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Written submission from Canadian Nuclear Laboratories Ltd.

Mémoire des Laboratoires Nucléaires Canadiens Ltée

In the Matter of the

À l'égard de

Whiteshell Laboratories

Laboratoires de Whiteshell

Application to renew the Nuclear Research and Test Establishment Decommissioning Licence for the Whiteshell Laboratories site for a period of ten years

Demande pour le renouvellement, pour une période de dix ans, du permis de déclassement d'un établissement de recherche et d'essais nucléaires pour les Laboratoires de Whiteshell

Commission Public Hearing

Audience publique de la Commission

October 2-3, 2019

Les 2 et 3 octobre 2019

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EXECUTIVE SUMMARY

This commission member document is presented to the Canadian Nuclear Safety Commission (CNSC) Secretariat, in support of an application from Canadian Nuclear Laboratories Ltd. (hereafter CNL) to renew the Nuclear Research and Test Establishment Decommissioning Licence for the Whiteshell Laboratories (WL) site, located in the Local Government District (LGD) of Pinawa in the Province of Manitoba, approximately 100 km northeast of Winnipeg, Manitoba. Owned by Atomic Energy of Canada Limited (AECL), a federal Crown corporation, the WL site has been in operation for more than five decades.

Figure: Aerial view of the Whiteshell Laboratories site.

As explained within this document, CNL manages the WL site under a Government-Owned, Contractor-Operated model under agreement with AECL, who retains ownership of the site and its associated liabilities on behalf of the Government of Canada. Under this management model, one of the three main objectives for CNL's management is to address (i.e., reduce) the nuclear legacy liabilities, specifically including those liabilities at WL.

The application for renewal is presented for consideration by the Commission, consistent with the corporate vision, mission, and identity of CNL.

Planning for the final decommissioning of the WL site, CNL submitted an application to the CNSC Secretariat on 2018 November 15 for renewal of the site decommissioning licence, for a ten-year term commencing on 2020 January 01. The required information for an application to renew the current licence was submitted to the Secretariat in accordance with the requirements of the Nuclear Safety and Control Act and associated Regulations. Supplementary information regarding the application was simultaneously submitted to CNSC staff.

The decommissioning of WL commenced with the acceptance in 2002 of the Comprehensive Study Report (CSR) on the environmental aspects of the decommissioning of WL, and the

issuance of the first WL Decommissioning Licence by the CNSC, commencing 2003 January 01 through 2008 December 31. This licence was subsequently renewed by the CNSC for the period from 2009 – 2018, and again for the 2019 calendar year.

This commission member document presents summarized information relating to key decommissioning projects planned during the proposed ten year period of the renewed licence. Subject to Commission approval through the issuance of the requested licence, CNL will continue with this substantial site closure project. [Subsequent to the Commission's issuance of a renewed licence, many decommissioning planning documents, etc. must still be submitted to, and accepted by, CNSC staff before work commences, and CNL anticipates that CNSC staff will continue to provide effective oversight of project activities, as has occurred during the current licence period.] CNL will proceed with these decommissioning, environmental remediation and waste management activities based on sound environmental and waste management principles, and based on world class practices.

In the 2002 CSR, 21 of the 25 LLW trenches in the WMA were identified as being able to be left in situ, pending a final safety assessment. A 2019 reassessment indicated that one of the 4 trenches to be remediated may also be a candidate to be left in situ, again pending a final safety assessment. Thus, 21 or 22 of the LLW trenches may be left in situ. It is CNL's plan that the final safety assessment for the proposed, in situ disposal of these underground LLW trenches will be developed and presented to CNSC staff for acceptance during the next licensing period.

The present decommissioning approach for the Phase 2 decommissioning of the WR-1 Reactor Building, as accepted by CNSC staff in 2015, involves the complete removal of the reactor core, other reactor components and contaminated equipment, the demolition of the building, and the remediation of the site. Work is continuing on proposed changes to this approach; that is, obtaining approvals through the Environmental Assessment process and a required licence amendment for in situ decommissioning of the WR-1 reactor. CNL is planning to submit a final Environmental Impact Statement (EIS) (and supporting documents) for the in situ decommissioning of the WR-1 reactor, under separate cover, at a later date. Discussion of the ISD of WR-1 in this commission member document will be made in brief terms only, in order to place this project in the context of existing and planned decommissioning activities at WL. Regulatory decisions pertaining to the proposed ISD for WR-1 will subsequently be determined by the Commission under a separate hearing process. Until the ISD project has been approved by the Commission, this licensing application will include the present, approved total decommissioning of the WR-1 complex.

At the end of the proposed ten year licensing period, the CNL plan is that all of WL will have been decommissioned to its final end-state, including the final decommissioning of the WR-1 reactor and the proposed in situ decommissioning (ISD) of certain Low-Level Waste (LLW) trenches in the Waste Management Area (WMA) (see previous paragraph), and the implementation of post-closure institutional controls. All other LLW, all Intermediate Level Waste (ILW), also formerly termed Medium Level Waste (MLW), and all High Level Waste (HLW), will be retrieved, characterized, and (re-)packaged (as necessary) for shipment to either Chalk River Laboratories

(CRL) or another suitable, licensed storage/disposal facility. It is anticipated that the physical decommissioning activities at WL will be completed on, or before 2026; final documentation may take additional time.

CNL's strategic plan, as stated in the preceding paragraph, is to relocate most (if not all) of WL's radioactive wastes, except for certain trench wastes, to CRL within the next licence period, as one part of the CNL plan to complete the cleanup and closure of Whiteshell Laboratories. Starting in 2017, CNL commenced the relocation of Whiteshell Laboratories radioactive wastes to CRL. As of 2019 July 15, 3,557 m^3 of LLW and 18 m^3 of ILW have been safely transported to CRL in 175 shipments. These shipments have covered 335,000 km of roads, with zero incidents/accidents and zero non-conformances. CNL anticipates that a total of approximately 1500 shipments of Low-Level Waste, 500 shipments of Intermediate-Level Wastes and 46 shipments of High-Level Waste (the baskets of irradiated reactor fuel from the Concrete Canister Storage Facility) will be transferred to Chalk River during the completion of the Whiteshell Labs Closure Project.

This commission member document is structured such that it provides an overview of the integrated performance at WL against each of the 14 CNSC Safety and Control Areas (SCAs), in addition to a brief summary of past decommissioning work, and the future CNL plans to complete the full and final decommissioning of WL. In addition, specific information is presented on other matters of regulatory interest (e.g., public information activities). The CNSC WL licence conditions handbook identifies the regulatory requirements and the licensing basis for the WL Nuclear Research and Test Establishment Decommissioning Licence.

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. CNL is committed to excellence in management, thereby providing the foundation on which the company and employees can thrive.

CNL respectfully submits this commission member document for consideration to enable the completion of the decommissioning of the WL site. Nuclear safety remains paramount at CNL at all times. Conventional and radiological safety, excellent environmental performance, and security requirements are ensured through the dedication of staff and the safety culture that is established through the implementation of the robust processes, procedures, and programs governed by the improved Management System. Safe operation extends protection to the CNL employees working at the site, contractors, visitors, members of the public, and the environment.

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1. INTRODUCTION

The purpose of this document is to present information in support of the application from Canadian Nuclear Laboratories, Ltd. (CNL) to renew the decommissioning licence for Whiteshell Laboratories (WL) for a period of ten years. It is anticipated that WL will complete physical decommissioning activities on, or before 2026, although completion of the final documentation may take additional time. The proposed ten year licence period provides additional time to cover schedule risk with respect to WL closure.

The Nuclear Research and Test Establishment Decommissioning Licence for WL was issued to Atomic Energy of Canada Limited (AECL) (the predecessor to CNL) by the Canadian Nuclear Safety Commission (CNSC) for the period from 2009 – 2018, and was subsequently renewed for 2019. The initial decommissioning licence ran from 2003 to 2008.

Throughout the requested licence period, CNL will continue its commitment for the provision of safe decommissioning and operational practices (nuclear and conventional) at WL. A comprehensive and mature system of programs and processes is fully implemented, and is being maintained to ensure the fostering of a strong safety culture, at all times. This further enables a commitment to ensuring the health, safety, and security of employees and members of the public, with protection for the environment, and ensures that international obligations to which Canada has agreed are appropriately maintained. Safe operation will always be the utmost priority for CNL.

1.1 Canadian Nuclear Laboratories Corporate Vision

This application for renewal is presented for consideration by the Commission, consistent with the CNL corporate vision and mission. The purpose of the company is to advance nuclear science and technology for a clean and secure world.

The CNL mission is reflected as follows:

- Restoring and protecting Canada's environment by reducing and effectively managing nuclear liabilities.
- Providing 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. Together with partners, demonstrating the commercial viability of advanced reactor designs including Small Modular Reactors (SMR).
- Collaborating with medical/educational institutions and pharmaceutical companies to pioneer new alpha therapies for cancer treatments that save countless lives.
- Leveraging all capabilities for commercial success in Canadian and international markets.

Administratively, the WL Closure Project is part of CNL's Environmental Remediation Management (ERM) organization. ERM's mission is to use innovative technologies, modern facilities and technical expertise for the safe storage and long-term management of radioactive

waste. Redundant buildings and infrastructure are decommissioned in a prioritized manner, reducing legacy liabilities and associated risks.

The CNL core values are:

- Safety: Freedom from harm, danger, injury, or loss to people and the environment. It is the foundation on which CNL's decision-making stands.
- Respect: Placing a high value on others, treating them fairly, and empathizing with their needs.
- Teamwork: The ability to work together, in a collaborative way, toward a common goal.
- Accountability: An attitude and a set of actions that affect how CNL impacts people, situations, and results in a positive way.
- Integrity: Adhering to high ethical standards and strong moral principles, even under pressure.
- Excellence: Striving to achieve an ever-rising standard of quality through continual improvement and innovation.

1.2 Description of the Whiteshell Laboratories Site

Whiteshell Laboratories was established near Pinawa, Manitoba (see Figure 1-1) in the early 1960s to carry out nuclear research and development activities for higher temperature versions of the CANDU® (CANada Deuterium Uranium) reactor. The initial focus of research was the Whiteshell Reactor-1 (WR-1) and the Organic Cooled Reactor (OCR) concept, 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.

The WL site property is located approximately 100 km northeast of Winnipeg, Manitoba, 10 km west of Pinawa, Manitoba and north of Highway 211, and includes lands on both the east and west side of the Winnipeg River. The property covers 4375 hectares (ha), although a majority of the WL facilities fall within a 40 ha area, adjacent to the east shore of the Winnipeg River. The Waste Management Area (WMA), the Concrete Canister Storage Facility (CCSF) and other facilities are located approximately 2 to 3 km north-east of the main site campus. The site lies approximately 267 m above sea level, within a broad zone where prairie grassland to the southwest transitions into 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.

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 WL.

Subsequently, AECL received government concurrence in 1998 to proceed with actions to commence closure of WL via decommissioning.

As part of the initial environmental assessment which led to the Comprehensive Study Report (CSR) on the decommissioning of Whiteshell Laboratories in 2002, the AECL licensed property was separated into two overall parts, which were designated as the Affected Area and Unaffected Area, shown as yellow and green, respectively, on Figure 1-2. The Affected Area, about 1400 hectares, included buildings, spaces and lands that were, or might have been, impacted by site nuclear operations, as well as a buffer zone around those impacted areas. The Unaffected Area contained only land that had no radiological history and was not impacted by site nuclear operations. This was confirmed by a radiological verification survey performed during the summer of 2000. The Unaffected Area was excluded from the scope of WL Decommissioning as defined in the CSR.

Figure 1-1 : Location of Whiteshell Laboratories in Eastern Manitoba

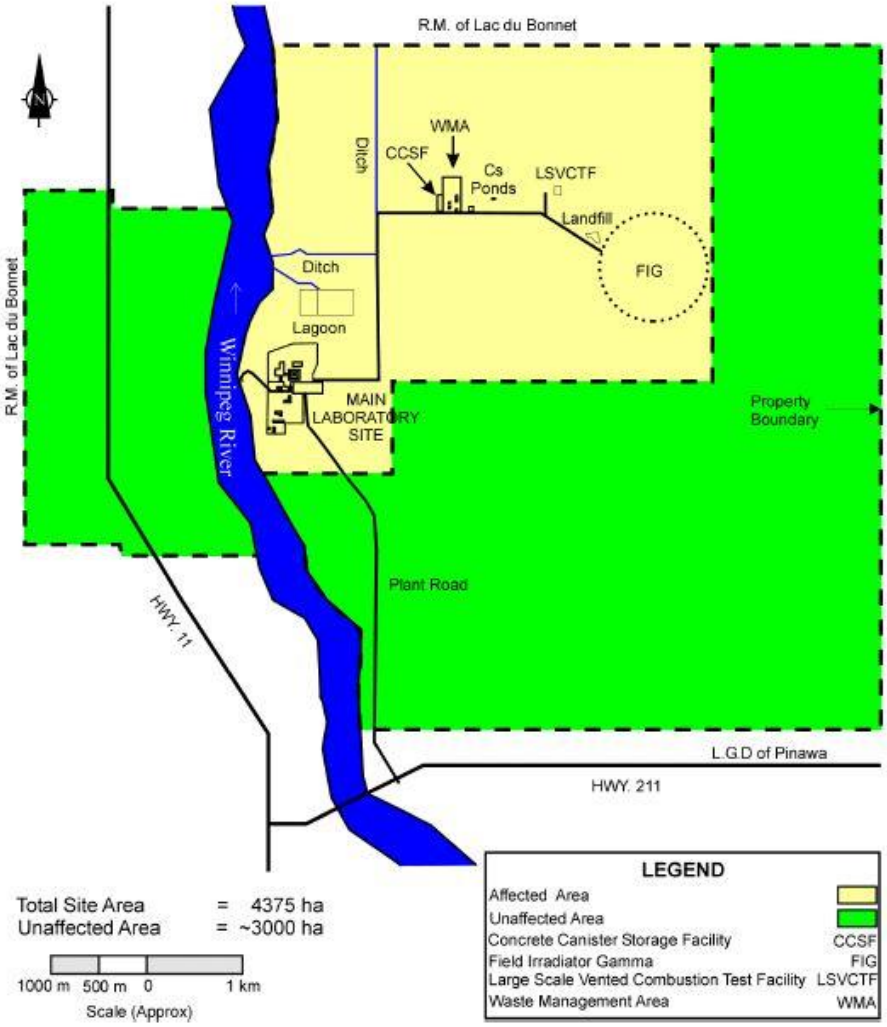

Figure 1-2: Area of Whiteshell Laboratories Site Possibly Affected by Nuclear Operations

2. DECOMMISSIONING PROGRESS DURING THE CURRENT (2009-2019) LICENCE PERIOD[1]

Following acceptance by the Canadian Government in 2002 of the Comprehensive Study Report (CSR) (environmental assessment) for the decommissioning of Whiteshell Laboratories, the CNSC issued the first decommissioning licence to AECL - WL for the period from 2003 – 2008. [The CSR proposed that the decommissioning of WL be carried out over approximately 60 years, based on the prerequisite that permanent, Canadian waste disposal facilities would be available by the end of that time period. The CSR concluded that the decommissioning of WL was not likely to cause significant, adverse environmental effects, taking into account the mitigation measures recommended in the report.] The 2003-2008 licence was subsequently renewed by the CNSC for the period from 2009 – 2018, and again for 2019.

Much progress has been made on the decommissioning of the WL site between 2008 and 2019[1]. Decommissioning of both nuclear and non-nuclear facilities has continued. Many redundant buildings have been demolished, new facilities which enable further decommissioning have been constructed, and improvements to general site services have all taken place.

A more complete list of accomplishments to date in the current licence period is as follows:

- Decommissioning/demolition of Shielded Facilities' "Warm Cells" (Cells 14 – 18) and Thorium Fuel Reprocessing Experiment (TFRE) tanks and piping was completed (note: interim decommissioning of Hot Cells 6-12 and the Storage Blocks was previously completed during the first decommissioning licence);
- Final decommissioning of the SLOWPOKE Demonstration Reactor (SDR) was completed;
- Cementation of Active Liquid Wastes from historical fuel reprocessing experiments was completed, and the cemented wastes are stored in the WMA;
- The remaining quantity of unirradiated WR-1 fuel material was removed from WL;
- The central oil-fired heating system was shut down after the reconfiguration of building heating to localized electric/propane heating systems (resulting in the elimination or reduction of green-house gases, and making it easier to isolate and decommission individual buildings); two large Bunker C heating fuel storage tanks were subsequently removed;
- A modern (state-of-the-art) fire detection and alarm system was installed site-wide;
- The WL SMAGS building was constructed and was partially filled with containers of radioactive waste. The waste is being removed and shipped to CRL in preparation for

[1] As the 2019 decommissioning licence was identical to the 2009-2018 licence, this document shall assume that the period from 2009 – 2019 is one licence period.

the re-purposing of SMAGS as a Cask Loading Facility (CLF) for intermediate-level wastes;

- A Soil Storage Compound (SSC) for storing radioactively contaminated soils was constructed in the Waste Management Area (WMA) and is operational;
- A Waste Clearance Facility and a Waste Handling Area were constructed on the main WL campus;
- The Cesium Pond experimental area was remediated and decommissioned - the contaminated soils from the Cesium Pond were characterized, sorted by radioactive contamination levels, stored in the WMA, and subsequently transferred to CRL;
- More than 25 smaller, redundant, non-nuclear and nuclear-related auxiliary buildings (totalling approximately 2700 m^2) were shut down and demolished (see Figure 2-1 for some equipment used for demolitions), and an obsolete weather tower was removed;

Figure 2-1: WL demolition equipment, on display during 2019 June WL Open House

- Pre-project work on WMA Standpipes was performed, and a contract for a design/build for remediation facilities for the Standpipes and Intermediate Level Waste Bunkers was issued to a qualified contractor having relevant decommissioning experience (design is nearing completion);
- The decommissioning of the Field Irradiation Gamma (FIG) and the Zoological Environment Under Stress (ZEUS) experimental areas was completed;
- A new Modular Office Complex (9 modular trailers) was constructed at the WMA in preparation for increased work load and decommissioning activity in and around the

WMA, and a new WMA Access/ByPass road and an expanded WMA Protected Area (PA) was also constructed in preparation to enable the use of additional equipment for the remediation of standpipes and ILW bunkers;

- A large quantity of Phase 1 WR-1 decommissioning waste was volume-reduced and moved from wooden crates to metal boxes;
- The Central Stores and Receiving Building (B408) and a Storage Warehouse (B415) were decommissioned and demolished (total of 3,690 m^2);
- The collection and processing of Intermediate-Level Liquid Waste (ILLW) via the Active Liquid Waste Treatment Centre (ALWTC) (B200) was terminated, and much of the existing inventory was shipped off-site for processing;
- Two Low-Level Liquid Waste (LLLW) collection systems were constructed in Buildings B100 and B300, and the ALWTC facility was shut down, allowing for operational clean up and decommissioning (see Section 2.1);
- Decommissioning of the radioactive drain system, including some previously abandoned radioactive drains was performed in 2019, following the shutdown of the ALWTC. This resulted in the collection and packaging of 2,100 metres of drain line. WL radioactive drain systems consisted of the actual waste liquid transfer line (1-1/4 inch diameter) within a larger (6 inch diameter) protective sleeve. Initial work consisted of disconnecting the out-of-service transfer line at both ends and pulling the line out of the outer sleeve, followed by the cutting of the transfer line into lengths appropriate for packaging for storage;
- The relocation and reconfiguration of laundry and decontamination services was completed, allowing the existing Laundry and Decontamination Building (B411) to be decommissioned and demolished (see Section 2.2);
- Decommissioning and demolition of the main radioisotope Research and Development Complex at WL (Building 300, or B300) Stages 4 and 7 were completed (approximately 8,500 m^2 of 17,000 m^2 for the entire building) - facility shutdown, equipment and furnishings removal, active ventilation and active drainage systems removal, radioactive surveying and decontamination, building services shutdown, isolation and capping, demolition and site remediation (see Section 2.3);
- Significant progress in decommissioning of B300 Stages 1 and 3 was completed – some facility shutdown, equipment and furnishings removal, active ventilation removal, and some radioactive surveying and decontamination; and
- Stage 6 of B300 (experimental facility RD-14) has been operationally shut down, equipment and furnishings removed, hazardous materials removed, energized systems deactivated, and the building has been fully radiologically characterized and verified to meet free release criteria. The building is ready for demolition (see Section 2.3.1).

2.1 Active Liquid Waste Treatment Centre – Building 200

The Active Liquid Waste Treatment Centre (ALWTC) (see Figure 2-2) collected low- and intermediate-level liquid wastes from WL nuclear facilities during the operational phases of WL. The ALWTC was essentially an indoor tank farm. Pairs of tanks accepted liquid waste from various sources on the WL site. While one of the pair of tanks was filling, the other was being processed prior to pump-out. Low-level liquids were sampled, chemically treated (e.g., pH adjustment) if required to meet release criteria, passed through 1 µm or 5 µm filters to remove laundry lint or small particulate matter (if required), and released to the Winnipeg River in a controlled manner. Intermediate-level wastes were transformed into a solid product and transferred to the WMA for storage.

In 2013, the Intermediate-Level Liquid Waste (ILLW) system was removed from service, and the existing inventory of ILLW in the ALWTC was pumped into road-transportable containers; some of this liquid was sent to an offsite processing facility to be volume reduced and solidified (this waste end-product was returned to WL for storage), with the remaining liquid stored in road-transportable containers in the WMA.

In 2017, new Low Level Liquid Waste (LLLW) processing systems began operation in the WR-1 Facility (WL Building 100, or B100) and in the Shielded Facilities/Building 300 (B300). All of the B100 low level liquid waste is now being tested, treated and controlled-released to the river via the B100 LLLW system, and likewise in B300.

All ALWTC process operations have been terminated and the ALWTC has been shut down and operationally cleaned up. The ALWTC Facility entered final decommissioning in 2018. The low-level liquid waste process tanks have been emptied, and the tanks and process equipment have been characterized for radioactive contamination, decontaminated as much as possible, and removed.

Additional work completed to date involves the selective removal of pipe sections, elbows, pumps, valves, ventilation ducting, etc. in order to reduce elevated radiation fields in the work area(s). A characterization survey of the LLLW and ILLW systems was first conducted to identify those components whose removal will produce the highest reduction in dose rates. Non-aggressive decontamination and the use of fixatives to minimize loose contamination was also performed to reduce worker doses.

The B200 sumps were taken out of service at an appropriate time, and any water collected from the sumps and associated piping was put into drums for processing. A standby ILLW tank (Tank 816) was removed from an underground vault in 2015 (see Figure 2-3). TK-816 was subsequently size-reduced for more efficient storage (see Figure 2-4).

Figure 2-2 : Exterior Views of the ALWTC

Other equipment (e.g., pumps, piping, sampling stations and glove boxes) (e.g., see Figure 2-5), is also being removed. Where required, additional access doorways into the shielded process cells were created (see **Error! Reference source not found.**). The active ventilation system, including the ducting, High Efficiency Particulate Air (HEPA) filters, fans, and associated equipment remain operational, but will eventually be removed.

Final demolition and removal of the building and remediation of the area are planned to be performed in 2020. Building services will be capped or removed to within 1 m of the edge of the building's footprint. Prior to demolition, an air dispersion model will confirm the safe demolition of the building structure and packaging of the waste.

The building footprint areas will be remediated to a level that meets the end-state criteria. Concrete piles below building foundations will be severed a minimum of 1.5 m below the ground surface, with the remaining portion of each pile left in place. Clean backfill material will be used to fill excavations.

Figure 2-3 : ALWTC Tank TK-816 Removal.

Figure 2-4 : Size-Reduction of TK-816 for Storage

Figure 2-5 : Decommissioning the interior of the ALWTC upper operations gallery

Figure 2-6 : Additional access doorway into ILLW process cell

2.2 Laundry and Decontamination Building – Building 411

During the operational phase of WL, the Laundry and Decontamination (L&D) Facility (WL Building 411) decontaminated respirators, tools and equipment that had become radioactively contaminated, and also contained laundry facilities for clothing and boots required for work in radioactive conditions.

With the progression of decommissioning work at WL, work practices evolved to the use of disposable clothing and single-use shoe coverings. The laundry and decontamination services were relocated and reconfigured elsewhere on site, being re-sized to meet present and future requirements.

During 2016 and 2017, the L&D Facility was decommissioned. All building equipment was removed, services were shut down and disconnected, and the building was surveyed for residual contamination (which was removed when discovered). The building was demolished in 2017 (see Figure 2-7), the first nuclear building at WL demolished using internal resources (a number of non-nuclear buildings were previously demolished using internal resources). Some remaining site grading, and the application of top soil and grass seed in the spring of 2018, completed the decommissioning project.

Figure 2-7 : Laundry & Decontamination Building Demolition (2017)

2.3 Research & Development Building - Building 300

One of the major facilities at WL during its operational years was the Building 300 Research and Development (R&D) Complex. Building 300 (B300) housed a variety of radiological and non-radiological laboratories, including the SF, High Bay lab facilities, Van de Graaff Accelerator, Neutron Generator, RD-14M Experimental Loop, Machine Shops, offices, conference rooms, and the Computer Centre.

The facilities and laboratories within B300 provided space for a wide range of radiological and non-radiological work including reactor materials laboratories, post-irradiation examinations, radiotracer studies, chemical and radio-chemical analysis, and storage of radioactive sources and materials. This work was done in support of the Nuclear Fuel Waste Management Program (NFWMP), Reactor Development and Reactor Safety Programs, Decommissioning and Waste Management (D&WM), and WL site engineering/environmental monitoring programs and activities.

The Van de Graaff Accelerator and Neutron Generator were licensed nuclear facilities within B300, which were previously decommissioned during the first licence period. The Shielded Facilities is a separate facility within B300 that is partially decommissioned (see Sections 2 and 3.2.3).

Building 300 evolved over time, with the complex being built in seven different stages. Stages 4 and 7 housed many laboratories, offices, meeting rooms, and storage facilities. These portions of the building were shutdown, all furnishings and laboratory equipment were removed, and the rooms were surveyed for radioactive contamination and decontaminated where required. All services, e.g., power, water, drains, etc. were isolated and severed, and Stages 4 and 7 of B300 have been demolished (see Figure 2-8, and Figure 2-10).

The remainder of B300, except Stage 6 (RD-14M) (see Section 2.3.1), and the SF are expected to undergo concurrent final decommissioning and demolition.

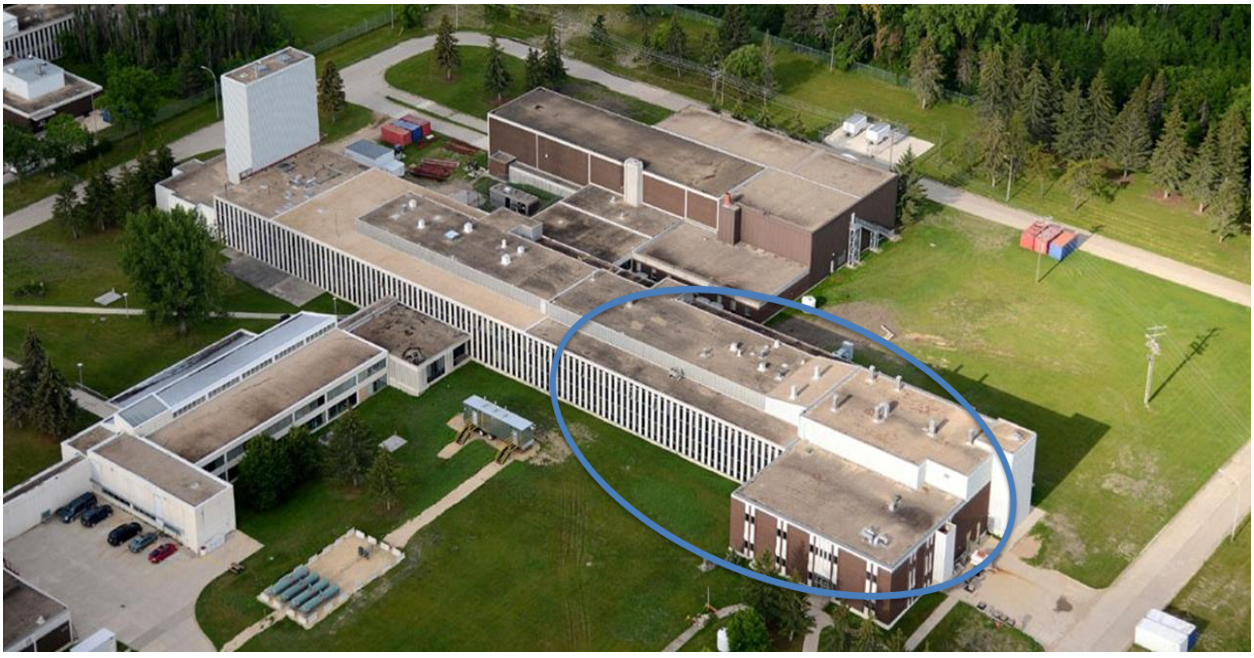

Figure 2-8 : Building 300 Stages 4 and 7 Prior to Demolition

Figure 2-9 : Building 300 After Demolition of Stages 4 and 7

Figure 2-10 : Building 300, Stage 7 Demolition in Progress (Water Used for Dust Suppression)

2.3.1 RD-14M Thermalhydraulics Laboratory

Stage 6 of the B300 complex is the RD-14M experimental facility. RD-14M was a large-scale thermalhydraulics test facility (see Figure 2-11), used for CANDU reactor experiments, such as loss-of-cooling scenarios. It had electrically-heated test sections, and full vertical scale representations of CANDU reactor Primary Heat Transport System components.

RD-14M completed its operational phase in 2018. With the exception of the use of sealed radioactive sources (used for fluid density measurements), RD-14M was contamination-free. The facility was operationally shut-down, following which the equipment within the facility was dis-assembled and removed. The building is ready for demolition, which is planned for the summer and fall of 2019.

Figure 2-11 : RD-14M Thermalhydraulics Laboratory – South End of Building 300

2.4 Large Scale Vented Combustion Test Facility

The radiologically-inactive Large Scale Vented Combustion Test Facility (LSVCTF), located east of the WL WMA, was an experimental facility to investigate the properties of possible hydrogen atmospheres within CANDU reactor containment buildings, following reactor accidents (e.g., loss of coolant accident where the containment could have a mixture of air, steam and hydrogen).

The LSVCTF ceased operations in the spring of 2018. The LSVCTF was operationally cleaned-up and surveyed for confirmation that the buildings were not radioactively contaminated during their lifetime. Final demolition occurred during the winter of 2018/19 (see Figure 2-12). Four buildings and 2,500 m of perimeter fencing were removed, with 705 m^3 of clean waste being sent to an approved offsite facility.

Figure 2-12 : Decommissioning LSVCTF facilities (winter 2018/19)

2.5 Decommissioning of Waste Management Area

One component of the WMA was a high-temperature incinerator (see Figure 3-8), formerly used to incinerate contaminated organic coolant from the WR-1 reactor and contaminated laboratory solvents. The incinerator was decommissioned and demolished in 2018 (seeFigure 2-13).

Figure 2-13: Organic Incinerator, Before and After Decommissioning

3. PLANS FOR THE PROPOSED TEN YEAR PERIOD OF THE RENEWED LICENCE

3.1 Introduction

This section presents summarized information relating to key decommissioning projects planned during the proposed ten year period of the renewed licence. Subject to Commission approval through the issuance of the requested licence, CNL will continue with this substantial and site transforming project.

At the end of the proposed ten year licensing period, the CNL plan is that all of WL will have been decommissioned to its final end-state, including the proposed, in situ decommissioning of certain Low-Level Waste (LLW) trenches in the WMA and the implementation of institutional controls. The overview DDP and the Comprehensive Study Report proposed dismantling for the WR-1 reactor decommissioning. In 2017, CNL proposed an alternative approach of partial dismantling and partial permanent disposal in situ. This work is currently undergoing an environmental assessment.

The following sub-sections provide summaries of planned activities for the proposed ten year licence period.

3.2 Summary of Authorized Whiteshell Laboratories Decommissioning

CNL plans to decommission the WL site as described in the WL Detailed Decommissioning Plan (DDP), Volume 1 - Program Overview. The Overview DDP describes the WL site and facilities in a general, high-level document, and summarizes the overall decommissioning strategy for WL. DDP Volumes 2 through 12 describe the decommissioning plans for each nuclear facility, or for non-nuclear buildings, areas, or supporting and general site infrastructure, and together encompass the entire WL site. (It should be noted that not all DDP volumes have been written to date, but will be completed before decommissioning work commences for work encompassed by a specific DDP.) The decommissioning work required within each DDP is described in more detail in Work Plan (WP) documents, which discuss the hazards associated with the work and the safety measures and procedures necessary to safely execute the work. After the work in a DDP or WP has been completed (and sometimes if different stages of the work are separated in time), an End-State Decommissioning Report (ESDR) (or Interim ESDR) will be written to document such things as the work performed, the end state achieved, any lessons learned, and the disposition of decommissioning wastes.

In keeping with the evolution of international best practices, CNL's decommissioning strategy has been moving towards reduced deferment periods. The resulting plan 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 and its Environmental Policy, and recognizing the Canadian Government's expectations to minimize its liability for legacy nuclear wastes at all CNL sites.

CNL plans to complete the remaining WL decommissioning work, as outlined below, within the next ten year licence period, subject to approval of this licence application by the CNSC.

3.2.1 Decommissioning of Concrete Canister Storage Facility

The Concrete Canister Storage Facility (CCSF) began operation in 1977 to provide passive storage of irradiated fuel bundles from the operation of the WR-1 reactor and WL R&D facilities, primarily the Shielded Facilities (SF). The Demonstration Canister Storage Site (DCSS) was established first. It consisted of four canisters, located on the eastern edge of the main WL campus. Two of the demonstration canisters never contained irradiated fuel bundles and were removed from service. The other two canisters did contain irradiated fuel bundles until approximately 1999. At that time, the irradiated fuel bundles were retrieved from the demonstration canisters and consolidated with the fuel already at the main CCSF site, thus becoming the final spent fuel to be loaded into WL canisters.

The main CCSF site (see Figure 3-1) consists of sixteen canisters; each canister can hold a maximum of six steel baskets (see Figure 3-2) containing irradiated fuel bundles, or sealed stainless steel cans containing fuel fragments.

The CCSF provides storage for approximately 2300 intact, irradiated fuel bundles, or sealed storage cans of defective fuel and fuel fragments from post-irradiation examination (PIE) in the WL Shielded Facilities. [The larger portion of irradiated fuel remaining at WL is stored in the CCSF, while some irradiated fuel is contained in WMA standpipes.] The fuel material was either irradiated in the WR-1 reactor, or resulted from PIE of irradiated CANDU power station fuel. Also included in this inventory are approximately 360 intact fuel bundles from the Douglas Point reactor – this fuel was transferred to WL in the 1970s to demonstrate the feasibility of dry storage of spent fuel in the DCSS. The fuel bundles or storage cans were placed into cylindrical, carbon steel fuel baskets, of which there are several designs. Up to six fuel baskets are stored in each of 16 cylindrical, hollow, reinforced-concrete canisters. The canisters are approximately 5.4 m high and 2.6 m in diameter, with an internal cavity approximately 0.8 m in diameter (for a concrete shielding thickness of about 0.9 m). Each canister weighs approximately 70 Mg (empty).

The scope of the CCSF decommissioning work is the complete defueling and decommissioning/demolition of the CCSF and the DCSS, and the remediation of the areas in accordance with the WL site-specific clean-up and release criteria of the defined end-state.

The fuel baskets will be retrieved from the canisters (see Figure 3-3) and transferred to the Used Fuel Transportation Package (UFTP) (see Figure 3-4 and Figure 3-5), for transport to and storage at CRL. The UFTP is a CNSC-certified Type B(U) Transportation Package, leased by CNL from its owner, the Nuclear Waste Management Organization (NWMO), for transporting CNL fuels, including the WL fuel materials. The UFTP is undergoing a comprehensive licensing process for CNL-specific fuels and configurations. Concrete canisters to contain the WL spent fuel baskets are being constructed at CRL. CNL will remain in communication with CNSC staff at all stages of this process, and regulatory oversight by CNSC staff will remain in effect.

International Atomic Energy Agency (IAEA) safeguards personnel will be fully informed and involved in the fuel recovery and transfer processes.

Figure 3-1 : Concrete Canister Storage Facility

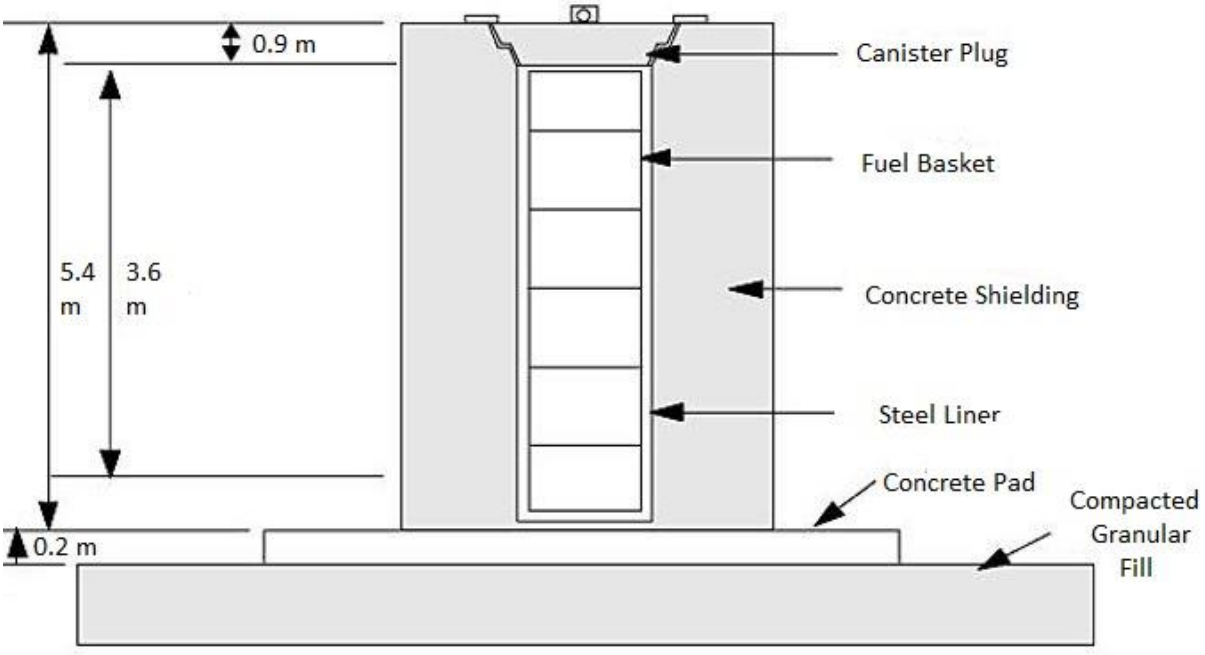

Figure 3-2 : Elevation view of concrete canister

Figure 3-3 : Mock trial of fuel basket retrieval from canister in 2017

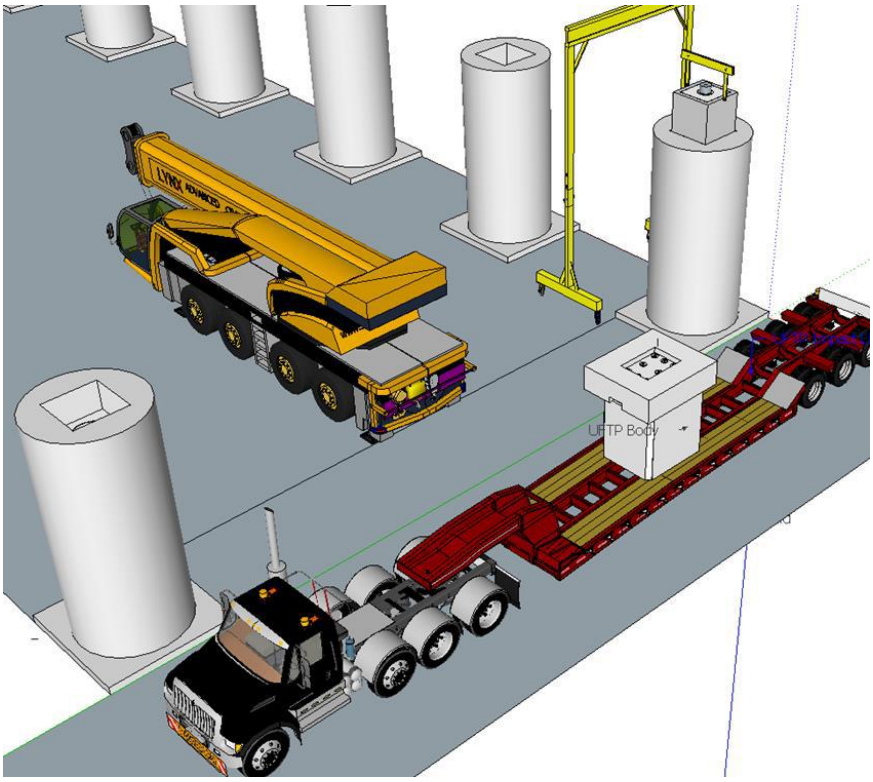

Figure 3-4 : Schematic diagram of transfer of CCSF fuel basket to transportation flask

Figure 3-5: Used Fuel Transportation Package for the removal of CCSF fuel to CRL

Once the canisters have been emptied, they will be surveyed for radioactive contamination, decontaminated to the extent possible, and either removed from the canister site or demolished. Once the canisters are gone, the CCSF site will be remediated to defined end-state criteria.

3.2.2 Decommissioning of Waste Management Area

The WL WMA (see Figure 3-6), located approximately 2.7 km north-east of the main WL site, has been operated by AECL/CNL since 1963. At the WMA, solid radioactive Low Level Waste (LLW), Intermediate Level Waste (ILW) (also formerly termed Medium Level Waste (MLW)), High Level Waste (HLW), Intermediate Level Liquid Waste (ILLW), High Level Liquid Waste (HLLW), and historic small volumes of hazardous laboratory and industrial chemicals were and/or are stored in buildings, trenches, below-ground tanks, concrete standpipes, and concrete bunkers. This waste is comprised of waste generated since the earliest days of WL operation, small amounts of waste accepted from external sources, and waste generated during ongoing operations and the current decommissioning activities.

Low Level Wastes are stored in LLW Trenches, LLW Bunkers, LLW Storage Quonset Buildings, a Shielded Modular Above-Ground Storage (SMAGS) building (see Figure 3-7) (note: SMAGS has now been emptied of LLW), and a Soil Storage Compound. There are also former operational buildings which will require decontamination as part of decommissioning.

Figure 3-6 : Aerial view (from the south) of the Waste Management Area

Figure 3-7 : Waste Containers in SMAGS (WMA Building 923)

The LLW Trenches are located along the entire eastern side of the WMA (see Figure 3-8.) ILW Bunkers 1 to 7 are located in the southern part of the WMA, east and north of the Standpipes Area (which is located in the south-west corner of the WMA).

Two stainless-steel HLLW tanks contained in separate vaults are located underground at a depth of ~3.2 m (to top of tanks) in the south-central area of the WMA near a small building housing the access pipes for the tanks. The HLLW was removed from the WMA in an earlier stage of decommissioning.

Activities are underway to complete the orderly decommissioning of the WMA.

With the exception of 21[2] of the 25 LLW Trenches (see Section 3.2.2.4), all wastes in the WMA are planned to be retrieved and relocated to CRL, or to other licensed waste storage/disposal sites.

After all wastes have been retrieved from the storage structures or buildings, they will be decontaminated as required or as possible, and either removed from the WMA or demolished as appropriate. The underground waste storage structures will be retrieved and demolished. Once all buildings and structures have been removed, the grounds will be remediated to appropriate end-use criteria.

The buildings, structures, and grounds within the WL WMA will be deactivated, demolished and/or remediated in accordance with the WL site-specific clean-up and release criteria of the defined end-state, with the exception of those LLW trenches which will undergo final disposal in place (as per the CSR, a safety assessment needs to be developed). It is expected that access controls (e.g., fencing and signage) and/or environmental monitoring equipment (e.g., instrumented boreholes) may be installed around the land above the remaining trenches. All other LLW, ILW, and HLW will be retrieved, characterized, and packaged (as necessary) for shipment to a suitable licensed storage/disposal facility (e.g., at CRL).

There is a Protected Area surrounding the Standpipe Area in the WMA. The Protected Area has recently (2017) been expanded (to the south) to facilitate the placement of equipment required for the decommissioning of the standpipes and (to the north and east) the ILW Bunkers 1 to 7. A bypass road was also installed to the south of the expanded Protected Area. Further, a modular office complex, consisting of nine, 60 foot mobile structures has been constructed to house office space and active area change rooms for the WMA decommissioning (see Figure 3-6).

[2] In the Comprehensive Study Report, 21 of the 25 LLW trenches were identified as being able to be left in situ, pending a final safety assessment. In 2019, an error in inventories used for the initial assessment for one trench (Trench 16 containing Technicium-99) that was deemed to be remediated at that time may also be a candidate to be left in situ, again pending a final safety assessment. Thus, 21 or 22 of the LLW trenches may be left in situ.

Figure 3-8 : Aerial View of the WL Waste Management Area (From the South West)

3.2.2.1 Standpipes

Standpipes (also termed “tileholes” at CRL) are vertical, in-ground storage structures (e.g., see Figure 3-9), located within the WL WMA to provide storage for ILW waste packages with radiation fields up to 4 Gy/h (400 rad/h) at 30 cm from the package. One hundred seventy-one (171) standpipes were constructed within the WMA. The first standpipes were commissioned in 1967, and a large majority of waste emplacements into standpipes were completed by 1977 (two standpipes never had wastes emplaced within them). Standpipes have internal diameters of 0.46 m, 0.61 m, 0.76 m, or 0.91 m, and extend approximately 4 m below grade. The first standpipes were constructed of unlined asphalt-coated concrete sewer pipes, while later standpipes were cast-in-place concrete, lined with galvanized carbon steel pipes. Early standpipes, once filled, were back-filled with sand, sealed with bitumen, capped with concrete and covered with a layer of soil up to 0.5 m thick. A removable concrete shielding plug, approximately 0.9 m thick, provides access to the later, uncovered standpipes, which extend about 0.5 m above grade (two partially excavated Standpipes with a removable concrete shielding plug are shown in Figure 3-9).

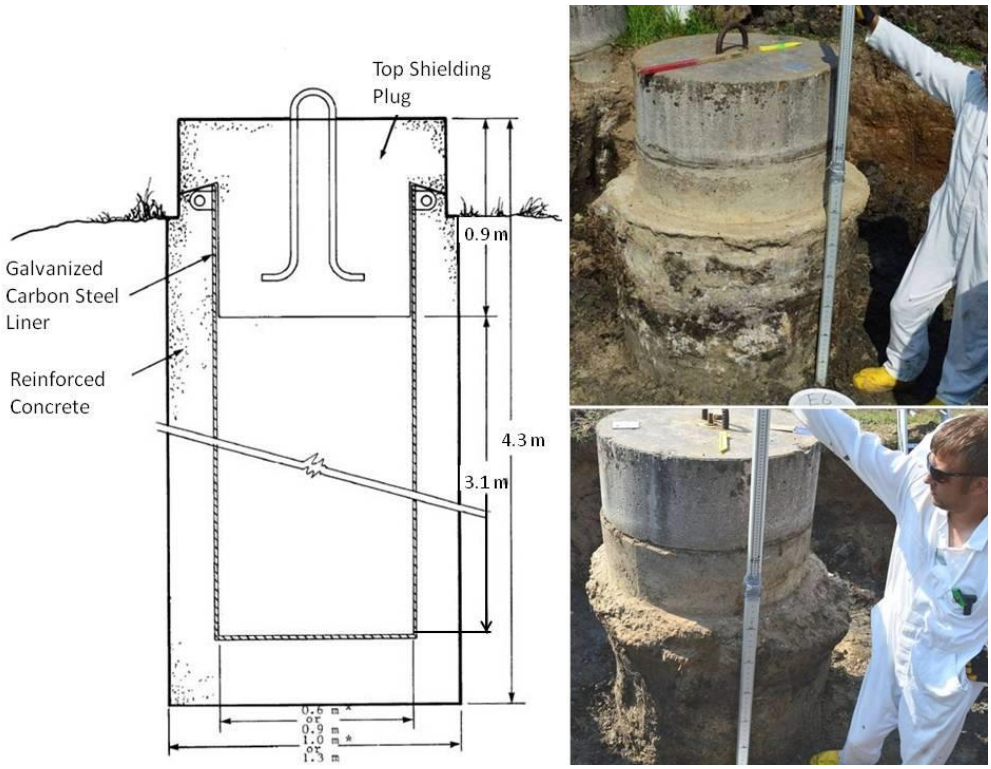

Figure 3-9 : Diagram and photographs of WMA Standpipes

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. 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 Area, located in the southwest corner of the WL WMA (see Figure 3-8), has dimensions of approximately 50 m (north-south) by 62.5 m (east-west).

The scope of the standpipe decommissioning project is to complete the following:

a) removal of all contents (emplaced waste, sand, gravel, bitumen and any groundwater that may have infiltrated the standpipe) contained within the 171 standpipes,

b) removal of all 171 standpipes, and

c) remediation of the grounds within the standpipes’ area.

Prior to the commencement of the actual standpipe decommissioning, a pre-project phase compiled a detailed inventory of the standpipe contents, and performed a condition assessment of the standpipe structures (see Figure 3-10).

Figure 3-10 : WMA Standpipes – Pre-Decommissioning Condition Assessment

A contract was issued in 2017 with an experienced external contractor for a design/build project for remediation facilities for the Standpipes and ILW Bunkers. The remediation of the standpipes and ILW Bunkers will be done largely by remotely-controlled equipment. Once this equipment has been procured and commissioned, and CNL operators have been trained in its operation and maintenance, the waste in these facilities will be retrieved, processed as required, and transferred to licensed shipping containers for transport to CRL or other licensed waste storage/disposal facility.

The first step in the decommissioning of the standpipes will be to puncture the standpipe cap (if poured in place), or to remove the cap (if possible) and vent any combustible and/or toxic gases that may have built up in the standpipe. If the old cap has been removed, a temporary, vented cap will be put in place. This part of the process will be done by the Standpipe Headworks (SPH) equipment (see Figure 3-11).

Next, the Standpipe Waste Retrieval System (SWRS) (see Figure 3-12) will be installed over the standpipe. A Standpipe Waste Retrieval Arm (SWARM), with a variety of tooling available, will retrieve the waste from the standpipe, using a grapple to lift larger objects, or a suction system for any groundwater and fine particles that may be present. Wastes will be placed in shielded containers and transferred to the Sorting and Conditioning Unit (SCU) (see Section 3.2.2.2) for further processing.

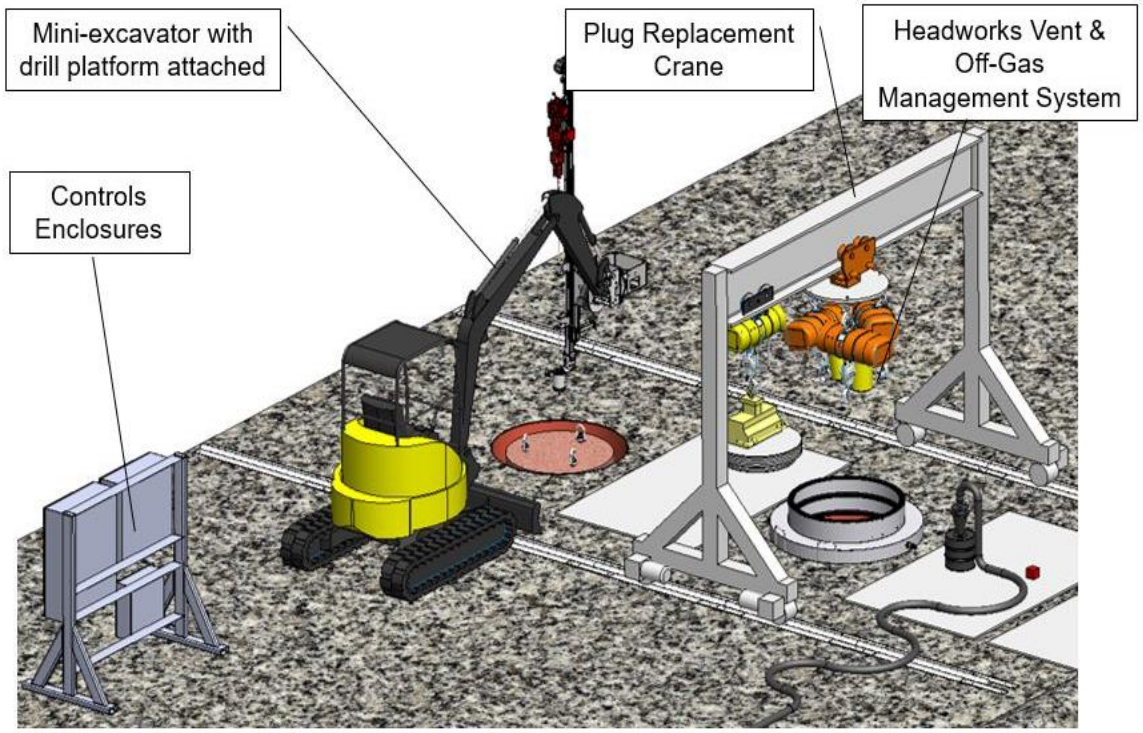

Figure 3-11: Schematic illustration of standpipe puncturing and de-gassing equipment

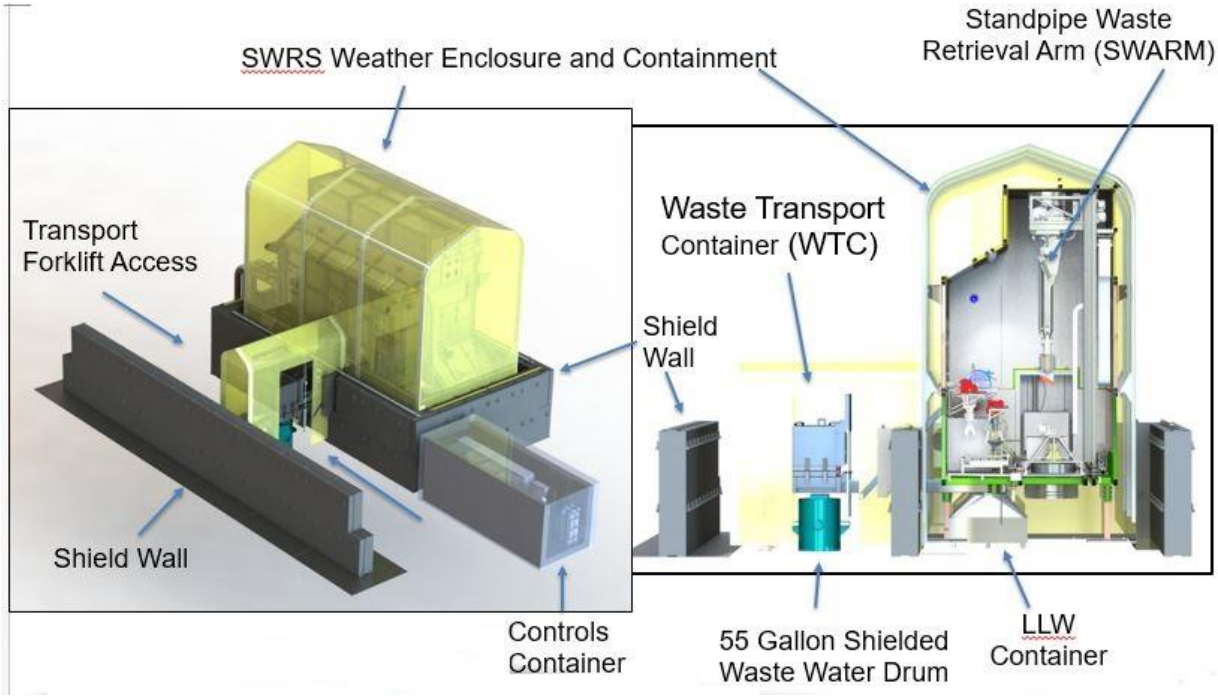

Figure 3-12: Standpipe Waste Retrieval System (SWRS)

The general decommissioning approach, where possible, will be to start with the lower hazard standpipes to gain experience with the methodology, equipment and procedures and to determine if any modifications are required. Once the process has been optimized, the work will progress to the balance of the standpipes.

Once the standpipes have been emptied and the structures themselves have been decontaminated (if possible) and demolished or removed, any identified radiological and/or industrial/chemical contaminants remaining in the soil will be cleaned or removed. These materials will be sent to an approved storage/disposal facility. Backfill material will be used to fill excavations.

The reference end-state for the standpipes' area is the removal of the contents of the standpipes, the removal of the standpipes and any contaminated soil, and the remediation of the area in accordance with the WL site-specific clean-up and release criteria of the defined end-state.

3.2.2.2 Intermediate Level Waste Bunkers

As stated previously, ILW Bunkers 1 to 7 are located in the southern part of the WMA, east and north of the standpipes area. The bunkers (e.g., see Figure 3-13) are located either partially, or completely, underground. The bunkers are of three different designs; in total, they contain over 4500 waste packages, or approximately 1200 m^3 of wastes. Three of the bunkers are operational, while four bunkers have been filled, backfilled with gravel, and sealed with a concrete cap.

The scope of the decommissioning project for ILW Bunkers is to complete the following:

1) Removal of all contents (emplaced waste, gravel, and any groundwater that may have infiltrated the bunker) contained within ILW Bunkers 1 to 7 (see Figure 3-13);
2) Removal of ILW Bunker 1 to 7 structures; and
3) Remediation of the grounds, in/on which the bunkers are located.

The Bunker Waste Retrieval System (BWRS) (see Figure 3-14) will retrieve the waste from the ILW bunkers with Remote Excavator Arms (REA), equipped with a variety of appropriate tools. The waste will be transferred to the SCU (see Figure 3-15). Similar to the waste retrieval operations for the standpipes, the REA will retrieve the waste from the bunker, using a grapple to lift larger objects, or a suction system for any groundwater and fine particles that may be present.

From the Standpipe or Bunker waste retrieval systems, the ILW wastes will be transferred to the SCU (see Figure 3-15). Standpipe wastes, or bunker wastes, will be transferred to separate loading ports in the SCU (see the green labelled ports in Figure 3-15). Once in the SCU, the wastes will be examined by gamma cameras (or other waste assay systems, as appropriate), and will go to shielded work stations. Here, the wastes will be dried if necessary, sorted into identifiable categories, e.g., fissionable and non-fissionable materials, and will receive other processing as required. The wastes will then be transferred by shielded containers (see the blue labelled port in Figure 3-15) to the Cask Loading Facility (the former SMAGS Building) for final assaying/characterization, and transfer to shipping containers for transport to CRL, or another licensed waste storage/disposal facility.

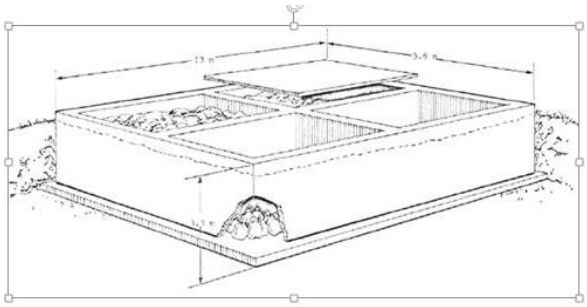

Figure 3-13: ILW Bunkers

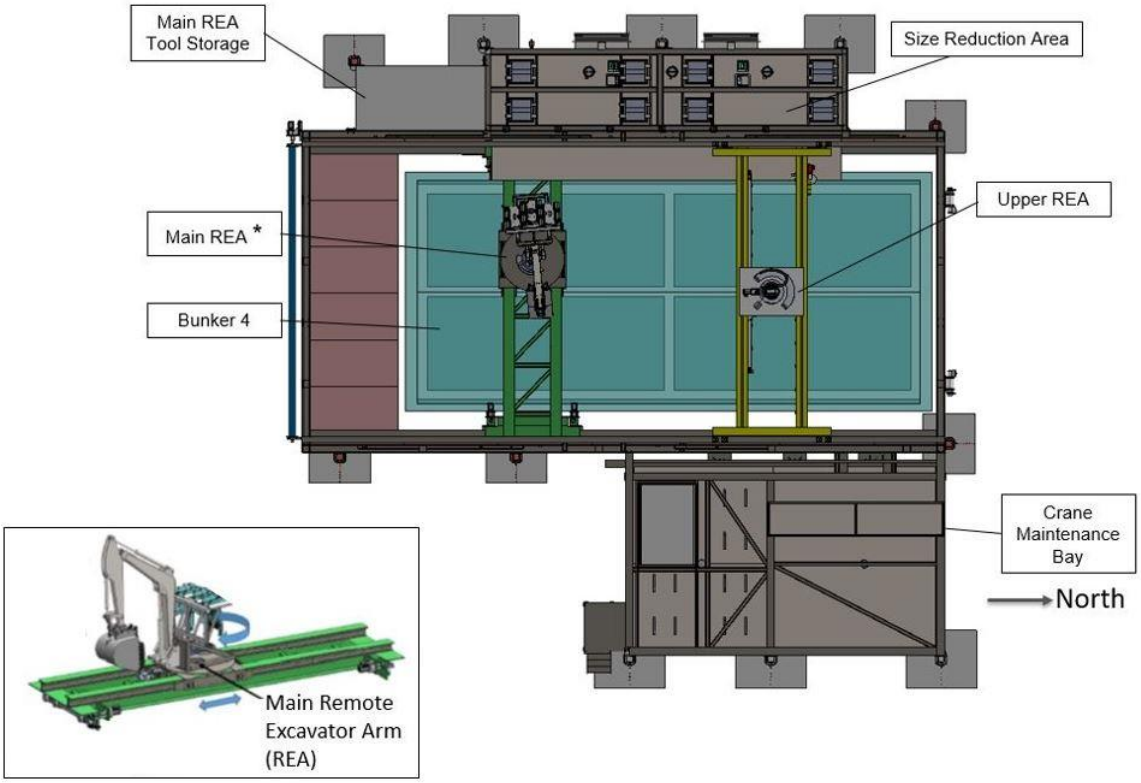

Figure 3-14 : Illustration of the Bunker Waste Retrieval System above ILW Bunker No. 4

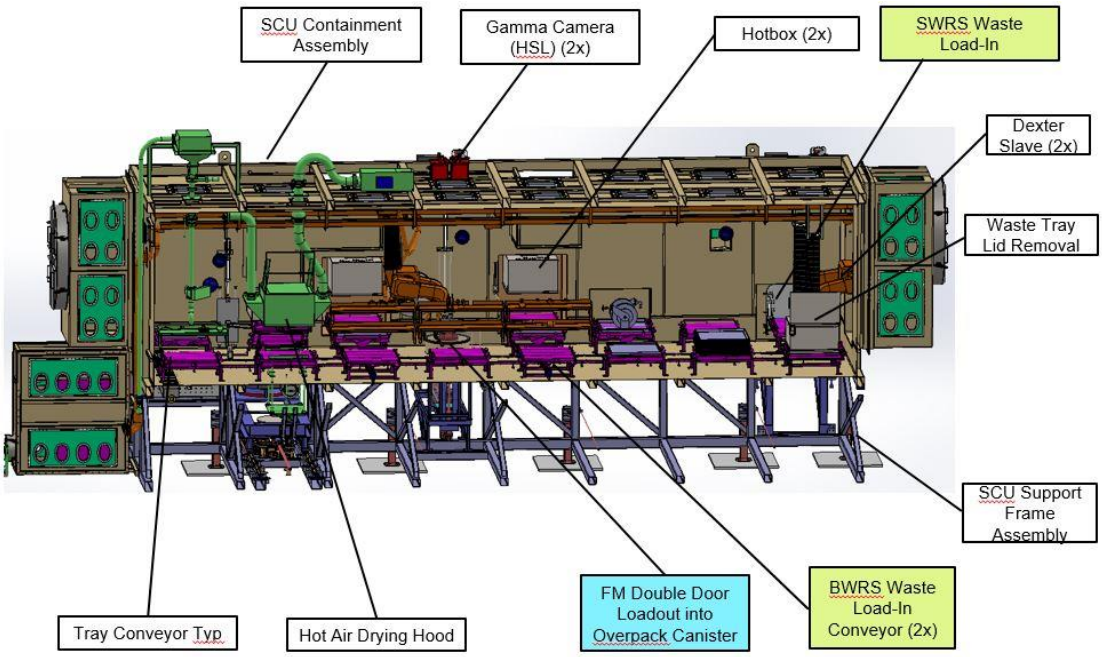

Figure 3-15: Sorting and Conditioning Unit (SCU)

Once decommissioning of ILW Bunkers 1 to 7 is complete, any identified remaining radiological or industrial/chemical contaminants in the structures will be cleaned or removed. These materials will be sent to an approved storage/disposal facility. The bunkers will then be demolished, and any excavations will be backfilled as required. The backfill material will have a clay base and will be compacted in place to re-establish the hydraulic conductivity conditions of the native soil.

3.2.2.3 Building 417, and Amine Waste Storage Tanks

Two stainless-steel HLLW tanks (denoted TK-1 and TK-2) contained in separate vaults are located underground at a depth of ~3.2 m (to top of tanks) in the south-central area of the WMA near a small building (Building 417 or B417) housing the access pipes for the tanks. The HLLW was removed from the WMA in an earlier stage of decommissioning.

The scope of this decommissioning project with respect to Building 417, the vaults and tanks TK-1 and TK-2 is to complete the following:

1) Removal of B417 (off-the-shelf metal garden shed, concrete plinth and wooden base);
2) Characterization of the heel remaining in tank TK-2 (if any[3]) and development of a remediation strategy;

[3] The bulk of the HLLW, which was contained only in tank TK-2, was removed in 2004. Although any remaining HLLW was diluted as a final step in the removal operation, CNL has been unable to verify the amount of any liquids or high level wastes remaining in TK-2.

3) Remediation and disposition of tank TK-1 and of tank TK-2 and its High Level Liquid Waste (HLLW) content (if any);
4) Removal of the vaults surrounding tanks TK-1, and TK-2; and
5) Remediation of the grounds, in/on which B417 and the associated tanks and vaults were located.

Once decommissioning of B417 and tanks TK-1 and TK-2 and their associated vaults (each tank is contained in a concrete vault, which includes a steel drip tray in case of leakage of the tank contents) is complete, any identified remaining radiological or industrial/chemical contaminants will be cleaned or removed. These materials will be sent to an approved storage/disposal facility. The affected area will be remediated to a level that will be in accordance with the WL site-specific clean-up and release criteria of the defined end-state. Backfill material will be used to fill excavations. The backfill material will have a clay base and will be compacted in place to re-establish the hydraulic conductivity conditions of the native soil.

3.2.2.4 Low Level Waste Bunkers, Trenches and WMA Grounds

The scope of the LLW decommissioning work includes the:

1. Retrieval, characterization and packaging of the LLW from the bunkers, where it is currently stored;
2. Remediation and demolition of buildings and structures;
3. Retrieval, characterization and packaging of hazardous waste from 4 of the underground LLW trenches (The CSR stated that some of the materials in 4 of the LLW Trenches contain either non-radioactive material (e.g., arsenic), or unique radioactive materials that must be remediated. However, a recent (2019) re-evaluation of the radioisotope inventory in one of those four trenches concluded that the contents of that trench may be acceptable for in situ disposal.);
4. Development of a final safety assessment, to be submitted to CNSC staff for acceptance, for the final in situ disposal of 21 or 22 of the underground LLW trenches (see next paragraph); and
5. Remediation of the area in accordance with the WL site-specific clean-up and release criteria of the defined end-state.

In the 2002 CSR, 21 of the 25 LLW trenches in the WMA were identified as being able to be left in situ, pending a final safety assessment. A 2019 reassessment indicated that one of the 4 trenches to be remediated may also be a candidate to be left in situ, again pending a final safety assessment. Thus, 21 or 22 of the LLW trenches may be left in situ. It is CNL's plan that the final safety assessment for the proposed in situ disposal of these underground LLW trenches will be developed and presented to CNSC staff for acceptance during the next licensing period.

The recovered wastes will be transferred (see Figure 3-16) to a suitable licensed storage/disposal facility (e.g., at CRL).

An environmental monitoring program will be in place (as required) for the long term institutional care and control of the in situ waste material.

Figure 3-16 : Photo of Low Level Waste (Contaminated Cesium Pond Soil) being loaded for transportation to CRL

3.2.3 Decommissioning of the Shielded Facilities

The WL Shielded Facilities (SF) comprised two related facilities constructed at different times: the Hot Cell Facility (HCF) (see Figure 3-17) and the Irradiated Fuel Test Facility (IFTF). The two facilities originally had both independent and shared services, e.g., ventilation, waste storage, power, etc.

The HCF provided facilities in support of CANDU Reactor Safety Research programs including: post-irradiation examination (PIE) of fuels and reactor core components; post-experiment examination of radioactive materials used in Nuclear Fuel Waste Management studies; fuel management services for the WR-1 research reactor; and remote handling services for other AECL/CNL research programs or industrial work involving radioactive materials.

The IFTF 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.

In 2005, a decision was made to retain the use of Cells 1 to 5 (and the associated active exhaust ducting, active drain systems, and some radioisotope laboratories, etc.) to support future decommissioning activities in the WL WMA, that is, to maintain a state of “operational readiness”. In 2018-19, the SF active ventilation exhaust flows from the hot cells were optimized, and the remote manipulator arm controls were updated.

Cells 6 to 11 have been partially dismantled and decontaminated (see Figure 3-18), thereby reducing the nuclear liabilities and risks associated with them. Cell 12 was fully decommissioned and dismantled, and the Warm Cells (shielded facilities with lighter shielding walls than ‘hot cells’), Cells 14 to 18, were decommissioned and removed from the IFTF (see

Figure 3-19). The Thorium Fuel Reprocessing Experiment (TFRE) Tanks and Piping, the IFTF canisters, and the IFTF main floor operating areas were also decommissioned and the space they occupied was prepared for reuse.

Figure 3-17 : HCF Operating Area South View (Rooms 1-82/1-83 and Cells 1 to 4 (left to right))

Before	**After**

Figure 3-18 : View of Cells 6-10 Before and After Decommissioning Activities

Figure 3-19 : IFTF Cells 14 to 18 Decommissioning – Before, During and After Completion

Cell 13 (which is visible at the far end of the IFTF area in Figure 3-19) is also being maintained in operational readiness to support future site decommissioning activities. The Horizontal and Vertical Storage Blocks were emptied of their contents, decontaminated and operationally shut down, and are now awaiting final demolition.

In the IFTF, a Waste Handling Area (WHA) was established in Room 1-181, two rooms were repurposed to perform radiological decontamination activities that were relocated from the B411 Decontamination Centre in 2016, and some Environmental Management labs were constructed to replace labs that were located in B300.

Decommissioning of the SF commenced in 2005, and some decommissioning has been completed (see Section 2).

Once it has been determined that there is no further requirement for the use of the Shielded Facilities, the remaining decommissioning work will be completed. The remaining Hot Cells will be emptied of operational equipment and decontaminated as much as reasonable. Any non-removable contamination will be fixed in place and marked so that it may be separated during demolition. All services and auxiliary systems will be decommissioned to a demolition-ready state.

Decommissioning of the main WL Research and Development (R&D) Complex, Building 300, which is connected to the SF complex, commenced in 2006, and some decommissioning has been completed (see Section 2.3). Any remaining facilities and systems in B300 will also be decommissioned to a demolition-ready state after their operations have ceased. Current plans are that the SF Hot Cells, the SF building structure, and the remaining parts of B300, will be demolished at the same time.

3.2.4 Decommissioning of Remainder of Whiteshell Laboratories

This work includes the decommissioning and demolition of all remaining non-nuclear buildings and support infrastructure. The remaining non-nuclear buildings (e.g., administrative offices, non-active laboratories, workshops, storage buildings, vehicle garages, shipping and receiving areas) will be operationally shut down, decommissioned and demolished once it has been determined that their continuing need has ended.

The original operations carried out in the former Medical Biophysics/Accelerator Buildings (Buildings 402 and 305) have ceased, and Building 402 is currently used for administrative offices and laboratories. At an appropriate stage in the decommissioning of WL, B402 will be operationally shut down, decommissioned and demolished.

CNL is evaluating options for decommissioning other underground services including the sewage system and storm drains and other general site infrastructure including the sewage lagoon and the WL inactive landfill. These projects include all grounds and services outside of facility boundaries that have the potential for being impacted by site nuclear operations and/or site industrial operations. The primary impacts that would have affected the grounds and structures would be radiological contaminants and chemical contaminants (including hydrocarbons). CNL will engage CNSC staff, Manitoba Sustainable Development, and other stakeholders in a dialogue to confirm regulatory requirements relative to the decommissioning of these services and facilities, including the sewage lagoon and inactive landfill.

3.3 Decommissioning of WR-1 Reactor

3.3.1 WR-1 Reactor - Background

The 60 MW (thermal) WR-1 research reactor (see Figure 3-20) was designed and built by Canadian General Electric. Structural steel erection began in 1964 and by June 1965, WR-1 was substantially complete (see Figure 3-21). First criticality was attained on 1965 November 01. WR-1 was built to test the feasibility of using an organic liquid (oil) as the primary heat transport (PHT) system coolant medium. This oil (70% hydrogenated terphenyl, 30% radiolytic tars) allowed the PHT system to operate at lower pressures and correspondingly higher temperatures than a similarly constructed light water heat transport system. Higher coolant temperatures equate, in general, to higher thermal-to-electrical power conversion efficiencies (although WR-1 was never used to generate electricity). Lower pressures equate to a reduction

in neutron absorbing materials within the core, which resulted in WR-1 having an average thermal neutron flux in the moderator of approximately 1.5×10^{14} n/cm^2 s.

After accumulating 120,000 operating hours during its lifetime, WR-1 was permanently shut down in 1985, and it was placed in a secure shutdown state. The shutdown activities included defueling the reactor, placing the irradiated fuel in the storage bays and removing the bulk heavy water moderator to storage.

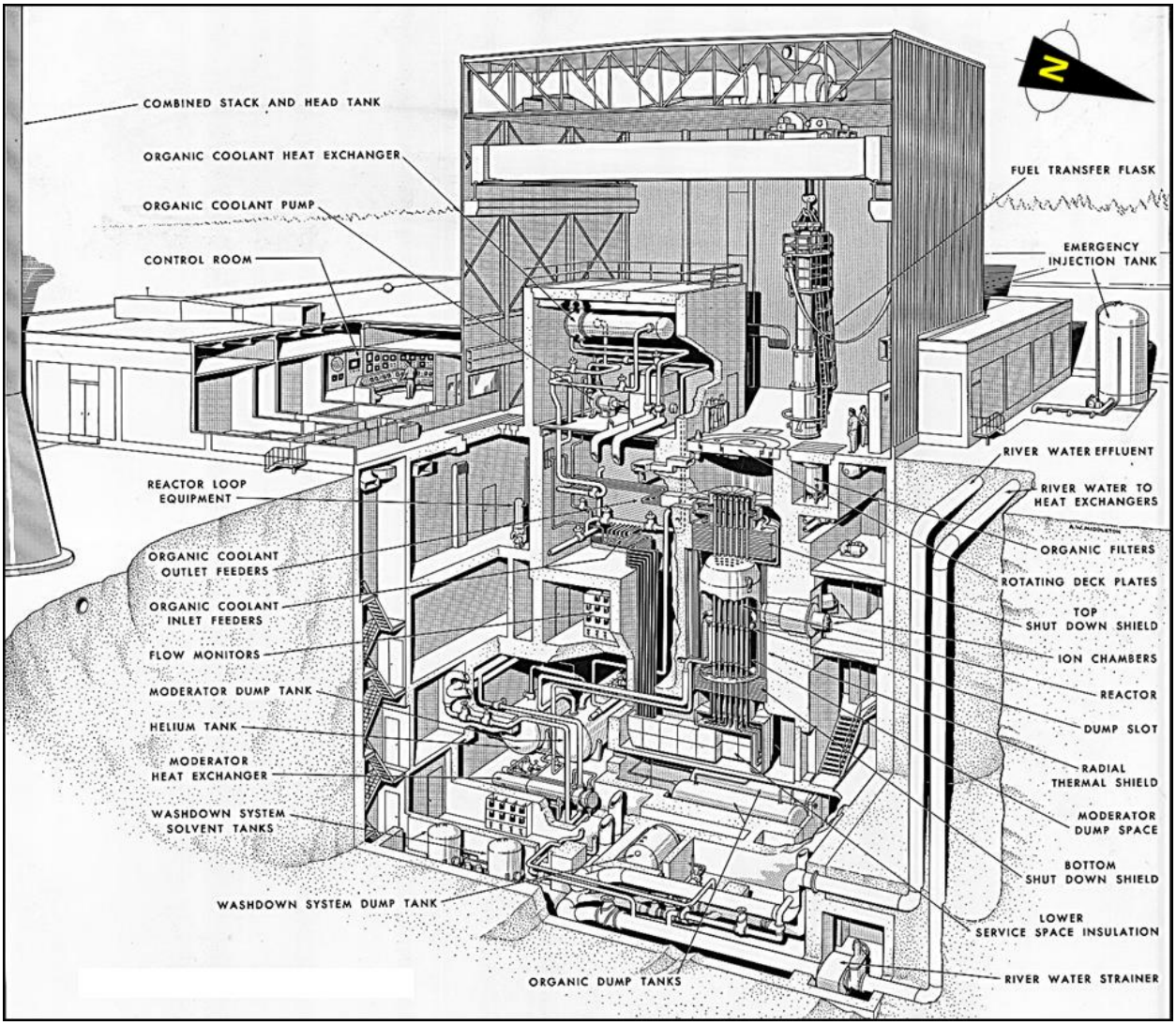

Figure 3-20 : Cut-away view of WL Building 100 (WR-1 Reactor Facility)

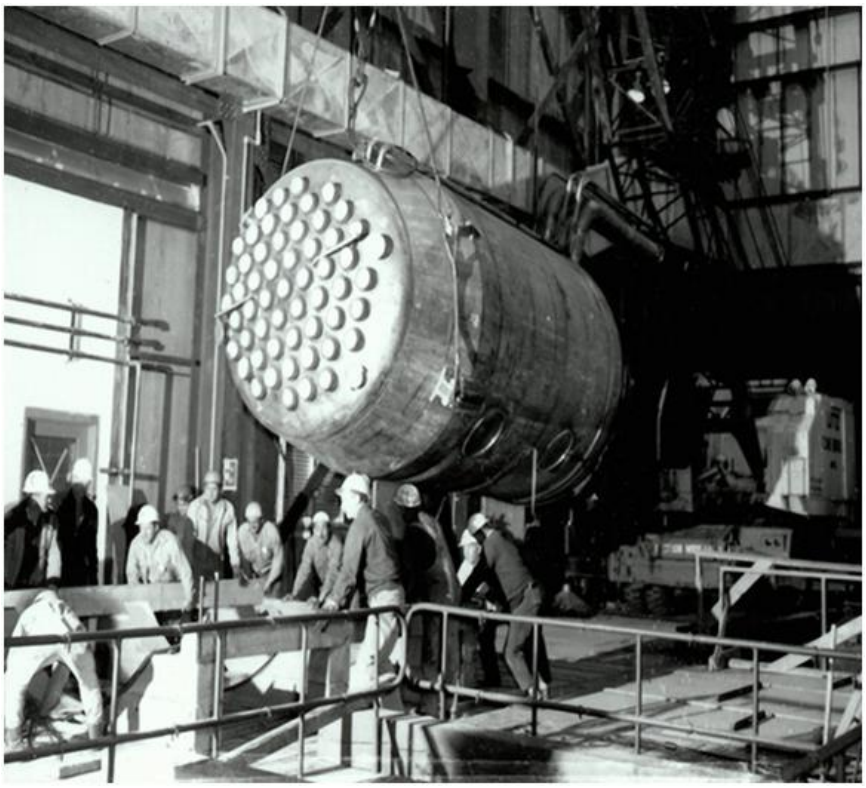

Figure 3-21 : Photograph of WR-1 Reactor Calandria Vessel during Installation

The decommissioning of WR-1 is being completed in two phases separated by a deferment period. For Phase 1, the facility was decommissioned to a secure state in a reduced facility-access-controlled area. Decommissioning will be completed in Phase 2 (proposed for the next licensing period), with the goal to demolish the Building 100 (B100) structure (see Figure 3-22).

The first phase of decommissioning commenced in 1989 and was completed in 1994. Phase 1 work addressed the removal of easily mobilized radioactive materials (fuel, fluids, etc.) from the facility and cleaning up the main floor (600 Level) and first sub-level (500 Level) space. The work removed potential hazards from the facility and reduced the monitoring and surveillance requirements for the deferment period. It also cleared priority space for alternative uses.

In 1993, the last irradiated fuel was removed from the B100 spent fuel storage bays was transferred to dry storage at the CCSF, adjacent to the WL WMA. Bulk organic coolant was also removed from the reactor cooling circuits and transferred to the WL WMA for incineration. Reactor control systems were isolated. Building services (e.g., heating, ventilation) were, and still are, maintained in an operating mode as per the Monitoring and Surveillance Plan for the WR-1 Deferment Period.

Phase 1 decommissioning was followed by an approximate 25 year monitoring and surveillance period. Decommissioning will be completed in Phase 2, during the term of the proposed licence.

Figure 3-22 : WR-1 Building (B100) [viewed from the south]

3.3.2 WR-1 Decommissioning

The present decommissioning approach for the Phase 2 decommissioning of the WR-1 Reactor Building, as approved by CNSC staff in 2015, involves the complete removal of the reactor core, other reactor components and contaminated equipment, the demolition of the above grade structures and building, and remediation of the site. Clean structural concrete located below grade would be disposed in situ at 3 m below grade. The WR-1 Reactor Complex includes the WR-1 Reactor Building extending two levels above and five levels below grade, and the east and south wings, which contained office space and supporting facilities (see Figure 3-23). Prior to demolition of the WR-1 Reactor Complex, all activated and contaminated components would be removed, packaged and dispositioned at off-site facilities. The facility structure would be decontaminated and then demolished to achieve release criteria.

Work is continuing on proposed changes to this approach; that is, obtaining approvals through the Environmental Assessment process and a required licence amendment for in situ decommissioning of the WR-1 reactor. CNL is planning to submit a final Environmental Impact Statement (EIS) (and supporting documents) for the in situ decommissioning (ISD) of the WR-1 reactor, under separate cover, at a later date. Discussion of the ISD of WR-1 in this commission

member document will be made in brief terms only, in order to place this project in the context of existing and planned decommissioning activities at WL. Regulatory decisions pertaining to the proposed ISD for WR-1 will subsequently be determined by the Commission under a separate hearing process.

3.3.2.1 WR-1 In Situ Decommissioning

The scope of the in situ decommissioning (ISD) includes the below grade elements of the WR-1 reactor, and the complete decommissioning/demolition of the balance of WL Building 100 (B100), including the SDR reactor pool, which is located in the north wing of B100. This involves the permanent, passive in situ disposal of contaminated reactor materials and equipment and the removal of the balance of the building and the remediation of the site. Remediation will include the soil within a 1 m boundary around B100.

CNL will be formally proposing an ISD approach to the decommissioning of the WR-1 Reactor Building at a later date. The below grade structure and selected reactor systems will be filled with engineered grouts that will encapsulate and immobilize remaining radiological and hazardous materials for permanent disposal.

The resulting grouted facility will be capped with an engineered cover, which will be graded to ensure proper drainage (see Figure 3-24). Access controls (e.g., fencing and signage) may be installed around the perimeter of the cap to restrict access. Environmental monitoring equipment (e.g., instrumented boreholes) are expected to be installed in the surrounding area to monitor the performance of the disposal system during the institutional control period.

Institutional controls will be incorporated for a duration that is appropriate to the post-closure model that will be described in the WR-1 Environmental Impact Statement (EIS). A defined portion of land will remain under Government of Canada control and monitoring.

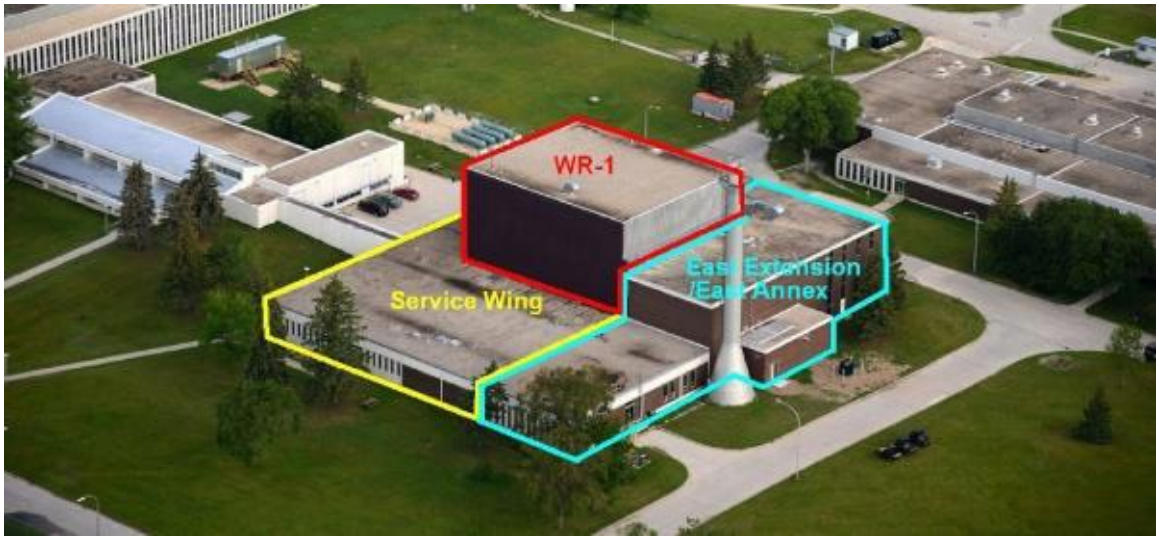

Figure 3-23 : Photograph of WR-1 Reactor Building

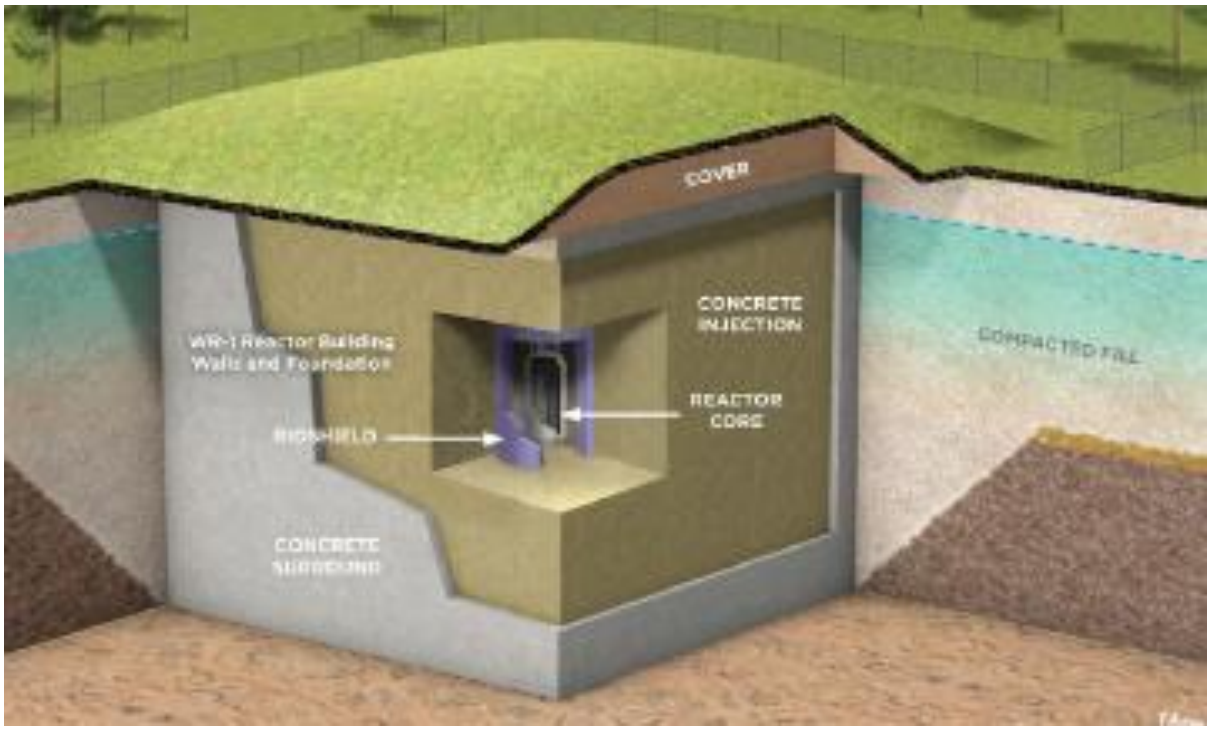

Figure 3-24 : Sketch of Completed In situ Decommissioning of WR-1 Reactor

3.4 Decommissioning and Waste Management

CNL will proceed with the decommissioning, environmental restoration and waste management projects at WL based on sound waste management and environmental principles. AECL/CNL fully supports recycling and reuse of materials wherever cost-effective, and has done so throughout the entire WL Closure Project.

The planned activities for decommissioning and environmental remediation will also substantially reduce Canada's radioactive waste and decommissioning liabilities, thus reducing the risk to the public and the environment, while ensuring the safety and security of workers.

All LLW, ILW (also formerly termed MLW), and HLW, with the exceptions to be formally proposed for ISD of WR-1 and some trenches, will be retrieved, characterized, and packaged (as necessary) for shipment to either CRL or another suitable, licensed storage/disposal facility. A fundamental assumption for WL decommissioning planning purposes is that sufficient room in suitable waste storage/disposal sites (e.g., CRL) will be available for the WL wastes as and when required.

The CNL Waste Management Program will provide the necessary structure, oversight, and guidance to the WL site for the effective and compliant management of all waste forms, including clean/recyclable, hazardous, radioactive, and radioactive-mixed waste forms. The activities will be enabled through alignment with international best practice and through

implementation of the skills, tools, and techniques based on industry experience and training, including the following:

- Implementation of an Integrated Waste Strategy for all CNL managed waste to optimize waste management practices in a holistic approach from the perspective of worker and public protection, risk reduction and lifecycle cost.
- Development of fully staffed integrated teams to safely plan and perform the activities, and implementation of an Integrated Work Control Package process to bring all the tradespersons and technical experts necessary to perform the work together in planning sessions to ensure the work is walked down and planned as a team. The process has been successfully used at many other large scale decommissioning sites.
- Completion of a technical and programmatic assessment of waste characterization to identify gaps in capabilities across all waste generation, retrieval, processing and disposal processes.
- Implementation of an Environmental Data Management System across CNL providing a consolidated storage location for historic and current environmental data.
- Development and implementation of a modern, integrated Waste Data Tracking System.
- Provision of the procedures and processes for acceptable waste packaging and treatment that meets all regulatory requirements.
- Provision of Waste Acceptance Criteria for wastes transported to CRL or other authorized storage/disposal facilities.

3.5 Transportation of Wastes

CNL has made a strategic decision to transport the majority of WL's current and decommissioning-generated radioactive wastes to either CRL or other authorized storage/disposal facilities for storage and/or disposal. Certain wastes may be sent to licensed waste processing facilities (e.g., liquid waste processing facilities or metal-melt facilities) as appropriate.

The CNL Transportation of Dangerous Goods (TDG) Program will provide program management and administrative/logistical services to enable the safe and efficient shipment of radioactive waste and materials from WL, supporting the closure mission of WL. The TDG Program responsibilities, in coordination with the CNL Waste Management Program, includes the procurement and distribution of reusable waste containers for LLW and ILW (e.g., intermodal containers and shielded over-packs), and the leasing of the Used Fuel Transportation Package (UFTP) for HLW. The TDG Program will also manage the logistical aspects of the transportation, for example, the establishment of transportation corridors, the establishment of contracts with licensed waste shipping companies, and the provision of all required Radioactive Material Shipping/Transport of Dangerous Goods documentation, including any CNSC approvals.

CNL has determined that approximately 25,500 m^3 of LLW, 1560 m^3 of ILW, and 92 baskets of irradiated fuel material (HLW) exist, or will be created during future decommissioning work. Recent LLW from decommissioning work has been stored in standard B25/B1000 metal containers, each with a nominal capacity of 2.4 m^3. It is anticipated that waste in these containers will be shipped as is, perhaps inside an overpack, e.g., an intermodal container. Other bulk LLW is planned to be loaded into either top- or end-loading intermodal containers, with an approximate capacity of 19 m^3. This would translate into approximately 1500 shipments of LLW from WL. It is anticipated that the inventory of ILW will be shipped from WL in either Type A containers or a Type B cask, depending on the nature and radioactivity of the waste. An estimated 500 shipments of ILW is expected. Present plans for the shipment of the HLW from WL are that two fuel baskets will be accommodated within the UFTP (see Figure 3-25), resulting in a total of 46 shipments of HLW. Additionally, the remediation of the Standpipes may generate additional fissionable material (FM) or HLW totaling a volume equal to approximately 2-4 baskets. This will require an additional 1-4 shipments of HLW.

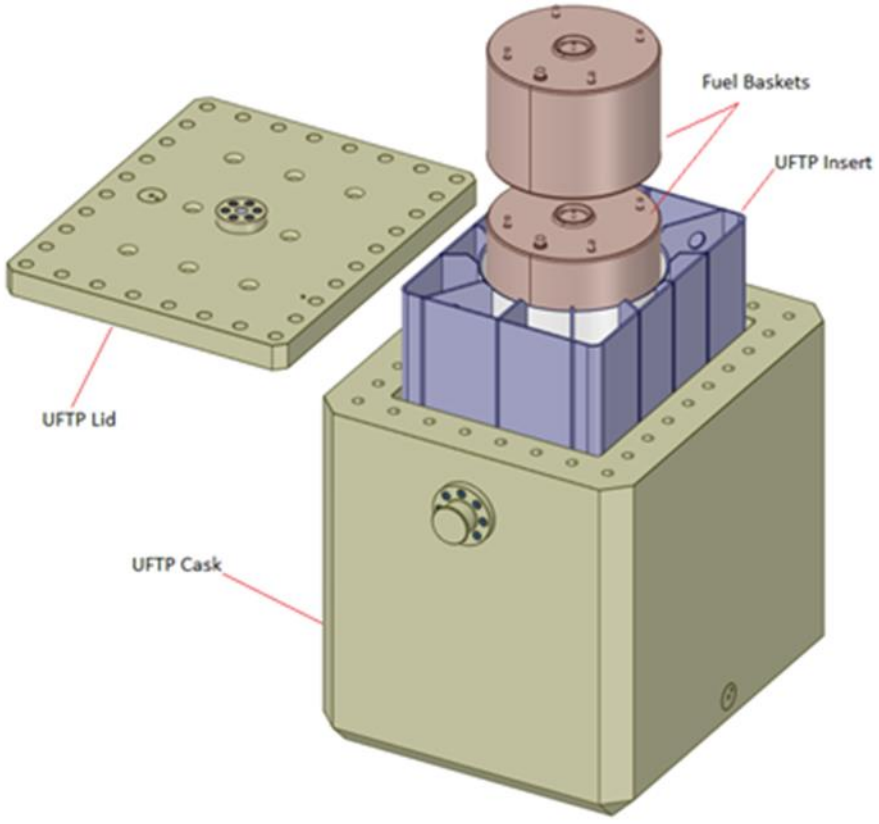

Figure 3-25 : Used Fuel Transportation Package, showing Fuel Baskets and UFTP Insert

Further, during the next licensing period, an estimated 500 m^3 of hazardous and mixed wastes will be shipped off-site to licensed waste receivers for treatment and disposition, an estimated 100,000 m^3 of clean waste (e.g., demolition rubble) will be generated and sent for recycling,

reuse (e.g., backfill) or landfill disposal, and there may be a need to transport ILLW not processed on-site and/or the residual solid waste from on-site ILLW processing.

3.6 Overall Schedule During Next licence Period

The current overall schedule for the final demolition of the remaining, major buildings on the WL site is provided in Figure 3-26.

FY 2019/20	FY 2020/21	FY 2021/22	FY 2022/23	FY 2023/24	FY 2024/25	FY 2025/26	CY 2026
	B303/303 Annex Containment Test Facility		B401 Security & Reception	B405 Technical Information Centre	B902, B903 Pump House, Water Filtration Plant		B401 Security and Reception
	B414 Active Area Gatehouse	B417 & Amine Tank Amine Tank Storage		Soil Storage Compound	B402 Health & Safety		B423 Main Access Building
	B304 Waste Clearance Facility		Inactive Landfill		B903 Water Filtration Plant		B533 Modular Office Complex
B300 Stage 6 Research & Development RD-14M		B300 and Shielded Facilities					B923 SMAGS / Cask Loading Facility
B200 Active Liquid Waste Treatment Centre		Demonstration Canister Storage Facility			B412 Machine Shop	WMA Quonsets	
WMA Trench Remediation							Sewage Lagoon
Low Level Waste Storage Bunkers					B911 Powerhouse		WMA Grounds Remediated
	Intermediate Level Waste Storage Bunkers						
B100 / WR-1 Reactor							
		Standpipes					
	Concrete Canister Storage Facility				B422 Outfall Monitoring Station		
SHIPMENTS FROM WMA							

Legend:

- Non Nuclear Building
- Nuclear Building (main campus)
- Waste Management Area / Concrete Canisters

FY - fiscal year
CY - calendar year

Figure 3-26 : Current Overall Schedule for Building Demolitions During Next Licencing Period.

3.7 Plans Following Site Closure

At the end of the proposed ten-year licensing period, the CNL plan is that all of WL will have been decommissioned to its final end-state (see Figure 3-27). In situ decommissioning will be the proposed option for the WR-1 reactor. It is CNL's expectation that the safety case for the proposed final in situ disposal of a large majority of the underground LLW trenches will be developed and presented to CNSC staff for acceptance during the next licensing period.

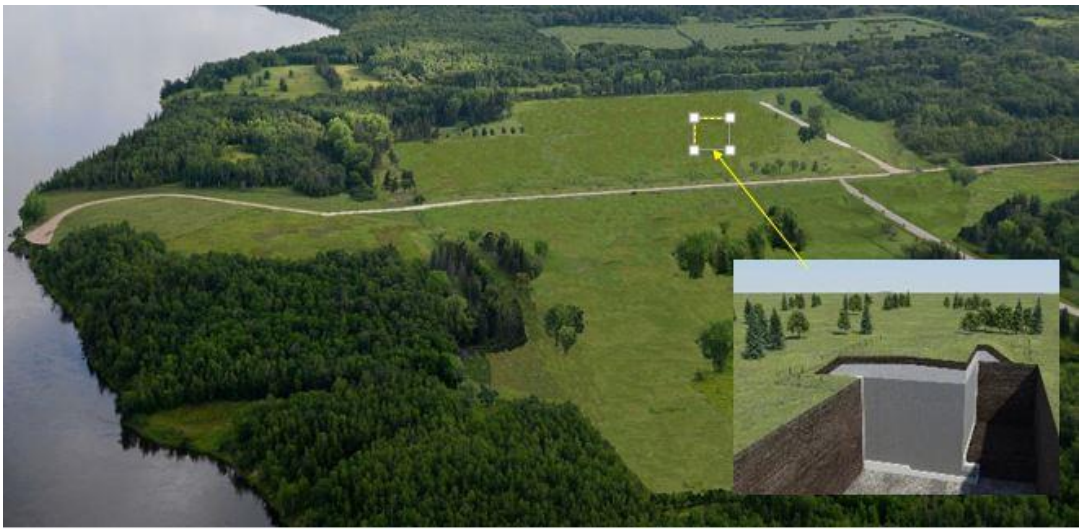

Figure 3-27 : Schematic illustration of final end state of the Whiteshell Laboratories main campus [from the South]

CNL will undertake considerations of the alignment of site clean-up and release criteria (for acceptable clearance levels of radiological and non-radiological contaminants) with subsequent land-use categories, and the definition of the end-state for WL lands following the successful completion of physical decommissioning of the WL site. As an early part of the WL Closure Project, four possible post-closure land-use categories are being defined and assigned to different areas of the WL site: industrial, agricultural, residential/parkland, and casual access[4]. Radiological clearance and release criteria, non-radiological contaminant remediation criteria, and soil cleanup criteria are being developed for each one of the four land-use categories. For example, some considerations may include whether to remove all or only portions of a building's or area's sub-surface structures, all or portions of sub-surface services (process water or firewater piping, inactive process drains), electrical distribution systems, and general infrastructure (main access road, internal site roadways, drainage ditches).

Plans for regulatory approval, including any required institutional controls, for the post-closure period will be developed and submitted to the CNSC.

[4] The WR-1 reactor site and the LLW trench site will be considered restricted access areas, not included in one of the four categories.

4. SAFETY AND CONTROL AREA - MANAGEMENT SYSTEM

The CNL Management System 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.

CNL's 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.

CNL's 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. CNL is committed to excellence in management, thereby providing the foundation on which the company and our employees can thrive. The realigned Management System has been specifically developed to the requirements of the new business model and contracts of CNL, ensuring the achievement of regulatory compliance.

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.

Internal reviews of performance provide CNL senior management with the ability to assess the performance and effectiveness of the management system through the following mechanisms:

- Nuclear Performance Assurance Review Board (NPARB), which reviews the performance of site-wide facilities and programs on a quarterly basis. The WL NPARB provides a mechanism for executing the Site Licence Holder's functional oversight of activities (processes and health, safety, security and environment programs) and facilities important to continued licensing of the WL site. The board meets quarterly to review the performance and effectiveness of CNL's processes, programs, and nuclear facilities, in order to identify opportunities for improvement and the need for change.
- Corrective Action Review Board, which reviews the status of the corrective actions program, its outcomes, and the results of internal audits.
- Contractor Assurance System, which is used to integrate various performance measures and indicators to provide an evaluation of contractor performance.

The CNL Management System aligns with Canadian Standards Association (CSA) N286-12 [1]. The Quality Assurance program for decommissioning at WL is based on CSA N286.6 [2], and also aligns with N286-12 [1].

4.1 Performance Since 2009 Licence Renewal

AECL/CNL continued to strengthen the framework through which it manages and operates to provide assurance that WL is decommissioned/operated safely and in full compliance with CNSC licensing obligations. During that period, the following actions took place to improve the Management System that was in place until the new (2017) system was implemented:

- A holistic, corporate framework for managing CNL was established to align and integrate safety, program delivery, people management, facilities management, and strategic improvement.
- Executive-level champions were appointed and held accountable for defining standards, institutionalizing enabling processes, and providing oversight for each area of the new corporate management system framework.
- Nuclear safety oversight mechanisms were strengthened by adjusting quarterly reporting to senior management to bring greater focus on health, safety, security, and environmental performance.
- Oversight of health, safety, security and environmental risk mitigation system comprises several mechanisms including: independent assessments, self-assessments, regulatory oversight, and review of status of health, safety, security, and environment priorities.

In 2014 November, AECL launched a wholly owned subsidiary under the name of CNL. In 2015, coincident with the transfer of the ownership of CNL from AECL to the Canadian National

Energy Alliance (CNEA), minor revisions to the Management System manual, the Management System Governing Documentation Index Sites, and the Management System Appointments Registry were made to capture administrative changes.

CNL has since embarked on a plan to significantly revise and improve the Management System suite of documentation whereby the company-wide support functions are centralized and standardized. The improved CNL Management System captures the development of the transformed organization from a federal entity to a Government-Owned Contractor-Operated (GoCo) company. Furthermore, there has been strengthening of the platform that enables CNL to satisfy the CNSC requirements for establishing and maintaining the 14 Safety and Control Areas (SCAs) as prescribed in the WL Licence Conditions Handbook (LCH) [3].

In 2016, a multi-phased project was launched to align the management system to the requirements of the new CNL business model; simplification of the management system framework; clarification of roles, responsibilities, authorities, and accountabilities; and, a reorganization of the management system documentation suite.

In year one (2016), a project team was assembled to develop improvements, to resource the writing of the new documentation suite, and to provide oversight to ensure that change was managed in a controlled manner. The focus of the project was to improve and simplify the management system, while continuing its alignment with safety and operational principles already being implemented.

A new management system document type, Executive Management Directive, was developed to address and implement any actions from the President and Chief Executive Officer in a timely manner. The directives may be developed to address compensatory measures or emergent requirements and are typically in effect for a specified period of time (generally less than six months), after which they may be incorporated into permanent document types, as necessary. The directives may contain implementing details, until such details can be captured in lower-level documents. For example, three directives were released for use in 2016: “Working on Roofs”, “Gating and Sanctioning”, and “Project Charge Codes Creation or Amendment”.

The revised and transformed Management System provides, enables, and defines a detailed framework for continued safe operation of the nuclear facilities and laboratories at all CNL sites, including WL. The various mature programs and processes, already in place, will continue to evolve to ensure that all regulatory requirements are achieved. The revised Management System manual and sub-tier documents were initially submitted to CNSC staff in 2017. The final (2018) phase of the multi-year Management System Evolution Project focused on the implementation level of processes and/or programs. The project provided a focus on safe operational practices and compliance with applicable regulator frameworks.

As mentioned previously, the Quality Assurance program for decommissioning at WL is based on CSA N286.6. The WL Quality Assurance Plan, originally issued in 2007, has been revised to align with CSA N286-12, which provides alignment to the CNL *Management System* manual, while still

retaining compliance to CSA N286.6. The revised Quality Assurance Plan was accepted by the CNSC in 2018.

4.2 Management of Safety

4.2.1 Performance Since 2009 Licence Renewal

CNL's safety culture continued to be enhanced through execution of an action plan, documented in internal staff newsletters focussed on safety culture, which included actions addressing the following key areas:

- improve equipment reliability
- drive desired behaviour
- improve problem identification and resolution
- improve use of operating experience and reduce isolationism
- improve standards of operation
- improve management oversight

Additionally, a detailed safety culture assessment was executed in the fall of 2012, and this comprised a comprehensive questionnaire delivered electronically to all staff; follow-up interviews with staff at WL, CRL, and Port Hope Area Initiative; and, discussions with focus groups at all three sites. Results of this detailed assessment were compared with those from a similar assessment in 2008. The surveys and the assessment indicated that additional effort was required to ensure that standards and expectations were established and clearly communicated to staff. Furthermore, oversight was needed to monitor work execution in the field in order to reinforce the desired behaviours. These activities targeted reinforcement of the fundamentals and strengthened overall safety culture.

In 2013, AECL/CNL released its Nuclear Safety policy aligned with the industry's ten Traits of a Healthy Nuclear Safety Culture. The traits evolved from the eight Nuclear Safety Culture Principles with a focus on behaviours at all levels of an organization.

In 2014, the organizational focus on safety culture continued through leadership skills development (Performance Leadership Essentials) training (see Section 5.4.1).

In 2016 September, an employee survey was conducted by a third-party organization for CNL. The results on safety and security questions ranked the highest overall, with a 76% positive rating. A key strength was the high positive rating on performance management and, specifically, clarity on job expectations, as well as a high positive scoring on collaboration within work groups. A number of high neutral scores, particularly in areas such as leadership and vision/direction indicated a need for more information on long-term plans. Overall survey results were published on CNL's intranet site enabling all employees to review the breakdown of the results.

In 2017 and 2018, CNL conducted additional employee surveys using a third party vendor to

administer the confidential survey and report on the findings. Results from the 2017 and 2018 surveys continued to support steady engagement and enablement results relative to 2016. Results demonstrated that CNL remains close to the overall North American norm. Six of the top ten positive responses in the 2018 employee survey related to questions about workplace safety showing CNL's safety culture was working, and remained successfully integrated into daily work and operations.

The organization continues to focus on safety culture through reinforcement of performance expectations in the Human Performance Management (HU) initiatives described in Section 5.

Both Human Performance Fundamentals and Nuclear Safety Culture courses are required training for all employees. The Human Performance Program continues to deliver both courses to all new employees during their new employee orientation, in addition to a variety of HU specific training facilitated throughout each year.

4.2.2 Licensee Organization

4.2.2.1 Performance Since 2009 Licence Renewal

Internal organizational changes have been executed to be consistent with the requirements of the Organizational Change Control process. The purpose of the process is to ensure that organizational changes are controlled in a manner such that safety and business risks are minimized, and will not adversely affect the safe and reliable operations of facilities and sites.

A major change for the future of the nuclear laboratories was triggered on 2013 February 28 with a public announcement made by the Honourable Joe Oliver, Minister of Natural Resources Canada. The Government of Canada announced its intention to launch a formal competitive process for the greater private-sector engagement in the management and operation of the nuclear laboratories. Under the new management model, the mandate would have three objectives:

- Address nuclear legacy and historic waste liabilities.
- Provide nuclear Science & Technology (S&T) capabilities and services to federal government departments.
- Support the nuclear industry's needs for in-depth nuclear research and development, and test and evaluation expertise.

In 2014 November, the creation and standing-up of CNL occurred, a wholly owned subsidiary of AECL. Applications were made to the Commission and to CNSC staff to transfer from AECL to CNL the various licences and certificates issued by the Commission and by Designated Officers. Although the licensee name was changed to CNL, there were no changes in corporate vision, strategic outcome or value proposition.

In 2015, the restructuring of the former AECL was completed. On 2015 June 26 the Government of Canada announced that CNEA was the preferred bidder chosen to manage and

operate CNL, and the final implementation of the GoCo model (see Figure 4-1) was achieved on 2015 September 13 with share transfer of CNL to CNEA.

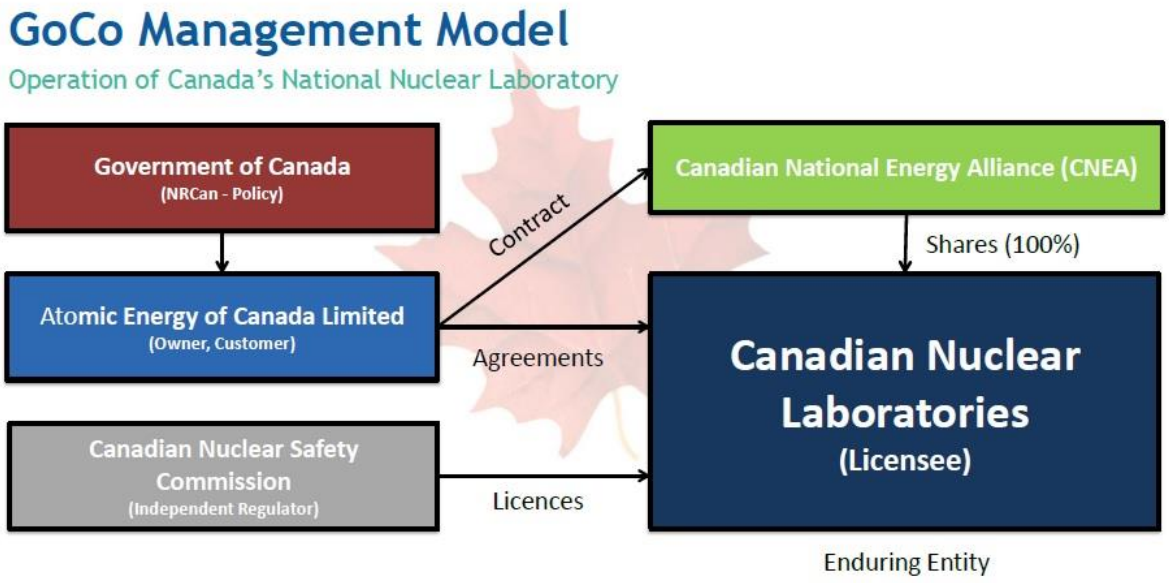

Figure 4-1 : GoCo Management Model for CNL Laboratories

With the transfer of shares to CNEA completed, the process of restructuring of the former AECL was completed. Later in 2015 September, the incoming President and Chief Executive Officer notified CNSC staff of the associated leadership team appointments with clear indication of the immediate organizational changes being made to the CNL board structure and key positions.

Responsibility for the management and operations of each element of CNL's organizational structure was assigned to executives and senior management reporting to the President and Chief Executive Officer. CNL's current organizational structure is depicted in Figure 4-2. The WL Site Head & General Manager is the WL Site Licence Holder, and reports to the Vice President, Environmental Remediation Management.

4.3 Plans for the Next Licence Period

CNL will continue the maintenance of the Management System, integrating both functional support programs and operations programs into a single, all-encompassing, integrated system that not only covers the compliance aspects of these programs, but also incorporates the key performance aspects of the business, including: requirements for risk management, legal, and other key considerations important to corporate governance.

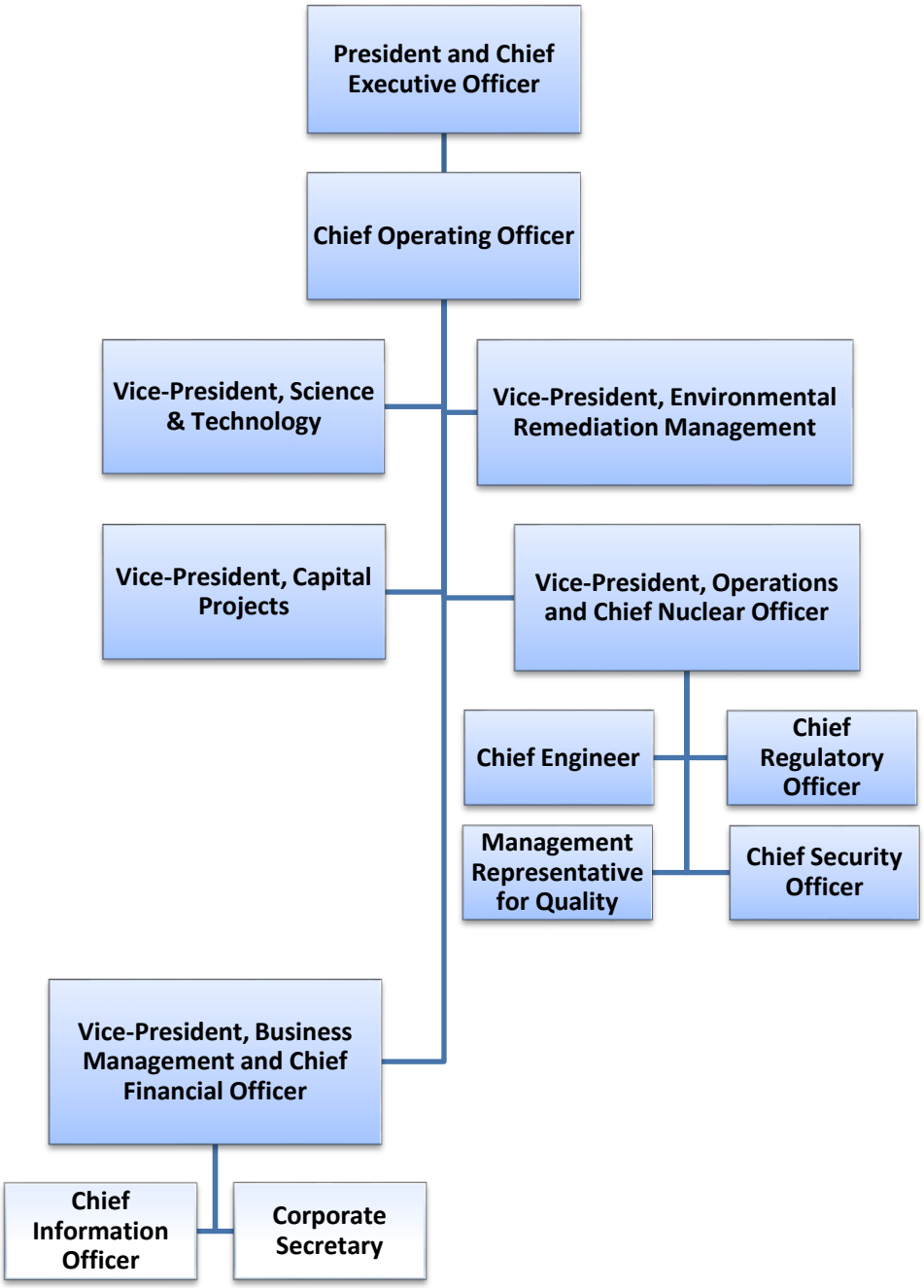

Figure 4-2 : Canadian Nuclear Laboratories Executive Team and Corporate Authorities

Plans for the next licence period include:

- Initiatives to ensure continued alignment to changing regulatory and standards requirements.
- Implementing a continuous improvement program to ensure that the integrated management system enables effective and efficient management of the company.
- Reflecting best-of-class management practices as seen both in the nuclear industry and in large S&T organizations operating in highly regulated environments.
- Implementation of the revised WL Decommissioning Quality Assurance Plan recently accepted by CNSC staff.

5. SAFETY AND CONTROL AREA - HUMAN PERFORMANCE MANAGEMENT

CNL has a responsibility to ensure safety for its employees and the public, and to protect the environment from any potential hazards associated with operating its sites and facilities including WL.

The Human Performance (HU) Program is managed by the Performance Assurance department within the Health, Safety, Security, Environment, and Quality organization at CNL. Performance Assurance requires all functional support areas, line management, and employees to report different types of events and implement specific documented programs and processes in their respective areas. To achieve this goal, the Performance Assurance function provides tools, methods, training, and expertise. The program also interfaces with other programs with respect to risk management related to variability in human performance and maintains a high level of line engagement to provide efficient delivery of program services.

The main objectives of the program are to:

- Strengthen the safety culture at CNL.
- Evaluate human performance effectiveness in the work environment.
- Reinforce the use of human performance methodology through training, communication, and observations.
- Assist leaders in promoting and modelling safe work practices and behaviours.
- Assist employees to recognize and avoid error-likely situations.
- Evaluate error-likely situations, assess defences based on evaluations, and ensure defence-in-depth.
- Reduce the error rates through the use of human performance tools.

5.1 Performance Since 2009 Licence Renewal

The HU Program has strengthened and ensured that relevant processes are in place to minimize human error and thus the frequency and severity of unplanned events in the CNL organization. Through the application of human performance concepts and tools (behaviours), CNL continues to improve its capability to recognize, predict, and safely respond to physical hazards and unsafe acts or conditions. The HU Program is implemented for all CNL employees, at all CNL and customer sites, including WL.

The HU program has developed line-led human performance training which is geared towards creating a healthy safety culture based on internalization of human performance principles and personal accountability.

The following improvement initiatives were carried out under the program:

- Established the Human Performance Steering Committee.
- Developed, tested, and implemented an Event Free Day Reset program.

- Established the Human Performance Advocate program.
- Developed and implemented a Field Observation and Coaching Fundamentals Workshop.
- Improved training materials in support of a Safety Culture Workshop.
- Conducted a comprehensive Safety Culture Survey in 2012 and in 2019.
- Completed the implementation of a Nuclear Safety policy in 2014.
- Implemented and aligned the Traits of a Healthy Nuclear Safety Culture to the existing Nuclear Safety policy.
- Rolled out a communication strategy that included: Traits of a Healthy Nuclear Safety Culture posters, personalized booklets, and weekly-topic bulletins.
- Developed, piloted, and released Observation-and-Coaching software (ObservationWay), which allows for building custom observation cards based on the requirement of each line.
- Developed and launched the “Focus of the Week” process.
- Created “Eventicons”, which consisted of posters, magnets, and booklets, in order to promote Event Free Tools (a set of seven discrete behaviours and techniques that assist employees to maintain positive control of a work situation) awareness.

In 2017, new Human Performance Program documents were created, based on revisions to existing documents, to align with the new CNL Management System.

In 2018, the HU team delivered 83 training sessions on a variety of Human Performance topics, reaching 1,223 CNL staff members, including sessions at WL. Also, WL developed a HU course titled “Reducing Risk Tolerance”. This course focuses on “Normalization of Deviance” (procedural drift) and details how deviating from procedure can become the accepted way of performing a task. The undesired consequences of this deviation are also discussed.

CNL conducted a company-wide Safety Stand Down on 2019 May 30. CNL had determined that its industrial safety metrics were declining, and were not as good as those of similar nuclear laboratories. All normal work ceased for the day; the day was devoted to increased safety awareness, strengthening work practices, and identifying emergent safety issues where immediate action would produce quick gains, in addition to recognizing issues where improvements would take longer. A high level of engagement by all staff, supervision and management resulted in a renewed commitment to safety across CNL.

HU continued to collaborate with the business lines to support the reinforcement and internalization of event free tools. Realizing that peer leadership is a part of achieving accountability, Human Performance ensured that this training was tailored and geared towards creating a healthy safety culture based on personal accountability through the internalization of human performance principles. The line-led training format promotes learning across the organization.

5.2 Plans for the Next Licence Period

The HU Program plans the following:

- Increase the strength of in-line ownership for human performance implementation.
- Execute line-led human performance training intended to drive increased line ownership.
- Integrate all aspects of safety culture, human performance, and transformation activities.
- Improve oversight from a program perspective to enable relevant learning from the business lines.
- Implement enhancements based on the feedback from stakeholders on established processes.
- Transform processes and practices to engage, enable, and empower the workforce.

5.3 Fitness for Duty

Elements of a mature fitness-for-duty program continue to be in place at CNL (e.g., Continuous Behavioural Observation Program). Pre-employment medical screening exists for firefighters, as does annual physical testing for specific emergency and protective services roles.

Drug and/or alcohol testing is part of the process for post-incident response and investigation procedures. It can also be conducted in case of suspected (for cause) breach of the Drug and Alcohol Program. CNL has the capability to conduct a legally admissible test to determine intoxication from alcohol.

The updated Fitness-for-Duty procedure addresses strategies for recognizing and mitigating the effects of fatigue in the workplace. The procedure was updated and included information for employees on how to access assistance at any location where CNL operates.

In 2017, CNL provided the CNSC with a gap analysis and implementation plan for REGDOC-2.2.4 (*Fitness for Duty: Managing Worker Fatigue)* [4]. In 2018, WL augmented the Security Officer contingent with casual Security Officers, to ensure conformity to the requirements of this REGDOC, with implementation in 2019. CNL remains on track to comply with all REGDOC-2.2.4 *Fitness for Duty, Volume II: Managing Alcohol and Drug Use* requirements [5], and continues to collaborate with other licensees on the implementation of this regulatory document.

Furthermore, a revision of the disability management and return-to-work programs was performed during 2015, and a third-party service provider has been contracted to support the disability management process for non-occupational illnesses and injuries, along with the support of a Medical Review Officer and addictions treatment services.

CNL provides and continues to actively promote its third-party Employee and Family Assistance program in support of the overall health and the wellness of its employees.

5.4 Systematic Approach to Training

Application of the Systematic Approach to Training (SAT) is mandatory for all personnel in direct operating positions in CNL nuclear facilities. The scale and scope of application for non-direct operating staff is determined based on the importance of the job to nuclear safety.

In 2012, CNL updated and reissued the process documentation supporting SAT, based on internal reviews and external benchmarking. Training procedures are aligned with REGDOC-2.2.2 (*Personnel Training*) [6] and are applied in a graded approach.

The CNL SAT is broken into four main areas:

- Training analysis
- Training design and development
- Conducting training
- Training evaluation

CNL has continued to enhance the training oversight role through the establishment of a Training Oversight Committee with a mandate to evaluate how training addresses the needs of the company and improves performance.

The Learning Management System at CNL was updated and new software was implemented in 2016 to enable more efficient and effective management of training records.

5.4.1 Performance Leadership Essentials

In 2013, a leadership enhancement program called “Performance Leadership Essentials” was initiated at CNL. This best practice and engaging leadership program provides an optimal combination of essential and advanced skills to strengthen leadership performance.

At the core of the program are five key principles to meet personal needs (esteem, empathy, involvement, share, and support), a communication process, and tools such as self-assessments, job aids, and discussion planners that leaders could immediately apply on-the-job to efficiently guide conversations to optimal outcomes. Skills practice provides opportunities for participants to apply what they have learned and they receive immediate feedback in an experiential and confidential environment.

5.4.2 Vision Plus Training

In 2013, two new courses, “Leading from Vision“ (directed at managers and supervisors) and “Vision Plus“ (designed for all employees) explored what a high-performance work culture looks and feels like and how it differs from past practices and performance at CNL.. These courses covered essential attitudes, skills and behaviours to help create a high-performance culture at work, regardless of the position held at CRL.

By the end of 2018, 1,651 out of 3,212 employees at CNL had completed Vision Plus and 444 employees had completed Leading from Vision. In 2017, 100% of WL managers completed Leading from Vision.

5.4.3 Plans for the Next Licence Period

The Training and Development program will continue to provide centralized leadership and management of training functions at CNL. This program will continue to be responsible for the assessment, development, implementation, and monitoring of the effectiveness of training programs for training and authorization activities throughout the company, including WL.

CNL's Training and Development staff administer the CNL SAT documentation, the corporate training plan, and the Learning Management System and will continue to maintain this accountability.

6. SAFETY AND CONTROL AREA - OPERATING PERFORMANCE

Whiteshell Laboratories decommissions and operates its facilities safely, according to operating limits and conditions, facility authorizations, laboratory protocols, prescribed programs and procedures. Operating performance is monitored through the Nuclear Performance Assurance Review Board (NPARB) and other internal assessment activities such as self-assessments and audits.

Monitoring of safety performance in the operational area is achieved through the concept of "events" and the associated record of "Event Free Days". This is a fundamental measure of CNL and WL's safety performance, and is a key element in ensuring staff remains engaged and committed to safety at all times.

CNL's Operating Experience (OPEX) Program, including implementation at WL, is CNL's learning mechanism to improve operational and safety performance. It utilizes tracking tools and database information, both from within CNL and from external sources, to improve the safety of operations, improve operational performance, and reduce the significance and occurrence of unplanned events at WL and other CNL sites.

6.1 Conduct of Operations

Conduct of operations documents ensure appropriate integration and adequate reflection of safe operating practices to meet business requirements. Inputs to the CNL Conduct of Operations Program include:

- Site and facility licensing (acts, regulations, licences, handbooks),
- Industry standards,
- Compliance programs (under CNL's Health, Safety, Security, Environment and Quality (HSSE&Q) organization),
- Policies, and
- Commitments.

The nuclear facilities located at WL continue to operate safely according to operating limits and conditions. Any non-compliances that were identified during the operation of the facilities and laboratories were reported to CNSC staff, as required, and were addressed.

6.2 Operational Experience Program

The Performance Assurance Program is comprised of two main elements, the Corrective Action Program and the OPEX Program. These programs review and analyze pre-existing events and issues, operating experience, and lessons learned, from both internal and external sources.

The overall objective of the OPEX Program is to achieve higher levels of operational safety and performance, and to reduce the significance and the occurrence of unplanned events at CNL. This is done by responding to and internalizing the "Lessons to be Learned" from unplanned events, both from CNL and from the Industry in general.

The OPEX Program provides and supports processes for identifying, recording, investigating, and implementing corrective actions, to prevent recurrence of internal events. This includes reporting those events internally, and externally to regulatory agencies and to the nuclear industry.

The process also includes responding to external events and disseminating "Lessons to be Learned" to prevent occurrence at CNL by providing the specific external information to internal organizations.

The OPEX Program interfaces with facility and line management mainly through the Corrective Action Program.

6.2.1 Annual Compliance Reporting

For each calendar period since licence renewal in 2009, annual compliance monitoring reports have been provided to CNSC staff in accordance with the specific requirements of the current WL LCH, Section 5.1. The Annual Compliance Monitoring Report (formerly Annual Safety Review reports) for WL for a given calendar year is submitted to CNSC staff by April 30 of the following year, and the Environmental Monitoring Report and the Environmental Assessment Follow-Up Program Report for each calendar year are submitted to CNSC staff by June 30 of the following year.

6.2.2 Reportable Events

Events at the WL site are reported to the CNSC as required by the Nuclear Safety and Control Act (NSCA) [7], the regulations and/or the WL licence. In 2016, the reporting procedure document was revised to fully incorporate the additional requirements (reporting to Duty Officer) specified in the 12(2) letters from CNSC staff regarding WL and modified accordingly to be applicable to the other licensed CNL locations for which similar requests were also received (CRL, Port Hope Area Initiative Management Office, and Prototype Reactor Decommissioning sites). Training and implementation of the revised procedure was subsequently completed for all sites.

6.2.3 Performance Since 2009 Licence Renewal

The following improvement initiatives were developed for the OPEX Program to fulfill the program's objectives:

- Issuance of OPEX bulletins, each year, to the business lines. For example, in 2018, 354 external OPEX bulletins and 25 internal OPEX bulletins were shared with all business lines for review of applicability.
- Operating experience records from both internal and external sources were made available to line organizations.

- The development and implementation of a new process called “Rapid Learning” was implemented company wide as part of a continued commitment to defence-in-depth and organizational learning.

Table 6-1 provides a summary, comparing the total number of reportable events categorized as Nuclear Facility, HSSE&Q Program, and Other, during the current licencing period. There were four reportable events at WL for 2017, and zero reportable events for 2018.

Table 6-1
Total Number of Reportable Events Categorized by Nuclear Facility, Program and Other

Year	Nuclear Facility	HSSE&Q Program	Other	Total
2009	2	3	1	6
2010	13	10	1	24
2011	5	5	0	10
2012	1	2	2	5
2013	1	3	0	4
2014	2	3	0	5
2015	0	0	0	0
2016	1	4	0	5
2017	1	3	0	4
2018	0	0	0	0

6.3 Corrective Action Program

The Corrective Action Program is a real-time system that provides rapid identification of issues and an effective and efficient means for communicating certain issues to management. The purpose of the program is to document and (where warranted) remediate problems, prevent occurrence/recurrence of significant problems, and address opportunities for improvement and trending.

The Corrective Action Program includes a comprehensive process for:

- Identifying, investigating, documenting, and resolving problems.
- Capturing and disseminating opportunities for improvement and operating experience (OPEX Program).
- Initiating, monitoring, completing and reviewing actions for effectiveness where warranted.
- Extracting facts, data, and trends of events and sharing them within the organization through the OPEX process.

The process is structured to provide for the timely and effective resolution of identified issues affecting personnel safety, operational safety, regulatory compliance, or business operations, which are entered into the ActionWay application, which is the software tool used for the ImpAct[5] process. Assessment and analysis of issues is facilitated through use of different methods and techniques such as rapid learning, root cause analysis, and apparent cause analysis.

6.3.1 Performance Since 2009 Licence Renewal

The development, pilot, and release of new computer software that supports the operating experience process was launched. This software allows for an automated process, allowing for a strengthened audit trail for the details of the review of operating experience. The users are given the capability to provide an additional layer of oversight and screening for applicability.

Following are some of the improvements for the Corrective Action Program:

- A reporting component and automated workflow were created and uploaded into the ActionWay software tool.
    - Trend Codes were developed and uploaded into the ActionWay software to aid in the facilitation of analysis to ImpActs. Trends are now easier to identify and will provide more accurate information for specific trends in each business line.
- Improvements have been made in standardized reporting and trending of low significance level events and they include:
    - trend reports were aligned with industry best practices
    - quarterly trend data report is provided to business lines for further analysis and review by management
    - low significance level events (Level 4) are continually being analysed to identify adverse conditions/trends in keeping with industry best practices
- Training material to reinforce the expectations and improve understanding of the workflow processes has been regularly offered to staff.
- New training material was created to improve corrective action quality.
    - A new process was developed known as the Rapid Learning Morning Call, and this call is made each business day. Managers and supervisors from across the organization present information related to any event that has any consequence to the health, safety, security, or environment. The focus is on ensuring that all immediate actions have been taken to minimize risk to employees. Rapid Learning training was developed and presented company wide. This process allows immediate investigation and resolution of unplanned occurrences by keeping the senior management teams informed in a timely manner.

[5] ImpAct = Improvement Action (process).

- A process for a Contractor Assurance System was developed and implemented to provide comprehensive and integrated oversight and assurance for all aspects of CNL operations. This process has strengthened the corporate responsibility for the safety and health of workers.

The total number of ImpActs categorized by significance level for the licence period is provided in Table 6-2. While there had recently been a small downward trend in the number of ImpActs raised, there was an increase in 2018, which is within the normal variation expected year-to-year. The level of reporting is indicative of a strong reporting culture, with better quality ImpActs being raised due to the maturity of the organization.

6.4 Plans for the Next Licence Period

The OPEX and the Corrective Action Programs will develop as follows:

- Increased strength in line ownership for the program's implementation.
- Integration of all aspects of safety culture, human performance, and transformation activities.
- OPEX Program will be built into Line-Led Human Performance training, intended to drive increased line ownership.
- Improved oversight from a program perspective that enables relevant learning from the business lines.
- Enhanced programs, by receiving feedback from stakeholders on established processes.
- Transformed processes and practices to engage, enable, and empower the workforce.

Table 6-2
Number of WL ImpAct Events by Significance Level - Ten Year Summary

Year	Level 0	Level 1	Level 2	Level 3	Level 4	Total
2009	28	0	8	163	309	508
2010	26	0	4	149	475	654
2011	16	0	0	113	379	508
2012	23	0	0	125	340	488
2013	8	0	1	106	366	481
2014	21	0	1	98	608	728
2015	12	0	3	44	577	636
2016	9	0	1	25	491	526
2017	5	0	0	42	449	496
2018	10	0	0	39	532	581

7. SAFETY AND CONTROL AREA - SAFETY ANALYSIS

The Safety Analysis Program develops and controls the suite of nuclear safety analysis documents required to support the licensing basis of all nuclear facilities at CNL, including WL. This program applies to all safety analysis activities involving CNL structures, systems and components, and all management, supervision and staff.

Safety Analysis Reports (SARs) are produced to demonstrate that the facilities are appropriately designed to meet health, safety, security, environmental and regulatory requirements, and are operated safely. These SARs form part of the basis for a set of limiting conditions for safe operation that are documented within Facility Authorizations for each nuclear facility. At WL, four facilities have SARs and Facility Authorizations: Shielded Facilities, Waste Management Area, Concrete Canister Storage Facility, and Active Liquid Waste Treatment Centre.

7.1 Performance Since 2009 Licence Renewal

7.1.1 Updates to Nuclear Facility Documentation

A number of updates to safety documentation have occurred during the licence period. The major updates include revisions to existing Final Safety Analysis Reports and Facility Authorizations for WL's Shielded Facilities and WMA.

The ALWTC is undergoing decommissioning. During this process, hazards addressed in the SAR, including safety-related systems that are no longer needed, will be removed. The ALWTC SAR and Facility Authorization documents will become obsolete once decommissioning of the ALWTC is complete.

7.1.2 Nuclear Criticality Safety

The Nuclear Criticality Safety (NCS) Program covers both WL and CRL. The CNL NCS Program provides oversight and direction to all activities that involve fissionable materials. NCS documentation ensures criticality safety with activities being performed and materials being handled or stored in accordance with limits and restrictions outlined in the relevant criticality safety document. Criticality safety documents continue to be updated on a risk-graded approach; upper subcritical limits have been documented and criticality hazard identification studies have been completed for all nuclear criticality controlled areas at WL. As well, criticality accident mitigation measures are now documented.

Nuclear criticality safety awareness training is delivered via computer-based training and is part of the required training for all staff. A module for the refresher of the full day in-class nuclear criticality safety course is also available. Refresher computer-based training is alternated with in-class training.

The effectiveness of the NCS Program at Whiteshell has been enhanced through:

- Criticality safety documents for WL being updated to meet current standards per the risk graded approach.

- Criticality hazard identifications prepared for nuclear criticality controlled areas.
- A training process that categorizes all staff based upon their involvement with fissionable materials.
    - Annual delivery of the NCS course and availability of computer based refresher training.
    - Continuing to provide technical and regulatory site-wide support to various CNL groups to improve and strengthen the Program processes.
- Holding semi-annual meetings with CNSC staff, to provide updates on the status of the NCS program.

7.2 Plans for the Next Licence Period

Facility safety governance documentation (Facility Authorizations, Safety Analysis Reports, and Nuclear Criticality Safety documents) will continue to be updated as required during the next licence period, as decommissioning activities progress at the WL site.

A SAR is being developed for the standpipe/bunker remediation, ILLW Processing System and use of the Shielded Modular Above Ground Storage (SMAGS) building for cask loading/testing. This document will be an addendum to the existing WMA SAR and will be submitted to CNSC staff for acceptance, before these facilities are operated.

8. SAFETY AND CONTROL AREA - PHYSICAL DESIGN

Physical design is managed under the Design Authority and Design Engineering program. The Design Authority and Design Engineering program maintains and controls the design basis within approved safety margins and regulatory requirements, and applies to all design engineering activities at WL.

The purpose of the program is to ensure that design is planned, executed, verified, and documented according to applicable codes, standards, regulatory, and customer requirements. The Design Engineering program complies with:

- CSA N286 (Management System Requirements for Nuclear Power Plants) [1]
- CSA N285.0 (General Requirements for Pressure-Retaining Systems and Components in CANDU Nuclear Power Plants) [8] when applied in conjunction with the applicable pressure boundary quality assurance manuals.

The change control process at WL is governed by the Configuration Management program, and is the mechanism by which Design Engineering ensures changes are assessed, designed, reviewed, controlled, implemented and appropriately captured in compliance with relevant safety and configuration management requirements. The program provides the framework to maintain and control the physical configuration of structures, systems, and components at CNL. This program applies to all design, operations, decommissioning, and maintenance activities, as executed by all management, supervision, staff, and contractors. It applies to all non-nuclear and nuclear documents, policies, programs, and procedures which contain information or instructions that could impact:

- design (both regulatory and non-regulatory),
- any plant physical configuration, or
- any configuration item or information.

8.1 Performance Since 2009 Licence Renewal

Design oversight and change control have been significantly strengthened, including new and improved processes for Design, Engineering Change Control, Field Change Control, and Item Equivalency Evaluations. The Chief Nuclear Engineer position was appointed as the Design Authority for the nuclear laboratories. This role is responsible for authorizing all design changes, and ensuring that all design, safety and licensing requirements are satisfied prior to construction (some duties of the Design Authority have been delegated to a WL Designated Engineering Manager).

Change control has been expanded to the whole WL site, and a more rigorous risk assessment process has been established to ensure changes are reviewed and approved by persons having an adequate understanding of the original and current requirements so as to allow assessment of the effect of the change. The Engineering Change Control Office was established to monitor all changes from initiation through to closeout to ensure that the appropriate approvals are

received and engineering and operational documents and drawings are updated prior to closeout. This oversight of Configuration Management has improved at the WL site through the NPARB and Corrective Action Program. Events and trends are identified and corresponding corrective actions are taken.

Over the years, design oversight and change control have undergone process improvement. Streamlining of procedures to appropriately grade the process to the risk has been implemented, as well as the addition of exclusions for very low risk changes that may be executed within the scope of the Maintenance Planning and Work Management Program.

CNL has begun the process of expanding the ability and accountability of staff who may execute the design process. The Chief Nuclear Engineer position continues to be an important oversight position and retains the responsibility to ensure that staff executing design processes understand their accountabilities. In addition, the Chief Nuclear Engineer has authority and provides oversight to the execution of the design program.

CNL continues to perform process reviews of the design program to appropriately grade the application of the program across all sites.

In 2017, a Certificate of Authorization was obtained from Engineers Geoscientists Manitoba. This authorizes CNL to engage in the practice of professional engineering in Manitoba in accordance with the provisions of *The Engineering and Geoscientific Professions Act* [9], and is renewed annually.

8.2 Pressure Boundary

The WL Pressure Boundary Program establishes a cross-organizational framework to provide assurance that CNL's obligations and risks pertaining to pressure boundary systems, structures, and components are being managed and executed safely and responsibly, in full compliance with the applicable codes, standards, and regulatory requirements. The program is governed by a quality assurance manual specifically designed to ensure the compliance of pressure boundary systems at WL.

8.2.1 Performance Since 2009 Licence Renewal

The implementation and management of the Pressure Boundary Program have been significantly strengthened. CNL continues to implement an effective Pressure Boundary Program with successful integration of the CSA N285.0 [8] and CSA B51 [10] programs at WL, including CNSC acceptance of WL's pressure boundary code classification procedure.

In 2017, the *Pressure Boundary Quality Assurance Manual* was revised and sent to Inspection and Technical Services Manitoba for their review and acceptance. Inspection and Technical Services Manitoba accepted this manual in 2018, and their Certificate of Authorization authorizes CNL to perform pressure boundary work as described in the revised Quality Assurance Manual.

WL discontinued pressure relief valve repair and testing on site in 2018. Moving forward, expired relief valves will be replaced with new ones or sent off-site for testing and repair.

WL was the subject of internal Pressure Boundary Audits in 2012 and 2018. All corrective actions that resulted from these audits have been addressed and closed.

8.3 Plans for the Next Licence Period

Over the next licence period, improvements in the WL Physical Design Process will be gained through the implementation of key initiatives and enablers including:

- Redistributing engineering functions to better leverage experience and knowledge in the workforce, strengthen work planning, and focus on engineering service delivery,
- Completing a series of specific projects that will deliver the tools necessary to provide efficient design services to customers,
- Greater engagement with third-party supply chain to improve availability and quality of specialty engineering services and provide augmentation for delivery of core engineering services, and
- Perform gap analysis on licence listed codes and standards to enable their implementation.

9. SAFETY AND CONTROL AREA - FITNESS FOR SERVICE

During the decommissioning mission, structures and systems on site must be maintained in an operable state to ensure compliance with regulations and to support the closure mission. Fitness for service work includes maintenance, equipment operational checks, alarm checks, periodic inspections of the state of structures and housekeeping inspections.

Preventative and corrective maintenance is carried out on nuclear and non-nuclear facilities on the WL site. Preventative and corrective maintenance is carried out on safety systems as well as on those aspects of buildings, structures and grounds required to maintain personnel and structural safety, protection of site assets, protection of the environment and support of the closure mission. Maintenance is carried out by qualified maintainers.

Preventative maintenance of safety-related systems in WL's nuclear facilities is carried out in accordance with each facility's Facility Maintenance Plan, and approved maintenance procedures. Preventative Maintenance is defined as the pre-planned routine testing, calibration, inspection, service, and overhaul of safety-related systems, structures, and components. Preventative maintenance is performed to prevent failures from occurring and to assure the continuing capability of the system, structure or component to perform its design function. The maintenance tasks and frequencies specified in the Facility Maintenance Plans are based on recommendations from qualified WL engineering and maintenance personnel, plus vendor's data where available. Corrective maintenance follows the same process but is undertaken when a system, structure or component is not performing its design function. Maintenance functions are planned and tracked in the site maintenance database.

Operations personnel perform functional checks of systems and alarms within the facilities to ensure systems required to operate are functioning correctly. This includes a regime of daily, weekly, monthly, quarterly, semi-annual and annual checks as described in operating procedures. Regular housekeeping inspections are also part of this process and housekeeping checks are done monthly. Deficiencies from these inspections are corrected by Operations personnel or requests are submitted through the site planning and maintenance group for items requiring corrective maintenance.

Under the long-term Environmental Assessment Follow-up Program (see Section 12), concrete waste storage structures (bunkers) are assessed under a Periodic Inspection Plan (PIP), which was implemented to confirm their ongoing fitness-for-service. The PIP describes methods for conducting scheduled inspection surveys of these facilities. The inspection is defined as examination, measurement and testing work done to ensure the bunker systems are functioning as designed and the bunkers remain fit-for-service. The inspections are documented annually, with preventative maintenance and repairs occurring as needed.

9.1 Performance Since 2009 Licence Renewal

Preventative and corrective maintenance continued to be performed. Preventative maintenance was optimized by ensuring systems that were under this program were those required for nuclear safety, personnel safety, compliance, operational need and environmental

protection. Historic systems no longer required for these functions were removed from the preventative schedule to allow resources to focus on those systems required. Preventative or corrective maintenance and testing of WL's safety-related systems were carried out to ensure the systems were fit-for-service. Situations where there is evidence of deteriorating conditions or suggestions of an increased probability of upcoming failure are addressed as they are identified through the WL work request system. Housekeeping inspections have continued and deficiencies continue to be corrected. The results of housekeeping inspections are now filed through the ActionWay Impact system with actions submitted to track items requiring correction.

The annual inspections of WL WMA concrete bunkers are conducted in accordance with the PIP, and repair items are identified, tracked through the WL work request system, and completed. Additionally, quarterly inspections of the Concrete Canister Storage Facility take place, and have shown no significant cracking or spallation. As with the WMA concrete bunkers, preventative maintenance and repairs are performed as required.

9.2 Plans for the Next Licence Period

Preventative and corrective maintenance will continue to be performed. As systems and structures are decommissioned, they are removed from service and preventative maintenance items are scrubbed from the system. Facility Maintenance Plan updates remain on a five year review cycle.

Fitness-for-service programs, including alarm testing and housekeeping inspections, will continue for site facilities to ensure operability until the facilities are decommissioned (all facilities will be decommissioned during the next licence period). For waste structure inspections under PIP, as bunkers at the WMA are removed from service as part of the overall decommissioning of the WL site, they will be removed from the inspection process.

10. SAFETY AND CONTROL AREA - RADIATION PROTECTION

The Radiation Protection (RP) Program applies to operations and activities that affect the safety of staff and equipment in terms of exposure to ionizing radiation at all CNL sites, including WL, and applies to all employees and other personnel (e.g., visitors, contract staff) conducting work at CNL sites. CNL's Dosimetry services are licensed by the CNSC via a separate licence.

The overall objective of the RP Program is to protect workers and the 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 Control Act and the CNSC Regulations. The program provides an overall framework, including organization and responsibilities, processes and procedures, and other related activities as it relates to radiation protection.

10.1 Performance Since 2009 Licence Renewal

CNL's RP Program was monitored and improved as necessary to ensure that CNL's radiation safety complied with or exceeded the requirements specified in the Nuclear Safety and Control Act [7] and the associated Radiation Protection Regulations [11].

A new Radiation Protection Program Requirements document was issued in 2017 and RP program procedural documents were updated in 2017 and 2018 to align with the new Management System at CNL. CNSC staff were provided with the updates, including an associated governing document index that provides a mapping of the documents.

Radiation protection training continued to be provided during the licence period. Training included initial and refresher training, and field check-outs. In 2014, revised Group 3 training based on the CNL's SAT was implemented. The Group 3 training was streamlined from a five-day course to a three-day course, to more effectively train employees to the level of required knowledge. In 2015, Group 2 training for laboratory personnel was updated to reflect current RP Program procedures for handling of radionuclides in laboratories.

Figure 10-1 : Radiation Surveyor in Personal Protective Clothing.

In 2017, a business decision was made to transfer the majority of WL Dosimetry service activities to CRL Dosimetry. WL procedures and processes were updated into 2018 to reflect the change of provider. Whole body counting remains the only internal dosimetry monitoring performed at WL. One Thermoluminescent Dosimeter (TLD) reader was retained for experimental and supplementary dosimetry, with any data acquired being intended for Radiation Protection (RP) control purposes and not for official assignment of doses.

The planning of radiological work has been integrated into the WL site work control and planning process. Health Physics and RP staff are engaged in the provision of radiological safety and ALARA assessments, providing authoritative advice regarding radiation protection matters, preparing radiological safe work documents, providing oversight of the execution of radiation work and in the planning and conduct of radiological clearance surveys. RP improvement initiatives completed during the current licence period included:

- A simplified and field friendly radiological hazard and precaution sheet was developed and implemented to communicate RP hazards and controls to work teams.
- Standard radiological safety assessment models and gamma dose rate tables were developed and are being used for the decommissioning of contaminated piping, tanks and ductwork.

- Optimal methods for the use of immobilizing agents and cutting methods were investigated and implemented to minimize worker exposure time and minimize contamination dispersion during removal of highly contaminated piping.
- Streamlined and standardized processes and procedures were implemented for the planning, execution, evaluation and documenting radiological clearance surveys for buildings and lands.
- Contamination clearance levels used for WL decommissioning were formally documented.

Successful implementation of the RP program has ensured WL's continued operation in compliance with CNSC regulations with no regulatory limits or Action Levels being exceeded during the licence period and individual and collective doses remaining ALARA. Through the use of the CNL management system and ImpAct reporting process, issues were identified, reported, and resolved in a timely manner. Weekly and quarterly RP performance reviews are undertaken to identify performance trends and track program corrective actions and improvement initiatives.

Figure 10-2 : Surveying a Decommissioned Room for Radioactive Contamination.

An updated version of the *Whiteshell Laboratories Source Term* report was issued in 2017 to document the current radiological source terms of nuclear facilities at WL and the calculation of on-site and off-site radiation doses to individuals resulting from hypothetical, accidental releases of radioactive materials, in light of the continuing decommissioning of these nuclear facilities.

CNL has submitted to CNSC staff a review of WL's Action Levels, recommending Action Levels for the site for activities to be carried out in the next licensing period. Following feedback and discussion with CNSC staff, action levels have been finalized in a revised submission and will be reviewed on an annual basis to confirm they are remaining valid and meaningful.

10.2 Occupational Radiation Exposure Action Levels

The RP Program has been effective in maintaining low radiation exposures during WL decommissioning activities. During the current licence period, no worker at WL received a dose (delivered plus committed) in excess of any of the respective dose limits for radiation workers, as defined in the Radiation Protection Regulations [11] or a dose exceeding an action level defined in the WL licence. All workers and contractors at WL who had a reasonable probability to receive annual doses approaching or exceeding 1 mSv were designated Nuclear Energy Workers. Radiation doses to members of the public did not exceed the annual dose limit of 1 mSv in a year for the most exposed members of the public. The maximum individual external whole body dose for WL has remained at less than the WL action level of 6 mSv for every year during the current licence period. There were no internal radiation exposures exceeding the WL action level of 1 mSv committed effective dose.

Over the current licence period, there has been a general downward trend in whole-body doses from 2009 to 2016, with doses increasing in 2017 (see Table 10-1). Worker doses during the licence period were highest in 2018 with the highest individual dose being 1.65 mSv, and with a site collective dose of 40 person·mSv. The increases in average, individual and collective doses in 2017 and 2018 were due to radiological characterization and decommissioning activities in the ALWTC, radiological characterization work in WR-1, remote manipulator repair work in the SF, and open air inspections in the CCSF. Good work planning, the use of personal alarming dosimeters when appropriate, and a unified team focus minimized exposure times and doses received for higher dose activities.

Table 10-1
Whole Body Dose Statistics for WL Workers During Current Licence Period

Dose Statistic	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Average Whole Body Dose (mSv/yr)*	0.06	0.03	0.03	0.05	0.02	0.02	0.04	0.02	0.03	0.07
Largest Individual Whole Body Annual Dose (mSv/yr)	1.35	0.89	1.12	1.07	0.80	0.65	0.42	0.36	1.41	1.65
Collective Dose (Person-mSv)	46	23	23	34	20	15	28	16	20	40

* CNL/WL Action Level is 6 mSv per year.

External surface doses (skin doses) and extremity doses are provided in Table 10-2 and Table 10-3, with the variability due to the type of decommissioning activities performed in a

given year. The significant increase in extremity doses in 2018 was due to a combination of decommissioning activities in the ALWTC and manipulator repair in the SF.

Table 10-2
External Surface (Skin) Dose Statistics for WL Workers During Current Licence Period

Dose Statistic	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Average Surface Dose (mSv/yr)*	0.08	0.03	0.03	0.07	0.03	0.02	0.04	0.02	0.05	0.12
Largest Individual Annual Surface Dose (mSv/yr)	4.1	1.2	1.2	3.97	1.27	1.63	0.65	0.36	2.90	3.72
Collective Dose (Person-mSv)	60	24	26	52	22	19	29	16	30	71

* CNL/WL Action Level is 60 mSv per year.

Table 10-3
Extremity Dose Statistics for WL Workers During Current Licence Period

Dose Statistic	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Average Extremity Dose (mSv/yr)*	1.2	0.4	0.38	1.00	0.19	0.36	0.09	0.05	1.51	5.02
Largest Individual Annual Extremity Dose (mSv/yr)	6.2	1.8	1.9	4.28	0.70	1.25	0.72	0.11	11.35	36.71
Collective Dose (Person-mSv)	45	11	13	34	2	3	1	0.2	27	226

* CNL/WL Action Level is 100 mSv per dosimetry monitoring period.

10.3 Plans for the Next Licence Period

Planned changes and improvements in the provision of radiation protection at WL during the next licensing period include:

- Reduction of radiological controlled areas to optimize provisions of RP controls, monitoring and resources to the decommissioning of remaining nuclear facilities.
- Development of an open air demolition radiological dispersion model, acceptance criteria and enhanced air monitoring program for nuclear building demolition.
- Introduction of gamma walk-thru monitors to provide reassurance of appropriate personnel monitoring prior to leaving WMA and main site.
- Acquisition and use of enhanced nuclear industry Personal Protective Clothing and Equipment (PPC&E) options such as air pressurized suits.
- Evaluation and employment of telescoping radiation detectors, high-range probes, and remote monitoring methods of measuring radiation fields.
- Evaluation and employment of remote handling techniques for the retrieval and packaging of intermediate level radioactive waste from the WMA standpipes/bunkers.

WL will continue to review, assess and acquire (as appropriate) new and updated RP equipment

over the duration of the licence period.

In addition to the actions and initiatives already tracked through CNL's ImpAct and ActionWay processes, the RP Program will continue to update documentation in the radiation protection requirements document and the RP manuals in response to changes in future work planned at WL and changes in regulatory requirements.

As all buildings and facilities are planned to be decommissioned, WL will continue to re-evaluate the radiological source term hazard in these areas to ensure that protection is optimized and exposures remain ALARA during the new licencing period. In particular, two initiatives are being explored to optimise the provision of radiation protection and contamination control as WL nuclear buildings are decommissioned and the site source terms are reduced. The first is the size reduction of the site radiological areas to ensure optimum radiation safety is maintained, and the second is a corresponding review of ongoing site dosimetry requirements.

11. SAFETY AND CONTROL AREA - CONVENTIONAL HEALTH AND SAFETY

CNL's Occupational Safety and Health (OSH) Program applies to all work performed by CNL employees, including WL, and to work performed by others on sites or work places controlled by CNL. Contractors hired by CNL/WL fall under the Manitoba Provincial Health & Safety Regulations, however CNL OSH still provides oversight when on CNL property and are governed by the CNL work permit process.

The scope of the OSH Program includes the processes for the management of hazards to health and safety of employees and other persons at CNL sites and workplaces. The purpose of the program is to prevent accidents and injuries 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. WL continues to be proactive in the approach to safety.

11.1 Performance Since 2009 Licence Renewal

An Information Technology software solution was implemented to support Workplace Hazardous Materials Information System-2015 (WHMIS-2015), and manage chemical inventories. In 2018, CNL implemented the Material Safety Data Sheets (MSDS) application – MSDSonline to provide all staff with access to chemical safety information as part of WHMIS-2015.

There has been an improving trend in the recordable lost-time accident frequency and severity for activities by CNL employees at the WL site (see Table 11-1). The main injuries at WL have historically been due to strains (e.g., the back), being struck by/struck against, and slips, trips and falls. Efforts towards prevention of these and other injuries include hazard recognition, protective measures such as safe lifting techniques, proper hand protection, and increased attention to guarding rotating pump shafts and pulleys.

Increased OSH presence in the field continued at pre-job briefings, walkdowns and daily work plan meetings, together with early involvement in the planning process and increased contractor oversight. These have contributed to WL's internal safety success. WL continued to participate in the CNL Rapid Learning Morning Call to quickly share safety information with all CNL sites, as well as gather safety information relevant for the WL site. Several OSH training courses originally provided by external resources have been brought in-house at WL (e.g., Overhead Crane and Forklift Training, Spotter Training, and Basic Spill Response Training), enhancing WL's ability to provide required training in a timely manner. A dedicated walkway program was initiated prior to the 2016 winter season, and a traffic safety campaign was held, focussing on the site access roadway and main parking lot speed limits. A Near-Miss Reporting initiative (a known industry best practice, with a focus on early hazard recognition and a strong situational awareness culture, supporting the minimization or elimination of hazards prior to resulting in injury) was initiated and is continuing at WL, including specifically defining what constitutes a near miss.

Table 11-1
Summary of WL Injury Rate Data

Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Person-Hours Worked	n/a[1]	n/a[1]	744,000	778,875	860,250	883,500	741,000	684,450	706,000	688,000
Lost-Time injuries	5	7	8	5	7	4	0	1	3	1
Working Days Lost	27	39	49	36	62	54	0	5	27	5
Lost-Time Frequency[2]	1.6	2.0	2.1	1.2	1.6	0.90	0	0.29	0.85	0.28
Lost-Time Severity[3]	8.5	12.2	13.1	9.2	14.4	12.2	0	1.46	7.67	1.45

1 Not available
2 Frequency rate equals # of Lost-Time Injuries x 200 000 hrs of exposure divided by person hours worked (based on 100 Full Time workers).
3 Severity rate equals # of Working Days Lost x 200 000 hrs of exposure divided by person hours worked (based on 100 Full Time workers).

Improvement actions continued to strengthen usability and accountability of OSH processes (e.g., Working at Heights, Hazardous Energy Control, Ergonomics, Job Safety Analysis). The WL Health Centre continues to support effective oversight by management of the return-to-work component of the Workers Compensation Program.

Revisions of the disability management and return-to-work programs were performed during 2015, and a third-party service provider has been contracted to support the disability management process for non-occupational illnesses and injuries.

CNL continues to actively promote its third-party Employee and Family Assistance program, and provides this service to support employee health and wellness.

11.2 WL Site Safety and Health Committee

The WL Site Safety and Health Committee is the principal forum at WL for joint employee/ management consultation and development of solutions for safety and health concerns at the WL site. Activities conducted by the committee include the inspection of all WL work locations and participation in incident investigations.

11.3 Health and Safety Policy Committee

CNL has a corporate Health and Safety Policy Committee that meets on a quarterly basis. The committee is the principal corporate-wide forum for joint employee/management consultation for the development of health and safety policies for CNL sites.

11.4 Plans for the Next Licence Period

Over the next licence period, the plans include:

- Occupational safety and health processes integrated as a requirement in all planning cycles.

- Enhance methods by which accurate contractor safety performance information is collected and evaluated, and use this information as an input for future procurement decisions.

12. SAFETY AND CONTROL AREA - ENVIRONMENTAL PROTECTION

CNL's 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.

Environmental performance at WL is assessed through an integrated Monitoring Program which is comprised of three components: effluent, environmental, and groundwater monitoring (see, for example, Figure 12-1 and Figure 12-2). Together, these three components comprise contaminant pathway monitoring at WL, enabling the tracking of contaminants throughout the different compartments of the geosphere 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.

Figure 12-1 : Collecting Groundwater Samples

12.1 Performance Since 2009 Licence Renewal

In 2016, revisions were made to the *Administrative Levels and Action Levels for WL Air and Liquid Radioactive Effluents* and *Derived Release Limits (DRLs) for AECL's (CNL's) Whiteshell Laboratories* program documentation. The CNSC reviewed and accepted the revised DRLs (which are based on CSA N288.1-08 [12]). Program documentation has been, and is being, updated to align with CSA N288.4, CSA N288.5, CSA N288.7 and CSA N288.8. Other documents are updated on an ongoing and/or as required basis.

Monitoring results verified that the levels of radiation and radioactive contaminants in the environment outside the WL site due to operations at the site remained low throughout the licence period (see Table 12-1). The radiation doses to members of the public did not approach the annual regulatory dose limit of 1 mSv per year for the most exposed members of the public. In fact, the dose to the public due to the sum of all releases from WL did not exceed 2E-03 mSv in any given year during the current licence period.

Radiological effluent monitoring results (both liquid and airborne effluents) over the span of the current licence period show that effluents are small percentages of the WL DRLs, and that both effluents are decreasing with time, as shown in Table 12-2. Airborne dust monitoring was performed for building demolitions, demonstrating that throughout the licence period, radioactivity concentrations in air were at background levels, and well below the alert levels of 0.03 Bq/m^3 gross alpha and 10 Bq/m^3 gross beta. All emissions of radioactive material from WL throughout the licence period were below CNL's Administrative Levels and Action Levels. The steady decrease in liquid emissions over the licence period is due, in part, to process changes in the laundry facility, as well as moving to non-water-based decontamination techniques. Note that data are reported against the revised DRLs that were approved in 2016.

Table 12-1 Total Estimated Doses to Critical Groups, Based on Environmental Monitoring at Whiteshell Laboratories, 2009 to 2018

Effluent Pathways	Airborne	Liquid
Critical Group	Adults and Infants Living at Boundary	Adult Living Downstream
2009 Total Effective Dose (mSv/a)	5 E-06	1.7 E-04
2010 Total Effective Dose (mSv/a)	6 E-06	1.8 E-03
2011 Total Effective Dose (mSv/a)	5 E-06	6.5 E-04
2012 Total Effective Dose (mSv/a)	8 E-06	1.0 E-04
2013 Total Effective Dose (mSv/a)	4 E-06	2.8 E-04
2014 Total Effective Dose (mSv/a)	4 E-06	1.4 E-03
2015 Total Effective Dose (mSv/a)	6 E-06	4.2 E-05
2016 Total Effective Dose (mSv/a)	2 E-06	7.5 E-05
2017 Total Effective Dose (mSv/a)	2 E-06	4.8 E-05
2018 Total Effective Dose (mSv/a)	1.6 E-06	3.6 E-05
As % of annual public dose limit (1 mSv).	1.6 E-04	3.6 E-03
As % of typical average background radiation dose in Canada (3.3 mSv).	5 E-05	1.1 E-03

Table 12-2 Summary of Radionuclides in Airborne and Liquid Effluents from WL

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Airborne Emissions as % DRL*	2.70E-04	3.70E-04	3.11E-04	4.10E-04	1.75E-04	2.49E-04	2.87E-04	2.02E-04	2.25E-04	1.64E-04
Liquid Emissions as %DRL*	1.27E00	1.04E00	8.66E-01	1.18E00	9.46E-01	4.19E-01	3.44E-01	3.93E-01	2.61E-01	3.79E-01

* These data are reported against the revised DRLs that were approved in 2016.

Figure 12-2 : Environmental Monitoring Fieldwork

Liquid effluents from WL are also monitored for non-radioactive contaminants in order to measure conformance with CNL's internal guidelines for chemical substances in liquid effluents. The federal requirements for the total residual chlorine in wastewater come into force in 2021 for WL's sewage lagoon. The site's chlorination practices have been adjusted over the last few years, to meet the proposed limit (0.020 mg/L).

Non-radiological monitoring results of liquid effluents and groundwater have been consistent over the licence period and verified that levels of non-radiological contaminant releases from operations at the WL site did not negatively affect the quality of water on-site or on the local environment.

Non-radiological emissions to air (greenhouse gases) dropped significantly, starting in 2013 with the conversion from centralized, fuel oil heating operations to localized electrical or propane heating (and the continuing shut down and demolition of site buildings).

Ongoing identification of Species at Risk on the WL site occurred over the licensing period, such as passive, acoustic songbird and bat recording studies as well as field sightings identification for a wide range of species. The site complies with the Species at Risk Act and the Migratory Bird Act throughout daily operations. An alternative habitat project was completed in 2018 in order to provide barn swallows (which nest on man-made structures) with an alternative nesting spot as buildings are removed on the WL site (e.g., see Figure 12-3).

Figure 12-3: Alternative habitat to replace demolished buildings for barn swallows (a species at risk)

All airborne and liquid effluent monitoring results for the current licence period are consistent with the cleanup and operational activities associated with decommissioning of the site, and indicate that CNL has taken reasonable precautions to control the release of radioactive nuclear substances within the site, and into the environment, as a result of the licensed activity. The results of the monitoring program also demonstrate that controls for the release of potentially hazardous substances currently in place at WL continue to provide substantial protection of the environment.

Following acceptance by the Canadian Government in 2002 of the CSR on the decommissioning of Whiteshell Laboratories, and the subsequent issuing by the CNSC of a decommissioning licence for WL, an Environmental Assessment Follow-Up Program (EAFP) was implemented. The targets for the EAFP have been achieved every year, and results are documented in an annual report to the CNSC. The information collected through the EAFP is being used to help verify the accuracy of the pre-decommissioning Environmental Assessment and confirm that appropriate mitigation measures are taken. In addition, the results assist in development of appropriate responses should unforeseen events occur, and identify effects from the project that may not have been predicted.

Overall, the environmental impact of decommissioning to date can be characterized as low, in that the potential for human or ecological impact is low, and overall trending indicates stable performance, with no cases of widespread degrading condition.

12.2 Certifications/Audits/Inspections

The WL Environmental Management System is registered to International Standards Organization (ISO) 14001:2015 [13]. As an ISO 14001 certified site, WL has gone through annual Environmental Management System audits. These annual audits are required to verify the effectiveness of the system and to strive for continual improvement of CNL's environmental performance. The WL site has maintained its ISO-14001 registration since initial registration in 2010. Additionally, regular evaluations of compliance to environmental legal requirements are carried out.

12.3 Plans for the Next Licence Period

Over the next licence period, improvements in the WL Environmental Protection Program will be gained through the implementation of:

- CSA N288.4-10, Environmental Monitoring Programs at Class I Nuclear Facilities and Uranium Mines and Mills [14]; and
- CSA N288.5-11, Effluent Monitoring Programs at Class I Nuclear Facilities and Uranium Mines and Mills [15];
- CSA N288.6-12, Environmental Risk Assessment at Class I Nuclear Facilities and Uranium Mines and Mills [16];
- CSA N288.7-15, Groundwater Protection Programs at Class I Nuclear Facilities and Uranium Mines and Mills [17]; and
- CSA N288.8-17, Establishing and Implementing Action Levels for Releases to the Environment from Nuclear Facilities [18].

Improvements to the WL Environmental Protection Program will be gained through continued certification to the ISO 14001:2015, Environmental Management System [13].

The federal requirements for the total residual chlorine in wastewater come into force in 2021 for CNL's lagoon. WL will continue to adjust the site's chlorination practices to meet the new requirements.

13. SAFETY AND CONTROL AREA - EMERGENCY MANAGEMENT AND FIRE PROTECTION

The Emergency Preparedness (EmP) Program consists of preparedness and response elements to ensure that plans, procedures, and resources are in place to manage on-site and off-site emergencies. Drills, exercises, and training (see Figure 13-1) are scheduled each year to test and improve the on-site and off-site emergency response capabilities and organizational structures. The program supports local, provincial, and federal emergency response as required through assistant agreements and as directed through the federal government of Canada.

Figure 13-1 : Fire Protection Training Drill

The Fire Protection Program applies a risk-graded approach in conjunction with the defence-in-depth principles to site operations and activities insofar as they may affect fire protection. Through the incorporation of fire prevention and protection procedures, the Fire Protection Program continues to reduce fire probability and the risk to life safety, conservation of assets, the protection of the environment, and the continuity of operations.

The WL Emergency Services Operations Branch fulfills the Emergency Preparedness and Fire Protection requirements at WL, as well as the Security Program requirements.

13.1 Emergency Preparedness

13.1.1 Performance Since 2009 Licence Renewal

The Emergency Operations Centre (EOC) at WL was not activated in the licence period.

Highlights of the EmP Program include:

- The EmP Program completes drills and exercises annually, in accordance with the WL five-year drill and exercise plan. All required annual drills and exercises were completed during the licence period as per schedule, except for a major exercise scheduled for 2012 that was deferred to and completed in 2013. Drill and exercise topics include fires, active threats, hazardous goods events (e.g., PCBs, chlorine, fuel), radiation events, transportation accidents involving radiological materials, and stay-ins.
- A gap analysis was performed in 2016 against REGDOC-2.10.1, *Nuclear Emergency Preparedness and Response* [19], as requested by the CNSC. Corrective actions were agreed upon by WL and the CNSC, and have been completed.
- All plans and procedures have been reviewed and updated as required. Emergency preparedness documentation is on a three year formal review and update schedule, with an informal review required annually. When significant changes are identified during informal reviews, a formal review and update is required.
- The WL Source Term Report was revised. This report is in support of emergency preparedness planning at WL, and documents the current radiological source terms of nuclear facilities in WL and the calculation of on-site and off-site radiation doses to individuals resulting from a hypothetical, accidental release of radioactive material. Intervention levels and dose risk criteria are provided for the provision of countermeasures and taking protective actions to minimize radiological doses from an accidental release. Based on the analysis documented in this report, there should no longer be a radiological requirement to have a site stay-in siren for the main campus. The WL Site Emergency Plan was then revised, removing the radiological requirements for the site stay-in siren, and accepted by CNSC staff.
- The WL site still employs the exterior siren, but only as a redundant form of emergency alerting. The site-wide Public Address system, using a tone generator system, is the primary alerting system. These site emergency signals are being maintained to support other non-radiological emergency potentials at Whiteshell.

The CNL/WL relationship with the RCMP continues to be cultivated. RCMP staff have come to the site for familiarisation tours and have been included in several joint training exercises. WL has hosted the RCMP - D Division Emergency Response Team, Explosive Disposal Unit and National Security Enforcement Section several times in 2017 and 2018 (see Figure 15-1 in the discussion regarding the SCA on Security). WL continues to offer up decommissioned buildings to these teams for training prior to their demolition. Whenever RCMP staffing permits, these groups are included in WL's security-oriented scenarios, enhancing realism for CNL staff and providing opportunities to practice integration. This ongoing training continues to increases RCMP knowledge and comfort with the WL site and site operations.

Improvements in EmP Program include:

- WL implemented a new organizational Emergency Operations Centre (EOC) and Incident Management framework in 2015. This framework is consistent with the industry standard Incident Command System (ICS) which has been adopted by most Canadian provinces and all across the USA. This framework ensures closer alignment between CNL EOCs, as well as with external agencies that have adopted the principles of the Incident Command System for emergency management. Implementation of this model necessitated the creation of new EOC positions and selection of staff to fill these roles. Two teams were established and training was delivered that brought the EOC staff members up to the new standard. The two EOC teams operate on a two week on-call rotation, augmented with an additional team. This “Alternate” team does not participate in the on-call rotation, but participates in EOC exercises and training to ensure they are prepared to fill in for either team during prolonged events, due to unexpected absentee members during an activation, or in the event of a retirement or departure from WL. EOC skills development and training is ongoing with multiple workshops and exercises run each year to support a continuous learning cycle.
- Whiteshell Laboratories was provided a fully stocked Mobile Nuclear Laboratory (MNL), maintained by WL Radiation Protection and Environmental Monitoring emergency staff, on behalf of the federal Chemical, Biological, Radiological-Nuclear, and Explosives Research and Technology Initiative headed up by Health Canada. The MNL was used at Canadian Forces Base (CFB) Suffield, Alberta, in 2012 for a Defence Research and Development Canada (DRDC) exercise involving a planned release of short-lived radionuclides. The exercise was to determine how a radioactive plume would react if released during a terrorist attack. The exercise gave the national team an opportunity to monitor how the activity spread through the air with a known wind direction. Three personnel from WL participated in this exercise. The ownership of the MNL hasis now been turned over to AECL/CNL and is no longer part of a federal response plan. The MNL and its equipment are maintained in a state of readiness to respond to any off-site emergencies that WL may be called upon to support. Due to the current and planned increase in radioactive shipping activities, WL conducted a full assessment of the ability of the MNL to respond to off-site incidents in 2018, ensuring current equipment is appropriate for potential tasks.
- An improvement made to the EOC at WL was a live video feed from the top of the WR-1 reactor ventilation exhaust stack, allowing for Emergency Operations Centre and Security Monitoring Room personnel to monitor emergencies around the site.
- WL re-instated the Officer-In-Charge (OIC) and Emergency Steward (ES) program that was historically used at WL. All occupied buildings were assigned Building Emergency Teams by the Facility Managers. The Teams consist of primary and alternate members. The resurrection of the OIC and ES program necessitated the delivery of several training sessions for these positions. All assigned members receive training within their first

year in the position. These roles and their procedures have been incorporated into the annual drill and exercise schedule.

- The WL site has adopted the use of the Everbridge Mass Notification System for use in notifying and activating the EOC teams and off-duty ESO members during an emergency. This system, which was first implemented by CRL, is a software system that allows EOC staff to be notified simultaneously on multiple devices that there is an emergency event. The increased speed and reach of this system has demonstrated improved response times and response statistics during the monthly test of the system through EOC call-out drills.

13.1.2 Plans for the Next Licence Period

The emergency preparedness program will continue to be implemented, revised, and prioritized as the needs of the site evolve. Major activities will address the following:

- Implementation of an all hazards, risk-based emergency management framework versus the previous design-based program, through the utilization of a hazard identification and risk assessment study.
- Training in, and enhancement of, the response capabilities of the WL staff to a variety of emergency events, developed in accordance with the hazard identification and risk assessment study, to ensure a prompt and efficient response to emergency events at WL.
- The 'Hazard Identification and Risk Assessment' process identifies risks to the site for all potential hazards, and also is applied at the facility level to determine what additional risks exist or could be magnified due to an external hazard occurring, that could potentially result in an emergency. The identified risks place a clear emphasis on areas that require a focus on planning, preventative/mitigative measures, training and drills/exercises.
- Increased engagement of off-site response groups in on-site and off-site emergency scenarios to further enhance WL's and its partner agencies' level of preparedness for potential emergency events. These training scenarios will be tailored to match the evolving risks at WL, including the handling and shipment of radiological materials.

13.2 Fire Protection

13.2.1 Performance Since 2009 Licence Renewal

General fire protection services capable of providing fire suppression response to mitigate loss-of-life and property damage are provided 24 hours per day, 7 days per week to meet the requirements of *Fire Protection for Facilities that Process, Handle, or Store Nuclear Substances,* (CSA N393-2013) [21], by the WL Emergency Services Operations personnel. Through the incorporation of fire prevention and protection procedures, the Fire Protection Program continued to reduce risk to life safety, conservation of assets, the protection of the

environment, and the continuity of operations. Firefighting equipment and components (e.g., portable extinguishers, fire water supply system, hydrants, and automatic sprinklers) are kept ready and functional at all times.

Third-party reviews are conducted on inspections, testing and maintenance operations and practices of WL facilities to ensure compliance with the National Fire Code (2010 edition) [20] and CSA N393-13 [21].

Some of the major improvements and achievements since licence renewal in 2009 for fire protection are:

- A gap analysis was performed against the operational requirements of CSA N393-13 [21], as requested by the CNSC. A corrective action plan to address the gaps identified was developed and implemented.
- Paired monthly building inspections were implemented to educate building personnel and to immediately resolve non-conformances when possible.
- A fire fighter physical fitness program was implemented.
- Fire hazard assessments were completed for all nuclear facilities and associated nuclear facilities.
- A modern (state-of-the-art) fire alarm and detection system was installed site-wide.

13.2.2 Plans for the Next Licence Period

Throughout the next licence period the Fire Protection Program will continue to manage fire risk using a defence-in-depth process that supports safe and efficient decommissioning/ operational activities. Fire risk at WL will continue to be reduced with the implementation of CSA N393-13 [21], fire hazard assessment actions, fire hazard assessment revisions, the accelerated decommissioning of buildings, and ongoing oversight provided by monthly building inspections. As per CSA N393-13, the third party review of inspections, testing and maintenance will be rescheduled from two years to the new requirement of three years.

14. SAFETY AND CONTROL AREA - WASTE MANAGEMENT

The Waste Management program provides oversight, compliance, and services for waste management, supporting all waste generators to meet strategic priorities for all phases of the waste management lifecycle, and associated business needs.

CNL is enhancing management of waste in order to have a truly integrated strategy across the company. The Waste Management Program continued to refine and communicate the CNL Integrated Waste Strategy (IWS) to integrate waste lifecycle management across all CNL-operated sites, and to capture the CNL baseline waste strategies and defined pathways for all CNL wastes. CNL is taking a holistic view to manage the volumes of waste in an efficient and safe manner, and has produced a CNL lifecycle waste forecast.

CNL will continue to provide waste processing and storage services that protect the environment, comply with regulations, and assure health, safety and security for future generations of Canadians. This will ensure the continued availability of waste storage facilities, capability for waste generated at WL and stored temporarily at WL, and for receiving waste from WL at the CRL site.

14.1 Performance Since 2009 Licence Renewal

The following are major achievements and improvements made in the Waste Management Program since licence renewal in 2009:

- There was a significant change to the organizational structure at WL, starting in 2016. A new division (WL Waste Management) was developed as the centralized organization to implement and maintain the site-wide Waste Management Program. The WL Waste Management division has subsequently transitioned from a strategy development stage to a work execution stage.
- Completed construction and put into operation a SMAGS building at the WMA in 2012. The SMAGS building stored LLW and some ILW (that meets the SMAGS Waste Acceptance Criteria (WAC)) from 2012 to 2018. Subsequently, in 2018, efforts began to reduce the legacy waste inventory stored in SMAGS , in preparation for transitioning the building into a Cask Loading Facility for radioactive waste generated as part of the standpipe and bunker remediation project.
- The Waste Clearance Facility, located in Building 304, was put into operation. It is a control point for likely clean waste generated at the WL site. Waste material is dispositioned in accordance with appropriate documented criteria for the purpose of recycling, reuse or disposal.
- Decommissioning activities at WL generate large volumes of radioactive waste. To reduce the waste storage requirements, compactable waste can be put through a volume reduction process. The wastes are compacted, then assayed for radioactivity. These activities are being carried out in the Waste Handling Area, located in the

Shielded Facilities. For example, in 2018, 166.1 m³ of compactable waste was compacted to a volume of 25.0 m³.

- The removal of buried intermediate-level liquid waste drain lines running between the SF and Building 200 was completed, which generated 3.36 m³ of likely clean solid waste (from 850 m of uncontaminated drain line piping), 3.51 m³ of low-level solid radioactive waste and 0.72 m³ of intermediate-level solid radioactive waste (from 425 m of contaminated drain lines). The contaminated waste is packaged in certified transportation packages awaiting disposition to CRL.
- A waste minimization activity for the site was the setting up of "Recycling Stations" at WL to encourage employees to reduce waste that would go to the WL landfill.
- Demolition of Building 408 Central Stores and Receiving and Building 415 Warm Storage was completed in 2018, generating a total of 6,341 m³ of clearable waste; 1,600 m³ of this waste was recycled, while 3,700 m³ waste, consisting of hydrocarbon-contaminated soil and asbestos-containing building debris, was safely dispositioned to an off-site waste receiver. The remaining waste was either used as fill (e.g., concrete rubble), or went to the WL landfill.
- In 2015, approximately 34 Mg of radioactively contaminated lead was shipped to an off-site mixed waste processing facility, plus an additional 18 Mg in 2017, to be melted for re-use in the nuclear industry.
- By the end of 2017, 1500 m^3 of contaminated soil (LLW) from the former experimental Cesium Pond was safely transported to CRL, with the remaining 866 m^3 shipped in 2018, in addition to 252 m³ of contaminated building debris from the demolition of the WL Decontamination Centre (Building 411) in 2017. A shipment of over sixty redundant radioactive sources, and twenty drums of cemented waste from historic fuel reprocessing experiments were also transported to CRL for storage. A total of 346.8 m³ of an estimated 1,100 m³ of stored, radioactive waste from SMAGS was transported to CRL during 2018, with the remainder scheduled to be shipped in 2019. Collaborative efforts between WL and CRL personnel enabled successful campaigns of qualification and inspection of waste contents to ensure transportation and waste acceptance criteria compliance was met.
- In 2016, 368 Mg of recyclable waste was shipped off site, with another 144 Mg in 2017 and 272 Mg in 2018.
- Starting in 2013, ILLW ceased to be stored at the ALWTC. In 2013, the contents of the ALWTC's ILLW tank was pumped into road-transportable containers and a shipment of this liquid was sent to an offsite processing facility for volume reduction. The remaining liquid is stored in road-transportable containers (5400 L) at the WMA.

14.2 Plans for the Next Licence Period

The Waste Management group at WL will continue to ensure that waste generated on site is dealt with safely and appropriately. This will include the following:

- Working with the Waste Management Program at CRL, the Integrated Waste Strategy will be implemented for all WL waste.
- Designing and constructing an ILLW treatment system primarily to process liquid waste from the decommissioning of the Standpipes and ILW Bunkers, and the ILLW in storage in road-transportable totes.
- Providing disposition solutions for WL waste liabilities. With the exception of the in situ decommissioning of the WR-1 reactor and LLW trenches, all other waste generated from the operational phase of WL or from the decommissioning of the WL site will need to be packaged and readied for transportation to approved off-site facilities (primarily CRL for radioactive wastes). This includes LLW, ILW, HLW, non-radioactive hazardous waste and mixed waste.

14.3 Financial Guarantee

CNL understands the requirement for an acceptable financial guarantee and cost estimate for decommissioning the WL site. While ownership of CNL has transferred to the CNEA, 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 [22], as per the current WL LCH, Sections 1.5 and 13.2. An associated cost estimate for decommissioning WL was submitted to CNSC staff in 2018, and will be updated in 2019.

15. SAFETY AND CONTROL AREA – SECURITY

The CNL Security Program[6] implements CNL's Security Policy within CNL operating sites in Canada, and ensures compliance with applicable legal and other requirements. The WL Emergency Services Operations Branch fulfills both the Security Program and Fire Protection requirements at WL (see Section 13).

15.1 Performance Since 2009 Licence Renewal

WL Emergency Services Operations carries out biennial security exercises involving the RCMP (the WL off-site response force), such as ones in 2015 and 2017. Recent exercises simulated realistic responses to the Protected Area of the Waste Management Area following an intrusion by an opposing force. CNSC representatives were present, acting as observers. WL Emergency Services Operations also hold monthly, internal drills to test both the operation of physical security equipment and the readiness of its security personnel.

A joint exercise was conducted in 2018 July between WL staff and the RCMP Explosives Disposal Unit (EDU) (see Figure 15-1 and also Section 13).The event was very successful, with excellent collaboration between building staff, WL security forces and the RCMP. RCMP found the experience tremendously beneficial for the EDU members, and look forward to more collaboration in the future.

In 2018 there was a United States (U.S.) "Interagency Physical Protection Team Visit to Canada" that included WL, CRL and Bruce Power. The purpose of the visit was to exchange information about physical protection best practices and review the physical protection measures for U.S.-obligated nuclear material. The U.S. team had many positive observations for WL, and one suggestion. Overall it was a very positive and useful interaction with an outside agency.

Figure 15-1: One Component of Joint CNL-WL – RCMP Explosives Disposal Unit Exercise

[6] Note: Some details are not presented herein due to their being prescribed information.

The following significant security improvements have been completed since the 2009 licence renewal:

- Access Control Measures: radio frequency identification (known as RFID) card access-authentication at pedestrian access points, vehicle denial barriers at administrative and protected area boundaries, relocation and upgrade of the main vehicle access gate (including the addition of drive-through radiation-sensing equipment to prevent radioactive materials from leaving the site), additional remote-controlled cameras to monitor the main site parking lot and vehicle access along the site access road, relocation of the main security desk to permit improved access controls by security officers, and enhanced security processes at various buildings.
- Launch of New Implements: security detection and assessment upgrades, explosive detection, and radioisotope identification devices.
- Physical Security System Upgrades: switch to digital network recorders, radio system upgrade in 2016, and installation of automatic, redundant, failover, back-up building controllers.
- System Upgrades: security lighting and security operating system. Security lighting equipment, intrusion systems, and other security features have been included in the expansion of the WMA Protected Area. The security operating system at WL has been upgraded.

15.2 Nuclear Security Officer Fitness for Duty

Nuclear Security Officer fitness-for-duty is managed in accordance with RD-363: *Nuclear Security Officer Medical, Physical and Psychological Fitness* [23]. WL Security Officers continue to meet regulatory requirements relative to physical, medical, and psychological fitness for duty. Ongoing officer testing is conducted in accordance with CNSC guidelines. Training facilities have been provided on-site to allow security officers to better maintain the required level of physical fitness.

15.3 Plans for the Next Licence Period

Security improvements will continue during the next licence period including:

- Physical and Integrated Security: primary focus on communication, integration, and culture.
- Upgrades to the WL Protected Areas to improve infrastructure and security posture in support of processing, storage and loading of nuclear material prior to shipment to CRL.
- Actions to comply with fitness-for-duty requirements of CNSC Regulatory Documents REGDOC-2.2.4 – Volume I and Volume II [4] and [5] will continue in the next licence period.

16. SAFETY AND CONTROL AREA - SAFEGUARDS AND NON-PROLIFERATION

The Nuclear Materials and Safeguards Management (NM&SM) Program applies to all nuclear material and safeguards management activities performed at CNL facilities, including WL. It covers procurement, receipt, transfer, accountancy, 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.

16.1 Performance Since 2009 Licence Renewal

The NM&SM program continues to meet CNSC requirements as defined in CNSC REGDOC-2.13.1: *Safeguards and Nuclear Material Accountancy* [24], and ensures that all IAEA activities are fully supported.

A security improvement was initiated to place the classified confidential inventory of nuclear material onto a stand-alone server. This approach greatly increased CNL's ability to provide the adequate care and control of information associated with nuclear material inventories.

In 2015, CNL participated in a five month pilot project, in collaboration with CNSC staff, to validate the effectiveness and operability of the new CNSC Nuclear Materials Accounting Reporting portal to allow e-submissions in a secure reporting environment. During this five month period, CNL submitted the monthly accounting reports to the portal, which also tested the compatibility of the CNL Integrated Nuclear Material Accounting System with the CNSC Nuclear Materials Accounting Reporting portal. This required CNL to implement programming changes to the Integrated Nuclear Materials Accounting System. CNL worked closely with CNSC staff to resolve identified issues in a timely manner in order to fully implement the Nuclear Materials Accountancy Reporting submissions in 2016 January. CNL Reports are now submitted through the CNSC Nuclear Materials Accountancy Reporting (NMAR) portal, which ensures accurate reporting, security verification, and efficiency of submission of required reports.

The IAEA introduced a new reporting tool, Protocol Reporter 3 (PR3) during the current licence period. PR3 is an updated software application that CNL is required to use to compile and submit the annual report providing detailed information about all buildings, on all CNL sites, including activities contained within, and research and development related to the nuclear fuel cycle at CNL. This new software is significantly more efficient that the previous software provided by the IAEA, but required significant retraining of CNL personnel.

CNL staff fully supported IAEA activities at WL to meet CNSC licensing commitments and international obligations.

There were no issues identified with IAEA Safeguards Inspections.

16.2 Plans for the Next Licence Period

CNL will continue working with the IAEA and CNSC to implement improvements to IAEA activities and equipment.

The NM&SM Program intends to upgrade the integrated nuclear material accountancy system and to finalize its integration for all facilities at CNL. The current version of the Nuclear Materials Accountancy system meets the reporting requirements currently defined in CNSC REGDOC-2.13.1 [24. This initiative will result in the accounting reports requiring less manual data entry, with less opportunity for human error.

The IAEA has developed, and will be implementing, a new state-level safeguards approach for all of Canada in the next licence period. The NM&SM Program fully intends to adapt to these upcoming changes and work with both CNSC staff and the IAEA to ensure that CNL remains in compliance with all regulatory requirements.

The current plan to retrieve all irradiated fissionable materials from the CCSF and the WMA Standpipes and transfer the materials to CRL for storage will increase the NM&SM workload at WL over the next licencing period. However, this increased workload will be supported by the central CNL NM&SM personnel.

The NM&SM program hosted a series of trilateral meetings with the IAEA and the CNSC to discuss the practical arrangements for the safeguards approach in support of the upcoming remediation and planned transfer of WL fissionable material to CRL.

A technical walk down was completed at WL with the IAEA and CNSC for the Concrete Canister Storage Facility (CCSF). This was in support of continuing negotiations with the IAEA for the development of a Practical Arrangement with minimal operational impact to CNL for the planned transfer of IAEA sealed canister fuel from WL to CRL.

17. SAFETY AND CONTROL AREAS - PACKAGING AND TRANSPORT

The Transport of Dangerous Goods (TDG) program provides an operational framework for the safe transport of dangerous goods by conforming to all applicable laws, regulations, company policies, and procedures. The program enables an effective, consistent, and comprehensive application of international standards.

The CNL TDG program requirements apply to any activities involving the transportation of dangerous goods to or from any of the CNL sites, by all personnel, and all modes of transport, and ensures that all the regulatory and licence requirements are completed prior to packaging and shipment.

17.1 Performance Since 2009 Licence Renewal

In 2014, the "Radioactive Material Transportation Program" was renamed the "Transportation of Dangerous Goods Program", and was expanded to include all nine classes of dangerous goods. The program is implemented at all CNL sites, including WL.

The TDG Program has developed and implemented a package program to fully meet the requirements of Section 42 of the *Packaging and Transport of Nuclear Substances Regulations* (2015 Edition) [25].

Qualified transportation specialists apply the *Canada Transportation Act* [26*], Transportation of Dangerous Goods Regulations* [28], CNSC and IAEA regulations [27], and implement the TDG program requirements with a high level of proficiency and diligence. The shipping documentation generated by Transportation Specialists, as applicable to various types of shipments, is consistent and in compliance with relevant requirements.

The TDG Program continues to meet all regulatory expectations and requirements with a high level of cooperation and communication between CNL personnel involved in TDG shipments (including both Shippers (Consignors) and Receivers (Consignees)) and staff representing external organizations.

The program has implemented, and continues to maintain compliance in the following areas:

- Training of personnel who customarily prepare shipments of dangerous goods for off-site consignees.
- Preparation of all types of packages containing dangerous goods.
- Shipment and receipt of packages containing dangerous goods from off-site consignors.
- Preparation of the documentation required by the *Packaging and Transport of Nuclear Substances Regulations* [25] and *Transportation of Dangerous Goods Regulations* [28*].*

The strategy for CNL is to safely accelerate decommissioning at WL, thereby resulting in an increase in shipments involving the TDG Program. This is especially true, given CNL's plans to relocate most (if not all) of WL's radioactive wastes to CRL within the next licence period.

CNL has recently established a new WL branch within the Waste Management Division called the Waste Certification & Transportation Branch. This branch was established as the centralized department responsible for planning, coordinating and executing radioactive waste shipments from the WL site to off-site disposal or storage facilities in a safe and compliant manner, including having fully trained Radioactive Material (RAM) Shippers as authorized under the CNL TDG Program.

Significant activities in 2017-2019 include:

- Major procurement of certified transportation/storage packages, waste handling equipment, and associated equipment to facilitate LLW transfer operations;
- The first large-scale waste shipping campaign, resulting in the transportation of approximately 1,500 m³ of contaminated soil to CRL in 2017, and the remaining 866 m^3 in 2018;
- Execution of a Type B shipment, which involved returning a redundant Co-60 source to the original manufacturer in Canada;
- As of 2019 July 15, 3,557 m^3 of LLW and 18 m^3 of ILW have been safely transported to CRL in 175 shipments. These shipments have covered 335,000 km of roads, with zero incidents/accidents and zero non-conformances.
- Establishing a waste transhipment area adjacent to the WMA to facilitate transport-ready packages for offsite disposition; and
- Continued collaboration with the Nuclear Waste Management Organization for the use of the Used Fuel Transportation Package to facilitate High-Level Waste transportation operations. Various technical assessments and studies on the WL used fuel inventory were completed in support of a future licensing application for the Used Fuel Transportation Package (UFTP). The UFTP, which is owned by the Nuclear Waste Management Organization, has been leased with the intention that it will be the Type B Transportation Package for high-level waste transportation operations. There is a two-phase licensing strategy for the UFTP, with the first phase focusing on licensing the UFTP for non-enriched CANDU fuels and the second phase focusing on WL's inventory of enriched and experimental fuels, including Uranium Carbide and Uranium Metal fuel types.

17.2 Plans for the Next Licence Period

The new edition of the IAEA safety standard (*Regulations for the Safe Transport of Radioactive Material*) [27] was released in 2018. The new standard shall be reflected in the TDG program and shall be fully implemented at all applicable CNL sites and in all CNL processes.

The new edition of the *Transportation of Dangerous Goods Regulations* is also expected to be released in the near future, as the result of Transport Canada enhancing compliance and strengthening safety in the transportation of dangerous goods by providing additional details

and greater clarity of their requirements. These changes shall also be reflected in the TDG Program and shall be fully implemented at all applicable CNL sites and in all CNL processes.

The new edition of the *Transportation of Dangerous Goods Regulations* will require implementation of a new training system as well as the enhancement of capabilities to respond to a transportation emergency. The TDG Program fully intends to adapt to the recent and upcoming changes and to work with Transport Canada to ensure that CNL remains in compliance with all regulatory requirements.

The CNL strategy to safely accelerate decommissioning, environmental remediation, and waste management, will result in a significant increase in shipments involving the TDG Program. TDG Program staff will continue to work with Waste Management Program staff, WL Decommissioning Projects staff and all appropriate CRL staff to implement an efficient and effective program. This strategy will achieve an overall reduction of risk to members of the public, workers, and the environment.

18. OTHER MATTERS OF REGULATORY INTEREST

18.1 Fukushima

The Great East Japan Earthquake occurred on 2011 March 11.

The CNSC issued a request pursuant to subsection 12(2) of the General Nuclear Safety and Control Regulations [29] on 2011 March 17, requiring CNL, and other major nuclear facilities in Canada, to review initial lessons learned from the earthquake, and to use this information to re-examine existing safety cases, and report on its plans to mitigate any identified gaps.

For WL, the review identified some areas for improvement that were subsequently completed. The WL emergency response procedures were updated, and all WL Safety Analysis Reports were reviewed, and subsequently the Shielded Facilities and WMA Safety Analysis Reports were updated. CNSC staff concluded that the actions taken by WL were sufficient to address the identified areas for improvement.

18.2 Public Information Program

18.2.1 Public Information Program and Public Disclosure

The Public Information Program document is intended to cover communication activities that occur between CNL and its immediate neighbouring communities. This document was prepared in accordance with CNSC regulatory document *Public Information and Disclosure,* REGDOC-3.2.1 [30].

During the transition period from AECL to CNL, all aspects of the Public Information Program were engaged to provide information on the nature, and the progress, of such things as the new management, restructuring plans and opportunities.

18.2.1.1 Information Material

CNL uses various communication modes to reach specific audiences (e.g., neighbouring communities, industry, customers, and employment prospects). All communication products are maintained and kept up to date; this includes the dedicated corporate website (www.cnl.ca), marketing materials, posters, advertisements, recruitment materials, and related products. Starting in 2016, CNL made material available through social media outlets.

CNL continues to utilize numerous tools for advertising not only company events, but also highlighting local events to the public; this includes boosted and targeted social media advertising.

18.2.1.2 Website

The corporate website "www.cnl.ca" informs the public on unique facilities and nuclear science and technology activities. The corporate website is a key part of the Public Information Program, and is used as a mechanism to highlight significant activities such as major projects,

provide environmental performance reporting, event reporting, attract potential employees, maintain contact with staff alumni, and to provide access to many publications and reports. This includes an archive of recent news releases.

CNL makes available, through its corporate website, a list of events reported to CNSC staff; this list is published within 60 days following the end of the preceding quarter. In addition to posting event titles, CNL also publishes voluntary disclosures for specific events.

Where reasonable, the website content is prepared in both official languages. This includes translation of some Environmental Impact Statement (EIS) documents relating to the WR-1 in situ decommissioning.

Visitors to www.cnl.ca may contact CNL for more information through the "Contact Us" page. For example, in 2016, CNL had 930 external website visitors use the "Contact Us" function on a broad range of subjects; in 2018, 213 visitors availed themselves of this opportunity. In addition to regular updates to the corporate website, program-related pages were created to inform visitors about the overall Whiteshell Laboratories Closure Project and specifically the proposed WR-1 in situ decommissioning.

18.2.1.3 Social Media

CNL's social media accounts have become an integral part of communications with the public. Social media are utilized to disseminate information in a timely manner and are able to reach specific audiences through targeted boosting of selected messages. CNL's social media pages have developed the capacity to be a direct line to the public. CNL has activated LinkedIn, Flickr, YouTube, Facebook and Twitter accounts to further engage the public.

In 2018, there were:

- 244 posts on Facebook – 3,002 people reached on average per post, 2,842 followers
- 199 Tweets – 789 followers
- 11 Videos on YouTube – 9,609 video views

CNL will continue to utilize these platforms to inform on projects, revitalization work and important science and technology developments.

18.2.1.4 Whiteshell Laboratories Closure Project Public Enquiries

The Whiteshell Laboratories Closure Project had a total of 17 officially recorded public inquiries in 2018 and 64 in 2017. These came through one of the feedback channels: telephone, email and social media.

18.2.1.5 Newsletters

Voyageur is an internal newsletter for CNL employees; it is focused on nuclear science and technology activities and accomplishments. *Voyageur* is distributed both electronically and in hard copy, and employees are welcome/encouraged to take the newsletter home and share it

with others. *Voyageur* is also provided to a limited external audience along with a monthly package of relevant internal news that is issued to CNL alumni, a group of former employees and retirees.

In the LOOP is an internal newsletter that is periodically distributed electronically to all WL employees as well as archived on the CNL internal website. This newsletter provides WL employees with current events, news and information.

CONTACT is an external newsletter distributed to community stakeholders and to residences and businesses in communities surrounding the Whiteshell Laboratories, and is available on www.cnl.ca. This publication informs the reader on activities undertaken at CNL, and profiles CNL's community activities. Approximately 8,000 homes receive this bilingual newsletter.

18.2.1.6 Journals

The CNL Nuclear Review (entitled AECL Nuclear Review until 2015 December) provides researchers with the opportunity to publish work that showcases innovative and important nuclear science and technology in a peer-reviewed publication.

Two editions per year are published, beginning in 2012 with the first issue, and are available in print and online at: www.cnl.ca/anr.

18.2.1.7 Media Releases and Public Disclosures

CNL news releases issued through www.cnl.ca are sent directly to local media. For example, in 2018, forty-two news releases were issued (company-wide) through www.cnl.ca and directly to local media. In addition, there is regular local media coverage regarding CNL.

In accordance with the ongoing commitment to voluntary public disclosure of events related to CNL, six public disclosures were made in 2018.

18.2.1.8 Engagement and Outreach with the Public

CNL shares information with the public through a number of activities including conducting public information sessions, media releases, the corporate website, a toll-free line, social media accounts and involvement in community events. Employees are CNL's greatest ambassadors and they are kept informed of developments so that they can also share information with their relatives, friends, and neighbours. CNL also engages with the public at a number of local, national, and international events. For example, some 2018 engagements and events are listed below:

- Regeneration Partnership site tour;
- Community benchmarking tour, Hallam Nebraska [in situ decommissioned reactor];
- Site tour and presentation to Rural Municipality of Alexander, Reeve and Council;
- Information booth at Lac du Bonnet Trade Fair;

- WR-1 open house and tour;
- Information booth at the Brokenhead agricultural festival;
- Presentation to the Lac du Bonnet and District Chamber of Commerce;
- Presentation to LGD of Pinawa Mayor and Council on Community Initiatives; and
- Engagement and update meetings with various First Nation representatives.

CNL's Whiteshell site continues to expand engagement and outreach with the public. For example, in 2015 CNL hosted transition-in engagements focussed on the CNL transition to a Government-Owned Contractor-Operated management model. CNL conducted nine public open houses in 2016 and five more in 2017; the focus was on the WR-1 project, but opportunity was given and tools were displayed for discussion on the entire site closure.

A very well-received public open house was held at WL on 2019 June 08 (see Figure 18-1). Over 300 people attended, saw a wide variety of displays, including one display on the 2019 WL Relicensing process, had the opportunity of taking a bus tour of the site, enjoyed children's activities (e.g., a magician and face painting), and were offered free lunch. Decommissioning equipment and waste transport containers were on display. Both CNSC and AECL were present and were available for discussions and questions. Feedback from the attendees was overwhelmingly positive.

Corporate communications provides support to the Whiteshell Laboratories Closure Project for the proposed WR-1 in situ decommissioning Environmental Assessment (EA). This is a key project identified by CNL as part of the overall integrated decommissioning and waste management approach to safely manage and reduce Canada's legacy liabilities. It is also a requirement in support of the EA process that the WR-1 project information be made available to CNL neighbouring communities and stakeholder groups through a variety of mechanisms to ensure accessibility of fact-based information.

18.2.1.8.1 Indigenous Engagement

CNL conducted (and continues to conduct) engagement activities with First Nations and Metis communities in accordance with CNSC Aboriginal Engagement Regulatory Document REGDOC-3.2.2 [31]. CNL recognizes and encourages the ongoing engagement of Indigenous communities as valued stakeholders. Engagement activities are similar to those undertaken for public and stakeholder engagement; however, specific engagement activities for First Nations and Metis communities include letters, phone calls, meetings and email correspondence. Through its engagement activities, CNL seeks to inform communities while building awareness and understanding of WL decommissioning activities, to communicate the potential effects of these activities to members of communities, and to seek feedback from communities regarding traditional and current uses of the land surrounding the WL site.

Figure 18-1: 2019 June 08 WL Open House

Indigenous groups were engaged based on the identified potential or established Indigenous or treaty rights of First Nation and Metis communities in the vicinity of the project.

Through its engagement activities, CNL has been able to solicit and respond to some First Nations and Metis community input. First Nations and Metis communities have sought more information and engagement on jobs, contracting opportunities, and environmental protection. First Nations and Metis communities have also sought further capacity to better understand traditional knowledge and impacts adjacent to the site. CNL has been working with local First Nations and Metis communities to provide reasonable capacity, and at the same time has engaged communities with opportunities to better understand concerns and build positive relationships.

18.2.1.8.1.1 Traditional Knowledge and Land Use Studies

Three Traditional Knowledge and Land Use (TKLUS) studies have been undertaken or being proposed to be undertaken by nearby First Nations or Metis communities for the WL site. These studies are intended to document traditional use around WL local and regional study areas, and are connected to the WR-1 environmental assessment project. CNL has supported the carrying out of such studies to assist it in better understanding modern and traditional land and resource use near the WL site.

A TKLUS for the Sagkeeng Anicinabe First Nation identified 519 site-specific land use values within the site local and regional study areas, which extend out to 25 km from the Whiteshell site. Site-specific data were mapped according to five categories of valued components: habitation values (including temporary, occasional, seasonal, and permanent camps and cabins), cultural and spiritual values (including burial sites, ceremonial areas, and community gathering areas), subsistence values (including harvest and kill sites, plant collection areas, and trapping areas), environmental feature values (including specific, highly-valued habitat for moose, elk, and deer), and transportation values (including trails, water routes, and navigation sites).

Values were generally labelled according to four categories: water; medicine, berries and other food plants; hunting and trapping; and, Anicinabe Pimatiziwin. The water category focused primarily on catch sites for numerous fish species, and can also include wild rice harvest sites and drinking water sites. Water is also important as it was historically the key travel corridor and is still a major way in which harvesters access areas. Anicinabe Pimatiziwin values are those that have a broader social, historical and spiritual significance and include: sacred places and gathering sites used by Sagkeeng members and their ancestors for ceremonial purposes and the transmission of traditional knowledge; camping sites, including those used as a base for fishing and hunting activities; trails and water routes, some of which have been used for multiple generations; and findings of archaeological materials.

Another TKLUS was prepared for the Manitoba Metis Federation (MMF). The study identified 424 locations of significance to Land Use and Occupancy Values (LUOs). A total of 192 LUOs were mapped within 25 km of the WL site and 75 were within 100 meters of the site. The MMF

report provides an overview of the types of traditional knowledge, and LOU values that were collected in interviews with Metis knowledge holders: access routes; fishing locations; trapping/snaring locations; gathering of plants for food or medicines; commercial guide or land use; Traditional Ecological Knowledge (TEK) information; changes to the environment; hunting; demographic; cultural; and, other land-use (e.g. ice fishing huts).

CNL notes that one conclusion of the MMF TKLUS study that Metis citizens rely on the lands and waters around the Whiteshell site is likely an accurate portrayal. The report concluded that Metis harvesters have relied on the lands and waters around the WL site for sustenance since before the site was built and continue to do so to the present day. Also, Metis people are consuming wild foods, for some in relatively large quantities, from the lands and waters around the WL site. As such, any contamination of surrounding lands, waters, and species, would have an impact on members of the Manitoba Metis Community. Metis people who participated in this Study are concerned about the potential impacts on human and environmental health from the WL site, including those related to decommissioning activities and both short and long-term monitoring and safety measures.

CNL/WL currently includes sampling of river water, groundwater, fish, native vegetation (grasses, weeds, and clover), soil, deer, rabbit, bear, and grouse in its' Environmental Monitoring Program. CNL staff would also accept samples of moose for analysis as well. [CNL normally collects samples of game via local hunters/trappers and/or by "roadkill"; however, moose samples haven't been available in the past 10 years.] CNL have added some of the harvester items e.g., wild berries, mushrooms and wild rice, identified in these TKLUS reports into its Environmental Monitoring plan.

18.2.1.8.2 Whiteshell Public Liaison Committee

The Whiteshell Public Liaison Committee was formed in 2003 and has been meeting regularly since its inception. Meeting minutes are recorded and actions are tracked and filed for reference. Two meetings per year are typically held: spring and fall. Both meetings are held onsite, with a tour of the site offered afterwards.

The committee is comprised of community and stakeholder representatives (as given below), consisting of elected officials and community interest groups. CNSC staff are invited to attend PLC meetings as observers. Its mandate is to provide an opportunity for open dialogue between community stakeholders and WL senior management on WL's various environmental and decommissioning projects.

- Local Government District (LGD) of Pinawa,
- Rural Municipality (RM) of Lac du Bonnet,
- Town of Lac du Bonnet,
- Town of Beausejour,
- RM of Brokenhead,

- RM of Whitemouth,
- RM of Alexander,
- Town of Powerview/Pine Falls, and
- Manitoba Sustainable Development.

18.2.1.8.3 Whiteshell Laboratories Economic Regeneration Partnership

The Whiteshell Laboratories Economic Regeneration Partnership was formed in 2015 as a result of the forthcoming closure of the Whiteshell Laboratories site and driven by a desire by both the Whiteshell region and CNL to encourage post-closure economic development (see, e.g., Figure 18-2). The partnership consists of municipalities, economic development organizations, First Nations and CNL. Regular meetings of the partnership have been held since 2015, with five meetings having taken place in 2018.

Figure 18-2 : CNL financially supports LGD of Pinawa Economic Development via North Forge Technology Exchange

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20. ACRONYMS

AECL	Atomic Energy of Canada Limited
ALARA	As Low As Reasonably Achievable, economic and social factors taken into account.
ALWTC	Active Liquid Waste Treatment Centre
BWRS	Bunker Waste Retrieval System
CANDU	Canada Deuterium Uranium (registered trademark)
CCSF	Concrete Canister Storage Facility
CFB	Canadian Forces Base
CLF	Cask Loading Facility
CNEA	Canadian National Energy Alliance
CNL	Canadian Nuclear Laboratories
CNSC	Canadian Nuclear Safety Commission
CRL	Chalk River Laboratories
CSA	Canadian Standards Association
CSR	Comprehensive Study Report
D&WM	Decommissioning and Waste Management
DCSS	Demonstration Canister Storage Site
DDP	Detailed Decommissioning Plan
DRDC	Defence Research and Development Canada
DRL	Derived Release Limit
EA	Environmental Assessments
EAFP	Environmental Assessment Follow-Up Program
EDU	[RCMP] Explosives Disposal Unit
EIS	Environmental Impact Statement

EmP	Emergency Preparedness (Program)
EOC	Emergency Operations Centre
ESDR	End-State Decommissioning Report
FIG	Field Irradiation Gamma
FM	Fissionable Material
GoCo	Government-Owned Contractor-Operated
HCF	Hot Cell Facility
HEPA	High Efficiency Particulate Air
HLW	High Level Waste (usually irradiated reactor fuel)
HLLW	High-Level Liquid Waste
HSSE&Q	Health, Safety, Security, Environment and Quality
HU	Human Performance (Program)
IAEA	International Atomic Energy Agency
IFTF	Irradiated Fuel Test Facility
ILW	Intermediate Level Waste
ILLW	Intermediate-Level Liquid Waste
ImpAct	Improvement Action (Process)
ISD	In Situ Decommissioning
ISO	International Organization for Standardization
L&D	Laundry and Decontamination
LCH	Licence Conditions Handbook
LGD	Local Government District
LLW	Low Level Waste
LLLW	Low-Level Liquid Waste

MB	Manitoba (Province of)
MLA	Member of Legislative Assembly (Provincial)
MLW	Medium Level Waste [also known as ILW]
MNL	Mobile Nuclear Laboratory
NCS	Nuclear Criticality Safety (Program)
NFPA	National Fire Protection Agency
NFWMP	Nuclear Fuels Waste Management Program
NIST	National Institute of Standards and Technology
NM&SM	Nuclear Materials and Safeguards Management (Program)
NPARB	Nuclear Program Assessment Review Board
NSCA	Nuclear Safety and Control Act
OCR	Organically Cooled Reactor
OPEX	Operating Experience (Program)
OSH	Occupational Safety and Health
PA	Protected Area
PCB	Polychlorinated biphenyls (Group of organic compounds)
PHT	Primary Heat Transport
PIE	Post Irradiation Examination
PIP	Periodic Inspection Plan
PPC&E	Personal Protective Clothing and Equipment
PR3	Protocol Reporter 3 [Application]
QA	Quality Assurance
R&D	Research & Development
RAM	Radioactive Material

RCMP	Royal Canadian Mounted Police
REA	Remote Excavator Arm
RFID	Radio Frequency IDentification
RM	Rural Municipality
RP	Radiation Protection (Program)
S&T	Science and Technology
SAR	Safety Analysis Report
SAT	Systematic Approach for Training
SCA	Safety and Control Area
SCU	Sorting and Conditioning Unit
SDR	SLOWPOKE Demonstration Reactor
SF	Shielded Facilities
SLOWPOKE	Safe Low Power Critical Experiment (Reactor, registered trademark)
SMAGS	Shielded Modular Above-Ground Storage
SMR	Small Modular Reactor
SPH	StandPipe Headworks
SSC	Soil Storage Compound
SWARM	Standpipe Waste retrieval ARM
SWRS	Standpipe Waste Retrieval System
TDG	Transportation of Dangerous Goods
TFRE	Thorium Fuel Recycle Experiment
UFTP	Used Fuel Transportation Package
WAC	Waste Acceptance Criteria
WANO	World Association of Nuclear Operators

WHA	Waste Handling Area
WL	Whiteshell Laboratories
WMA	Waste Management Area
WP	Work Plan
WR-1	Whiteshell Reactor Number 1
ZEUS	Zoological Environment Under Stress