incumbent on AECL to keep the government informed as to the appropriate measures for dealing with nuclear waste in their business. AECL does not appear to be telling the government that Canada is decades behind other OECD countries in implementing measures to store and dispose of decommissioning waste. Rather they use the lack of decommissioning facilities as an excuse to defer the immense costs of decommissioning a nuclear site.		As in many other countries, including OECD countries, decommissioning activities are impacted by the availability of disposal facilities. However, deferment is also practiced in many countries to benefit from natural radioactivity decay prior to decommissioning. A detailed decommissioning plan, including detailed cost estimates in support of financial guarantees for that decommissioning, will be prepared for CNSC licensing purposes. The CNSC will not permit deferments of decommissioning activities that would pose an unreasonable risk to human health, safety, security and the environment.	
60	Local Government District of Pinawa	In the CSR, page ES-3, it is stated that if storage and disposal facilities for decommissioning waste could be made available within ten years then full decommissioning of the labs could be carried out in 20 years. Building such facilities in ten years is achievable if we start now.	ES-3	Noted.	

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61	Local Government District of Pinawa	By delaying decommissioning for 60 years we will be competing for funds and resources with decommissioning of most of the current CANDU Power Reactors and probably a major activity at Chalk River. Full decommissioning now will not only ensure that the job gets done in Manitoba, but will provide an opportunity to develop the facilities and expertise that will be needed at other sites later on.		Decommissioning of CANDU Power Reactors is the responsibility of the Utilities and therefore does not create competition for funds. AECL programs must be co-ordinated to address priority-decommissioning projects at all of our sites. The reality of significant decommissioning scope in the future will provide on-going opportunities for developing/maintaining and utilizing decommissioning expertise. Decommissioning is not being delayed for 60 years; rather it is proposed to end in 60 years, with a significant amount of work being done in the early phases	
62	Local Government District of Pinawa	In response to our criticism on page 10-12 of the CSR, AECL says, "deferred decommissioning is practised in nearly every OECD country". This is false. The only examples of deferred decommissioning we have been able to find are for some reactor cores, a practice that is more or less acceptable depending on the reactor design.	10-12	AECL maintains that deferment is incorporated in decommissioning strategy for nuclear facilities in OECD countries as well as others. For example, the UKAEA Corporate Plan 2000 (available from the UK Atomic Energy Authority) lists extended schedules up to 2050 to achieve endstate for nuclear sites such as Harwell, Winfrith, Windscale and Dounreay. The primary component of the decommissioning project, which is being deferred for radiation safety reasons, is the WR-1 reactor.	
63	Local Government District of Pinawa	The issue of passing on liabilities to future generations is minimized by AECL and claimed to be not within the scope of the review by CNSC and CEAA.		Liabilities associated with the decommissioning project, and subsequent institutional controls, will be addressed through the requirements for financial guarantees under the CNSC licensing process.	
64	Local Government District of Pinawa	There are serious safety implications with deferred decommissioning. Very few institutions last more than a generation or two. The concept of making future generations pay for our present activities is irresponsible and unprecedented in the history of mankind. It is totally unjustified to allow AECL to defer to future generations the decommissioning expenses and risks of handling improperly stored materials.		The issue of decommissioning liabilities and the associated requirements for the provision of financial guarantees, will be the subject of licensing under the Nuclear Safety and Control Act. The decommissioning project includes the proper storage of materials on site until they can be transferred to a national disposal repository. Further analysis of the WMA in the early stages of the decommissioning project will determine what interim remediation activities are required to ensure all wastes are in proper storage for the duration of the decommissioning project.	

Comment Number	Comment By	Summarized CNSC Comment	CSR Rev.2 Reference	Response	Addendum Reference
65	Local Government District of Pinawa	At Whiteshell there will soon be no continuing nuclear operations with the attendant skills (not the case at other nuclear facilities in a partially decommissioned monitoring phase). The qualifications of the residual force that AECL is planning to leave to monitor the site is not clearly defined in the CSR. It is very unlikely that they will be able to find competent professional and technical staff to do the very boring and unchallenging tasks that will remain. We will therefore be at the mercy and convenience of people 2000 kilometres away to ensure that the site is secure. This is totally unacceptable.	Sec. 1.5	AECL is committed to maintaining a qualified team to conduct monitoring and surveillance activities on future project work, as outlined in AECL Commitments, Sec. 1.5. That commitment includes training programs as required to maintain the required skills/capabilities. This will be a regulatory requirement of the CNSC.	
66	Local Government District of Pinawa	I have not been able to find any other major nuclear facility in any OECD country that has been abandoned in this way, especially one at the centre of a major recreational area. If AECL is allowed to proceed with this plan they will be setting a very dangerous precedent, not just for a nuclear facility but any federal operation that has created a potential for a significant negative environmental impact.		AECL is not abandoning WL. AECL is committed to maintaining a qualified team to conduct monitoring and surveillance activities on future project work, as outlined in AECL Commitments, Sec. 1.5. That commitment includes training programs as required to maintain the required skills/capabilities. This will be a regulatory requirement of the CNSC.	
67	Local Government District of Pinawa	There are several large decommissioning companies who could be contracted to provide facilities now. Because similar facilities are already licensed and operating in other countries, licensing in Canada should be straightforward.		The decommissioning project includes the maintaining and building of waste storage facilities on the WL site, as required, to manage the current WMA inventory and waste arising from the decommissioning until disposal facilities are available. The establishment of national radioactive waste disposal facilities is not part of the WL decommissioning project.	
68	Local Government District of Pinawa	The CNSC has the authority to compel the government to start now to build facilities for the decommissioning wastes from their own nuclear facilities.		The CNSC does not have the authority to compel the government to build waste disposal facilities. The CNSC has the authority to, and will ensure that the wastes currently at the WL site (and which will arise from the decommissioning activities), remain under CNSC licensed control for as long as is necessary to prevent unreasonable risk to health, safety, security and the environment.	
69	Local Government District of Pinawa	The CNSC has the authority to stop any federal nuclear operations at Chalk River that are continuing to produce waste and contamination while no steps are taken to build decommissioning facilities.		The CNSC regulates the use of nuclear energy and materials at all licensed sites to protect health, safety, security and the environment and to respect Canada's international commitments on the peaceful use of nuclear energy.	

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70	Local Government District of Pinawa	We most strongly urge the CNSC and CEAA to use their powers to force the government to act now so that the only sensible, safe and ethical plan for decommissioning Whiteshell, the 20 year plan, can be implemented.		Neither the CNSC nor the CEAA, have the authority to compel the government to complete the decommissioning in 20 years. The CNSC, however, will ensure that the decommissioning is carried out in a manner that does not pose an unreasonable risk to health, safety, security and the environment and that radiation exposures to people and the environment are as low as reasonably possible. The CNSC will consider how deferment of certain decommissioning activities contributes to these overall radiation protection objectives.	
71	Local Government District of Pinawa	The CSR should be clear as to which of three types of waste facility is being referred to when addressing specific issues on future availability of disposal facilities. These should be clearly defined in the CSR as the anticipated availability dates are different.		Assumptions for disposal facilities are for two categories: 1) high-level waste, which is irradiated fuel and 2) low-level wastes which includes everything else, except that this category may consist of more than one facility to accommodate a range of radiation levels and irradiated/contaminated materials.	
72	Local Government District of Pinawa	It is AECL's stated intention to continue with the practice of using bunkers without properly packaging the wastes even though they admit that they will have to recover and dispose of the wastes eventually. This poses unjustified risks on the future generation s that will have to handle these wastes.		The decommissioning strategy for WL schedules major demolition and waste transfers with the availability of waste disposal facilities. Only a small amount of waste is produced in the early phases of decommissioning work to place facilities in secure monitoring and surveillance. Those wastes will be packaged in accordance with current requirements. Processing operations to address wastes which cannot remain in existing storage structures until waste disposal becomes available are listed in Sec. 4.3.1 (Waste Management Area). Additional detail on the process for designing and implementing an enhanced monitoring program at the WMA, assessing the fitness for service of existing storage facilities and for establishing remediation schedules has been added to the Addendum.	Sec. 3.1
73	Local Government District of Pinawa	The UK Atomic Energy Authority has several former research sites that are being decommissioned and, as individual facilities or buildings are released from the nuclear license, they are occupied by new businesses. This is an activity that must be duplicated at Whiteshell if the town of Pinawa is to become self-sufficient.		AECL continues to support business development initiatives for the WL site. Planning includes opportunities for early use of site land and buildings in the inactive area for commercial activity, within the constraints of the site licence conditions. Examples include the businesses already operating in Building 402 (ACSION, ECOMatters, Channel, etc) and the lease agreement under development for non-AECL tenant use of inactive area buildings generally.	
74	Local Government District of Pinawa	Low Level waste facilities similar to those at Drigg in Cumbria, England are in use or under construction in most OECD countries and could readily be constructed in Canada if someone was prepared to pay for it.		Noted.	

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75	Local Government District of Pinawa	A facility for the disposal of LLW is an essential component of any nuclear industry. The fact that Canada not only does not have one but does not even have any plans to build one is a national disgrace and should be a matter of extreme embarrassment to AECL who try to present the image of being on the "cutting edge" of the nuclear industry.		Noted.	
76	Local Government District of Pinawa	The plan to remove all nuclear operations from Whiteshell has identified the immediate need to provide a LLW disposal facility. This must be AECL's and the Government's first priority and it is incumbent on the CNSC to use their regulatory powers to enforce it.		The CNSC does not have the authority to force the government of Canada or AECL to construct LLW disposal facilities. CNSC will ensure that the decommissioning project, including the interim storage of LLW, is carried out in a manner that does not pose an unreasonable risk to health, safety, security and the environment.	
77	Local Government District of Pinawa	AECL must be compelled to start immediately to provide a low-level waste disposal facility to accommodate Whiteshell wastes or discontinue immediately all nuclear operations that are continuing to produce wastes.		The CNSC does not have the authority to force the government of Canada or AECL to construct LLW disposal facilities. CNSC will ensure that the decommissioning project, including the interim storage of LLW, is carried out in a manner that does not pose an unreasonable risk to health, safety, security and the environment.	
78	Local Government District of Pinawa	Medium or Intermediate Level Wastes are presently stored in concrete bunkers which are not weather-proof, and the wastes themselves are not sealed in intrusion-proof containers. This does not meet international standards for safety. A comparison can again be made with the practice in the UK.		Processing operations to address wastes which cannot remain in existing storage structures until waste disposal becomes available are listed in Sec. 4.3.1 (Waste Management Area). Additional detail on the process for designing and implementing an enhanced monitoring program at the WMA, assessing the fitness for service of existing storage facilities and for establishing remediation schedules has been added to the Addendum.	Sec. 3.1
79	Local Government District of Pinawa	The bunkers in the Whiteshell WMA, aside from being unsafe for storage, present dangers to staff when recovering the wastes for final disposal because of the primitive packaging used. The hazards associated with remediating these wastes will increase with time as knowledge of the bunker contents dims and the conditions of the bunkers and wastes deteriorate. It is unthinkable that AECL should consider continuing with this storage scheme for wastes generated by their decommissioning process.		The decommissioning project is scheduled on the basis of direct transfer of decommissioning waste to disposal facilities. Accordingly, only small volumes of waste are produced during the early phases of the project. Those wastes are packaged and stored in facilities, which meet CNSC safety requirements. Additional detail on the process for designing and implementing an enhanced monitoring program at the WMA, assessing the fitness for service of existing storage facilities and for establishing remediation schedules has been added to the Addendum.	Sec. 3.1

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80	Local Government District of Pinawa	The medium level waste bunkers should be remediated immediately, the wastes packaged in safe, sealed metallic containers and placed in an engineered disposal vault or concrete canister until a repository for high level waste is constructed. Because of the possibility that a national HLW repository may be rejected in favour of continued surface storage, the containers should be designed to be easily retrievable after a long period of storage so that they can be moved when the design life of the storage facility is exceeded. AECL should act immediately to develop procedures to recover MLW from bunkers, properly seal it in corrosion-proof containers and store it either in an engineered facility or concrete canisters similar to those used for fuel.	Sec. 4.3.1	Processing operations to address wastes which cannot remain in existing storage structures until waste disposal becomes available are listed in Sec. 4.3.1 (Waste Management Area). The materials do not present a near term hazard in the present storage location. Additional detail on the process for designing and implementing an enhanced monitoring program at the WMA, assessing the fitness for service of existing storage facilities and for establishing remediation schedules has been added to the Addendum.	Sec. 3.1
81	Local Government District of Pinawa	The approximate 3 tons of spent fuel presently in the standpipes should be put in safe retrievable containers as soon as possible and stored in concrete canisters until a final disposal vault is available. This must proceed with the highest priority and guarantees as to the completion date must be given.	Sec. 4.3.1	Processing operations to address wastes which cannot remain in existing storage structures until waste disposal becomes available are listed in Sec. 4.3.1 (Waste Management Area). The materials do not present a near term hazard in the present storage location. 69 standpipes containing irradiated fuel wastes are planned for remediation early in Phase 2 (approx. 2010). These wastes must be repackaged consistent with CCSF storage practices to accommodate future transfer to disposal facilities.	
82	Local Government District of Pinawa	Lack of disposal facilities or funding should not be a permitted excuse for delay. Canada has made no decision to build one as yet and there is a strong possibility that we may finally opt to stay with retrievable surface storage in canisters indefinitely because of public concerns about deep irretrievable burial. No delays in decommissioning should be justified on the unavailability of a national deep HLW repository. One may never be built but the waste must be dealt with now.		The CNSC will require that the waste arising from the decommissioning (and currently in storage at the WMAs) be maintained in approved waste management facilities until such time as other disposal facilities become available. A further examination of the fitness for service of the existing WMA facilities over time will be conducted in phase 1. Where a facility is judged unsuitable storing the waste until disposal facilities become available, the transfer of waste to interim storage facilities will be required.	
83	Local Government District of Pinawa	The highly radioactive pressure tubes buried in trench 6 should be cut up and put in sealed shielded containers for storage in concrete canisters.	Sec. 4.3.1	The processing schedule to address the pressure tubes in Trench #6 is listed in Sec. 4.3.1 and is planned for late in Phase 2, approx. 2015. The materials do not present a near term hazard in the present storage location.	

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84	Local Government District of Pinawa	Comparative costs given in the CSR for the decommissioning alternatives are not supported. The basis for their derivation and assumptions made should be given.		The cost comparisons are considered to be adequate for environmental impact decisions. The detailed cost for the decommissioning is a component of Detailed Decommissioning Plans.	
85	Local Government District of Pinawa	Economics should not be a determining factor while there are safety and ethical concerns.		Noted. CNSC licensing of the decommissioning project is contingent on the protection of human health, safety, security and the environment.	
86	Local Government District of Pinawa	AECL estimates the liabilities for both AECL research sites at $400 million "present value". We believe that such accounting is irrelevant as no funds are actually being invested. In 1996, WT Hancox, AECL Vice president, estimated the cost of decommissioning CRL at $4 billion. Our own estimates of the liabilities at Whiteshell are in the range of $500 million, based on comparisons with costs for similar sites around the world and using some of AECL's own figures. AECL publicly understates the real costs of decommissioning. The real costs for decommissioning should be publicized along with the costing models used. The funding should be identified and guaranteed by the federal government.		A detailed decommissioning plan for the entire decommissioning project, including detailed cost estimates in support of financial guarantees, will be prepared for and approved by the CNSC for the purposes of licensing.	
87	Local Government District of Pinawa	The basis for the 60-year remaining life of the buildings is not supported. Buildings are already showing significant deterioration. AECL should provide an independent civil engineering assessment to support their claims.		The project, as described, does not involve the retention of all buildings for 60 years. Redundant buildings will be decontaminated and dismantled, as appropriate, throughout the decommissioning program. Where buildings are not scheduled for immediate demolition or release from licensed control for other uses, the CNSC will require that AECL maintain them in a condition that does not pose a significant risk to people or the environment.	
88	Local Government District of Pinawa	We have been told by AECL employees that there are already serious problems with the integrity of other reactor buildings in Eastern Canada (NPD etc.) put into monitoring and surveillance by AECL.		Problems associated with buildings at other AECL reactor sites under storage with surveillance do not affect the safety and security of the radioactive inventory. The problems are being addressed by AECL under the regulatory authority of the CNSC.	

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89	Local Government District of Pinawa	AECL states that deferral reduces risk because of the decay of the contamination. This is only true for the WR1 reactor core as the rest of the waste and contamination has already decayed sufficiently or will not significantly decay further in the next sixty years. There is danger in waiting several generations before dealing with a difficult and dangerous job (It will still be dangerous 60 years from now).	Sec. 3.3	The rationale for deferment is detailed in Sec. 3.3 of the CSR. The primary component of the decommissioning project that is being deferred to allow for radioactive decay is the WR-1 core dismantling. The wastes to be held in interim storage at the WMA will be moved upon availability of a disposal site.	
90	Local Government District of Pinawa	AECL suggests that deferred decommissioning is practised in nearly every OECD country. This is not true except possibly for reactor cores. Early decommissioning is done in the UK and USA because it is not acceptable to leave waste in structures that do not meet modern standards.	10-12	As the original response to comment in table 10.4 outlines, deferment is incorporated in decommissioning strategy for many reactors and other nuclear facilities in OECD countries as well as others. For example, the UKAEA Corporate Plan 2000 (available from the UK Atomic Energy Authority) lists extended schedules up to 2050 to achieve end-states for nuclear sites such as Harwell, Winfrith, Windscale and Dounreay. Processing operations to address wastes which cannot remain in existing storage structures until waste disposal becomes available are listed in Sec. 4.3.1 (Waste Management Area).	
91	Local Government District of Pinawa	The issue of double handling of the waste is not a concern. If the waste is properly packaged now and stored retrievably in an engineered facility then removal to a final site will pose no risk to the workers.		The rationale for deferment is detailed in Sec. 3.3 of the CSR. Although WR-1 is the basis for the argument, there are significant quantities of WR-1 waste already stored in the WMA facilities as a result of the WR-1 operational program. Since AECL will have a significant presence and will manage waste at WL for decades the optimized plan is based on transfer of decommissioning waste directly to disposal facilities. Additional detail on the process for designing and implementing an enhanced monitoring program at the WMA, assessing the fitness for service of existing storage facilities and for establishing remediation schedules has been added to the Addendum. Where necessary we will retrieve and repackage waste for interim storage in enhanced facilities.	Sec. 3.1

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92	Local Government District of Pinawa	Because the CNSC approach to regulation has been generally non-prescriptive, operators of Canadian nuclear facilities have been able to license activities that they could not do in other OECD countries. Rather than meet a specific rule for a given activity, the CNSC reviews volumes of safety analysis to show that what AECL is doing meets the CNSC requirements. AECL has been able to produce safety analyses faster than the regulator has been able to read and understand them. This has already been seen to be a problem in resolving the licensing issues of power reactors and has just been identified as a concern in the recent report of the Auditor General of Canada. It is preferable that the CNSC rule that the facilities be decommissioned as soon as physically possible.		Noted.	
93	Local Government District of Pinawa	There is no valid safety argument for deferring decommissioning other than for the WR1 core. Even with WR1 the fuel channel assemblies could be easily removed and stored as is done in the CANDU power reactors when they are re-tubed. There is a strong ethical and safety argument against committing the decommissioning risks to future generations. These risks should be minimized by doing as much as possible now to put the wastes in a safe and easily retrievable state.		The rationale for deferment is detailed in Sec. 3.3. Although WR-1 is the basis for the argument, there are significant quantities of WR-1 waste already stored in the WMA facilities as a result of the WR-1 operational program. Since AECL will have a significant presence and will manage waste at WL for decades the optimized plan is based on transfer of decommissioning waste directly to disposal facilities.	
94	Local Government District of Pinawa	Any directions to AECL regarding decommissioning must also be made to and accepted by the Federal Government as they bear the ultimate financial responsibility.		The CNSC regulates the operators of nuclear facilities and other users of nuclear energy in Canada. At this time for the Whiteshell Laboratories, AECL is the entity that is legally responsible for compliance with the Nuclear Safety and Control Act, its regulations and the conditions of the licence issued by the CNSC. The Government of Canada is not the licensee for this decommissioning project. The CNSC will require that AECL arrange for financial guarantees for the decommissioning.	

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95	Local Government District of Pinawa	AECL's decommissioning plan is driven primarily by their (and the Government's) reluctance to spend the necessary funds to build the necessary facilities for handling the decommissioning wastes. CNSC now requires all licensees except for the federal government to make real financial provisions for decommissioning of all their facilities. The same rules should apply for the federal government with the funds put aside and protected from diversion to other uses.		Under the Nuclear Safety and Control Act, the requirements for the provision of financial guarantees applies equally to all licensees. The CNSC will require financial guarantees for the Whiteshell Laboratories decommissioning project.	
96	Local Government District of Pinawa	The facilities required immediately are a national LLW disposal facility (this could be a modular design and modules placed at different locations), processing and engineered storage facilities for MLW and, processing (e.g. stand-pipe remediation) and storage facilities for HLW.		Noted.	
97	Manitoba Conservation (TAC)	In Chapter 3, Table 3.3 (also Table ES 1) provides a comparison of costs for decommissioning alternatives. Under "Base Cost" estimates have not been provided. Instead, the term "reference project cost" is used. This term has not been defined nor is there specific reference made to this term in the text of Chapter 3. There should be some discussion of this term and its relation to the Detailed Decommissioning Plan. It is not possible to determine the relative relationship of incremental costs to the "reference project cost" with specific estimates. Although alternatives 1 and 2 result in incremental costs, their relationship to the overall project costs cannot be determined and may not represent a significant incremental cost to alternative 3.	Tables 3.3 & ES 1	The cost comparisons in assessment of alternatives are relative and conceptual only. No alternatives were screened on the basis of not being economically feasible. The CEAA requires that the alternative methods be compared on the basis of environmental effect. Therefore the RAs did not require AECL to prepare a more detailed assessment of relative cost, nor did they consider the relative costs presented in their consideration of which alternative is preferred. Detailed cost estimates of the proposed project will be a requirement of the CNSC licensing process, including as required in support of the financial guarantees.	

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98	Manitoba Conservation (TAC)	It is stated that decommissioning program includes contingency provisions for longer-term waste storage on the site and/or at other interim locations until the permanent disposal facilities are available. Specific details of the contingency plan and the interim waste storage facilities and locations have not been provided. Have cost estimates for these facilities been included in the alternative options?	S. 4.2.2 Sec. 5.3.3	Noted. Cost estimates for enhancing/replacing facilities are included in the incremental costs for Alternative 2. The details of the specific contingency storage facilities will be determined at the time based on the type, form and volume of waste involved. All designs will be subject to approval by AECL's SRC and the CNSC prior to construction and operation. It is currently assumed that any such facilities would be located in, or in the immediate vicinity of the existing WMA. For the purpose of an EA decision, all such contingencies are assumed to be economically feasible. Furthermore, the RAs did not use cost as a factor in the comparison of alternative decommissioning strategies. Under the subsequent CNSC licensing process, and based on a regulatory review of a detailed decommissioning plan, the need for contingency funds will be considered in the context of financial guarantees.	
99	Manitoba Conservation (TAC)	Will the incremental releases from the operation of the ALWTC during decommissioning affect the risk assessment that has already been completed for the river sediments in the Winnipeg River?	S. 4.5.4	No. Releases from the ALWTC are currently a small fraction of the DRLs (see Table 5.4) and are expected to decrease throughout the project. Nevertheless, AECL intends to carry out a final assessment at the end of Phase 3 to confirm final end-state objectives are achieved.	
100	Manitoba Conservation (TAC)	Will the residual effects of releases of treated effluents from the ALWTC and sewage lagoon be addressed as part of the monitoring and surveillance program and the contingency plan?	S. 6.3.3.4	Yes. As mentioned in the main report, (Section 4.3.3) monitoring will continue throughout Phase 2 and most of Phase 3.	
101	Manitoba Conservation (TAC)	The location of the two well nests RW1 and RW5, as shown on Fig. 1, Vol. 2) should be indicated in the Main Report.	S. 5.4.4	The two well nests appear on Figure 4.2: RWS1 is in the centre of the image whereas RWS5 is in the middle of the west side.	
102	Manitoba Conservation (TAC)	Due to the identified problems with well nest RW1, this well nest should be replaced as part of the long-term monitoring and surveillance program.	S. 5.4.4, V.2 C1.1.2	As stated in section 9.5.2, AECL intends to install additional groundwater-monitoring wells and to evaluate any potential changes to the flow patterns. Additional detail on the process for designing and implementing an enhanced monitoring program at the WMA, assessing the fitness for service of existing storage facilities and for establishing remediation schedules has been added to the Addendum.	Sec. 3.1

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103	Manitoba Conservation (TAC)	Specific details of the monitoring program provided in Table 9.1 indicate that the frequency of groundwater monitoring will be semi-annually while the Executive Summary on page ES-11 indicates monitoring of this area will continue beyond the decommissioning program until the beginning of the 23rd century. Is this correct?	Table 9.1, ES-11	Yes. Monitoring will continue during the institutional control period. It should be noted that Table 9.1 summarizes the current monitoring activities. Monitoring requirements are expected to change over time. The factors affecting the scope of monitoring are given in section 9.6. Additional detail on the process for designing and implementing an enhanced monitoring program at the WMA, assessing the fitness for service of existing storage facilities and for establishing remediation schedules has been added to the Addendum.	Sec. 3.1
104	Manitoba Conservation (TAC)	It is stated that protection systems will remain in effect during the first phase of decommissioning, and that similar measures will apply in subsequent phases to ensure that any process streams or malfunctions from decommissioning activities would be handled in a controlled and effective manner. Will there be sufficient staff and resources with the level of training required during the later phases of decommissioning? Does this also include site security?	S. 6.2.2	AECL is committed to maintaining a qualified team to conduct monitoring and surveillance activities on future project work, as outlined in AECL Commitments, Sec. 1.5. That commitment includes training programs as required to maintain the required skills/capabilities. Site security is included. Maintenance of a competent work force at WL will be a regulatory requirement of the CNSC.	
105	Manitoba Conservation (TAC)	It is noted that under extremely windy conditions decommissioning activities will be curtailed. These adverse meteorological conditions have not been qualified. At what wind speed would decommissioning activities be curtailed?	S. 6.3.1.3	Decommissioning activities will be curtailed as the hourly average wind speed approaches the wind erosion threshold speed – i.e. 40 km/hr at a height of 7 metres (the height of the meteorological station above surface	
106	Manitoba Conservation (TAC)	It is stated that AECL will develop a safety case to demonstrate compliance with those requirements to confirm in-situ disposal of LLW as a final end state. When will this be provided and will there be opportunity for public input?	S. 6.3.4.2	The development and testing of the safety case will continue throughout the planned licensed waste storage period. Enhanced environmental monitoring in the vicinity of the subject trenches will begin early in the decommissioning program and continue throughout the project. A more in-depth examination of the WMA facilities, including a refinement of source-term information and adequacy of long-term containment, will be competed early in Phase 1. Opportunities to sample and confirm inventories will be taken during other planned WMA remediation projects. Detailed decommissioning plans will be prepared using that information to confirm the feasibility of the in situ option, or conversely, establish the timing and scope of remediation actions. A final safety case for any remaining in-situ disposal of waste will be prepared by AECL towards the end of the 60-year period of active decommissioning. All of the above monitoring and evaluation information will be available to the public.	Sec. 4.1

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107	Manitoba Conservation (TAC)	It is stated that there will be ground-surface radiation surveys to monitor potential surface contamination for cesium ponds and active area soil contamination. Will this be part of the long-term monitoring and surveillance program?	S.6.3.4.3	Yes, such surveys will be conducted until conditions have stabilized or have been reduced to a level that meets the decommissioning endstate objectives.	
108	Manitoba Conservation (TAC)	The need for contingency plans and emergency preparedness plans is identified. Will there be sufficient resources and staff to implement these plans for the long-term Phase 2 and 3 of the decommissioning activities?	S. 6.2	AECL is committed to maintaining a qualified team to conduct monitoring and surveillance activities on future project work, as outlined in AECL Commitments, Sec. 1.5. That commitment includes training programs as required to maintain the required skills/capabilities. Maintaining the capability to deal with emergencies is also a licensing requirement of the CNSC.	
109	Manitoba Conservation (TAC)	Where there is an agreement with local communities with respect to fire protection, will there be sufficient resources and training provided to ensure the level of response is appropriate to meet the plans?	S. 6.2	AECL is committed to maintaining a qualified team to conduct monitoring and surveillance activities on future project work, as outlined in AECL Commitments, Sec. 1.5. That commitment includes training programs as required to maintain the required skills/capabilities. Where community resources are involved, AECL training programs will extend to the training of those resources. Although AECL will be responsible for fire protection at WL, shared community services will be considered as a component of fire protection.	
110	Manitoba Conservation (TAC)	It is stated that accident mitigation is based on prevention, early detection, remediation and accommodation. Will there be sufficient staff and resources to ensure as part of the monitoring and surveillance program there will be early detection and prevention?	ES-13	AECL is committed to maintaining a qualified team to conduct monitoring and surveillance activities on future project work, as outlined in AECL Commitments, Sec. 1.5. That commitment includes training programs as required to maintain the required skills/capabilities. Maintaining the capability to deal with emergencies is also a licensing requirement of the CNSC	
111	Manitoba Conservation (TAC)	It is stated that AECL's existing contingency plans and emergency preparedness plans will be implemented. Is this true for all phases of the decommissioning activities or will there be a reduction in the resources to implement these plans?	ES-13	AECL is committed to maintaining a qualified team to conduct monitoring and surveillance activities on future project work, as outlined in AECL Commitments, Sec. 1.5. That commitment includes training programs as required to maintain the required skills/capabilities. Maintaining the capability to deal with emergencies is also a licensing requirement of the CNSC	
112	Manitoba Conservation (TAC)	Will there be opportunity provided for public input with respect to future modification of decommissioning plans and monitoring programs? Will the Public Advisory Committee mentioned in section 9.9 be created prior to these activities and have the opportunity to provide input?	S. 9.2, 9.6	The development of the PAC is expected to be a collaborative activity with the local communities and interest groups. AECL supports formation of the PAC as a valuable communications activity and is open to suggestions on the structure and mandate of such a committee. All information relating to the regulation of the decommissioning project, including any modifications of the approved plans and monitoring information, will be available to the public from the CNSC.	

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113	Manitoba Conservation (TAC)	The visible black organic material, confirmed to contain little of the reactor coolant, should be characterized to determine if there may be environmental or human health impacts from this material.	V. 2, S. B1.4	The black organic material was analyzed by GC/MS for the presence of HB40, which was the contaminant of concern at the time of the investigation. Only trace quantities of HB-40 were detected. Observations by the sampling team and later by the analyst support the conclusion that this material has a high boiling point, is non-volatile and very recalcitrant, all attributes that suggest low biological interaction and effect.	
114	Manitoba Conservation (TAC)	There is an indication that other non-radiological contaminants (metals) may be slightly elevated in the sediment. The assessment of toxic end-points appears to concentrate on the radiological risk. No values are provided to levels of metals in the clams and if bioaccumulation may be occurring.	V. 2, S. B1.4	Clam tissues were not analysed for metals since the objective of the fieldwork was to confirm the possible contamination from WL, and the signature of WL contamination is most clearly indicated by radionuclides. Although clam tissues were not analysed for metals, no toxicity issues are anticipated based on the low concentrations of metals in the sediment (see Table 7 of Appendix B).	
115	Manitoba Conservation (TAC)	Better characterization of the trench wastes should be undertaken if these wastes are to be considered candidate for in-situ disposal.	V.2, S. C1.1.1, C1.4.1	Characterization will be carried out during remediation or selective removal of trench waste. Details will be developed as part of the design of the follow-up monitoring program.	Sec 4.1
116	Manitoba Conservation (TAC)	It is noted that there has been no intrusive sampling of the trenches, however there will be a follow-up monitoring program to more fully characterize the aspects of the WMA important to in-situ disposal. Details of the follow-up monitoring program should be provided for public consultation.	V. 2, S C1.4.1	The details and results of the follow-up program will be routinely available to the public.	
117	Manitoba Conservation (TAC)	Although Appendix C.3, C.4 and C.5 provide a reasonable assessment of the trench characteristics and hydrogeology, there does not appear to be a clear assessment of the fate and transport of radionuclides in the WMA. It is also stated under section C1.2 on page C1-7 that the degree of degradation of waste is unknown. Will a fate and transport model for the radionuclides be undertaken?	V. 2, Sec C	AECL indicated that a final safety case for in-situ disposal of trench wastes would be prepared. Transport modelling will be based on the additional information collected through the follow-up monitoring program and will form part of such safety case. (Section 4.3.1) Additional detail on the process for designing and implementing an enhanced monitoring program at the WMA, assessing the fitness for service of existing storage facilities and for establishing remediation schedules has been added to the Addendum.	Sec. 3.1

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118	Manitoba Conservation (TAC)	It is stated that interviews with staff indicate some trenches were covered with contaminated soil removed from other facilities on the Whiteshell site, thus contamination in these areas does not indicate a release from the trench. There is no explanation provided for this conclusion. How was this assessed?	V. 2, C1.2	The point needs clarification. Several waste trenches were initially filled/covered with contaminated soil originating from a spill in the laboratory active area. An additional layer of clean fill was then capped over the contaminated soil. Accordingly, when core samples are taken in these areas it is not possible to clearly differentiate the boundary between the clean fill and the contaminated soil. (In trenches without a contaminated soil layer at the top of the trench, differentiating between soil cover and unconsolidated trench waste allows for definition of where the capping layer ends.) The transport of radionuclides in the contaminated sub surface soil layer will also be considered in the final safety case.	
119	Manitoba Conservation (TAC)	Characterization of the non-radiological materials in the trenches and appropriate modelling to determine environmental and human health impacts should be undertaken if these materials are considered to be part of the in-situ disposal. It should also be noted that DDT will breakdown to form DDE which has a much longer life in the environment.	V.2, C1.4.7, C2.5	AECL will assess the recovery potential and the need for recovery of lead and drums containing DDT, glycol and solvents as part of the enhanced monitoring program. If recovery is not planned, AECL will confirm that contaminant concentrations are within acceptable ranges as part of the safety case for converting the trenches to in-situ disposal	Sec. 3.1
120	Manitoba Conservation (TAC)	It is stated that the presence of non-radiological contaminants in the LLW trenches may raise the need for selective removal and/or partial remediation of the affected trenches. If environmental impacts of non-radiological contaminants are not assessed as previously noted, then this would be an appropriate management option.	V.2, C2.6	Agreed.	
121	Manitoba Conservation (TAC)	The environmental and human health impacts of non-radiological contaminants detected in the trench cap core metal analysis (specifically high chromium) should be determined.	V. 2, C.4.4.1	The total Cr levels indicated in the table are below the Canadian Soil Quality Guidelines. Nonetheless, any contamination in the trench covers would be considered in the final safety case for in-situ disposal (see section C.4.4.1).	
122	Cancer Care Manitoba (TAC)	The technical work done in justifying the conclusions and in developing support for Alternative 3 is well done and I have found no areas of disagreement with the methods or conclusions based on the science and technology presented in the report.		Noted	

Comment Number	Comment By	Summarized CNSC Comment	CSR Rev.2 Reference	Response	Addendum Reference
123	Cancer Care Manitoba (TAC)	I have reviewed the tables that describe recent radiological sampling and the measurement of gamma radiation levels on-site and in the surroundings. These data do not give rise to any concern for public safety or for impact on biota.		Noted	
124	Cancer Care Manitoba (TAC)	I have a concern about the time frame associated with the requirement for institutional control "now estimated at 200 years". I do not think I understand the significance of this statement in the context of Alternative 3 that purports to be a 60-year scenario. Further rationalization of the concept of the 200-year institutional control should be provided.	ES-5	The rationale for the 200-year institutional control period has been added to the addendum.	Sec. 3.1
125	Cancer Care Manitoba (TAC)	The arsenic content of Trench 1 has raised some concern. Unlike the radioactive nuclides that will decay during any possible migration, arsenic will not do so. I support the conclusion re the need for remediation of Trench 1. This should be a defined task, rather than a study of the potential during the long times of the project's phases.	S. C1.4.6.1	Trench 1 is one of four trenches that will be remediated. Other trenches or parts of trenches may become candidates for remediation depending on the conclusions of future investigations planned for early in Phase 1 and in support of the final safety case for in-situ disposal.	
126	Cancer Care Manitoba (TAC)	For Question 221: The reference section is 5.3.4, not that as stated.	App. F	Agreed	Sec. 2.2
127	Cancer Care Manitoba (TAC)	The commitment is made to ensure that funding is identified as a component from Treasury Board. I do not think that this is sufficient guarantee for a project plan of this nature. The plan is highly developed and is offered for public and expert review and acceptance. The requirement to fund the project must be as strong as the science and technology that is used to rationalize the plan.	ES-15, S. 1.5	The CNSC now has the legal authority to require financial guarantees from its licensees. Although the specific instruments that will be used for these guarantees in this case have not yet been determined, the CNSC's policy is that the guarantees be sufficient to address the subject liabilities and be readily accessible in the event of failure of the licensee.	
128	Cancer Care Manitoba (TAC)	The Province needs assurance that the federal regulator will actively pursue government to maintain these commitments and to follow the detailed plans and promises in the document for developments during the project lifetime, even if AECL is no longer in existence.	S. 1.5	The CNSC assures the Province that it will continue to regulate the Whiteshell facility throughout the decommissioning project. The CNSC's objectives, as the federal regulator, will be to see that human health, safety, security and the environment are protected, and that appropriate financial guarantees to achieve that are maintained. That regulatory control will continue regardless of whether AECL, the Federal Government, or any other entity is subject to the requirements of the NSCA, its regulations and the CNSC licence conditions.	

Comment Number	Comment By	Summarized CNSC Comment	CSR Rev.2 Reference	Response	Addendum Reference
129	Cancer Care Manitoba (TAC)	I remain concerned that the reference Alternative is of such long duration and remains contingent on the development of a national repository, over which neither the proponent or the Province has control. The Province needs a stronger assurance than this document provides concerning the ultimate disposition of the waste. I recommend that the assumptions concerning the ability to move wastes to the national repository be viewed with scepticism.		The RAs acknowledge the uncertainty associated with the ultimate disposition of the wastes, and can provide no further assurances to the Province as to when those uncertainties will be resolved. However, the CNSC will provide assurances that the wastes will remain under its regulatory control for as long as is necessary to protect human health, safety, security and the environment. Additional detail on the process for designing and implementing an enhanced monitoring program at the WMA, assessing the fitness for service of existing storage facilities and for establishing remediation schedules has been added to the Addendum.	Sec. 3.1
130	Cancer Care Manitoba (TAC)	I recommend that the Province ensure that the Canadian Nuclear Safety Commission has a plan in place and a commitment to the plan to maintain a detailed evaluation of the progress of AECL in undertaking their decommissioning plan and in undertaking the promises for additional studies and the development of remediation plans during the project tasks, as outlined in this report, including the commitments in responses to questions (e.g. Appendix F - Question 183).		The CNSC regulatory licensing process, including the use of approved detailed decommissioning plans, follow-up and monitoring requirements, financial guarantees, and the other provisions of the applicable regulations, will provide the desired assurances to the Province and the public with respect to the CNSC's role and commitment."	
131	Cancer Care Manitoba (TAC)	I am not satisfied that the AECL-Manitoba Agreement for grants in lieu is beyond the scope of the decommissioning project plan. While this is a political commitment and a political negotiating task, it is necessary for the decommissioning plan to address this topic because it is the primary socio-economic impact that remains. I recommend that continued commitment to the Manitoba-AECL agreement be a part of Manitoba's acceptance of the decommissioning project.	App. F (#155)	The socio-economic impacts were assessed in the context of the federal environmental assessment regime. The economic impacts considered were those caused by a change in the environment due to the decommissioning project. Therefore, the economic effects resulting from the closure of the Whiteshell Laboratories were not considered in the CSR. (App. C)	

Comment Number	Comment By	Summarized CNSC Comment	CSR Rev.2 Reference	Response	Addendum Reference
132	Cancer Care Manitoba (TAC)	The analysis of the socio-economics concludes the "other industries now provide the bulk of employment in the area". This statement does not appropriately indicate that the transfer and closure of high technology projects has already resulted in the transfer from this locale of many of the trained staff in non-retirement age. This statement cannot be used to indicate that the local industry now provides substitute economic strength to the area and, de facto, is a substitute for corporate support of the LGD of Pinawa.	ES-9	The statement is intended to be one of fact only and does not imply that local industry has filled the void. The socio-economic impacts were assessed in the context of the federal environmental assessment regime. The economic impacts considered were those caused by a change in the environment due to the decommissioning project. Therefore, the socio-economic effects resulting from the closure of the Whiteshell Laboratories were not considered here.	
133	Manitoba Conservation (TAC)	I still have a fundamental concern with the time frame (sixty years) selected for decommissioning, identified as Alternative 3, "the reference alternative" and as "the least cost option". My previous comments (143 to 147 Appendix F) and concerns with respect to this approach stand.		Although Alternative 3 represents the least cost option, the demonstration still had to be made that the preferred alternative would not result in significant adverse environmental effects. The comprehensive assessment that was carried out led to that conclusion. The choice among the alternatives was based on relative potential environmental effect (as required by the CEAA). The approximate and relative cost estimates in the EA were presented to first show that all of the alternatives were economically feasible (i.e., none were screened on the basis of being technically or economically unfeasible as required by the CEAA), and second, to illustrate that certain alternatives may have economic advantages without compromising the ability to protect the environment.	
134	Manitoba Conservation (TAC)	I note the possibility identified in the document that "should off-site waste disposal availability take longer than assumed, the contingency would be to revert to Alternative 2". Alternative 2 is one hundred years. My concern is, what degree of confidence do we have that off-site nuclear waste disposal will be available by that time?		AECL will continue to manage its wastes under CNSC regulatory control until either the desired end-states are achieved or disposal facilities become available.	
135	Manitoba Conservation (TAC)	Under the "Constraint" section of the report some information about AECL's Waste Management Program for a national disposal facility (where it is at presently) could be expanded.		The federal government is taking steps to respond to the recommendations of the environmental assessment panel on the nuclear fuel waste disposal concept. For example, Minister Goodale introduced legislation for the long-term management of nuclear fuel waste: http://www.nrcan.gc.ca/css/imb/hqlib/200127e.htm	
136	Manitoba Conservation (TAC)	Under the section Surface Water (Hydrology) what involves a controlled release?		A controlled release is a release of an effluent to a water body only after confirmation that contaminant concentrations meet applicable limits.	

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137	Manitoba Conservation (TAC)	Under Soil and Groundwater section it is stated that small amounts of contaminants are either in the soils or could still occur into the groundwater. Is the reason for groundwater effect to the Waste Management Area only because of the stated very low amounts of contaminants present?	Sec. 6.3.5.2	Essentially, yes. The likely environmental effects on soil and groundwater are related to the operation and decommissioning of the waste management area, inactive landfill, sewage lagoons, buried services and the planned in-situ disposal of the LLW trenches. No other effect such as an alteration of the flow regimes is expected.	
138	Manitoba Conservation (TAC)	There is some concern towards off-site contamination of Winnipeg River sediments with radionuclides such as Cesium (137Cs). The preferred decommissioning option of abandoning the contaminated sediment in-situ may avoid any disturbance that could further expose contaminants.		Noted	
139	Manitoba Conservation (TAC)	Environmental monitoring of sediments is planned for up to 60 years to determine if contaminants require remediation to achieve final end-state objectives. Monitoring of clams and fish for this same period is also recommended both to determine if remediation is required to achieve end-state objectives and to serve as bio-indicators of any future unanticipated increase in contamination.		AECL is committed to monitoring activities to determine if contaminants deposited as a result of decommissioning activities changes the conclusions of this study. Contaminant uptake by non-human biota will be considered as part of the monitoring activities	
140	Manitoba Health (TAC)	Manitoba Health is in general agreement with the conclusion that no residual effects on public health are expected.		Noted	
141	Manitoba Conservation (TAC)	I did not find any major concerns with the information provided or with the proposed sequencing and time lines for decommissioning activities to occur.	Gen.	Noted	
142	Manitoba Conservation (TAC)	Based upon the information, current contaminant concentrations appear to be within acceptable values and effluent emissions during decommissioning are expected to be lower than when the laboratory was operating.	Gen.	Noted	
143	Manitoba Conservation (TAC)	Monitoring activities and frequencies generally appear to be sufficient	S.9.0	Noted	

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144	Manitoba Conservation (TAC)	Maps showing significant features such as the effluent outfall discharge point and sampling stations/sites should be included. Surface and groundwater sampling points and fish sampling locations are difficult to determine accurately from the text.	S.9.0	Additional maps, showing Winnipeg River sampling locations as well as surface water and groundwater sampling locations near the WMA, are provided in the Addendum.	Sec. 4.1
145	Manitoba Conservation (TAC)	The lagoon sediment sampling indicated low levels of contamination. Verification that contamination concentrations remain stable or decrease needs to be reviewed at the time of final decommissioning.	S. 9.5.4	As each component of the facility reaches the end of decommissioning, AECL will be required to demonstrate to the CNSC that the end-state objectives have been met.	
146	Manitoba Conservation (TAC)	Water hardness ($CaCO_3$ should be reported in the lagoon effluent monitoring since it is often needed for determining some base metal guideline values for protection of aquatic species. The addition of dissolved phosphorus could also be considered.	S. 9.5.4	The 1983 Manitoba Water Authority Guidelines by which AECL measures compliance do not allow for water hardness adjustments. However when the new guidelines (based on the April 2000 draft) came into effect we will determine hardness and apply the appropriate guidelines value. We are in agreement with the comments on considering dissolved phosphorus.	
147	Manitoba Conservation (TAC)	Manitoba Conservation should be kept informed of the ongoing decommissioning activities and monitoring results.	S. 9.0	AECL plans to maintain an on-going communications program. Reporting of project activities and of monitoring results would be components of routine communications.	
148	Canadian Environmental Assessment Agency	It is stated that "*In addition to the time frame of the project as described above, the temporal boundaries of the assessment were considered to be flexible to ensure that the duration of any significant effects beyond the project time frame would be fully characterized*." This statement gives the impression that the project results in significant effects. We strongly suggest that the meaning of this paragraph be made more clear, or that the word "significant" not be used.	S. 2.3.**2**	Agreed. The word 'significant' was deleted.	Sec. 3.1
149	Canadian Environmental Assessment Agency	Section 6.1.2 begins with the sentence "*The analysis of effects is organized into an analysis of the effects of:…*" This sentence would have more clarity for some but not all of the effects listed if it read "*The analysis of effects is organized into an analysis of the effects of the project on:…*".	S. 6.1.2	Agreed. The words 'the project on' were added to the end of the 1st sentence.	Sec. 2.1
150	Canadian Environmental Assessment Agency	Section 6.3 outlines the assessment of potential environmental effects. For clarity purposes, it would be useful to outline up front how this section is organized.	S. 6.3	Agreed. A lead-in paragraph was added.	Sec. 3.1

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151	Canadian Environmental Assessment Agency	It is noted that "*excessive noise has been documented to have a negative influence on wildlife breeding, migration and feeding patterns*". The conclusions that result from this section, taking into consideration the ability of the species identified to temporarily relocate, seem to be lacking in the information necessary to substantiate the final claim that "*no residual effects from noise and vibration are expected* ". For example: are any species more sensitive to noise that others?; does the timing of various decommissioning activities which produce noise need to be scheduled with the consideration of breeding schedules of specific species?	S. 6.3.2	Because the wildlife species identified as VECs (deer and moose) have a range that extends beyond the site and can temporarily and easily relocate to other suitable habitats during the brief periods when noise is disruptive, it is not considered necessary to schedule decommissioning activities to coincide with any particular activities of these species.	
152	Canadian Environmental Assessment Agency	It is stated that, with respect to mammals "*There is the potential for exposure from contaminated soils and surface water, in particular near WMA*." It is further stated that "*No effect on the population of mammals is expected because: the geographic extent of areas affected by residual contamination is expected to be limited to the Project Study Area; and mammals are mobile and will also feed and graze outside contaminated areas*." Again, information to substantiate these conclusions is could be added.	S. 6.3.5.2	It is acknowledged that mobility of the mammal populations does not guarantee dilution. However, there is no basis to argue that there is a mammal population specific to the WMA. Two other points are worth noting. First, large mammals cannot be impacted significantly by contamination that can be inside the WMA fenced area. Although not intentionally excluded by the integrity of the fence, deer for instance, would not spend a large fraction of time grazing inside the fence. Small mammals can penetrate the fence but the habitat in the WMA is of no better or poorer quality than that in the old-field that surrounds the WMA. Should individuals be impacted through feeding in the WMA, they belong to a larger population that extends beyond the fence. This limits impacts on the population.	
153	Canadian Environmental Assessment Agency	It is stated that "*The Canadian Environmental Assessment Act considers socio-economic impacts only when a biophysical effect is identified*." This wording must be changed to correctly reflect *the Act*.	S. 6.3.9, S. 6.3.9.3	Agreed. Both paragraphs were revised.	Sec. 3.1

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154	Canadian Environmental Assessment Agency	It is indicated that "*Cessation of a monitoring activity will occur once it can be shown that an effect has stabilized or has been reduced to a level where it is no longer considered significant by regulatory or other standards such as community concerns*." It may be more appropriate to avoid the use of the term "significant". Monitoring and follow-up should be done to verify the environmental assessment, and determine the effectiveness of mitigation measures.	S. 9.6	Agreed. The sentence was corrected.	Sec. 3.1
155	Environment Canada	Because detailed decommissioning plans (DDPs) will be developed later for various facilities, we are unable to evaluate these various components (such as dispersion modelling) at this time, or any proposed mitigative measures. We recommend that the CSR indicate whether FAs will be consulted during the development of the DDPs, and if so, the process that will be followed to obtain FA input.		In carrying out is licensing responsibilities, the CNSC will consult with other expert government departments and other stakeholders where appropriate, and will consider all submissions to that public licensing process.	
156	Environment Canada	Section 1.4.1.3 (Fisheries Act) - The first sentence should read "The *Fisheries Act* is administered by the Ministers of Fisheries and Oceans and Environment Canada."	S. 1.4.1.3	Agreed. The sentence was corrected.	Sec. 3.1
157	Environment Canada	It is stated that 20 km/hr is the wind erosion threshold speed. The proponent does not specify if this threshold is at the surface, 6m or 10m. We recommend that the proponent specify at what level the wind erosion threshold is being measured.	S. 5.4.1, Table 5.12	The 20 km/hr wind erosion threshold speed is measured at 15 cm above the surface. This is equivalent to approximately 40 km/hr at a height of 7 metres above surface - the approximate height of the meteorological station.	

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158	Environment Canada	It seems that the labels are reversed in Figures 5. 8, 5.9 and 5.10. The Environment Canada station measures winds at 10m, not 6m or 25m. This may explain why the analysis of Figure 5.10 on page 5-15 is contrary to expectations. Usually winds increase with height from 6m to 10 m, not decrease. Also, the veering and increasing winds (with height) in the boundary layer is due to the Ekman spiral or the lessening effect of friction with height, not the Coriolis force. We recommend that the proponent review the data in the above figures and clarify the analysis of the wind data.	S. 5.4.1, S. 5.4.2	Agreed. Figure captions and text appearing on p. 5-15 were corrected.	Sec. 2.1
159	Environment Canada	We would like to correct our previous comment that fine particulate matter (PM_{10}) was declared CEPA toxic in May 2000. The *intention* to declare it toxic was announced at that time, but the actual declaration has not yet been done. However, this is expected to occur in the near future. Also, joint federal and provincial initiatives have also been undertaken under the auspices of the Canadian Council of the Ministers of the Environment (CCME) related to fine particulate matter.	S. 6.3.1, App. F(182)	Noted.	
160	Environment Canada	The report indicates that activities will be curtailed during periods of adverse meteorological conditions (e.g., during periods of very high winds). However, these conditions are not defined, and we recommend that the proponent define the high wind thresholds.	S. 6.3.1.3	Decommissioning activities will be curtailed as the hourly average wind speed approaches the wind erosion threshold speed – i.e. 40 km/hr at a height of 7 metres (the height of the meteorological station above surface).	
161	Environment Canada	We note that AECL's response to our previous comment about handling of Ozone Depleting Substances indicates that they will be "vented in accordance with the Environmental Code of Practice….". The *Federal Halocarbon Regulations* under CEPA generally prohibit (among other requirements) the release of regulated ODSs. A preferable statement would have been that ODSs will be "handled in accordance with…".	App. F (178)	Agreed. Wording changed from 'vented' to 'handled'.	Sec. 2.2

Comment Number	Comment By	Summarized CNSC Comment	CSR Rev.2 Reference	Response	Addendum Reference
162	Natural Resources Canada	It is unclear to what extent the proponent is required to "make the safety case" for current in-situ disposal of low-level and other waste in the WMA in the present CSR. This is important because it determines standards for evidence presented in the CSR in support of on-going disposal practices at the WMA.	S. 6.3.4.2, S. 9.5.2, App. C5	The licensing safety case for in-situ disposal of selected LLW trenches has not yet been made, and AECL is not currently authorized to "dispose" of any waste on the site at this time. Given what is currently known about the selected wastes at this time, the environmental assessment is considering only what the likelihood of significant adverse effects from in-situ disposal may be. The selected trenches will remain under CNSC licensed control as part of a waste *storage* facility until the EA follow-up activities (integrated with the CNSC's other regulatory requirements) demonstrates, as part of a detailed safety assessment, whether in-situ disposal will indeed allow for the protection of human health, safety, security and the environment. That licensing decision is not anticipated to occur for approximately 60 years.	
163	Natural Resources Canada	The hydrogeological study conducted at the WMA in the summer 2000 inadvertently presents a disturbing picture of record keeping practices at AECL and it also fails to demonstrate conclusively that upward hydraulic gradients exist throughout the WMA. Only at a single piezometer nest could such conditions be confirmed. The CSR should be revised in order to present a more thorough and convincing picture of current hydrogeological conditions at the WMA.	S. 5.4.4, App C.5	In the region of interest, upward hydraulic conditions existed for more than 95% of the time over the 1968 to 1983 period. Analysis of groundwater monitoring data from two well nests for the period 1984-2000 were analyzed to review the hydraulic conditions at the WMA. Unfortunately, of the two well nests one had failed, but the records for the other supported the upward hydraulic gradient. The AECL follow-up monitoring program will be designed to collect and analyze additional data to confirm hydraulic conditions. Additional detail on the process for designing and implementing an enhanced monitoring program at the WMA, assessing the fitness for service of existing storage facilities and for establishing remediation schedules has been added to the Addendum.	Sec. 3.1
164	Natural Resources Canada	Although the contaminant transport code used at the WMA may well be correct, it has not been subject to external peer review. It is surprising that AECL did not use its own more rigorously tested and generally accepted MOTIF code for this study.	App. C.1	The MOTIF code was not used because it is more detailed and comprehensive than the data inputs support. The objective for the CSR was to provide a screening estimate to determine the viability of in-situ disposal. The model used to estimate migration from the trenches was selected to be consistent with the scale and complexity of the screening estimate. Future work for the final safety assessment for the LLW trenches will use more comprehensive evaluation methods. Future modelling will take into account the data collected during the follow-up program. Furthermore, more detailed modelling will need to be conducted in support of any application to convert the trenches to in-situ disposal. The models and modelling results will be reviewed by CNSC staff.	
165	Natural Resources Canada	The one-dimensional transport assumption used in the contaminant transport code at the WMA is not necessarily conservative and likely represents an over-simplification of possible migration paths at the WMA.	App. C.1	The MathCAD calculations used provide a conservative, simple and transparent evaluation. The trench is in fractured clay, which is a dual porosity medium. AECL's calculations used the conservative approximation of the highest fracture conductivity and lowest capacity factor that accounts for only sorption in the fractures.	

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166	Natural Resources Canada	Values for the dispersivities and diffusion coefficients used in the contaminant transport modelling at the WMA are not documented.	App. C.1	Table 3 of Appendix C-1 provides migration model parameters, including diffusion coefficients, tortuosity and dispersivity. The diffusion coefficient is a handbook value within the range for most common ions. The tortuosity value used in the model is typical of values found in references. The dispersivity value was estimated for fractured clay.	
167	Natural Resources Canada	The CSR should be revised to include a more realistic three-dimensional study of contaminant transport based on a detailed hydrogeological model of the WMA and surrounding area.	App. C.1	The MathCAD calculations used provide a conservative, simple and transparent evaluation. The trench is in fractured clay, which is a dual porosity medium. AECL's calculations used the conservative approximation of the highest fracture conductivity and lowest capacity factor that accounts for only sorption in the fractures.	
168	Natural Resources Canada	Due to the identified problems in past record keeping and lack of understanding of hydrogeologic conditions at the WMA, it is recommended that the proponent start follow-up groundwater monitoring sooner rather than later in order to achieve a better understanding of current hydrogeological conditions at the WMA. This understanding should allow the proponent to develop a more realistic contaminant transport model and to site new sentinel wells at locations that are more likely to detect leachate plumes.	App. C.1	Additional detail on the process for designing and implementing an enhanced monitoring program at the WMA, assessing the fitness for service of existing storage facilities and for establishing remediation schedules has been added to the Addendum.	Sec. 3.1
169	Natural Resources Canada	The last two sentences of the soils and groundwater section of the Executive Summary should be revised in order to conform to more conventional geological terminology, perhaps as follows: 'The site is underlain by soils, formed in discontinuous organic deposits, silt, silty clay, fine sand and clay till, overlying Precambrian bedrock.'	ES	Agreed. The two sentences were replaced with the suggested sentence.	Sec. 3.1
170	Natural Resources Canada	The legend of Figure 5.12 was not revised, so the word 'fill' still appears where 'till' should be used	Fig. 5.12	Agreed. The correction was made.	Sec. 2.1

Comment Number	Comment By	Summarized CNSC Comment	CSR Rev.2 Reference	Response	Addendum Reference
171	Natural Resources Canada	Text titled 'Radioactivity in Sediments' in section 5.4.7 is evasive regarding the source of the second Cs peak in Lake Winnipeg. An unpublished source by Soonawala is cited, without summarizing the basis of the conclusion. Without necessarily endorsing the conclusion, the CSR should acknowledge that Lockhart et al. (2000) found elevated levels of 137Cs in Lake Winnipeg sediments deposited in the 1970s and 1980s that they attribute to releases from the Whiteshell Labs. (Lockhart, W. L., P. Wilkinson, B. N. Billeck, G. A. Stern, R. A. Danell, J. DeLaronde, and D. C. G. Muir. 2000. Studies of dated sediment cores from Lake Winnipeg, 1994; in B. J. Todd, C. F. M. Lewis, D. L. Forbes, L. H. Thorleifson, and E. Nielsen, eds., 1996 Lake Winnipeg Project: Cruise Report and Scientific Results, Geological Survey of Canada Open File 3470, p. 257-267.)	S. 5.4.7	AECL acknowledged that the Cs-137 concentrations measured downstream of WL result from its operation (see section 5.4.7). However, it was also demonstrated that those elevated levels would not result in any significant environmental impacts. Therefore, since the removal of the sediments immediately downstream of WL cannot be justified based on those conclusions, it follows that the even lower levels of Cs-137 measured between WL and Lake Winnipeg would not constitute an environmental concern.	
172	Health Canada	Health Canada is satisfied with the demonstration made by the proponent that the decommissioning activities are not expected to impact on human health		Noted	
173	Health Canada	Although we understand the arguments put forth by the proponent for choosing option 3 (60 years) for decommissioning, we still believe that a shorter period closer to option 1 (20 years) would be preferable. This, we believe, would limit the risk of future accidental releases of radioactivity to a much more manageable time line.		The potential impacts from accidents and malfunctions were analyzed (section 6.4) and found to be mitigable. Mitigation will be based on prevention, early detection, accommodation and remediation. Throughout the decommissioning project, the structural integrity of buildings and structures will be maintained, and include repair and/or replacement where necessary. The CNSC will require that AECL continually demonstrate the safe condition of the site.	
174	Health Canada	We note that section 6.3.7.2 (pg. 6-25) provides estimated collective radiation doses for workers undertaking phase 1 only. Individual doses would be preferred.	S. 6.3.7.2	Collective dose estimates take into account the decommissioning activities and the personnel resource hours required to complete the work. Individual doses are controlled below 20 mSv/a and ALARA through the application of AECL's Radiation Protection Program.	

Comment Number	Comment By	Summarized CNSC Comment	CSR Rev.2 Reference	Response	Addendum Reference
175	Health Canada	It is indicated that the proponent will carry out an evaluation of doses to workers undertaking phase 2 and 3 of the proposal at a later date and will provide them in decommissioning plans. In the absence of such information, it is impossible for Health Canada to comment on the impact of the proposal on workers' health.		To meet the CNSC's regulatory requirement of keeping doses ALARA, evaluating work environments and optimizing radiation protection measures is a necessary part of planning all tasks involving potential exposures to ionizing radiation. This can only be completed at the time detailed decommissioning plans are being prepared. Nevertheless, all individual doses will have to be maintained below the 20 mSv/a legal limit and ALARA. It is on this basis that the CNSC staff conclude, for the purpose of an EA decision, that the adverse effects are not likely to be significant.	
176	Health Canada	We believe that the proposal to decommission the low level radioactive wastes in situ should be acceptable provided rigid protocols are followed. The proponent and the regulator must ensure that long-lived radionuclides are not present there to a significant degree.		Noted.	
177	Health Canada	We agree with AECL that moving the sediments will be more harmful than maintaining the status quo.		Noted	
178	Health Canada	The proposed 200 years institutional control period seems to be contrary to the intent and spirit of R-104 which aims at reducing the burden to future generations with regard to the long-term management of radioactive wastes.		R-104 does not preclude the use of long-term institutional controls, taking into account the appropriate timing, future risks, technical, social, and economic factors. The Commission, in this EA, is only considering the likelihood and significance of adverse environmental effects of the proposal in a planning context. The Commission will not make a regulatory decision on the in-situ proposal until an application to dispose of the waste is made and this application will include a justification for the use of institutional controls in this circumstance. It is also noted that time frames for control in the order of 200 years are not out of line with other near surface low-level waste disposal projects.	
179	Pinawa Resident	I am concerned about the vague time line. Why is it taking so long to make a decision? The economic development of the community of Pinawa and the surrounding area is dependent on a resolution to this problem. The work appeared to be theoretical. However, the consequences of the long time frame is very real to the economy of eastern Manitoba.		The time line for decision-making is affected by the environmental assessment requirements under the CEAA and the licensing review process of the CNSC. The need to conduct additional studies in 2000 have extended the environmental assessment longer than anticipated. The responsible authorities are also intent that the community and all government and private stakeholders have ample time to review and comment during each stage of the assessment before it is submitted to the Canadian Environmental Assessment Agency and federal Minister of the Environment for a decision. Public hearings will also be held by the Commission before a final licensing decision is made on the project. In the meantime, steps have been taken to facilitate access to unaffected land and buildings at the Whiteshell site for other business developments.	

Comment Number	Comment By	Summarized CNSC Comment	CSR Rev.2 Reference	Response	Addendum Reference
180	Pinawa Resident	This report is unsatisfactory, in that it does not demonstrate the feasibility of “decommissioning” the WNRE, nor cleaning-up radioactive pollution in the surrounding region. Some of the radioactive substances, which have been released into the ecosystem through nearly half a century of nuclear operations, will pose a threat to plant and animal life for millennia.		Throughout its operation, WL has conducted an environmental monitoring program under which fish, native vegetation, cultivated vegetation and wildlife such as deer, fox, etc., have been sampled and analyzed for radionuclides. This sampling occurs routinely and annual reports are produced. There is no indication that WL operations have produced a negative effect on the local environment. Also an assessment of contaminated Winnipeg River sediments at the WL outfall, which evaluated impacts on aquatic biota (clams), concluded that leaving the contamination in place is unlikely to produce any significant impact on the local environment (see App. B.1).	
181	Pinawa Resident	Methodology for decommissioning is presented in vague terms. The report is little more than an administrative, procedural document, which does not truly address the underlying problems and issues surrounding the decommissioning of a nuclear research facility.		An environmental assessment is a planning document aimed at assessing the general likelihood and significance of the environmental effects of a project, taking account of the types of mitigation measures available. The specific details of how each component of the facility will be decommissioned will be set out in detailed decommissioning plans that will form the basis of the CNSC licensing. Those detailed plans will include the specific radiation protection and contamination control measures that will protect people and the environment.	
182	Pinawa Resident	The lack of specifics in the CSR is probably because the technology for decommissioning major nuclear facilities is in its infancy and has yet to be demonstrated in large-scale situations.		Decommissioning technology is in fact well developed. The level of detail presented in the CSR is considered sufficient to support the environmental assessment. Implementation details will be presented in Detailed Decommissioning Plans, which must be approved by the regulator prior to initiating project work.	
183	Pinawa Resident	Reliance on the use of common household items such as HEPA filters does not instil confidence that the site can be restored to a very safe condition.		HEPA filters are an effective mitigation control on release of dust and contamination to the environment. AECL plans to rely on such proven technology where required.	
184	Pinawa Resident	The report conveniently fails to mention that much natural background radiation in the region of the WNRE exceeds Canadian radiation safety standards. the WNRE has added to the area’s already unsafe levels of background radiation.	Sec. 5.3.1	Ambient radiation data which includes natural background is given in CSR Section 5.3.1. Additional gamma survey data for the project study area is given in Figures 5.3, 5.4, 5.5.	
185	Pinawa Resident	In the early 1980s the Manitoba Government found that many water wells in the area contained unsafe levels of naturally occurring radioactive substances and alternative sources had to be found. The public should not be misled on this point.		AECL believes that the public has been made aware of natural background radiation from water and geological formations in the area.	

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186	Pinawa Resident	The three "timetable-based" options are purely conjectural and arbitrary and ignore the strong possibility that an acceptable method to deal with long-lived nuclear waste may never be constructed. In view of this, AECL, or other agencies of the Government of Canada should be fully committed to a permanent caretaker role at the WNRE facility.	Sec. 1.5 Sec. 3.2.2	AECL is committed to managing the WL site wastes until waste disposal becomes available and a final free release endstate can be achieved. A small portion of the Waste Management Area (LLW trenches) proposed for in-situ disposal will require an extended period of institutional control. The CNSC is committed to continued licensing control of the wastes at the site until such time as they are moved to another location or disposed in-situ under another form of institutional control that will provide for the protection of human health and the environment.	
187	Pinawa Resident	I take strong exception to the report's exclusion of the nearby underground research laboratory (URL). The fact that it was "not licensed by CNSC" is rather a lame excuse for keeping that facility active and available. Clearly the URL had served its stated purpose at the time of the "concept" submission to the Canadian Environmental Assessment Agency.		The URL is not being proposed for decommissioning and does not fall under the Whiteshell Laboratory licence. Only the nuclear substances being used in research activities at the URL fall under CNSC licence control.	
188	Pinawa Resident	As a former resident of Lac du Bonnet I was assured by AECL that the URL would be restored to its' original condition. It is time that AECL made good on that promise; otherwise the public has a right to suspect a hidden agenda with regard to the future use of the URL.		The URL is a separate facility and is not within the scope of the proposed Whiteshell Laboratories decommissioning project. It therefore is not part of this environmental assessment.	
189	Pinawa Resident	The public in the affected region should not be misled into believing that the planned WNRE decommissioning, as outlined in this study report will result in an environment free of the risks brought about by the past operations of the nuclear research facility.		Throughout its operation, WL has conducted an environmental monitoring program under which fish, native vegetation, cultivated vegetation and wildlife such as deer, fox, etc., have been sampled and analyzed for radionuclides. This sampling occurs routinely and annual reports are produced. There is no indication that WL operations have produced a negative effect on the local environment. Also an assessment of contaminated Winnipeg River sediments at the WL outfall, which evaluated impacts on aquatic biota (clams), concluded that leaving the contamination in place produced no significant impact on the local environment (see App. B.1). The decommissioning end-state for the site will be such that any residual contamination does not pose a significant risk to human health or the environment. Those end-state objectives will be a requirement of the decommissioning licence issued by the CNSC. The CNSC will also conduct independent verification of compliance with those criteria.	

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190	Pinawa Resident	AECL promised to bring in other industry. Then AECL refused to allow these other industries to come in. When AECL finally allowed another industry to come in, the industry was prevented from coming in by nuclear regulations and the AECB (CNSC). Now they are saying that the problems of the last 6 years will continue for the next 60 years.		AECL continues to support business development initiatives for the WL site. Planning includes opportunities for early use of site land and buildings in the inactive area for commercial activity, within the constraints of the site licence conditions. Examples include the businesses already operating in Building 402 (ACSION, ECOMatters, Channel, etc) and the lease agreement under development for non-AECL tenant use of inactive area buildings generally.	
191	Pinawa Resident	The land involved in decommissioning is the only industrial land for the town of Pinawa, and additional industrial land needs to be serviced by AECL and the Federal Government to provided an economic base for Pinawa, while decommissioning takes place. Preventing access to this serviced industrial land for 20 to 60 years is a major concern that would not exist in non-nuclear industry decommissioning projects.		Same as response #190.	
192	Pinawa Resident	Whiteshell Labs should be decommissioned in no less than 20 years.		The project schedule is dependent on waste disposal facilities being available off-site and the schedule assumptions for waste disposal are 2025 for low-level waste and 2050 for high-level waste. For radiation safety considerations, the activity in the WR-1 core is being permitted to decay for approx. 50 years before dismantling begins.	
193	Pinawa Resident	The costs of building radioactive waste disposal facilities should be considered part of the costs of decommissioning Whiteshell Labs.		National waste disposal facilities are not part of the WL Decommissioning Workscope.	
194	Pinawa Resident	If waste disposal facilities are not ready in time to complete the decommissioning of Whiteshell Labs in 20 years, the wastes at Whiteshell Labs should be moved out of Manitoba to Chalk River Labs or some other suitable radioactive waste storage site.		The rationale for moving waste when disposal is available is given in Sec. 3.3. Moving waste initially to alternate storage and then to disposal incurs additional personnel dose. Therefore, the reference plan is to manage wastes within existing facilities until disposal is available. Additional detail on the process for designing and implementing an enhanced monitoring program at the WMA, assessing the fitness for service of existing storage facilities and for establishing remediation schedules has been added to the Addendum.	Sec. 3.1
195	Pinawa Resident	Leaving the nuclear waste around for 60 years is not how to decommission a nuclear facilities responsibly.		The project schedule is dependent on waste disposal facilities being available off-site and the schedule assumptions for waste disposal are 2025 for low-level waste and 2050 for high-level waste. For radiation safety considerations the activity in the WR-1 core is being permitted to decay for approx. 50 years before dismantling begins.	

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196	Pinawa Resident	The report says there will be no socio-economic effects; however, tying up the land for 60 years to do the clean up ignores the fact that this land is the only serviced, let alone developed, industrial land for the town of Pinawa. Pinawa derives half of its taxation income from this land.		AECL continues to support business development initiatives for the WL site. Planning includes opportunities for early use of site land and buildings in the inactive area for commercial activity, within the constraints of the site licence conditions. Examples include the businesses already operating in Building 402 (ACSION, ECOMatters, Channel, etc) and the lease agreement under development for non-AECL tenant use of inactive area buildings generally.	
197	Pinawa Resident	Most of Pinawa's residents used to derive their livelihood by working at this industrial site. Those who did not work at this site made their living providing services, like education, to the people working there. Even now Pinawa is largely living on the residue of incomes earned at that site (i.e. pensions & E.I.). Pinawa cannot expect these residue incomes to continue for 60 years.		Noted. AECL will continue to use local work force and business during the decommissioning project where appropriate. The socio-economic impacts were assessed in the context of the federal environmental assessment regime. The economic impacts considered were those caused by a change in the environment due to the decommissioning project. Therefore, the socio-economic effects resulting from the closure of the Whiteshell Laboratories were not considered here.	
198	Pinawa Resident	The taxation problem can be mitigated by requiring AECL to continue to pay to Pinawa the same grant in lieu of taxes, indexed for inflation, for the 20 or 60 year decommissioning period, and for the addition 200 year monitoring period. (Many of us are afraid that once AECL has a decommissioning licence, they will tell Pinawa that they will no longer pay the grant in lieu of taxes.)		AECL continues to support business development initiatives for the WL site. Planning includes opportunities for early use of site land and buildings in the inactive area for commercial activity, within the constraints of the site licence conditions. Examples include the businesses already operating in Building 402 (ACSION, ECOMatters, Channel, etc) and the lease agreement under development for non-AECL tenant use of inactive area buildings generally.	
199	Pinawa Resident	It would help to mitigate the employment problem if AECL and the Federal Government immediately pay to service industrial land in Pinawa. They should also be prepared to build buildings to lease to tenants of the new industrial park. This would at least restore the physical asset that Pinawa is losing by the fact that the decommissioning of Whiteshell Labs will take decades to complete. This was needed to be done by 1998. Pinawa has already lost one industry because this has not been done.		Same as response #198.	

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200	Pinawa Resident	The CNSC can have a useful effect on decommissioning projects by convincing AECL and the Federal Government to pay for servicing an industrial park at Pinawa before public hearing are held on the decommissioning, and preferably before the rest of AECL's staff leaves in June 2001.		The CNSC does not have the authority to engage in such proposals.	
201	Pinawa Resident	In order to promote other industries in the area, such as tourism, it would help if AECL and the Federal Government paid to repair the Marina in Pinawa that became run down when AECL owned it.		Same as response #198.	
202	Pinawa Resident	When people see that a nuclear facility cannot be decommissioned in a timely manner, then they will not want nuclear industry to start in their area. This will put in jeopardy the future of the nuclear industry and AECL. As a result, AECL and resources to clean up Whiteshell Labs may not exist in the future. Therefore Whiteshell Labs needs to be cleaned now, and the radioactive waste must be removed now.		The optimized decommissioning plan to minimize radiation doses and to control costs is scheduled over 60 years to coincide with waste disposal assumptions.	
203	Pinawa Resident	I am concerned that AECL's proposal to leave the waste here for 200 years will lead to surprising discoveries of dangerous materials in the future in Manitoba, only it will then be radioactive contamination in Manitoba.	Sec.4.3.1 WMA	"In-situ" means the wastes remain in the LLW trenches as final disposal. The 200-year institutional control period is required to ensure no intrusion until the waste has decayed to negligible levels. See Sec. 4.3.1 WMA. Before the CNSC approves any in-situ disposal, it will be satisfied that the likelihood of discovering any such surprise wastes is very low and that the disposal will not result in unreasonable risk to human health, safety and the environment.	
204	Pinawa Resident	With the closure of Whiteshell Labs, Manitoba looses its only toehold in the Nuclear Industry. We will no longer be receiving the benefit of nuclear energy. Also we will loose our expertise in dealing with things nuclear. Therefore it would be unfair to burden us with the wastes from the Nuclear Industry. This is the principle that the people who receive the benefit also accept the risk of the activity.		The socio-economic impacts were assessed in the context of the federal environmental assessment regime. The economic impacts considered were those caused by a change in the environment due to the decommissioning project. Therefore, the socio-economic effects resulting from the closure of the Whiteshell Laboratories were not considered here. The project schedule is dependent on waste disposal facilities being available off-site and the assumptions for waste disposal are 2025 for low-level waste and 2050 for high-level waste.	

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205	Pinawa Resident	The benefit of the money saved, by taking 60 years to clean up the lab will go to the taxpayers of Canada, most of whom do not live in Manitoba. Meanwhile those of us living in the Whiteshell Labs, Pinawa area are asked to take to burden of having the radioactive wastes left here, without receiving any of the benefits.		Same as response #204.	
206	Pinawa Resident	It would be unacceptable to leave, for 200 years, waste that is not stored in a manner acceptable today. When this waste is disturbed, it should be shipped to Ontario, presumably Chalk River.	Sec. 4.3.1 WMA	"In-situ" means the wastes remain in the LLW trenches as final disposal. The 200-year institutional control period is required to ensure no intrusion until the waste has decayed to negligible levels. See Sec. 4.3.1 WMA. Before the CNSC approves any in-situ disposal, it will be satisfied that the likelihood of discovering any such surprise wastes is very low and that the disposal will not result in unreasonable risk to human health, safety and the environment.	
207	Pinawa Resident	All the radioactive waste generated while decommissioning Whiteshell Labs should be transported directly to Chalk River Labs without storing them at Whiteshell Labs.		The project schedule is dependent on waste disposal facilities being available off-site and the schedule assumptions for waste disposal are 2025 for low-level waste and 2050 for high-level waste. Only small amounts of waste are produced during Phase 1 and 2 of the project and these will be managed in WL facilities until waste disposal becomes available.	
208	Pinawa Resident	There is no guarantee that we could transport the waste out Manitoba. Therefore we need a transportation corridor to remove the waste now. We need to start transporting the waste down corridor, and keep transporting the waste to keep the corridor open.		Waste cannot be transported until there are established waste disposal facilities to receive it. The shipping schedules will be addressed consistent with waste disposal facility availability.	
209	Pinawa Resident	It is essential that the Shielded Facilities MUST remain operational as long as the radioactive waste remains in Manitoba. It is need to handle any unforeseen problems that might arise.	Sec. 4.5.3	Shielded Facility operation is only required until processing of TFRE/Amine waste is completed. Management of fuel and WMA wastes will require some additional facilities local to the WMA/CCSF to retrieve and process or transfer waste. See Sec. 4.5.3.	
210	Pinawa Resident	The Whole Body Counting room should remain operational as long as decommissioning is proceeding.		Noted.	

Comment Number	Comment By	Summarized CNSC Comment	CSR Rev.2 Reference	Response	Addendum Reference
211	Pinawa Resident	A major problem with the Whiteshell Labs Decommissioning Project is that the people given responsibility for decommissioning the lab do not have the authority to decommission the lab. They cannot decommission the lab until the waste disposal facilities are built, and they have no control over whether the waste disposal facilities will ever be built. By moving the radioactive waste to Chalk River, it will then be located closer to where the authority to dispose of it is located.		The rationale for moving waste when disposal is available is given in Sec. 3.3. Moving waste initially to alternate storage and then to disposal incurs additional personnel dose. Therefore the reference plan is to manage wastes within existing facilities until disposal is available. Where necessary, and disposal facilities are not yet available, additional waste management facilities will be built at the WL WMA for interim storage.	
212	Pinawa Resident	If the CNSC were to take away the decommissioning licence, AECL could say OK, stop decommissioning, and go home to Chalk River. So the CNSC would no longer have any hold over Whiteshell Labs after the AECL staff leave at the end of June 2001.		The CNSC will retain licensed control over the site for as long as is necessary to complete the decommissioning program and ensure that the facilities and substances do not pose a significant risk to human health, safety, security and the environment. The CNSC will also ensure that financial guarantees are in place to ensure the necessary work will continue even if AECL is no longer the licensee.	
213	Pinawa Resident	Manitoba will not have the expertise to deal with issues and other proposals that AECL may come up with in the next 60 years, on dealing with the radioactive waste left in Manitoba. This makes it unfair to burden Manitoba with the hi tech radioactive waste.		Regardless of where the personnel and resources are found, the CNSC will require that AECL maintain a workforce and resources necessary to carry out the project so that human health, safety, security and the environment is adequately protected. Socio-economic effects not directly associated with predicted effects to the environment are not considered in this EA.	
214	Pinawa Resident	We are concerned that the next time the Federal Government needs money they will cut all the funding for the decommissioning and monitoring of what they will view as the useless Whiteshell Labs site.		Under the NSCA, the CNSC has the authority to require that financial guarantees be in place to complete the project in the interest of health, safety, security and the environment. That authority also applies to the guarantees that must be provided by the Government of Canada.	
215	Pinawa Resident	Federal Government ignores problems in Manitoba, but pays more attention to problems in Ontario. If the radioactive waste is moved to CRL in Ontario it is more likely that it will eventually be disposed of properly.		The CNSC regulates equally the use of nuclear energy in all Canadian provinces and territories.	
216	Pinawa Resident	It appears that AECL, despite its claims to be trying to inform the public, is trying to avoid comments on its decommissioning plans.	Sec. 5.0	Both AECL and the RAs have consulted extensively with the public on this environmental assessment. Each comment is carefully considered, documented and responses are provided in the Comprehensive Study Report. See Section 10, Appendices E and F, and Section 5 of the Addendum Report.	

Comment Number	Comment By	Summarized CNSC Comment	CSR Rev.2 Reference	Response	Addendum Reference
217	Pinawa Resident	The local newspaper ads that AECL placed did not say that the purpose of the open house on Apr. 4, 2001 was to release to the public the decommissioning report. They also did not mention in the ads that the public have until Apr. 30 to comment on the report. I talked to one person who spent a lot of time at the open house and did not know that we have until Apr. 30 to comment on the report.		The draft CSR was released to the public for review in mid-March by the CNSC. Notices, and in some cases copies of the CSR, were mailed to key stakeholders and local libraries. A notice was also placed on the CNSC web site. In all cases, the notices clearly indicated the duration of the formal comment period. The Pinawa Open House was arranged to provide an opportunity for interested members of the public to discuss the project with CNSC/DFO (Responsible Authorities) and AECL who were present at the Open House. The meeting time and date were broadly communicated through the media.	
218	Pinawa Resident	CNSC and AECL use the large size of the report as an excuse not to give it to people.		On the basis of environmental responsibility, efforts were made to print only the required number of hard copies of the CSR. Hard copies were sent to key interest groups and placed in several public locations. All additional requests for hard copies were met promptly.	
219	Pinawa Resident	By offering the report on CD-ROM you limit access to people with computers. By putting it in Acrobat you require people to have a very powerful computer to access the report. This also gives control over the report to Adobe Acrobat. They decide what we can, and cannot do with the report.		The CD-ROM version of the report (released in a commonly readable format) reduced unnecessary waste paper, and offered a number of conveniences and advantages to several reviewers. If a reviewer did not wish to, or was unable to use the electronic version, a hard copy was promptly provided.	
220	Pinawa Resident	The problems of accessing the report can be reduced by printing the executive summary as a separate volume, and making many copies available. Then people could read the executive summary and decided if they want to read the rest of the report. The whole report should also be available in paper form.		The suggestion for using the executive summary is noted. The entire report was readily available in paper form.	
221	Pinawa Resident	The CSR lacks any review of the socio-economic effects of the decommissioning of the Whiteshell Laboratories. In particular, it lacks any discussion of the socio-economic consequences of the cumulative environmental effects of the decommissioning process, if carried out according to AECL's plan and timetable.		The direct and cumulative socio-economic effects of the project were assessed in the context of the federal environmental assessment regime. The economic impacts considered were those caused by a change in the environment due to the decommissioning project. Therefore, the socio-economic effects resulting from the closure of the Whiteshell Laboratories were not considered here. The assessment of cumulative effects in Section 8.3 and 8.4 concludes that there will be no measurable effect on socio-economic conditions resulting from the effects of the project on the environment.	

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222	Pinawa Resident	If the decommissioning process is carried out according to AECL's plan and timetable as laid out in the CSR, this has the potential to jeopardise several lucrative and socially beneficial activities in the Eastman region in the future.		AECL continues to support business development initiatives for the WL site. Planning includes opportunities for early use of site land and buildings in the inactive area for commercial activity, within the constraints of the site licence conditions. Examples include the businesses already operating in Building 402 (ACSION, ECOMatters, Channel, etc) and the lease agreement under development for non-AECL tenant use of inactive area buildings generally.	
223	Pinawa Resident	Under section 16.(1) of the Act, environmental effects include 'any cumulative environmental effects that are likely to result from the project in combination with other projects that have or will be carried out.' Therefore it is contented that it is necessary to assess what the potential is for future activities based at the Whiteshell Laboratories, and what the effect of the decommissioning might be on those activities.		As required by the CEAA the cumulative effects assessment in section 8.0 of the CSR considers all current activities and known potential future activities (including those at the WL site) that have a potential to combine with the effects of the decommissioning project. The CEAA does not require the RAs to speculate about other future activities.	
224	Pinawa Resident	In the CNSC's final Scope of Assessment, reference to the biophysical environment is limited to suggestions as to how any description of the biophysical environment may be carried out. It does not equate the biophysical environment with the environment as a whole; no dependence of the socio-economic environment on the biophysical environment is stated or implied; and the socio-economic environment is equated with the project. Therefore, a discussion of the effects of any change on socio-economic conditions should appear in the CSR.		As required by Section 2 of the CEAA, the CSR considers the effects on socio-economic conditions, on physical and cultural heritage, on the current use of lands and resources for traditional purposes by aboriginal persons, or on any structure, site or thing that is of historical, archaeological, paleontological or architectural significance, that may be caused by the predicted changes that the project may cause in the "environment". As defined in Section 2 of the CEAA, the "environment" includes "a) land, water and air, including all layers of the atmosphere, b) all organic and inorganic matter and living organisms, and c) the interacting natural systems that include components referred to in paragraphs a) and b).	
225	Pinawa Resident	Because AECL has limited objectives in the decommissioning process, it is further recommended that this study is carried out by an organisation other than AECL.		The RAs consider that AECL has the knowledge of the facility and the surrounding environment to undertake the initial technical assessments of the project effects. That work was formally delegated to AECL pursuant to Section 17 of the CEAA. The work of AECL, however, is thoroughly examined by staff of CNSC and DFO (RAs), as well as by the other federal and provincial expert government departments before the RAs draw conclusions and finalize the CSR. The RAs believe that this process provides adequate independent review, while also making maximum use of the licensee's intimate technical knowledge of its facility.	
226	CNSC	In the 3rd paragraph, page ES-4 of the Executive Summary; replace the words "more benign" with "fewer".	ES-4	Agreed. The words "more benign" were replaced with "fewer".	Sec. 3.1

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227	CNSC	The proposed end-state for the river sediments is not correctly stated in the Executive Summary. A more accurate summary would be that further remediation or management of the river sediments is not required, and thus is not part of the decommissioning project. The CNSC notes, however, that monitoring of the outfall effluents and sediments will continue as part of the follow-up program, and that a final safety assessment of the end state for the sediments will be considered by the CNSC at the conclusion of the decommissioning project.	ES-6	During the EA workscope definition process, the sediments were identified as a component of the decommissioning project and included in the scope of the assessment. It was only following an analysis of alternatives within the preferred time frame that the in-situ abandonment option was selected AECL agrees that monitoring needs to continue as part of the follow-up program since there will continue to be releases at the outfall over the decommissioning period. A more definitive description of the decommissioning approach is given in Sec. 4.	
228	CNSC	The alternative of removing all low-level waste trenches should be compared to the other alternatives on the basis of relative environmental effects and cost, and should not be screened on the basis of economic feasibility as is implied in Table 3.5.	S. 3, Table 3.5	The removal alternative was not screened out on the basis of cost. As suggested by the Operational Policy Statement of the Canadian Environmental Assessment Agency (OPS-EPO/2-1998), AECL analyzed the alternatives to determine whether each was technically, economically and environmentally viable. The relative merits of the alternatives were then compared to select a preferred alternative, which was carried forward for a detailed assessment of effects.	
229	CNSC	The plans for removal of all significant quantities of chemically hazardous materials from the WMA trenches needs to be clarified.	S. 4.3.1, S. 4.5.4	AECL will assess the recovery potential of drums and other wastes (e.g., Pb) as part of the enhanced monitoring program. Decisions on the possible recovery of those wastes will depend on the results of the in-situ investigations.	Sec. 3.1
230	CNSC	The degree of co-occurrence of the relatively short-lived radioactive wastes and the chemically hazardous constituents should be discussed to support the ability to effectively separate the wastes that may be suitable for in-situ disposal from those that may not be suited to in-situ disposal.		AECL will assess the recovery potential of drums and other wastes (e.g., Pb) as part of the enhanced monitoring program. Decisions on the possible recovery of those wastes will depend on the results of the in-situ investigations.	Sec. 3.1
231	CNSC	The report should indicate what will be done if, at the time chemical wastes are being removed from the trenches, the integrity of containers is discovered to have been compromised and there is evidence of resulting soil and/or groundwater contamination.		If the in-situ investigation activities reveal that drums have in fact been breached, AECL will conduct additional monitoring to confirm that contaminant concentrations are within acceptable ranges as part of the safety case for in-situ disposal.	Sec. 3.1

Comment Number	Comment By	Summarized CNSC Comment	CSR Rev.2 Reference	Response	Addendum Reference
232	CNSC	It should be clarified when chemically hazardous wastes, not suited to in-situ disposal, will be removed from the WMA trenches for off-site management. Where containment is not presently assured, that removal should be at the beginning of the decommissioning program.		Such removal is carried out for Phase 3. However, should an immediate hazard be identified through the monitoring and surveillance activities, early remediation will be carried out. Additional detail on the process for designing and implementing an enhanced monitoring program at the WMA, assessing the fitness for service of existing storage facilities and for establishing remediation schedules has been added to the Addendum.	Sec. 3.1
233	CNSC	It is unclear if the described plan for high-level liquid wastes management reflects the recently proposed experimental processing under the current operating licence.	S. 4.5.2.1	The timing of this proposal is dependent on the licensing decision under the site licence. However, the solidification of the liquid waste was included in this environmental assessment to ensure consideration of all potential effects.	
234	CNSC	Figure 4.5 does not show any waste from the Waste Management Area as ending up in “in-situ disposal” as proposed elsewhere.	Figure 4.5	The figure has been revised.	Sec. 3.1
235	CNSC	The section on Worker Health and Safety reflects AECL's commitment to keep doses to workers ALARA. It should also address how workers will be protected from non-radiological risks.	S. 6.3.7	Section 6.2.1 describes the compliance programs that will continue to apply to the project. Application of the Occupational Health and Safety program, including the work permit system, will safeguard workers against industrial hazards.	
236	CNSC	In the section on Public Health, it is not accurate to state “public health effects were reviewed”. Rather, it was the activities that could potentially affect public health that were reviewed. The former wording suggests that a community health study was undertaken and the effects reviewed. Similarly, the public dose estimates presented in this section are used to estimate the risk or likelihood to cause a significant health effect, rather than to describe the nature of an observed or expected health effect.	S. 6.3.8	Agreed. 2nd and 3rd sentences of the first paragraph were revised.	Sec. 3.1
237	CNSC	The results of the gamma survey should be presented in terms of absorbed dose rate in order to facilitate comparison with the ENEV's in Table 2.	App. B1.2.3	The data were presented in Figures 2 and 3 in the units measured, because this was considered a more accurate representation of what was done. The activity can easily be converted to nGy/h by dividing by 3.27, the empirical factor found in Table 3 of Appendix B-1.	

Comment Number	Comment By	Summarized CNSC Comment	CSR Rev.2 Reference	Response	Addendum Reference
238	CNSC	AECL notes that it is committed to maintaining monitoring and surveillance programs until the final end state is achieved. This does not include the institutional control period commencing in year 61, as shown in Figure 4.4. A statement needs to be added indicating that an entity, other than AECL, will have to assume responsibility for the site during the institutional control period.	S. 1.5	Statement added to addendum.	Sec. 3.1
239	CNSC	The Scope of the Project needs to be expanded to state that the in-situ disposal of radioactive waste in trenches at the Waste Management Area (WMA) is part of the project.	S. 2.1	During the EA workscope definition process, the WMA was identified as a component of the decommissioning project and included in the scope of the assessment. It was only following an analysis of alternatives within the preferred time frame that the in-situ abandonment option was selected. See Section 3.5 in the CSR.	
240	CNSC	The description of temporal boundaries implies that the project ends when the final end-state is achieved. This section needs to be revised to include the institutional control period (see Figure 4.4) as a component in the overall duration of the project.	S. 2.3.2	Agreed. The last sentence of section 2.3.2 highlights the need for flexibility to ensure effects beyond the project time frame are adequately considered.	
241	CNSC	It is stated that the institutional control period will extend approximately 200 years beyond the physical project work. Assuming the preferred project option of achieving the final end-state after 60 years, the institutional control period would appear to end 260 years in the future. This is in disagreement with Figure 4.4 and other sections of the CSR, which indicate that the institutional control period will terminate at year 200. This needs to be clarified.	Section 4.2.2	Agreed. Figure 4.4 has been revised to reflect a 60-year project period followed by 200 years of institutional control.	Sec. 2.1
242	CNSC	AECL needs to provide scoping calculations to support their proposed length of the institutional control period.	Section 4.2.2	The rationale for the 200-year institutional control period has been added to the addendum.	Sec. 3.1

Comment Number	Comment By	Summarized CNSC Comment	CSR Rev.2 Reference	Response	Addendum Reference
243	CNSC	It is stated that only irradiated fuel in standpipes and high-level waste (HLW) in trench #6 cannot remain in existing storage structures until waste disposal becomes available. Due to potential problems at all below-ground standpipes and bunkers, AECL needs to commit to evaluating the viability and desirability of continuing to use all existing subsurface storage structures until waste disposal facilities become available. This evaluation should be completed in sufficient time for AECL to be able to relocate the wastes from any other unsuitable storage structures to new storage structures at the same time that the irradiated fuel in standpipes and HLW in trench 6 are relocated.	S. 4.3.1	Current monitoring information (see Table 9.6 in CSR) does not indicate a near term risk from managing wastes in the present storage locations. The objective of the follow-up monitoring program is to design additional monitoring to confirm this conclusion. Follow-up monitoring is planned to be implemented in Phase 1. The detailed plans for identifying where remediation is necessary as well as timing will be part of the monitoring program output. Additional detail on the process for designing and implementing an enhanced monitoring program at the WMA, assessing the fitness for service of existing storage facilities and for establishing remediation schedules has been added to the Addendum.	Sec. 3.1
244	CNSC	AECL has identified that trenches 1, 6, 10 and 16 are also unsuitable for in-situ disposal (p. 6-18 of CSR), and CNSC staff has determined that chemically hazardous materials should also be removed from trenches (for example, trenches 3 and 5). A commitment to doing this remedial work is needed in Section 4.3.1, including the timing for completing this work. The remedial work on these trenches will provide further opportunities for AECL to do confirmatory monitoring of the waste inventory in the trenches, as stated in the cross reference from Section 9.5.2.	S. 4.3.1	Additional detail on the process for designing and implementing an enhanced monitoring program at the WMA, assessing the fitness for service of existing storage facilities and for establishing remediation schedules has been added to the Addendum.	Sec. 3.1

Comment Number	Comment By	Summarized CNSC Comment	CSR Rev.2 Reference	Response	Addendum Reference
245	CNSC	CNSC staff disagree with the statement that the WMA hydrogeology review presented in Appendix C.5 "confirms" the conclusions of the Waterloo Research Institute's studies of the hydrogeology of the WMA during the 1980s. Appendix C.5 states that most of the available hydrogeologic data was unusable and only one well pair (RW-5/RWT-5) showed a distinct upward groundwater gradient. As such, the sentence in Section 6.3.4.2, "A review of hydrological data collected over the past 20 years has confirmed our understanding of the groundwater flow regime at the WMA", should be replaced with: "During the follow-up program, further work will be required to confirm the understanding of the groundwater flow regime at the WMA that was developed in the 1980s (Cherry and Robertson, 1988)."	S. 6.3.4.2	The independent review of collected monitoring data was only intended to review the hydrogeological conditions relative to the comprehensive Waterloo studies. Although the data from one well was inconclusive, the well located nearest to the trenches supported the original Waterloo model. There is no indication that the hydrogeologic condition has changed. However, AECL acknowledges that a follow-up monitoring program designed to provide a comprehensive level of confirmation is necessary. That program will be designed and implemented as part of Phase 1 work. "Confirmed" will be changed to "supported". Additional detail on the process for designing and implementing an enhanced monitoring program at the WMA, assessing the fitness for service of existing storage facilities and for establishing remediation schedules has been added to the Addendum.	Sec. 2.1 Sec. 3.1 Sec. 4.1
246	CNSC	The follow-up program needs to be expanded to more broadly describe the groundwater flow regime at the WMA (i.e., more than simply evaluating selected hydrographs). AECL needs to update the water table map for the WMA and the information on the distribution of hydraulic head with depth at representative locations across the WMA. This may require AECL to install additional groundwater monitoring wells at the WMA.	S. 9.5.2	Agreed. Additional detail on the process for designing and implementing an enhanced monitoring program at the WMA, assessing the fitness for service of existing storage facilities and for establishing remediation schedules has been added to the Addendum.	Sec. 3.1
247	CNSC	Groundwater quality wells will be needed close to the various WMA engineered storage facilities, such as the standpipes and in-ground concrete bunkers, to assess whether any soil contamination has occurred around those structures. Section 9.5.2 suggests that groundwater quality wells will only be needed close to the waste trenches.	S. 9.5.2	Additional detail on the process for designing and implementing an enhanced monitoring program at the WMA, assessing the fitness for service of existing storage facilities and for establishing remediation schedules has been added to the Addendum.	Sec. 3.1
248	CNSC			Comment deleted by CNSC.	

Comment Number	Comment By	Summarized CNSC Comment	CSR Rev.2 Reference	Response	Addendum Reference
249	CNSC	The HLW and MLW radionuclide inventory needs to be added to the description of the WMA on p.4-14 of section 4.3.1. In particular, AECL needs to identify the numbers of standpipes that contain irradiated fuel. Also a proper plan needs to be provided that shows the position of the CCSF in relation to the WMA.	S. 4.3.1, S. 1.7	The inventory provided in Table 4.6 and Appendix C-2 is considered adequate for the purpose of this environmental assessment. Additional details on the standpipe inventory relating to 69 standpipes containing irradiated fuel will be added in the DDP for the WMA (also see comment #81). A CCSF location map has been added to the addendum.	Sec. 4.1
250	CNSC	The analytical scope for the existing groundwater monitoring program for the WMA is inadequate (Table 9.6) since the groundwater is monitored only for gross alpha and gross beta.	S. 9	The existing monitoring requirements apply to the operation of the WL. Adjustment to the monitoring requirements will be made where required as part of the follow-up program. Additional detail on the process for designing and implementing an enhanced monitoring program at the WMA, assessing the fitness for service of existing storage facilities and for establishing remediation schedules has been added to the Addendum.	Sec. 3.1
251	CNSC	Groundwater monitoring has neither been done nor proposed for non-radiological hazardous substances that are known to be stored within the WMA.		Some data was obtained as part of the trench study carried out in the fall of 2000. Additional monitoring will be carried out in support of the final safety case for in-situ disposal. Additional detail on the process for designing and implementing an enhanced monitoring program at the WMA, assessing the fitness for service of existing storage facilities and for establishing remediation schedules has been added to the Addendum.	Sec. 3.1
252	CNSC	Tables 5.16 and 5.17 only report total beta activity, no alpha data. Furthermore, the text needs to confirm if alpha activity is also present and whether the results in these tables are based on monitoring results for all groundwater sampling locations listed in Table 9.6.	Tables 5.16 and 5.17	New information has been added to the addendum.	Sec. 4.1
253	CNSC	The period of record and the number of analyses on which the average activities are based should be indicated.	Tables 5.16 and 5.17	New information has been added to the addendum.	Sec. 4.1
254	CNSC	The locations of groundwater monitoring piezometer P23 and well S12 (Table 9.6) are not shown on any of the WMA plans.	Table 9.6	Piezometer well P23 is located 60m west of the WMA western boundary and 183m north of the east/west WMA access road. RWS12 (referred to in the text as S12) is located 12m north of the WMA northern boundary and 33m east of the WMA eastern boundary. The wells are shown on a new map, which appears in the addendum.	Sec. 4.1
255	CNSC	Monitoring results for groundwaters within the WMA need to be compared to background groundwater values, i.e. piezometer P23.		New information has been added to the addendum.	Sec. 4.1

Comment Number	Comment By	Summarized CNSC Comment	CSR Rev.2 Reference	Response	Addendum Reference
256	CNSC	AECL lost an opportunity to monitor the groundwater chemistry adjacent to the trenches during their recent auguring of the lateral boreholes. In particular, it is reported that water was encountered in BH7 at a depth of 335 cm adjacent to trench #1 but apparently was not sampled. This trench contains 3000 lb. of arsenic. Lateral borehole cores collected from BH5 and BH7 should also have been analyzed for arsenic, not just the metals reported in Table 8 (App. C.4).	App. C3	The coring program around the trenches was hypothesis driven (see CSR Section C1.3), and was not the start of an enhanced monitoring program. The priority was given to soil samples because most contaminants are sorbed to solids. An enhanced monitoring program is planned and is expected to include piezometers for water sampling. The position and sampling depths of those piezometers will be carefully chosen to meet the monitoring program objectives. Additional detail on the process for designing and implementing an enhanced monitoring program at the WMA, assessing the fitness for service of existing storage facilities and for establishing remediation schedules has been added to the Addendum.	Sec. 3.1
257	CNSC	The decommissioning approach for the WMA described on p.4-15 of the main report identifies only trench #6 as being unsuitable for in situ disposal because of its inventory of HLW. AECL must also commit in their documentation of the WMA decommissioning approach to the retrieval of radioactive and hazardous waste from trenches #'s 1, 10 and 16 on p.4-15.	S. 4.3.1	AECL has determined that, at the moment, 4 trenches are unsuitable for in-situ disposal and will be remediated. Additional detail on the process for designing and implementing an enhanced monitoring program at the WMA, assessing the fitness for service of existing storage facilities and for establishing remediation schedules has been added to the Addendum.	Sec. 3.1
258	CNSC	In appendix C1, AECL argues that the DDT and solvent would have degraded in the soil to non-hazardous levels since their disposal in the trenches. However, there is no direct evidence provided which indicates that the drums containing these substances have actually failed exposing their contents to the biochemical degradation processes that can take place in the subsurface. The only way to determine the condition of the drums and whether they have failed is to excavate these trenches. Efforts should be made to retrieve the hazardous wastes from trenches #3 (2 drums of DDT) and trench #5 (5 drums of solvent-benzene/xylene/acetone)	App. C1	AECL will assess the recovery potential of drums and other wastes (e.g., Pb, DDT) as part of the enhanced monitoring program. Decisions on the possible recovery of those wastes will depend on the results of the in-situ investigations.	Sec. 3.1

Comment Number	Comment By	Summarized CNSC Comment	CSR Rev.2 Reference	Response	Addendum Reference
259	CNSC	It is understood from earlier reports that some of the early unlined concrete standpipes used to store MLW and HLW were not watertight. These standpipes in the southwest corner of the WMA are now earth covered. Potentially, these leaky standpipes may have contaminated soils within the WMA. By definition (p.4-24) such soils are "affected lands" and need to be added to Table 5.9.	Table 5.9	Contaminated land within the WMA is addressed within the scope of the WMA as a nuclear facility. Table 5.9 provides a listing of currently known affected areas that do not 'belong' to a nuclear facility. Conceivably, other areas can be discovered through surveying and will then be managed as described in section 4.3.1. Additional detail on the process for designing and implementing an enhanced monitoring program at the WMA, assessing the fitness for service of existing storage facilities and for establishing remediation schedules has been added to the Addendum.	Sec. 3.1
260	CNSC	Management plans for contaminated soils near stand pipes, Cs pond sediments, contaminated ALWTC soils etc. need (i) to include an estimation of the volume of contaminated soils in "affected lands", (ii) to identify how these soils will be disposed, and (iii) to state, based on (i), whether the boundaries of the existing WMA may need expanding in the future in order to accommodate these and other wastes generated during decommissioning.	S. 4.5	This will be done during Phase 1 and early in Phase 2 and will be documented in a volume of the DDP. Plans include direct transfer of soil waste to disposal facilities. Preliminary estimates of contaminated soil wastes indicate that this represents less than 5% of overall LLW from the decommissioning project. Although there is some uncertainty in this estimate the contaminated soil will not impact significantly on management and handling of such waste. It is not expected that the boundaries of the WMA need to be expanded.	
261	CNSC	The decommissioning plans are not described sufficiently to justify the cost comparison in Table 3.3.	S. 3.3	The approximate and relative cost estimates in the EA were presented to illustrate that certain alternatives appear to have economic advantages without compromising the ability to protect the environment. The selection of the preferred alternative was, as required by the CEAA, based on comparison of potential environmental effects. For this reason, more detailed cost estimates are not necessary to complete this part of the CSR. Detailed cost estimates of the project will be prepared under the licensing process for the purpose of providing for financial guarantees.	
262	CNSC	The decommissioning approaches for the various facilities are too generic to assess risks and costs and residual impacts. Monitoring, surveillance and maintenance requirements for each of the main facilities within each alternative should be described and the relative risks and costs of those activities included in the comparison.	S. 3.4	The level of detail is considered sufficient to support EA decisions on alternative methods. The preferred method is assessed in greater detail in the balance of the environmental assessment for the purpose of drawing an appropriate EA conclusion about the project overall. Under the CNSC licensing process, and specifically in the preparation of detailed decommissioning plans, further details concerning the costs and risks associated with each of the active and inactive decommissioning phases will be provided for CNSC approval.	

Comment Number	Comment By	Summarized CNSC Comment	CSR Rev.2 Reference	Response	Addendum Reference
263	CNSC	With the lack of reported information on the waste inventory and the site hydrology, the analysis of the effect of the WMAs is based mainly on conjecture. All waste known to be unsuited for in-situ disposal, and which is not presently in secure and monitorable engineered containment, should be moved to new interim facilities as early as possible in the decommissioning program. Detailed site investigations and waste inventory confirmation should also begin early in the program to follow-up on the projected suitability of the site for the in-situ disposal of remaining wastes.	S. 6.3.4	Current monitoring information (see Table 9.6 in CSR) does not indicate a near term risk from managing wastes in the present storage locations. The objective of the follow-up monitoring program is to design additional monitoring to confirm this conclusion. Follow-up monitoring is planned to be implemented in Phase 1. The detailed plans for identifying where remediation is necessary as well as timing will be part of the monitoring program output. Additional detail on the process for designing and implementing an enhanced monitoring program at the WMA, assessing the fitness for service of existing storage facilities and for establishing remediation schedules has been added to the Addendum.	Sec. 3.1
264	CNSC	The risk evaluation considers only the in situ disposal of some of the low-level waste trenches. The assessment should also take account of the projected residual contamination that will likely remain from remediated waste management facilities. Minimum clean up criteria should be estimated for each facility.	S. 6.3.4	The EA conclusions are based on an assumption that all areas will be cleaned-up to an end-state that would allow for unrestricted use, or for specified locations, other institutional controls, to prevent unreasonable risk to human health or the environment. More site-specific criteria that meets that objective will be established in the detailed decommissioning plans required under the CNSC licensing process.	
265	CNSC	The low-level waste inventory was poorly recorded, so bounding assumptions of the inventory were adopted. These assumptions, based on shielding calculations, include several isotopes that are not reported as being included in the operation records of the WMA. The shielding calculations should be better described	App. C1	Section C2.5 documents the methodology used to estimate the upper bound LLW trench inventory. In particular, page C2-12 lists the assumptions that were used to estimate the complete range of radionuclides that may be currently present. Additional clarifications have been added to the Addendum.	Sec. 3.2
266	CNSC	AECL should explicitly identify all of the waste facilities that will be remediated (including standpipes, bunkers and specified trenches) and make firm commitments to achieving a minimum clean-up criterion for those locations.	App. C1, S. 4.5.2	All facilities except those identified for in-situ disposal will be remediated. The level of detail is considered sufficient to support EA decisions. Safety and risk associated with project implementation are a subject of Detailed Decommissioning Planning and are administered through the regulatory process. Additional detail on the process for designing and implementing an enhanced monitoring program at the WMA, assessing the fitness for service of existing storage facilities and for establishing remediation schedules has been added to the Addendum.	Sec. 3.1

Comment Number	Comment By	Summarized CNSC Comment	CSR Rev.2 Reference	Response	Addendum Reference
267	CNSC	AECL should also explicitly commit to a program to analyze the recovered waste and apply that information to the operational monitoring data for the purpose of refining the in-situ waste inventory.	S. 4.5.2	Agreed. A statement has been added to the Addendum.	Sec. 3.1
268	CNSC	The independent review of the WMA hydrology confirmed that the monitoring data is insufficient to give a definitive understanding of groundwater flow at the site. Only a portion of the data from two pairs of wells was usable and the data showed significant gradient reversals. AECL should provide a detailed map of the current piezometric conditions at the WMA. AECL should also explicit commit to a sufficient follow-up monitoring program that will hydraulically (and geochemically) characterize the WMA.	App. C	The independent review of collected monitoring data was only intended to review the hydrogeological conditions relative to the comprehensive Waterloo studies. Although the data from one well was inconclusive, the well located nearest to the trenches supported the original Waterloo model. There is no indication that the hydrogeological condition has changed. However, AECL acknowledges that a follow-up monitoring program designed to provide a comprehensive level of confirmation is necessary. That program will be designed and implemented as part of Phase 1 work. Additional detail on the process for designing and implementing an enhanced monitoring program at the WMA, assessing the fitness for service of existing storage facilities and for establishing remediation schedules has been added to the Addendum.	Sec. 3.1
269	CNSC	The assessment of the trenches should be expanded to include the impact of a much shorter (vertical) transport pathway to the surface (even if only by prorating the current predictions of impact to account for smaller retention time in the subsurface).	App. C4	Upward migration of dissolved contaminants was not considered in the screening assessment in Appendix C.1 because the assessment only addressed the time period when institutional controls are in place. During this period, it is assumed that the site is fenced, and the general public will not have direct access to the site. For this time period, upward migration of dissolved contaminants was not considered a strong dose contributor because 1) upward migration is very limited unless the water table is consistently within a metre of the surface, and 2) exposure to contaminants moving upward would be indirect from processes such as dust suspension. In addition, fieldwork carried out in the fall of 2000 indicated that upward contaminant migration was less than 10 cm since closure 20 years ago (see page C1-9). Thus, since the cover is 100 cm thick, contaminants will take over 200 years to reach the surface. The Addendum provides additional clarification on the safety implications of in situ disposal for the period after institutional controls end. The potential impacts of the upward migration of contaminants will be assessed in the final safety case for in-situ disposal.	Sec. 3.2

Comment Number	Comment By	Summarized CNSC Comment	CSR Rev.2 Reference	Response	Addendum Reference
270	CNSC	The assessment of the trenches should be expanded to include an evaluation of exposure pathways based on the C-14 and H-3 losses to the atmosphere assumed in the lateral groundwater transport scenario.	App. C4	Both transport mechanisms, i.e., both with and without volatilization, have been evaluated (see Table 4 in Appendix C). In terms of convection or mass flow, HTO will move with water (H_2O), and $^{14}CO_2$ will move with stable CO_2. However, in diffusion processes, HTO will follow the HTO gradient, and $^{14}CO_2$ will follow the $^{14}CO_2$ gradient. This means that HTO and $^{14}CO_2$ in soil pore water will tend to diffuse out to the atmosphere. The $^{14}CO_2$ volatilization data used in the assessment are especially appropriate, because they were measured on a site adjacent to the WMA. As a result, the volatilization losses of HTO and $^{14}CO_2$ are well supported in theory and with data. If there continues to be an emission, it would be at a very slow rate. In addition, exposure pathways are not direct: for C-14, it involves plant photosynthesis, and for H-3, it involves either skin absorption or absorption by plants. Additional studies to confirm the transport mechanism for C-14 are outlined in the Addendum.	Sec. 3.2
271	CNSC	The computer calculations of the contaminant migration are not well described. The WMA is in fractured clay, but the reported input data for the computer calculations are a mixture of fractured-medium and equivalent-porous-medium values. The characteristics of groundwater flow and contaminant transport can vary by several orders of magnitude depending on the conceptual approach adopted - fracture flow or porous media flow. The groundwater linear velocity can be calculated as 225 m/a from the data reported, or 39 m/a assuming multiple fractures (as measured at the site), or 3 m/a from a tracer test reported in the literature referenced in the report. The sensitivity of the impact predictions to higher linear groundwater velocities should be discussed in the CSR, to identify the limits of potential impacts.	App. C4	Transport equations used have been included in the Addendum. The fractured clay is conceptualized as an equivalent porous media. The hydraulic conductivity for the clay is based on field studies. The porosity is derived from estimates of the fracture aperture and average fracture spacing. Retardation factors are calculated using a linear sorption model and the distribution coefficients (K_d) values represent conservative estimates for porous media. We recognize that there are significant uncertainties in the scoping calculations, particularly with respect to the estimates of the linear velocities as noted in the comment and in the application of K_d values for porous media to fractured clay. The objective for the CSR was to provide a screening estimate to determine the viability of in-situ disposal. The model used to estimate migration from the trenches was selected to be consistent with the scale and complexity of the screening estimate. Future work for the final safety assessment for the LLW trenches will use more comprehensive evaluation methods and additional site-specific data collected through the follow-up monitoring program. Also see responses #164-167.	Sect. 4.2

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272	CNSC	The referencing in some of the parts of Appendix C is inconsistent and incorrect, particularly in Appendix C-2 where the referencing is done by number but the reference list is by author.	Ref.	Agreed. The reference list was corrected.	Sec. 3.2
273	CNSC	The planned end-state conditions for each area of the site should be clarified in the project description.	S. 4.0	The EA conclusions are based on cleaned-up of facilities, services and land to an end-state that would allow release from licence conditions for unrestricted use with the exception of two areas. The in-situ disposal of LLW trenches in the WMA will require institutional control beyond the project period. Some affected lands areas (e.g. Cs ponds, sewage lagoons, inactive landfill) may also require institutional controls. The schedule for achieving endstates is summarized in Figure 4.4 Site-specific criteria that meet endstate objectives will be established in the detailed decommissioning plans required under the CNSC licensing process.	
274	Fisheries and Oceans	The documentation in support of the hydrological understanding of the area to be decommissioned needs to be expanded to provide assurance that predictions relating to the water-borne movement of contaminants from the site are well substantiated. The information, at present, leaves some questions owing to the extent of data available for use in the analysis.		Additional detail on the process for designing and implementing an enhanced monitoring program at the WMA, assessing the fitness for service of existing storage facilities and for establishing remediation schedules has been added to the Addendum. Details on the follow-up groundwater monitoring activities for other areas such as the sewage lagoons and the inactive landfill are provided in section 9.5 of the CSR.	Sec. 3.1
275	Fisheries and Oceans	The accidental release of the inventory of contaminants on-site should be modelled or assurances provided that state of the art technology is available to deal with such a release.		Potential impacts of accidents, malfunctions and non-routine events were assessed in sections 6.4 and 6.5 of the CSR. Accidents and malfunctions are either prevented by design or mitigated. Mitigation includes a range of contingency and emergency preparedness plans which are based on best available technology.	
276	Fisheries and Oceans	Contaminant concentrations present in sediments in depositional areas downstream of the Whiteshell Laboratories outfall need to be documented to provide assurance that the contaminant concentrations found in the sediments near the outfall, represent the “worst case” situation. Sampling in depositional areas downstream should be undertaken. Such samples would also serve as a benchmark against which changes in sediment chemistry during the decommissioning period could be compared.		Although a detailed assessment of the potential impact from the contaminated sediments at or below the outfall revealed that the sediments could not cause any significant environmental effects, AECL will undertake some additional monitoring as part of the follow-up monitoring program. The additional monitoring will provide assurance that conclusions remain valid over the life of the decommissioning project.	Sec. 4.1

Comment Number	Comment By	Summarized CNSC Comment	CSR Rev.2 Reference	Response	Addendum Reference
277	Fisheries and Oceans	Discharge of contaminants during decommissioning should adhere to the ALARA principle rather than to operational release limits.		It is AECL's policy to maintain emissions below regulatory limits and ALARA. AECL also uses administrative limits to provide timely warning of above normal emissions with the intent of aiding in the application of ALARA.	
278	Fisheries and Oceans	Clarification should be provided as to the extent to which decommissioning of the pump house and removal of the intake are likely to affect the nearshore habitat in the Winnipeg River. Detailed decommissioning plans (DDP's) should address the procedures to be followed and timing for such activities.		Agree. Such information will be provided in the infrastructure shut down plan.	
279	Fisheries and Oceans	Reword: "The CNSC determined that a *comprehensive study*…."	ES-1, 2nd para	The correction was made.	Sec. 2.1
280	Fisheries and Oceans	If no action except periodic monitoring of the sediments is proposed, the wording should be amended to reflect this, rather than implying that the sediments are going to be "managed".	ES-6	The river sediments will be abandoned in-situ after confirmation that concentration of contaminants deposited as a result of the decommissioning activities do not change the conclusions of the assessment presented in Appendix B of the CSR.	
281	Fisheries and Oceans	The time forecast for attaining the "end state" for the river sediments and the North Ditch area should be indicated (i.e. when will radiation levels in these areas approximate background levels?)	Fig ES.2	Both components are in the desired end-state. Follow-up monitoring in Phase 1 will include sampling for sediments in depositional areas at down stream hydroelectric dam locations. The additional sediment sampling data will be used to confirm that the conditions have not changed as a result of the decommissioning activities. This will be done in Phase 3. For the North Ditch, such confirmation will be made during Phase 1.	Sec. 4.1
282	Fisheries and Oceans	First bullet – Provide "the typical background radiation dose in Canada" in brackets.	ES-8	The information was added.	Sec. 3.1
283	Fisheries and Oceans	Anticipated residual hydrological effects on the Winnipeg River should listed here.	ES-11	The residual effects are summarized in Table 7.1.	
284	Fisheries and Oceans	Groundwater effects are anticipated to be limited to the Waste Management area, yet monitoring is expected to be continued until the 23rd century. Additional assurance needs to be provided to the reader here, concerning the loadings that will accrue to the Winnipeg River over this time interval taking into consideration the implications that global warming may have on the envisaged scenario. The linkage between the groundwater discharge through the WMA and the surface discharges needs to be clarified so that the magnitude of the contaminant movement out of the WMA is clearly quantified.	ES-11	Effects of global warming are difficult to predict with any certainty. The enhanced monitoring program proposed by AECL will help identify any changes in the groundwater flow regime or in the transport of contaminants. Additional detail on the process for designing and implementing an enhanced monitoring program at the WMA and for establishing the remediation schedules for WMA storage facilities has been added to the Addendum.	 Sec. 3.1

Comment Number	Comment By	Summarized CNSC Comment	CSR Rev.2 Reference	Response	Addendum Reference
285	Fisheries and Oceans	The table could be updated to include the open house held in April 2001.	ES-15	The open house took place after Revision 2 was issued and could not have been mentioned in Rev.2 of the CSR.	
286	Fisheries and Oceans	The "Conclusions" would be enhanced by inclusion of a list of the recommended mitigation measures to be implemented.	ES-16	Added '(see sections 6.3 to 6.5)' at the end of the sentence.	Sec. 3.1
287	Fisheries and Oceans	The definition of "Air Kerma" should be expanded to identify that Kerma refers to "Kinetic Energy Released per unit Mass" (unit J/kg or gray).	Glossary	The definition was clarified.	Sec. 3.1
288	Fisheries and Oceans	A definition for "beta radiation" should be included.	Glossary	A definition was added.	Sec. 4.1
289	Fisheries and Oceans	The definition of TLD should be revised to be consistent with the acronym on page AC-2.	Glossary	The correction was made.	Sec. 2.1
290	Fisheries and Oceans	Responsible Authority - Reference should be to Fisheries and Oceans Canada (DFO), rather than Department of Fisheries and Oceans.	pg. 1-4	The correction was made.	Sec. 2.1
291	Fisheries and Oceans	Typo: "Minister of Fisheries and Oceans". **"Harmful alteration, disruption or destruction** of fish habitat …."	S. 1.4.1.3	The correction was made.	Sec. 2.1
292	Fisheries and Oceans	While the Underground Research Laboratory is included in the "Local Study Area" as noted on pg. 2-1 it is not included in the project. To avoid misunderstanding by the public it should be reemphasized here that it is not part of the project.	S. 2.3.1.3	Agreed. A sentence was added to clarify this point.	Sec. 3.1
293	Fisheries and Oceans	The last sentence needs to be modified since it is counter to the conclusion in the Executive Summary (i.e. That the Project is "not likely to cause significant adverse environmental effects".) in that it implies that there will be significant effects that extend beyond the project time frame.	pg. 2-4	Agreed. The wording was corrected.	Sec. 3.1
294	Fisheries and Oceans	The Institutional Control Period only mentions the monitoring of the "low level waste trenches". The in-situ disposal of river sediments also needs to be monitored during the Institutional Control Period.	pg. 4-6	Monitoring will continue during the decommissioning project. A final confirmation of the end-state will be made in Phase 3 when liquid emissions are terminated. No further monitoring is planned after the confirmation is obtained.	
295	Fisheries and Oceans	The sources and nature of the materials to be used to backfill the sewage lagoons should be identified.	pg. 4-23	It is expected that local soils, with characteristics comparable to soils adjacent to the lagoons, will be used. Provincial regulations will be considered in developing a remediation plan for the lagoons.	

Comment Number	Comment By	Summarized CNSC Comment	CSR Rev.2 Reference	Response	Addendum Reference
296	Fisheries and Oceans	Storm drains - Clarification is needed as to why process water is needed to maintain a minimum flow of 50L/s at the outfall to obtain flow measurements.	pg. 4-24	A flow of 50 L/s is the minimum flow to enable flow measurement in a large diameter pipe (1.8 m).	
297	Fisheries and Oceans	The levels of beta and gamma radiation in the vegetation next to the ALWTC should be stated in the text.	pg. 4-24	Agree. New information is provided in the addendum.	Sec. 4.1
298	Fisheries and Oceans	River Sediments b) Reword: "… final end-state objectives (background concentrations)."	pg. 4-27	The end-state is not background levels. Instead, it is a level deemed harmless to aquatic life or humans. The assessment document in Appendix B of the CSR confirmed the current conditions do not pose a risk to aquatic life or humans.	
299	Fisheries and Oceans	Dates for attaining the final end states for the "River Sediments" and the "North Ditch Area" should be indicated.	Fig. 4.4	Both components are in the desired end-state. Sediments need confirmation that the conditions have not changed as a result of the decommissioning activities. This will be done in Phase 3. For the North Ditch, such confirmation will be made during Phase 1.	
300	Fisheries and Oceans	Deminimis Segregation Facility . A table should be included to show the "free-release requirements" associated with various radioactive wastes.	pg. 4-38	There are no free-release levels as such. A safety case meeting the requirements specified by the CNSC in Regulatory document R-85 has to be made by the licensee.	
301	Fisheries and Oceans	No arrows are associated with the "Contaminated Soil Sediments and Piping" box. The fate of each component should be indicated.	Fig. 4.5	The figure was revised.	Sec. 3.1
302	Fisheries and Oceans	Mercury is shown as "n/a" for the "Monthly Limit" with a daily limit in a single sample of 0.001 μg/L, but in Table 9.10 analyses are based on monthly composites taken weekly. Inclusion of the monthly limit in Table 5.5 is therefore relevant.	Table 5.5	AECL's guidelines are based on Environment Canada 'Guidelines for Effluent Quality and Wastewater Treatment at Federal Establishments' which do not include a monthly limit for mercury.	
303	Fisheries and Oceans	The text here indicates that Environment Canada monitors wind on a ten metre tower whereas the caption for Fig. 5.10 provides data for a height of 6 metres. Is there an error in the figure caption?	pg. 5-11	The figure captions were corrected.	Sec. 2.1
304	Fisheries and Oceans	Table 5.10 should be updated to reflect the 34 years of available data, as opposed to the 32 years of data that are summarized.	Table 5.10	The table included readily available information at the time of writing. Additional, more recent data would not affect the values significantly nor will they affect the conclusions of the study.	
305	Fisheries and Oceans	Clarify why data for 1996 and 1997 are not included in Table 5.12.	Table 5.12	The table included readily available information at the time of writing. Additional, more recent data would not affect the values significantly nor will they affect the conclusions of the study.	

Comment Number	Comment By	Summarized CNSC Comment	CSR Rev.2 Reference	Response	Addendum Reference
306	Fisheries and Oceans	The recent data supporting understanding of groundwater flow movement through the WMA are derived from two piezometer wells. The data from one well were deemed to be inconclusive due to poor well construction. Since understanding of the groundwater movement through the WMA affects the migration of contaminants from the WMA to the Winnipeg River, additional wells should be installed to provide conclusive evidence as to the nature of groundwater movement through the WMA. [when? pre or post-EA?]	pg. 5-24	Additional detail on the process for designing and implementing an enhanced monitoring program at the WMA and for establishing the remediation schedules for WMA storage facilities has been added to the Addendum. The enhanced monitoring program will be implemented as part of the follow-up for the environmental assessment.	Sec. 3.1
307	Fisheries and Oceans	The fate of the sewage lagoon sludges upon decommissioning of the lagoons should be detailed. It should also be indicated that the primary lagoon is located west of the secondary lagoon.	pg. 5-28	The lagoons will be taken to a condition meeting the applicable provincial regulations (currently Reg. 163/88 under the Manitoba Environmental Act). The relative location of the lagoons was clarified	Sec. 3.1
308	Fisheries and Oceans	An explanation should be provided for the increases in gross alpha and beta radioactivity in the north ditch in 1998 relative to 1996.	pg. 5-32	The 1998 levels are within the observed variability at the North Ditch and cannot be interpreted as a degradation of the conditions.	
309	Fisheries and Oceans	Reference is made to spills that have taken place during the operational period, however little information is presented about the locations or radionuclides associated with the spills. Although mention is made in a previous section that an assessment and description of spills will be done, a brief description would greatly improve the context of the survey plan and results.	pg. 5-32	Table 5.9 presents the information relative to the spills. With respect to the North Ditch, 7 GBq of fission products were spilled. Following remediation, very low levels of contamination remain. Confirmation that the North Ditch remains in the desired end-state will be obtained during Phase 1.	
310	Fisheries and Oceans	Present projections of impact are based upon historical information from plant discharge records and analyses of "outfall sediments". Are there projections of the effects of accidental releases based upon present on-site inventories using different accidental release scenarios? Very little information is provided concerning the activities of all isotopes released in past spills. While emphasis has been placed on ^{137}Cs, if carefully examined other isotope activities may be present in the sediments.	pg. 5-32	The analysis of effects from accidents and malfunctions was documented in section 6.4 of the CSR. The analysis was based on conditions and inventories at the site during decommissioning. As stated on page 6-34, accident mitigation is based on prevention, early detection, remediation and accommodation. See also response to comment #275. As indicated in Appendix B, page B3-14, Cs-137 and K-40 (a naturally occurring radionuclide) are the only radionuclides identified by in-situ gamma spectrometry.	

Comment Number	Comment By	Summarized CNSC Comment	CSR Rev.2 Reference	Response	Addendum Reference
311	Fisheries and Oceans	The fact that the total inventory of ^{137}Cs amounted to 1.3 GBq based on the sediment survey, which is "substantially less than the annual releases of ^{137}Cs prior to 1985 when the reactor was operating", points to the fact that considerable quantities of ^{137}Cs contamination reside outside of the zone in which intensive sediment investigations were conducted.	pg. 5-36	Noted. The investigation focused on the outfall area and the next most likely depositional area. Levels of contaminants in those areas do not pose a risk to aquatic life or humans (see Appendix B). It is therefore fully expected that contaminant levels will be even lower further down river.	
312	Fisheries and Oceans	Units should be added beside the isopleth bar.	Fig. 5.24	The correction was made.	Sec. 2.1
313	Fisheries and Oceans	Reword: "… sport fishing has **in** the general area …"	pg. 5-51	The correction was made.	Sec. 2.1
314	Fisheries and Oceans	Non-residents (Continued) Reword: "…in **whole or in part** to sport fishing…"	Table 5.33	The correction was made.	Sec. 2.1
315	Fisheries and Oceans	Check spelling of "Lac du Bonnet"	pg. 5-51	The correction was made.	Sec. 2.1
316	Fisheries and Oceans	During decommissioning AECL should strive to meet discharge limits that meet the intent of the ALARA principle rather than merely complying with the operational release limits.	S. 6.3.3.3	It is AECL's policy to maintain emissions below regulatory limits and ALARA. AECL also uses administrative limits to provide timely warning of above normal emissions with the intent of aiding in the application of ALARA.	
317	Fisheries and Oceans	AECL should undertake to provide additional information to support the contention that there is minimal potential for groundwater contaminant migration to the Winnipeg River from the WMA, sewage lagoons and the inactive landfill. The extent of surface water effects on the Winnipeg River should be clarified.	S. 6.3.3.4	Additional detail on the process for designing and implementing an enhanced monitoring program at the WMA and for establishing the remediation schedules for WMA storage facilities has been added to the Addendum. Details on the follow-up groundwater monitoring activities for other areas such as the sewage lagoons and the inactive landfill are provided in section 9.5 of the CSR.	Sec. 3.1
318	Fisheries and Oceans	As part of Phase 1 activities, AECL should commit to determining whether contaminant movement to ground water is occurring from the sewage lagoons and provide a remediation plan designed to address any ongoing releases during the decommissioning period.	Pg. 6-18	Agreed. This investigation will be part of the enhanced monitoring program and is described in section 9.5.4 of the CSR. Any remediation plan would be formulated based on the results of the investigation	
319	Fisheries and Oceans	Reword last sentence: "**Benthic species are important, but many are short-lived.**"	S. 6.3.6.2, pg. 6-21	The correction was made.	Sec. 3.1
320	Fisheries and Oceans	A statement should be added to clarify whether the potential combined effects of radiological and non-radiological contaminants to aquatic biota were assessed.	S. 6.3.6.2, pg. 6-22	Combined effects were not assessed. See response to comment #114.	

Comment Number	Comment By	Summarized CNSC Comment	CSR Rev.2 Reference	Response	Addendum Reference
321	Fisheries and Oceans	Given the fact that at times the surface elevation of water in the sewage lagoons exceeds the elevation of the surrounding lands, a projection should be made concerning the likelihood that an extreme rainfall event could cause overtopping of the sewage lagoons during the proposed decommissioning period. (i.e. Would a 105 mm 24h rainfall event result in overtopping of the lagoons and what contingency is in place to deal with such an event?) The potential for this effect should be added to table 6.5.	pg. 6-35	Such an event has a return period of 100 years. The lagoons do not have a catchment basin as such and the levees are expected to accommodate an extra 10 cm of water. As shown in Table 5.5, emissions from the lagoons are below emission limits; therefore an overflow would not pose a risk to aquatic life.	
322	Fisheries and Oceans	Tornado Last line. The wind forces that the reactor and concrete canisters are designed to withstand, should be stated.	pg. 6-35	The canisters are designed to withstand wind forces in accordance with USAEC safety structure defined as: 1) a tangential wind speed of 483 km/h, and 2) a translational wind speed of 96.6 km/h. Since the WR-1 reactor vault is an underground structure contained in a concrete and steel-shielded structure, high winds would have no effect on that facility.	
323	Fisheries and Oceans	Conclusions. Contingency plans should undergo annual review and be revised as necessary.	pg. 6-39	A review of the emergency preparedness program takes place annually. The plans are reviewed for adequacy and are revised as needed.	
324	Fisheries and Oceans	This section needs to be reworded. Once released in surface water or groundwater discharges, there is no apparent mechanism that will confine contaminants to the shoreline of the Winnipeg River within the Whiteshell Laboratory site.	S. 6.7.1.1, 3rd para.	Agreed. The first sentence referred to a possible human exposure scenario and can be misleading. The sentence was deleted.	Sec. 3.1
325	Fisheries and Oceans	It should be noted that while the mobility of organisms provides an opportunity for significant dilution through the intake of clean food, it does not guarantee that dilution.	pg. 6-41	It is acknowledged that mobility of the mammal populations does not guarantee dilution. However, there is no basis to argue that there is a mammal population specific to the WMA. Two other points are worth noting. First, large mammals cannot be impacted significantly by contamination that can be inside the WMA fenced area. Although not intentionally excluded by the integrity of the fence, deer for instance, would not spend a large fraction of time grazing inside the fence. Small mammals can penetrate the fence but the habitat in the WMA is of no better or poorer quality than that in the old-field that surrounds the WMA. Should individuals be impacted through feeding in the WMA, they belong to a larger population that extends beyond the fence. This limits impacts on the population.	

Comment Number	Comment By	Summarized CNSC Comment	CSR Rev.2 Reference	Response	Addendum Reference
326	Fisheries and Oceans	Mitigation measures for areas of the Winnipeg River shoreline that may become contaminated from surface runoff or groundwater discharges should be provided.	S. 6.7.1.2	The only two sources of contamination are the outfall and the west drainage ditch from the waste management facilities area. Mitigation of any accidental releases would be at the source. Thus, mitigation at the shoreline is considered unnecessary.	
327	Fisheries and Oceans	last line Reword: "**Existing contamination in** river sediments is unlikely to affect aquatic biota (Section 6.3.6)"	pg. 7.3	A clarification is provided in the addendum.	Sec. 3.1
328	Fisheries and Oceans	Table 7.3 would benefit from the inclusion of "Criterion" above the various symbols (M, D, O, G, R)	Table 7.3	The correction was made.	Sec. 2.1
329	Fisheries and Oceans	pg. 8-4, Line 2 Reword: "… reveals that there **are** no measurable interactions …"	pg. 8-4	The correction was made.	Sec. 2.1
330	Fisheries and Oceans	The "non-radiological" parameters that are monitored should be specified in the table. Are non-radiological parameters not monitored at all in groundwater, sediments or fish as part of the monitoring program? If this is the case, how is the intent of bullet 33 (para. 2)[to assure the public re non-radiological hazards] on this page achieved strictly through surface water monitoring? Why is ^{90}Sr not monitored in fishes?	pg. 9-2, Table 9.1	Table 9.1 provides a summary of the monitoring activities only. The list of non-radiological parameters monitored for is provided on page 9-9 of the CSR. The highest potential of non-radiological contamination of the environment is from the process outfall and the sewage lagoon releases. Thus, the current monitoring program includes monitoring of non-radiological contaminants as part of the site effluent verification monitoring. The data acquired through the monitoring program provides a confirmation that the releases from WL are kept below regulatory levels. As mentioned in section 9.6 of the CSR, the monitoring program is reviewed periodically and scope changes are made where required. With respect to fish, AECL's monitoring program includes fish flesh measurements since it is an exposure pathway for humans. Since Sr-90 accumulates in bones and not substantially in flesh, it is not measured in fish flesh. The parameters measured include Cs-137, K-40 and gross beta.	

Comment Number	Comment By	Summarized CNSC Comment	CSR Rev.2 Reference	Response	Addendum Reference
331	Fisheries and Oceans	If Tritium is not sampled it should be removed from the table. Analytical methods are missing from the Table. Clarification should be provided as to whether individual samples of Winnipeg River water are ever analyzed as part of the monitoring program. There would be benefit during decommissioning of instituting monitoring that is proportional to flow. This would provide a better understanding of loadings than samples based on monthly composites of weekly samples. Table 9.3 should include the "non-radiological parameters" (referred to in Table 9.1) and analytical methods.	Table 9.3, pg. 9-5	Surface waters are not analyzed for tritium. A correction has been made in the addendum. As mentioned in the response to comment #330, only the outfall and sewage lagoon emissions are monitored for non-radiological contaminants. Laboratories supplying analytical services to AECL have to meet AECL's quality assurance requirements (AECL, Design and Conduct of Radiological Effluent and Environmental Monitoring Programs, Element ENV-2.7-R-01 of RC-2000-021, 1996 May). AECL and its supplier employ widely accepted analytical methods (e.g. HASL, WHO and IAEA accepted methods). As the legend of table 9.3 states, two of the three downstream Winnipeg River samples are collected daily (not weekly) to create a monthly composite sample. AECL does monitor its outfall effluent continuously (proportional to the discharge flow). Grab samples of river water are also collected at several locations downstream of WL if the gross beta levels measured at the outfall rise above a warning level.	Sec. 2.1
332	Fisheries and Oceans	Clarify why "Gross Alpha" is not reported. Clarify whether analyses are on whole fish digests, flesh or bone. Provide analytical methods.	Table 9.4, pg. 9-6	There is no requirement to monitor fish for gross alpha. A correction has been made in the addendum. Laboratories supplying analytical services to AECL have to meet AECL's quality assurance requirements (AECL, Design and Conduct of Radiological Effluent and Environmental Monitoring Programs, Element ENV-2.7-R-01 of RC-2000-021, 1996 May). AECL and its supplier employ widely accepted analytical methods (e.g. HASL, WHO and IAEA accepted methods).	Sec. 2.1
333	Fisheries and Oceans	Provide Analytical Methods in Table 9.5.	Table 9.5	AECL's quality assurance requirements (AECL, Design and Conduct of Radiological Effluent and Environmental Monitoring Programs, Element ENV-2.7-R-01 of RC-2000-021, 1996 May). AECL and its supplier employ widely accepted analytical methods (e.g. HASL, WHO and IAEA accepted methods).	
334	Fisheries and Oceans	For Table 9-6, the analytical methods and non-radiological parameters should be included.	Table 9.6	As mentioned in the response to comment #330, there is no requirement to monitor groundwater for non-radiological contaminants at the moment. AECL's quality assurance requirements (AECL, Design and Conduct of Radiological Effluent and Environmental Monitoring Programs, Element ENV-2.7-R-01 of RC-2000-021, 1996 May). AECL and its supplier employ widely accepted analytical methods (e.g. HASL, WHO and IAEA accepted methods).	Sec. 2.1

Comment Number	Comment By	Summarized CNSC Comment	CSR Rev.2 Reference	Response	Addendum Reference
335	Fisheries and Oceans	For Table 9.7, analytical methods should be included	Table 9.7	AECL's quality assurance requirements (AECL, Design and Conduct of Radiological Effluent and Environmental Monitoring Programs, Element ENV-2.7-R-01 of RC-2000-021, 1996 May). AECL and its supplier employ widely accepted analytical methods (e.g. HASL, WHO and IAEA accepted methods).	
336	Fisheries and Oceans	Table 10 footnote: Typo "Fecal Cloakroom"	pg. 9-10	The correction was made.	Sec. 2.1
337	Fisheries and Oceans	Elaborate on the annual percentage of time and calendar months that the WMA is not a discharge zone.	S. 9.5.2	Percent recharge condition is presented in Figure 5.19 and is discussed in Sec. 5.4.4. of the CSR showing that the downward gradient occurs less than 5% of the time at the WMA. That level of gradient reversal is insufficient to result in contaminant transport toward the sand aquifer.	
338	Fisheries and Oceans	Reword last line para. 2: "Modifications to the monitoring program will be submitted to the CNSC for approval prior to implementation."	S. 9.6, pg. 9-18	Agree. The change of wording was made.	Sec. 3.1
339	Fisheries and Oceans	There would be merit in adding more specificity in this section with respect to the actual contaminants that being referred to.	App. B 1.1.1	The contaminants of interest are those monitored for. These contaminants are identified in tables 9.1 and 9.10.	
340	Fisheries and Oceans	The area has water velocities that vary seasonally and annually. Areas or periods of deposition near the outfall could have clean sediments deposited from above the outfall. During erosion events the contaminated hard packed clays could be exposed.	App. B 1.1.3	Noted.	
341	Fisheries and Oceans	The separation in the top of the outfall pipe near where the pipe emerges from the riverbank should be repaired to prevent effluent release near to the shore.	App. B, 1.2.1	There is no evidence of significant deposition nearer to the shoreline as a result of the partial pipe separation. Since the emissions during decommissioning are expected to be a small fraction (~1%) of the releases during the operational period, no significant deposition will occur during deco-mmissioning. Thus, no repair of the pipe is required. However, periodic inspection of the pipe break will be conducted (every 10 years).	
342	Fisheries and Oceans	A scale and north arrow should be added to the figure.	App B. Fig. 1	A revised figure was provided.	Sec. 2.2
343	Fisheries and Oceans	Units of time (days or years) should be added for the half lives at the bottom of the table.	App. B, Table 1	The correction was made.	Sec. 2.2
344	Fisheries and Oceans	The releases corrected for radioactive decay to 2000 should be presented. (Otherwise the scaling factors appear to be in error.)	App. B, Table 1	The scaling factors were computed taking into account radioactive decay to 2000.	

Comment Number	Comment By	Summarized CNSC Comment	CSR Rev.2 Reference	Response	Addendum Reference
345	Fisheries and Oceans	It is indicated that the background sediment radioactivity is 4 Bq/kg dry sediment. Then it is indicated that greater turbation limits local contamination resulting in contaminant transport further downstream. On page B1-9 it is indicated that there is less contamination where the current accelerates removing sediment from the river bed. Then it is indicated that the total radioactive inventory in sediments within 100 m downstream of the outfall pipe is 1.3 GBq. **The annual discharge of ^{137}Cs** from the Whiteshell Laboratories in 1984 was 40.7 GBq while the total beta was 170.6 GBq. It is acknowledged that the annual monitoring data indicate that losses of contaminants from the area occurred. It therefore is evident that inventories of radioactive contaminants released from the facility are not predominantly in the outfall zone examined, but rather in areas downstream of the site of intensive examination, which to date have not been identified. The likelihood of depositional areas downstream containing radioactive contaminants that could pose a hazard to humans or biota warrants comment and clarification so that the present distribution of the contaminants released from the facility are clearly characterized.	App. B, pg. B1-7	As part of the follow-up monitoring activities, AECL will sample depositional areas upstream of four hydroelectric dams along the Winnipeg River and to analyze sediment cores for radiological and non-radiological contaminants. The initial sampling will be done during Phase I of the decommissioning project and repeated 20, 40 and 60 years after the commencement of the decommissioning activities.	Sec. 4.1
346	Fisheries and Oceans	Cores 1 and 3 with the thick surface slices should show the concentration measured to be present over the entire interval, not just at 0 cm. The levels might be better represented as bars extending over the intervals at all levels.	App. B-1, Fig 4	Agreed. However, the data as presented, with explanatory notes below the table, does indicate the sample thickness and depth of contamination. Revision of the graph would not change the environmental assessment conclusions.	
347	Fisheries and Oceans	The phrase "most radionuclides do not biomagnify" is inappropriate. There are hundreds of radionuclides, only a few of which are dealt with in this report. The report should be specific to the radionuclides of interest in connection with the decommissioning project.	App. B, S. B1.3.1	The comment is valid for the WMA radionuclides as it is for most radionuclides. The point is that the level of biomagnification seen with lipophilic organic contaminants does not happen with radionuclides. The exceptions sometimes are radionuclides that behave like essential elements in settings where those elements are deficient. We do not believe this is the case for the WMA.	
348	Fisheries and Oceans	Typos in the table caption should be corrected (upper case for first letter of radionuclide symbols, etc.)	App. B, Table 6	The correction was made.	Sec. 2.2

Comment Number	Comment By	Summarized CNSC Comment	CSR Rev.2 Reference	Response	Addendum Reference
349	Fisheries and Oceans	Add a note to the table caption clarifying the shading. Detection limits for several elements could be improved upon for decommissioning monitoring.	App. B, Table 7	The correction was made.	Sec. 2.2
350	Fisheries and Oceans	Reword para. 1 last line: "Comprehensive **Study** Report"	App. B3.1	The correction was made.	Sec. 2.2
351	Fisheries and Oceans	Include units (cps) for the count bars in Figures 7 and 8.	App. B, Figs. 7 & 8	The correction was made.	Sec. 2.2
352	Fisheries and Oceans	The conclusions in Appendix C are based on 2 wells in the waste management area. Data from one of these wells (RW1) - the one located in the center of the WMA - "indicated that the well construction has been compromised and accordingly the data are inconclusive" (C1-4). There are also elevated radioactive levels present in samples from monitoring wells located around the trenches for certain years. Based upon the information presented, there is a need to ensure that the groundwater monitoring program is expanded. This is required in order to provide adequate assurance that there is a sound basis for the conclusion that the WMA is in a groundwater discharge area, and therefore radioactive contaminants from the WMA are not entering the Winnipeg River through the groundwater flow path.	App. C	Additional detail on the process for designing and implementing an enhanced monitoring program at the WMA and for establishing the remediation schedules for WMA storage facilities has been added to the Addendum.	Sec. 3.1