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A Licence Renewal

Un renouvellement de permis

# Canadian Nuclear Laboratories Ltd.

# Whiteshell Laboratories

# Laboratoires Nucléaires Canadiens Ltée

# Laboratoires de Whiteshell

Commission Public Hearing

Audience publique de la Commission

Scheduled for:
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Prévue pour :
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Submitted by:
CNSC Staff

Soumise par :
Le personnel de la CCSN

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**Summary**

This CMD presents information about the following matter of regulatory interest with respect to Canadian Nuclear Laboratories:

- Canadian Nuclear Laboratories application for the Nuclear Research and Test Establishment Decommissioning Licence for the Whiteshell Laboratories

CNSC staff recommend the Commission take the following actions:

- Renew the Whiteshell Laboratories licence from January 1, 2020 to December 31, 2029.
- Delegate authority as set out in section 4.7 of this CMD.

The following items are attached:

- The proposed licence, NRTEDL-W5-08.06/2029
- The draft Licence Conditions Handbook
- The current licence, NRTEDL-W5-08.05/2019
- The Environmental Protection Review report

**Résumé**

Le présent CMD présente de l'information sur un ensemble de questions d'ordre réglementaire concernant les Laboratoires Nucléaires Canadiens (LNC) :

- La demande de Laboratoires Nucléaires Canadiens visant à renouveler le permis de déclassement de l'établissement de recherche et d'essais nucléaires pour les Laboratoires de Whiteshell

La Commission pourrait considérer prendre les mesures suivantes :

- Renouveler le permis pour les Laboratoires de Whiteshell du 1er janvier 2020 au 31 décembre 2029.
- Accepter la délégation des pouvoirs telle qu'elle est établie à la section 4.7 du présent CMD

Les pièces suivantes sont jointes :

- Le permis proposé, NRTEDL-W5-08.06/2029
- L'ébauche du Manuel des conditions de permis
- Le permis actuel, NRTEDL-W5-08.05/2019
- Le Rapport d'examen de la protection de l'environnement

**Signed/signé le**

August 6, 2019

Kavita Murthy for.

Haidy Tadros

**Director General**

Directorate of Nuclear Cycle and Facilities Regulation

**Directrice générale de la**

Direction de la réglementation du cycle et des installations nucléaires

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# TABLE OF CONTENTS

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# EXECUTIVE SUMMARY

The current Whiteshell Laboratories (WL) licence, NRTEDL-W5-08.05/2019, is valid until December 31, 2019. Canadian Nuclear Laboratories (CNL) has applied to renew the licence for a period of 10 years, until December 31, 2029.

The purpose of this Commission Member Document (CMD) is to provide the results of CNSC staff's assessment of the CNL application, including conclusions and recommendations to inform the Commission decision on the licence renewal. In their assessment of the application, CNSC staff reviewed all 14 safety and control areas (SCAs) and took the licensee's past performance into consideration.

Based on this assessment, CNSC staff conclude that CNL has made and will continue to make adequate provisions for the protection of the environment and the health and safety of persons, and that there will be no adverse effects on the health and safety of persons or the environment as a result of the decommissioning of WL.

This conclusion is supported by CNSC staff's Environmental Protection Review (EPR) report for the WL site. The EPR report is attached to this CMD.

The matter before the Commission in this CMD **does not include in situ decommissioning (ISD)** of the WR-1 reactor. ISD of WR-1 is currently undergoing an environmental assessment under the Canadian Environmental Assessment Act (CEAA), 2012. This will be presented to the Commission at a separate public hearing. ISD of WR-1 is out of scope of this licence consideration.

The public, Indigenous groups and other stakeholders were invited to participate in the regulatory licence renewal process. To enable their participation, up to $50,000 was made available through the CNSC Participant Funding Program (PFP).

This CMD has two parts. Part one presents CNSC staff's review and assessment of CNL's licence application and a summary of CNL's performance in the operation of WL since 2008. Part two presents CNSC staff's proposed licence and licence conditions handbook (LCH).

Referenced documents in this CMD are available to the public upon request.

# PART ONE

This Commission Member Document (CMD) is presented in two parts.

Part One includes:

[1] An overview of the matter being presented;

[2] Overall conclusions and overall recommendations;

[3] General discussion pertaining to the safety and control areas (SCAs) that are relevant to this submission;

[4] Discussion about other matters of regulatory interest; and

[5] Addenda material that complements items 1 through 4.

Part Two provides all available information pertaining directly to the current and proposed licence.

# 1. OVERVIEW

## 1.1 Background

CNL is authorized to decommission the Whiteshell Laboratories (WL), comprising both nuclear and non-nuclear facilities under a CNSC issued Nuclear Research and Test Establishment Decommissioning Licence NRTEDL-08.05/2019[1].

The WL site is located approximately 100 km northeast of Winnipeg near the town of Pinawa, Manitoba. Figure 1 illustrates the WL site location in relation to surrounding communities. The WL site encompasses an area of 4,375 hectares and includes facilities such as the Whiteshell Reactor (WR-1), the shielded facilities, the radioactive waste management facilities and structures, the concrete canister storage area and various research laboratories and support buildings. The WL site was operated by Atomic Energy of Canada Limited (AECL) as a nuclear research facility for approximately 40 years. During this time WR-1 operated for a period of 20 years under an operating licence issued by the Atomic Energy Control Board. In 2002 AECL applied for and was granted a decommissioning licence. In October 2014, the Commission approved the transfer of the licence from AECL to CNL. CNL remains the current licensee.

**Figure 1: Location of WL** (source Google)


Since 2002, significant decommissioning progress has been made with activities including: demolition of redundant buildings, phased decommissioning of the main research building, severing or redirecting services where necessary, construction of new enabling facilities, repurposing of buildings to support decommissioning and initiating subsurface investigations into the conditions of various containment structures inside the waste management area. An aerial view the WL site can be seen in figure 2.

**Figure 2: Aerial view of WL in 2018** (Source: CNL)

## Licensing History

The decommissioning licence was first issued by the Commission in November 2002 for a six-year period. This was followed by the Commission renewing the licence in December 2008 for a ten-year period. Licence amendments were approved by the Commission in 2010 and 2012 to reflect requested changes in report submission dates, reference documents and action levels. In October 2014, the Commission approved the transfer of all AECL licences, including the Whiteshell licence, to the Canadian Nuclear Laboratories. In January 2016, the Commission approved an administrative licence amendment that revised the licence to the standardized format with an associated LCH. In March 2018, the WL licence was renewed by the Commission for a 1-year term until December 2019. Details of the 2018 one year licence renewal are provided below.

## CNL's 2018 Licensing Request

In September 2017, CNL submitted an application to renew the WL decommissioning licence for a 10-year period. With this application, CNL submitted a proposal for the in-situ decommissioning (ISD) of the WR-1 reactor. CNL's proposal to conduct ISD of the WR-1 reactor was a change from the original decommissioning approach of dismantlement and triggered the requirement for an environmental assessment (EA) under the Canadian Environmental Assessment Act (CEAA), 2012 [2].

As part of the CEAA 2012 process, a draft environmental impact statement (EIS) for the proposed ISD of the WR-1 reactor was submitted by CNL and made available to the public for comment. CNL determined that additional time was needed to address the large number of comments raised by the public, Indigenous groups, Métis communities and regulators in relation to the draft EIS that was developed in support of the EA. Note that this EA, and the associated licensing request for the ISD of WR-1, is not part of the current licence application.

Consequently, on March 13, 2018, CNL requested that the Commission renew their existing licence for a one-year period ending December 31, 2019, under the same terms and conditions as the previous licence. This short-term renewal request was granted by the Commission on August 1, 2018 with no changes to the terms, conditions or licensed activities.

The current decommissioning licence includes a decommissioning strategy for the WL site that was previously accepted by the Commission in 2002 and does not authorize the ISD of WR-1. The proposed ISD of WR-1 is out of scope of this licence application and safety case. CNL must seek separate Commission authorization for the newly proposed decommissioning strategy for WR-1.

### Current Relicensing Request

CNL's current decommissioning licence NRTEDL-W5-8.05/2019 remains valid until December 31, 2019. On November 15, 2018 CNL requested a 10 year renewal of the WL licence in order to continue on-going decommissioning activities and provide adequate time to complete the safety case for the ISD of the WR-1 reactor. The matter before the Commission in this CMD does not include ISD of WR-1. The proposed ISD of WR-1 is out of scope of this licence consideration.

### Reporting on Licensee Performance

CNSC staff conduct ongoing regulatory oversight and compliance verification activities at the WL site. Regular updates on licensee performance and project status have and will continue to be brought to the Commissions' attention via regulatory oversight reports (RORs) at public meetings. In relation to interim reporting, CNSC staff have kept the Commission informed of the status of decommissioning activities in 2012 (interim status report) [3], 2014 (annual performance report) [4], 2016 (status report) [5], and in 2018 (progress update) [6]. This CMD builds on the information provided in those documents. CNSC staff will next update the Commission on the status of CNL's performance at the WL site in a ROR to be presented to the Commission at a public hearing in November 2019. This ROR will discuss CNL's performance at all its licensed facilities.

## 1.2 Highlights

The purpose of this CMD is to provide the Commission with the results of CNSC staff's assessment on CNL's application for renewing the WL site licence. This CMD provides CNSC staff's conclusions and recommendations to inform the

Commission decision on the licence application. CNSC staff's assessment of the application takes into consideration the results of CNSC staff's compliance verification activities, CNL's operational performance history and information submitted by CNL in support of the application.

CNSC staff have prepared a proposed licence that uses the standard format and incorporates the standard licence conditions applicable to the WL site.

CNSC staff typically present supporting information for the previous licence period in submissions regarding licence applications. In this case, since the previous licence period was only 12 months, CNSC staff have provided supporting information dating back to 2009 for more meaningful trending for the Commission.

This CMD provides a summary of CNSC staff's review of all safety and control areas (SCAs).

## 1.3 Overall Conclusions

CNSC staff have concluded the following with respect to paragraphs 24(4)(a) and (b) of the *Nuclear Safety and Control Act* (NSCA) [7], in that the licensee:

1. Is qualified to carry out the activity authorized by the licence.
2. Will, in carrying out that activity, make adequate provision for the protection of the environment, the health and safety of persons and the maintenance of national security and measures required to implement international obligations to which Canada has agreed.

## 1.4 Overall Recommendations

CNSC staff recommend the following:

1. accept CNSC staff's conclusions and exercise the Commission's authority under the NSCA [7] to renew the CNL licence of the Whiteshell Laboratories from January 1, 2020 to December 31, 2029
2. authorize the delegation of authority as set out in subsection 4.7 of this CMD

# 2. MATTERS FOR CONSIDERATION

## 2.1 Environmental Protection Review Report

CNSC staff have determined that this licence application request is not on the designated project list under the *Canadian Environmental Assessment Act, 2012* and therefore does not trigger an EA under CEAA 2012. Addendum D of this CMD provides an Environmental Protection Review Report under the NSCA and its Regulations. The EPR is a science-based environmental technical assessment by CNSC staff of CNL's application for renewal of the decommissioning licence for the WL site. CNSC staff conclude that the licensee has, and will, continue to make adequate provision for the protection of the environment and health of persons.

## 2.2 Relevant Safety and Control Areas (SCAs)

The functional areas of any licensed facility or activity consist of a standard set of safety and control areas (SCAs). Each SCA is comprised of "specific areas" of regulatory interest; however, the applicable specific areas associated with each SCA vary between facility types. See Addendum C, "Safety and Control Framework", for further information about SCAs.

In the following table, the rating level for each SCA relevant to the WL site is indicated. The rating indicates the overall compliance with regulatory requirements (refer to Addendum A, "Rating Levels").

| Functional Area | Safety and Control Area | Rating Level[1] |
|---|---|---|
| **Management** | Management System | SA |
| | Human Performance Management | SA |
| | Operating Performance | SA |
| **Facility and Equipment** | Safety Analysis | SA |
| | Physical Design | SA |
| | Fitness for Service | SA |
| **Core Control Processes** | Radiation Protection | SA |
| | Conventional Health and Safety | SA |
| | Environmental Protection | SA |
| | Emergency Management and Fire Protection | SA |
| | Waste Management | SA |
| | Security | BE |
| | Safeguards and Non-Proliferation | SA |
| | Packaging and Transport | SA |

Each SCA is discussed in detail in Section 3, *General Assessment of SCAs*.

[1] FS = Fully Satisfactory, SA = Satisfactory, and BE = Below Expectations

## 2.3 Other Matters of Regulatory Interest

The following table identifies other matters that are relevant to this CMD.

| OTHER MATTERS OF REGULATORY INTEREST | |
|---|---|
| **Area** | **Relevant to this CMD?** |
| Aboriginal Consultation | Yes |
| Other Consultation | Yes |
| Cost Recovery | Yes |
| Financial Guarantees | Yes |
| Improvement Plans and Significant Future Activities | Yes |
| Licensee's Public Information Program | Yes |
| Nuclear Liability Insurance | Yes |

The relevant "other matters" of regulatory interest are discussed in section 4.

## 2.4 Regulatory and Technical Basis

The regulatory and technical basis for the matters discussed in this CMD are provided in Addendum B to this document.

# 3. GENERAL ASSESSMENT OF SCAS

The relevant specific areas that comprise the SCAs for the WL site are identified in Addendum C, section C.2.

## 3.1 Management System

The Management System SCA covers the framework that establishes the processes and programs required to ensure an organization achieves its safety objectives, continuously monitors its performance against these objectives, and fosters a healthy safety culture.

The specific areas that comprise this SCA at the WL site include:

- Management system
- Organization
- Performance assessment, improvement and management review
- Operating experience (OPEX) - (no significant observations to report)
- Change management - (no significant observations to report)
- Configuration management - (no significant observations to report)
- Records management - (no significant observations to report)
- Management of contractors - (no significant observations to report)

### 3.1.1 Trends

The following table indicates the overall rating trends for the Management System over the current licensing period:

| TRENDS FOR MANAGEMENT SYSTEM | | | | |
|---|---|---|---|---|
| **Overall Compliance Ratings** | | | | |
| **2014** | **2015** | **2016** | **2017** | **2018** |
| SA | SA | SA | SA | SA |
| **Comments** | | | | |
| The ratings for the time period of 2009 to 2011 were SA for each year. These were reported in the CMD 12-M47, *Interim Status Report on the Progress of Decommissioning Activities at Whiteshell Laboratories* [3].<br>The ratings for 2012 and 2013 were both SA. These were reported in CMD 14-M79, *Annual Performance Report AECL's Nuclear Sites and Projects: 2013* [4].<br>The licensee has maintained a management system in accordance with CNSC requirements over this licensing period. CNL continues to be rated SA in this SCA at the Whiteshell Laboratories. | | | | |

### 3.1.2 Discussion

In order to meet CNSC requirements for this specific area, the licensee must implement and maintain the management system requirements set out in Canada Standards Association (CSA) standard N286-12, *Management system requirements for nuclear facilities*. The management system brings together, in a planned and integrated manner, the processes necessary to satisfy the requirements that must be met to safely carry out the licensed activity. During the current licensing period, CNL has implemented and maintained a management system at the WL site.

CNSC staff performed a desktop review of CNL's implementation of their management system program at the WL site, and conclude that the program meets all applicable regulatory requirements and CNSC expectations. In addition, CNSC staff have reviewed CNL's updates to the WL Decommissioning Quality Assurance Plan. In each update to the document, CNSC staff comments were resolved satisfactorily by CNL. All inspection findings from the previous licensing period have been closed to CNSC staff's satisfaction by the licensee.

### 3.1.3 Summary

A summary of the licensee's past performance, challenges and proposed improvements are presented in the following subsections.

#### 3.1.3.1 Past Performance

#### Management System

During the licensing period under review, CNL has provided CNSC staff with updates to their management system. The major update in this time period was the adoption of the CSA N286-12 standard requirements. This update applied to all CNL sites, as CNL made the decision to integrate management system requirements into one CNL-wide program.

CNL sites, such as WL, have developed Quality Assurance Plans to describe site-specific aspects of the CNL management system and the site-specific functions, responsibilities and authorities. Other changes described in the management system updates submitted included reorganizing the company document structure and format and also changes in responsibilities. CNSC staff confirmed that the WL Decommissioning Quality Assurance Plan incorporates all the requirements necessary to meet the CSA N286-12 standard.

CNSC staff verify elements of CNL's management system during all inspections conducted on the site. This is done through CNSC staff review of CNL's records, verification of the licensee's implementation of document control, training program and general maintenance of the programs relevant to the safe and secure conduct of the licensed activities.

Overall, the WL management system continues to meet CNSC requirements.

## Organization

WL is owned and was historically operated by AECL, a federal crown corporation. In 2013 the Government of Canada announced its decision to engage a private-sector contractor to manage operations at WL under a government owned-contractor operated (Go-Co) business model [8]. CNL was established as a wholly-owned subsidiary of AECL in 2014. AECL applied to the Canadian Nuclear Safety Commission, under subsection 24(2) of the Nuclear Safety and Control Act, to transfer five licences to CNL. Based on its consideration of the matter, following a hearing held on October 22, 2014 the Commission concluded that CNL met the conditions of subsection 24(4) of the NSCA and approved the transfer of the licences. CNL then assumed responsibility for the day-to-day operations of WL.

In 2015, the management of CNL was contracted to Canadian National Energy Alliance (CNEA), completing the transition to the Go-Co model [9].

Under the Go-Co arrangement, AECL retains ownership of all the assets of WL while CNL remains the licensee with a CNEA-selected executive team. AECL's role is now focused on the oversight of the Go-Co contract to ensure CNL's performance meets the government objectives for the contract.

As part of the Go-Co transformation management, CNL created new:

- corporate profile, mission, vision and values,
- governance model/Board of Directors/Executive Team,
- organization structure, and
- roles, responsibilities, accountabilities and authorities.

CNSC staff confirmed that CNL has appropriately documented the changes to the CNL organization. CNSC staff have no concerns regarding the changes to the CNL organization and have confirmed CNL's organization is suitable to ensure continued safe operation and compliance with regulatory requirements.

## Performance assessment, improvement and management review

CSA N286-12 requires that problems are identified, controlled, documented and resolved by the nuclear facility operator. CNL documents issues and opportunities for improvement through a problem identification and resolution mechanism referred to as ImpAct.

CNSC staff verify ImpAct initiation, routing, trending, approval, and effectiveness by performing routine desktop reviews of ImpAct reports. Field verification of the completion of followup actions, where appropriate, are integrated into site inspection activities. As a result of these reviews CNSC staff conclude that CNL continues to meet CNSC regulatory requirements in this area.

#### 3.1.3.2 Regulatory Focus

CNSC staff will verify the implementation of the revised WL Decommissioning Quality Assurance Manual during compliance activities.

CNSC staff will continue to monitor CNL's performance in this SCA through regulatory oversight activities including onsite inspections and desktop reviews of relevant program documentation to ensure WL continues to meet applicable regulatory documents, codes and standards for the upcoming proposed 10-year licence period.

#### 3.1.3.3 Proposed Improvements

CNL has stated that they will implement the revised WL Decommissioning Quality Assurance Plan that was recently accepted by CNSC staff. CNL will also implement a continuous improvement program to ensure that the integrated management system enables effective and efficient management of the company.

### 3.1.4 Conclusion

There are no challenges with CNL's implementation of this SCA.

Based on CNSC staff's assessments of CNL's application, supporting documents, and correction of inspection findings, CNSC staff conclude the licensee continues to maintain an effective management system in accordance with regulatory requirements.

### 3.1.5 Recommendation

One licence condition is included in the proposed licence for this SCA. Licence condition 1.1 requires CNL to implement and maintain a management system. Compliance verification criteria for this licence condition are included in the draft LCH.

## 3.2 Human Performance Management

The Human Performance Management SCA covers activities that enable effective human performance through the development and implementation of processes that ensure a sufficient number of licensee personnel are in all relevant job areas and have the necessary knowledge, skills, procedures, and tools in place to safely carry out their duties

The specific areas that comprise this SCA at the WL site include:

- Human performance program
- Personnel training
- Fitness for duty

### 3.2.1 Trends

The following table indicates the overall rating trends for the Human Performance Management over the current licensing period:

| TRENDS FOR HUMAN PERFORMANCE MANAGEMENT | | | | |
|---|---|---|---|---|
| **Overall Compliance Ratings** | | | | |
| **2014** | **2015** | **2016** | **2017** | **2018** |
| SA | SA | SA | SA | SA |
| **Comments** | | | | |
| The ratings for the time period of 2009 to 2011 were SA for each year. These were reported in the CMD 12-M47, *Interim Status Report on the Progress of Decommissioning Activities at Whiteshell Laboratories* [3].<br>The ratings for 2012 and 2013 were both SA. These were reported in CMD 14-M79, *Annual Performance Report AECL's Nuclear Sites and Projects: 2013* [4].<br>The licensee has maintained a human performance management program in accordance with CNSC requirements over this licensing period. CNL continues to be rated SA in this SCA at the Whiteshell Laboratories. | | | | |

### 3.2.2 Discussion

CNL is required to implement and maintain a human performance program in order to ensure a sufficient number of qualified workers are available in all relevant job areas, and they have the necessary knowledge, skills, procedures and tools in place to safely carry out their duties. Compliance inspections conducted by CNSC staff during the current licensing period included verifications of the training records of staff in safety-related positions and a general verification of the licensee's maintenance of a complement of competent and knowledgeable workforce. CNSC staff conclude that programs related to CNL's Human Performance Management activities at WL have met applicable regulatory requirements and CNSC expectations.

### 3.2.3 Summary

A summary of the licensee's past performance, challenges and proposed improvements are presented in the following subsections.

#### 3.2.3.1 Past Performance

#### Human Performance Program

For the past few years, CNL has been transitioning to a new management system structure. As part of that work, they have been developing corporate-level program documents applicable to all activities at CNL sites.

The main elements of the corporate Performance Assurance Program at CNL are as follows:

- Operating Experience (OPEX) and Corrective Action Program (CAP),
- Assessment,
- Human Performance,
- Continual Improvement, and
- Performance Measures and Analysis.

The six elements of the Human Performance Program are operationalized through the application and use of:

- Event Free Day Reset,
- Event Free Tools,
- Observation and Coaching,
- Operational Decision-Making,
- Safety Culture Assessment, and
- Dynamic Learning Activities.

The suite of management system documents relevant to human performance include Procedures, Management Control Procedures (MCP), Operating Instructions, and other documents that will be used to manage and support human performance.

Though CNL is still in the process of updating its management system documents, a review of the top two governing documents for the Performance Assurance Program has been completed by CNSC staff. Staff comments will be communicated to CNL, and follow-up will be performed on CNL's response. CNSC staff comments represent opportunities for improvement, and do not raise any impediments for the renewal of the WL site licence.

### Personnel Training

CNL is required by the *General Nuclear Safety and Control Regulations* to ensure there are a sufficient number of properly trained and qualified workers to safely conduct the licensed activities. REGDOC 2.2.2, *Personnel Training* provides additional requirements. CNL has incorporated the requirements of REGDOC 2.2.2 in to their corporate-wide training program.

Compliance inspections conducted by CNSC staff during the current licensing period included verifications of training records. These reviews showed that training records were maintained and that CNL employees were provided appropriate training.

### Fitness for Duty

In 2017, CNL provided the CNSC with a gap analysis and implementation plan for REGDOC-2.2.4, *Fitness for Duty: Managing Worker Fatigue* (Fatigue), and

in 2018, a gap analysis and implementation plan for REGDOC-2.2.4, *Fitness for Duty, Volume II: Managing Alcohol and Drug Use* (Alcohol and Drug), with the purpose of providing the measures by which CNL will meet the requirements of REGDOC-2.2.4.

For Vol I of the REGDOC (Fatigue), CNL has indicated that they have revised scheduling requirements to meet REGDOC-2.2.4.

For Vol II (Alcohol and Drug), CNL has proposed timelines of July 2019 for implementation of all program and testing requirements of this REGDOC except random testing. A date has yet to be determined for implementation of random testing. Licensees have requested that their implementation dates for this REGDOC be delayed to allow discussion of industry-proposed amendments regarding the use of oral fluid testing. CNSC staff have agreed to this delay and are assessing the industry-proposed amendments. Should the REGDOC be amended, the revised draft will be subject to Commission approval at a future date.

#### 3.2.3.2 Regulatory Focus

CNSC staff will focus on monitoring the implementation of the requirements of REGDOC 2.2.4.

A few refinements to licensee program documentation has been identified by CNSC staff. Once responses to those recommendations have been made, CNSC staff will be able to determine appropriate compliance activities. As stated in section 3.2.3.1, CNSC staff comments do not raise any impediments for the renewal of the WL site licence.

#### 3.2.3.3 Proposed Improvements

CNL plans to implement the requirements of REGDOC 2.2.4 volumes I and II.

CNSC staff will continue to monitor CNL's performance in this SCA through regulatory oversight activities including onsite inspections and reviews of relevant program documentation.

### 3.2.4 Conclusion

There are no challenges to with CNL's implementation of this SCA.

Based on CNSC staff assessments of CNL's application, supporting documents and past performance, CNSC staff conclude that CNL continues to implement and maintain an effective human performance program for WL in accordance with regulatory requirements.

### 3.2.5 Recommendation

Two licence conditions are included in the proposed licence for this SCA. Licence condition 2.1 requires CNL to implement and maintain a human performance program, and condition 2.2 requires CNL to implement and maintain a training

program. Compliance verification criteria for the two licence conditions are included in the draft LCH.

## 3.3 Operating Performance

The Operating Performance SCA includes an overall review of the conduct of the licensed activities and the activities that enable effective performance.

The specific areas that comprise this SCA at the WL site include:

- Conduct of licensed activity
- Procedures
- Reporting and trending

### 3.3.1 Trends

The following table indicates the overall rating trends for the Operating Performance over the current licensing period:

| TRENDS FOR OPERATING PERFORMANCE | | | | |
|---|---|---|---|---|
| **Overall Compliance Ratings** | | | | |
| **2014** | **2015** | **2016** | **2017** | **2018** |
| SA | SA | SA | SA | SA |
| **Comments** | | | | |
| The ratings for the time period of 2009 to 2011 were SA for each year. These were reported in the CMD 12-M47, *Interim Status Report on the Progress of Decommissioning Activities at Whiteshell Laboratories* [3].<br>The ratings for 2012 and 2013 were both SA. These were reported in CMD 14-M79, *Annual Performance Report AECL's Nuclear Sites and Projects: 2013* [4].<br>The licensee has maintained an operating program in accordance with CNSC requirements over this licensing period. CNL continues to be rated SA in this SCA at the Whiteshell Laboratories. | | | | |

### 3.3.2 Discussion

CNL is required by the Class I Nuclear Facilities Regulations to ensure measures, policies, methods and procedures for safely operating and maintaining the nuclear facility are in place. Verification of the licensee's compliance with the requirements of this SCA are an integral part of all of CNSC's compliance activities ranging from desktop reviews of reports, documents and events to site inspections. CNSC staff confirm that CNL has implemented and maintains an effective Operating Program in order to ensure licensed activities are performed safely and in compliance with regulatory requirements. CNSC staff conclude that CNL's Operating Performance at the WL site met all applicable regulatory requirements and CNSC staff's expectations. CNSC staff are satisfied that licensed activities at the WL site are conducted in a safe manner.

### 3.3.3 Summary

A summary of the licensee's past performance, challenges and proposed improvements are presented in the following subsections.

#### 3.3.3.1 Past Performance

##### Conduct of Licensed Activity

Nuclear facilities at the WL site are governed by CNL's Facility Authorization and facility-specific Conduct of Operations documents, which indicate the operational limits and conditions for the various facilities. Facilities in permanent safe shutdown state or undergoing active decommissioning are governed by storage-with-surveillance plans or decommissioning plans, respectively. These governing documents prescribe how each facility is operated and maintained to ensure nuclear safety and that the risk to the public remains low.

CNSC staff carried out many verification activities since 2009 on CNL's operations across the WL site and found that overall, all nuclear facilities at the WL site have been operating safely. As CNL transitions to its new management system structure, operating procedures and instructions are being revised to align to the new format.

In accordance with the current LCH, CNL continues to provide information regarding the operating performance of nuclear facilities at the WL site in annual reports submitted to CNSC staff. CNSC staff evaluate the information provided in these reports to ensure CNL remains in compliance with regulatory requirements.

##### Procedures

CNL's Management System consists of high level documentation supported by lower level procedures. CNL maintains a comprehensive suite of procedures across all programs and facilities at the WL site. Since 2009, CNL has continually updated the facility-specific procedures as needed to support ongoing process improvements at the WL site.

CNSC staff review procedure level documents as part of ongoing compliance verification activities. Based on these reviews, CNSC staff conclude that the changes made to CNL's procedures were carried out in accordance with CNL's change control process and there were no significant changes to operating documentation that could have affected the safe operation of the facilities at the WL site.

##### Reporting and Trending

Detailed requirements for reporting unplanned situations or events at the WL site to the CNSC are included in the WL LCH. CNL has complied with the requirements for submission of these reports since 2009.

Events reported to the CNSC by CNL are presented in table 1.

**Table 1: Reportable Events for the WL Site (2009-2018)**

| Year | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|---|---|---|
| Total | 6 | 24 | 10 | 5 | 4 | 5 | 0 | 5 | 4 | 0 |

CNSC staff review all reported events to identify if there are any regulatory concerns and report significant events to the Commission at public meetings of the Commission. There were no event initial reports (EIR) related to the WL site presented to the Commission since 2009.

CNL also submits annual reports on compliance monitoring and operating performance of facilities at the WL site, as required by licence condition 5.1 of the current licence. CNSC staff reviewed these reports and no significant regulatory issues were identified during the review.

#### 3.3.3.2 Regulatory Focus

CNSC staff continue to monitor CNL's performance in this SCA through regulatory oversight activities including onsite inspections and desktop reviews of relevant program documentation.

CNSC staff will focus compliance verification activities on operational activities at the WL site. As the licensee's activities on the WL site continues its steady shift towards decommissioning and demolition activities and the transport of waste offsite, CNSC staff's compliance activities will focus on verification of the safe conduct of these activities.

#### 3.3.3.3 Proposed Improvements

The regulatory document REGDOC-3.1.2, *"Reporting Requirements, Volume I: Non-Power Reactor Class I Nuclear Facilities and Uranium Mines and Mills* is referenced in the proposed WL LCH. This document sets out requirements and guidance for reports and notifications that licensees must submit to the CNSC. This REGDOC outlines the types of reports that are required to be submitted to the CNSC, and the applicable timeframe for reporting.

### 3.3.4 Conclusion

There are no challenges to with CNL's implementation of this SCA.

Based on CNSC staff assessments of CNL's application, supporting documents and past performance, CNSC staff conclude that CNL continues to implement and maintain an effective operating program for the WL site in accordance with regulatory requirements.

### 3.3.5 Recommendation

Two licence conditions are included in the proposed licence for this SCA. Licence condition 3.1 requires CNL to implement and maintain an operating program, which includes a set of operating limits. Licence condition 3.2 requires CNL to implement and maintain a program for reporting to the Commission or a person authorized by the Commission. The recommended delegation of authority for

licence condition 3.2 is detailed in section 4.7 of this CMD. Compliance verification criteria for both licence conditions are included in the draft LCH.

## 3.4 Safety Analysis

The Safety Analysis SCA covers maintenance of the safety analysis that supports the overall safety case for the facility. Safety analysis is a systematic evaluation of the potential hazards associated with the conduct of a proposed activity or facility and considers the effectiveness of preventative measures and strategies in reducing the effects of such hazards.

The specific areas that comprise this SCA at the WL site includes:

- Deterministic safety analysis
- Hazard analysis
- Criticality safety

### 3.4.1 Trends

The following table indicates the overall rating trends for the Safety Analysis over the current licensing period:

| TRENDS FOR SAFETY ANALYSIS | | | | |
|---|---|---|---|---|
| **Overall Compliance Ratings** | | | | |
| **2014** | **2015** | **2016** | **2017** | **2018** |
| SA | SA | SA | SA | SA |
| **Comments** | | | | |
| The ratings for the time period of 2009 to 2011 were SA for each year. These were reported in the CMD 12-M47, *Interim Status Report on the Progress of Decommissioning Activities at Whiteshell Laboratories* [3].<br>The ratings for 2012 and 2013 were both SA. These were reported in CMD 14-M79, *Annual Performance Report AECL's Nuclear Sites and Projects: 2013* [4].<br>The licensee has over this licensing period maintained a safety analysis program in accordance with CNSC requirements. CNL continues to be rated SA in this SCA at the Whiteshell Laboratories. | | | | |

### 3.4.2 Discussion

CNL is required by the Class I Nuclear Facilities Regulations to prepare formal Safety Analysis Reports (SAR) for Class I nuclear facilities. CNL has implemented a safety analysis program that ensures systematic evaluation of the potential hazards associated with the conduct of a proposed activity or facility and to consider the effectiveness of preventative measures and strategies in reducing the effects of such hazards.

CNSC staff note that the scope, content and detail of the safety analysis for the WL site is not the same as for an operating nuclear power reactor. There is no operating reactor on site and there are no activities related to fissionable material

on this site, other than storage of low-risk irradiated fuel. The CNSC applies a graded approach to safety analysis, commensurate with the level of risk of the facility.

CNSC staff conducted desktop reviews of CNL's safety analysis documentation and conclude that CNL's Safety Analysis at the WL site met applicable regulatory requirements and CNSC expectations.

### 3.4.3 Summary

A summary of the licensee's past performance, challenges and proposed improvements are presented in the following subsections.

#### 3.4.3.1 Past Performance

##### Deterministic Safety Analysis

CNL maintains SARs for all Class I nuclear facilities at the WL site.

CNL updates the SARs over time as operational requirements change. Updates are carried out in accordance with the requirements of the licensing basis. When CNL updates the SARs, they are provided to CNSC staff for review. CNSC staff monitors changes in the SAR to ensure continued compliance with the licensing basis.

##### Criticality Safety

There remain no activities associated with fissionable material at the WL site, other than storage of used fuel in the Concrete Canister Storage Facility (CCSF) and the waste management area's standpipes, which CNL and CNSC staff consider to be low risk. CNSC staff continue to monitor any changes to the risk that result from activities to remediate the standpipes and CCSF.

CNL is required to implement and maintain a nuclear criticality safety program compliant with RD-327, *Nuclear Criticality Safety*. The nuclear criticality safety program at CNL is a corporate-wide program, and is used at both the WL and CRL sites. CNL has developed a suite of nuclear criticality safety program documents acceptable to CNSC staff. CNL maintains and updates its criticality safety documents (CSD). CNSC staff reviewed changes to the CSDs as they were updated by CNL. Based on the reviews, CNSC staff concluded that CNL continues to make changes and updates to CSDs that are consistent with CNSC regulatory requirements.

##### Hazard Analysis

CNL carried out code compliance reviews and Fire Hazard Analysis for the WL site facilities in accordance with CSA-N393, *Fire protection for facilities that process, handle, or store nuclear substances*. These reviews are discussed in section 3.5.3, Fire Protection Program, of this CMD.

#### 3.4.3.2 Regulatory Focus

CNSC staff continue to monitor CNL's performance in this SCA through regulatory oversight activities including onsite inspections and desktop reviews of relevant program documentation, new and/or revised safety analyses and criticality safety documents.

#### 3.4.3.3 Proposed Improvements

CNL is required to continually update its safety analyses to reflect the current operational state of all facilities on site.

### 3.4.4 Conclusion

There are no challenges to with CNL's implementation of this SCA.

Based on CNSC staff assessments of CNL's application, supporting documents and past performance, CNSC staff conclude that CNL continues to implement and maintain a Safety Analysis program at the WL site in accordance with regulatory requirements.

### 3.4.5 Recommendation

Two licence conditions are included in the proposed licence for this SCA. Licence condition 4.1 requires CNL to implement and maintain a safety analysis program. Licence condition 4.2 requires CNL to implement and maintain a nuclear criticality safety program. Compliance verification criteria for both licence conditions are included in the draft LCH.

## 3.5 Physical Design

This SCA relates to activities that impact on the ability of systems, components and structures to meet and maintain their design basis given new information arising over time and taking changes in the external environment into account.

Given that the WL site is undergoing decommissioning, there is very little activity on physical design.

The specific areas that comprise this SCA at the WL site include:

- Design governance
- Site characterization - (no significant observations to report)
- Facility design
- Structure design - (no significant observations to report)
- System design - (no significant observations to report)
- Component design - (no significant observations to report)

### 3.5.1 Trends

The following table indicates the overall rating trends for the Physical Design over the current licensing period:

| TRENDS FOR PHYSICAL DESIGN | | | | |
|---|---|---|---|---|
| **Overall Compliance Ratings** | | | | |
| **2014** | **2015** | **2016** | **2017** | **2018** |
| SA | SA | SA | SA | SA |
| Comments | | | | |
| The ratings for the time period of 2009 to 2011 were SA for each year. These were reported in the CMD 12-M47, *Interim Status Report on the Progress of Decommissioning Activities at Whiteshell Laboratories* [3].<br>The ratings for 2012 and 2013 were both SA. These were reported in CMD 14-M79, *Annual Performance Report AECL's Nuclear Sites and Projects: 2013* [4].<br>CNL continues to be rated SA in this SCA at the Whiteshell Laboratories. CNSC staff conclude that CNL's Physical Design performance meets regulatory requirements. | | | | |

### 3.5.2 Discussion

CNL is required to implement and maintain a design program so that design of facilities is managed using a well-defined systematic approach. Implementing and maintaining a design program confirms that safety-related structures, systems and components (SSC), and any modifications to them, continue to meet their design basis taking new information and changes in the external environment into account. It also confirms that SSCs continue to be able to perform their safety functions under all facility conditions. An important cross-cutting element of a design program is design basis management.

CNSC staff confirm that CNL has implemented and maintained a design program to ensure the ability of systems, structures and components to meet and maintain their design basis. CNSC staff conclude that CNL's physical design measures at the WL site meet all applicable regulatory requirements and CNSC expectations.

### 3.5.3 Summary

A summary of the licensee's past performance, challenges and proposed improvements are presented in the following subsections.

#### 3.5.3.1 Past Performance

### Design governance

**Fire Protection Program**

CNL's Fire Protection Program at the WL site identifies how protection from fire is achieved through planned, coordinated and controlled activities to reduce the risk to the health and safety of persons and to the environment from a fire. CNL continues to maintain its fire protection program in accordance with the current licence and associated LCH, the National Building Code, the National Fire Code [10] and CSA standards. During the current licence period, CNSC and CNL fire protection staff at the WL site held meetings to discuss the progress of projects, and any other programmatic matters or subjects of interest. CNSC staff conclude that the fire protection program at the WL site meets regulatory requirements and the WL site is performing satisfactorily.

CNL carried out fire protection assessments, which include code compliance reviews (CCR) and Fire Hazard Analysis (FHA), for the WL site facilities in accordance with the CSA-N393 standard, as well as key standards referenced herein, such as the National Building Code of Canada, National Fire Code of Canada, associated NFPA standards etc.

CNL has submitted to CNSC staff their CCR which demonstrates that they are in compliance with the programmatic and operational requirements of the CSA standard. The opportunities for improvement identified as part of the self-assessment were also provided to CNSC. CNSC staff assessed CNL's CCR and conclude that the findings from the CNL CCRs are not considered to be risk significant and CNL's proposed modifications will increase the safety margin of the facility with respect to fire protection.

CNSC staff conducted two inspections at WL in 2012 & 2018 which included a review of compliance with the regulatory requirements on fire protection. Seven actions were raised as a result of the 2012 inspection. These actions addressed: the storage of combustible materials, damage to fire doors, obstruction of sprinkler discharge and fire alarm system upgrades. CNSC staff have confirmed that all actions have been adequately addressed by CNL. As a result of an inspection conducted in May 2018 CNSC staff recommended that CNL ensure all legacy safety-related equipment that are no longer in use be clearly labelled and/or made inaccessible to workers in order to prevent workers from trying to use such equipment in the case of an accident or emergency. CNSC staff verified CNL's implementation of this recommendation during two subsequent inspections conducted in October 2018 and June 2019.

**Pressure Boundary Program**

During the current licence period, CNL updated and revised their Pressure Boundary Quality Assurance Manual WL-508140-QAM-001 and associated pressure boundary procedure. CNSC staff reviewed the information submitted by CNL and concluded the pressure boundary systems at the WL site meet regulatory requirements.

### Facility Design

CNL constructed some new facilities to support the on-going decommissioning activities at the WL site. CNSC staff reviewed elements related to the design of facilities and the FHA prior to the operation of new facilities. These new facilities were not related to ISD of WR-1. CNSC staff reviewed and assessed CNL's application of appropriate sets of codes and design standards for the new facilities. Reviews carried out by CNSC staff included the design of:

- Shielded Modular Above-Ground Storage Building, and
- Soil Storage Compound

CNSC staff concluded CNL met regulatory requirements related to the design of its facilities, and the operation of these new facilities remained within the design basis.

During the next licence period, CNL plans to design and construct facilities for the remediation of the Standpipes and Intermediate Level Waste Bunkers. Standpipes are vertical, in-ground storage structures, located within the WL WMA which provide storage for ILW or HLW waste packages. One hundred seventy-one (171) standpipes were constructed within the WMA. CNL expects that these structures will be emptied of their contents and removed during the next licence period. CNL will construct a number of supporting facilities for the removal, characterization, packaging, and shipment of the ILW and HLW waste from the Standpipes and Intermediate Level Waste Bunkers. CNSC staff will review the design of these facilities prior to their operation.

### 3.5.3.2 Regulatory Focus

CNSC staff continue to monitor CNL's performance in this SCA at the WL site through regulatory oversight activities including onsite inspections and desktop reviews of relevant program documentation, and review of designs for new or modified facilities.

### 3.5.3.3 Proposed Improvements

CNL is required to update the pressure boundary procedure WLD-508140-PRO-001, *Whiteshell Laboratories Code Classification and Design Registration of Pressure-Retaining Systems/Components* (part of Pressure boundary program) to include the decommissioning of pressure boundary systems/components.

CNSC staff continue to review the design of facilities prior to the operation of new facilities at the WL site. This will include a review of the standpipe and intermediate bunker remediation facility design.

### 3.5.4 Conclusion

There are no challenges with CNL's implementation of this SCA.

Based on CNSC staff assessments of CNL's application, supporting documents and past performance, CNSC staff conclude that CNL continues to implement and maintain programs for pressure boundary and design at the WL site in accordance with regulatory requirements.

### 3.5.5 Recommendation

Two licence conditions are included in the proposed licence for this SCA. Licence condition 5.1 requires CNL to implement and maintain a design program. Licence condition 5.2 requires CNL to implement and maintain a pressure boundary program. Compliance verification criteria for both licence conditions are included in the draft LCH.

## 3.6 Fitness for Service

The fitness for service SCA covers activities that impact the physical condition of structures, systems and components to ensure that they remain effective over time. This area includes programs that verify all equipment is available to perform its intended design function when called upon to do so.

The specific areas that comprise this SCA at the WL site include:

- Maintenance
- Structural integrity

### 3.6.1 Trends

The following table indicates the overall rating trends for the Fitness for Service over the current licensing period:

| TRENDS FOR FITNESS FOR SERVICE | | | | |
|---|---|---|---|---|
| **Overall Compliance Ratings** | | | | |
| **2014** | **2015** | **2016** | **2017** | **2018** |
| SA | SA | SA | SA | SA |
| **Comments** | | | | |
| The ratings for the time period of 2009 to 2011 were SA for each year. These were reported in the CMD 12-M47, *Interim Status Report on the Progress of Decommissioning Activities at Whiteshell Laboratories* [3].<br>The ratings for 2012 and 2013 were both SA. These were reported in CMD 14-M79, *Annual Performance Report AECL's Nuclear Sites and Projects: 2013* [4]. | | | | |

The licensee has over this licensing period maintained a fitness for service program in accordance with CNSC requirements. CNL continues to be rated SA in this SCA at the Whiteshell Laboratories.

### 3.6.2 Discussion

CNL is required to implement and maintain a fitness for service program to cover activities that impact on the physical condition of systems, components and structures to ensure that they remain effective over time.

Elements of the fitness for service program requirements are incorporated into CNSC inspections carried on at the site, with CNSC inspectors verifying that: in-service inspections of safety related structures are carried out by CNL as required, safety related equipment is maintained in good working order and ,where required, components are appropriately calibrated and are tested at the requisite frequency. The fitness for service program at the WL site focuses on in-service inspections of the concrete bunkers in the Waste Management Area (WMA).

### 3.6.3 Summary

A summary of the licensee's past performance, challenges and proposed improvements are presented in the following subsections.

#### 3.6.3.1 Past Performance

##### Maintenance

As part of their management system, CNL is required by CSA N286-12 to have processes in place to maintain systems, structures and components (SSCs). CNSC staff reviewed CNL's governing documents for the conduct of maintenance at the WL site and concluded that the program meets regulatory requirements.

CNSC staff have found that SSCs observed during CNSC inspections were well-maintained. Based on CNSC inspection results and reviews conducted of CNL submitted information, CNSC staff conclude that CNL has met and will continue to meet the regulatory requirements related to this specific area.

##### Structural Integrity

CNL is required to conduct annual inspections of the WL WMA concrete bunkers in accordance with the Periodic Inspection Plan (PIP), and report the results annually to CNSC staff.

Additionally, CNL performs quarterly inspections of the Concrete Canister Storage Facility (CCSF). These CCSF inspections have shown no significant cracking or spallation.

In October 2018 CNSC staff performed an inspection on CNL's Waste Management Program at the WL site, during which CNSC staff confirmed that the CCSF inspections had been performed by CNL at the required frequency, and that actions

were identified by CNL to correct any deficiencies. CNSC staff also visually inspected the CCFS canisters and found them to be in good condition.

Based on CNSC staff inspections and reviews of the PIP and CCSF inspection reports submitted by CNL, CNSC staff conclude that CNL has met and will continue to meet the regulatory requirements related to this specific area.

#### 3.6.3.2 Regulatory Focus

CNSC staff continue to maintain oversight of the fitness for service program until the facilities are decommissioned.

CNSC staff continue to monitor CNL's performance in this SCA through regulatory oversight activities including onsite inspections and desktop reviews of relevant program documentation.

#### 3.6.3.3 Proposed Improvements

No improvements within this SCA are proposed.

### 3.6.4 Conclusion

There are no challenges to with CNL's implementation of this SCA.

Based on CNSC staff assessments of CNL's application, supporting documents and past performance, CNSC staff conclude that CNL continues to implement and maintain effective fitness for service programs at the WL site in accordance with regulatory requirements.

### 3.6.5 Recommendation

One licence condition is included in the proposed licence for this SCA. Licence condition 6.1 requires CNL to implement and maintain a fitness for service program. Compliance verification criteria for this licence condition are included in the draft LCH

## 3.7 Radiation Protection

The radiation protection SCA covers the implementation of a radiation protection program in accordance with the *Radiation Protection Regulations*. The program must ensure that contamination levels and radiation doses received by individuals are monitored, controlled and maintained As Low As Reasonable Achievable (ALARA).

The specific areas that comprise this SCA at the WL site include:

- Application of ALARA
- Worker dose control
- Radiation protection program performance
- Radiological hazard control
- Estimated dose to public

### 3.7.1 Trends

The following table indicates the overall rating trends for the Radiation Protection over the current licensing period:

### 3.7.2 Discussion

During the current licensing period, CNL has implemented and maintained a Radiation Protection (RP) program at the WL site that protected the health and safety of persons and ensured occupational exposures are below regulatory dose limits and maintained ALARA. From 2009-2018 the average effective doses to workers at WL has remained very low, typically less than 10% of the 1 mSv annual dose limit for members of the public.

CNSC staff conclude that CNL's implementation of their RP program at the WL site meets all applicable regulatory requirements and CNSC expectations. CNSC staff are satisfied that licensed activities at the WL site are conducted in a safe manner.

### 3.7.3 Summary

A summary of the licensee's past performance, challenges and proposed improvements are presented in the following subsections.

#### 3.7.3.1 Past Performance

CNSC staff's assessment of performance considers indicators such as: monitoring of performance data, event reviews and results of inspection.

#### Application of ALARA

CNL has a documented ALARA program that identifies the methods and processes in place at the WL site to control dose and minimize exposures. This program integrates ALARA into design, planning, management and control of radiological activities. The ALARA program is based on current industry best practices and operating experience.

CNL's application of ALARA within the RP program includes management commitment and oversight, personnel qualification and training, provision of design features to optimize exposure, provision of protective equipment and clothing, ALARA assessments and reviews for higher risk radiological activities.

Radiological work assessments and radiological work plans/procedures are prepared and used to provide assurance that work activities at the WL site will be consistent with the ALARA principle and provide effective control to prevent unplanned exposures. These documents incorporate radiological control hold and back-out points, individual and collective dose estimates, and control measures to ensure worker safety.

CNSC staff are satisfied with the implementation of CNL's RP program at the WL site and conclude that the program meets all applicable regulatory requirements and expectations related to the application of ALARA.

### Worker Dose Control

The *Radiation Protection Regulations* require that all licensees implement a RP program to control the occupational doses received by persons.

The RP program at the WL site has been effectively implemented to ensure doses received by workers are monitored, controlled and maintained well below regulatory limits.

CNL operates a CNSC licensed dosimetry service to monitor, assess, records and report doses received by employees and contractors as a result of licensed activities at the WL site. The RP program includes the criteria and procedures necessary to provide assurance that licensed dosimetry will be provided in accordance with regulatory requirements for all potential hazard types. The implementation of the RP program relating to personal dosimetry meets regulatory requirements.

At the WL site, all workers (e.g. full time workers, contractors) that have a reasonable probability of receiving an occupational dose greater than 1 mSv/year are identified as Nuclear Energy Workers (NEWs) in accordance with RP program criteria.

During the period from 2009 to 2018, no person received an exposure that exceeded the annual dose limit of 50 mSv/year for a NEW:

- The maximum annual individual effective dose[2] received by a NEW over this period was 1.7 mSv (approximately 3.3% of the 50 mSv annual effective dose limit).
- The maximum equivalent dose[3] to the skin received by a NEW over this period was 4.1 mSv (approximately 0.8% of the annual 500 mSv equivalent dose limit for the skin).
- The maximum equivalent dose to the skin of the hands and feet received by a NEW over this period was 36.7 mSv (approximately 7.3% of the annual 500 mSv equivalent dose limit for the hands and feet).

Figure 3 illustrates the distribution of annual effective dose to workers at the WL site for the years 2009 – 2018.

Figure 4 illustrates the average and maximum effective doses to WL workers for the years 2009 – 2018. Average effective doses to workers remained very low

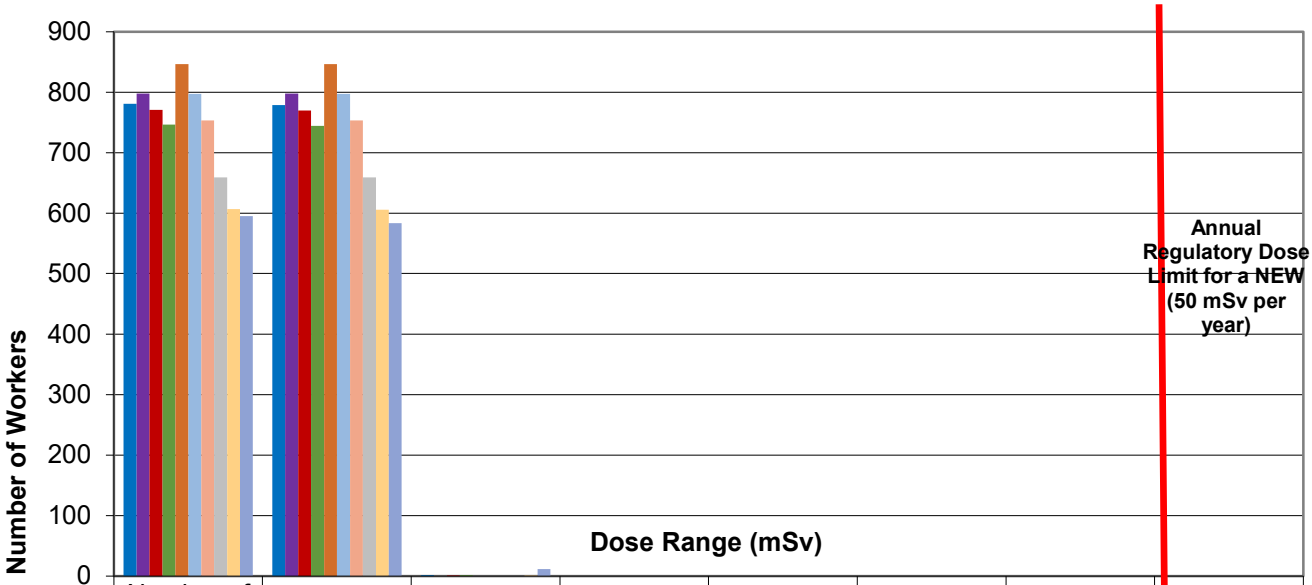
[2] Effective dose is a measure of the total detriment, or risk, due to an exposure to ionizing radiation. It is calculated by multiplying the equivalent dose of radiation received by and committed to each organ or tissue by the weighting factor for that tissue/organ and then summing the products.

[3] The equivalent dose is a measure of detriment to an organ or tissue. It is calculated by multiplying the absorbed dose of radiation by its radiation weighting factor (radiation type specific). It is designed to reflect the amount of detriment caused regardless of the type of radiation.

throughout the licensing period, typically less than 10% of the 1 mSv annual dose limit for members of the public.

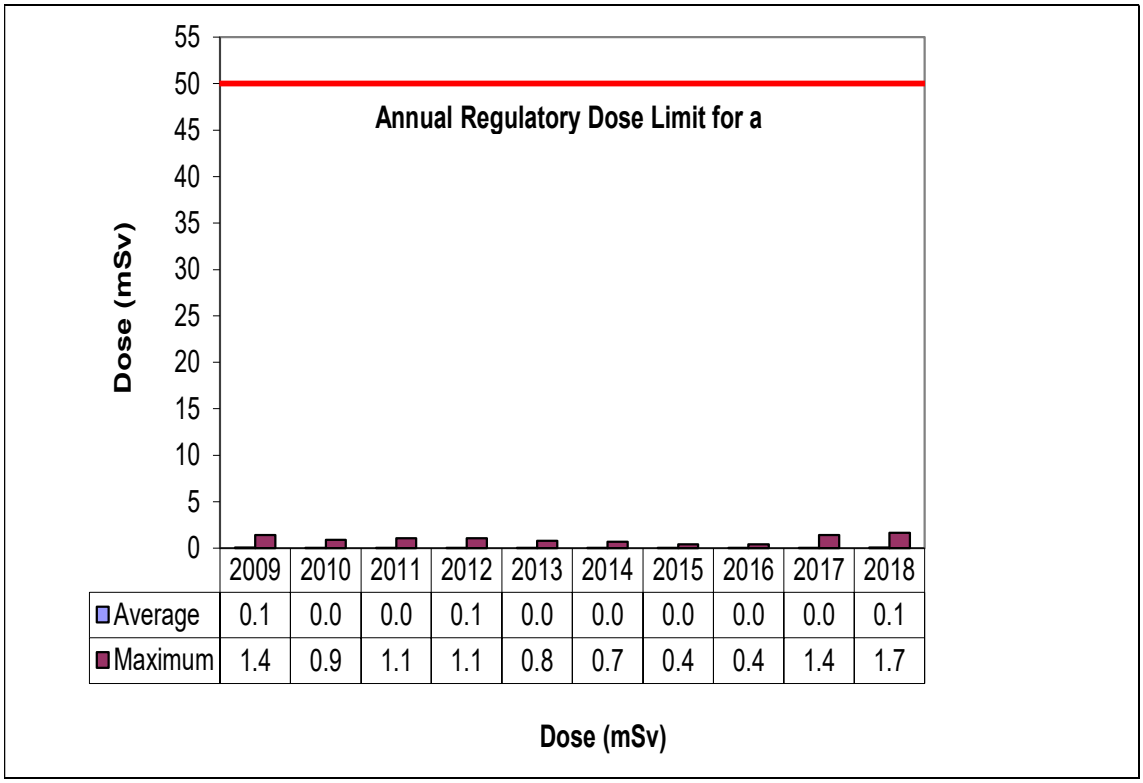
The average and maximum effective and equivalent doses, along with the effective dose distribution data demonstrate that CNL is maintaining effective control over worker exposures at the WL site.

**Figure 3: Effective dose distribution to CNL-WL workers from 2009 to 2018**




| | Number of Workers Monitored | ≤ 1 mSv | > 1 - 2 mSv | > 2 - 5 mSv | > 5 - 10 mSv | > 10 - 20 mSv | > 20 - 50 mSv | > 50 mSv |
|---|---|---|---|---|---|---|---|---|
| 2009 | 781 | 779 | 2 | 0 | 0 | 0 | 0 | 0 |
| 2010 | 798 | 798 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2011 | 771 | 770 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2012 | 746 | 744 | 2 | 0 | 0 | 0 | 0 | 0 |
| 2013 | 846 | 846 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2014 | 797 | 797 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2015 | 753 | 753 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2016 | 659 | 659 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2017 | 607 | 606 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2018 | 595 | 583 | 12 | 0 | 0 | 0 | 0 | 0 |

**Figure 4: Average and maximum effective doses to CNL-WL workers from 2009 to 2018**




*Average doses are calculated values rounded to the nearest tenth of a mSv (e.g. 0.0 mSv denotes from 0.00 mSv to 0.04 mSv).

**Table 2: Dose to the skin of the hands and feet to CNL-WL's workers from 2009 to 2018**

| Dose Statistic | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | Annual Regulatory Dose Limit for a NEW |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Average extremity dose (mSv) | 1.2 | 0.4 | 0.4 | 1.0 | 0.2 | 0.4 | 0.1 | 0.1 | 1.5 | 5.0 | 500 mSv/yr |
| Maximum extremity dose (mSv) | 6.2 | 1.8 | 1.9 | 4.3 | 0.7 | 1.3 | 0.7 | 0.1 | 11.4 | 36.7 | |

**Table 3: Skin doses to CNL-WL's workers from 2009 to 2018**

| Dose Statistic | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | Annual Regulatory Dose Limit for a NEW |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Average skin dose (mSv) | 0.1 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 500 mSv/yr |
| Maximum skin dose (mSv) | 4.1 | 1.2 | 1.2 | 4.0 | 1.3 | 1.6 | 0.7 | 0.4 | 2.9 | 3.7 | |

CNSC staff are satisfied with the implementation of CNL's RP program at the WL site, and confirm that the program meets all applicable regulatory requirements and expectations related to worker dose control

## Radiation Protection Program Performance

CNL has effectively implemented the RP program at the WL site. This program satisfies the requirements of the *Radiation Protection Regulations* and includes a number of performance indicators to continuously monitor RP program performance.

In 2016, CNL began revising RP documentation in order to reflect and support the radiological activities performed at all CNL sites and to harmonize it with CNL's revised company-wide management system.

CNL has established action levels for effective dose, equivalent dose (for skin and the skin on the hands and feet), internal exposure and skin exposure due to a skin contamination event. If any of the action levels are reached or exceeded, CNL must notify CNSC staff and conduct an investigation of the circumstances so that corrective actions can be taken well before a regulatory dose limit is exceeded.

RP program inspections were conducted by CNSC staff throughout the licensing period. Findings from these inspections confirmed compliance with regulatory requirements. Findings of a non-compliant nature were non-safety significant and corrected in a timely manner. Currently there are no open findings of regulatory non-compliance in the RP SCA.

CNSC staff are satisfied with the implementation of the RP program at the WL site. The program meets regulatory requirements and adequate oversight is being applied by the licensee to monitor the implementation and the performance of the RP program

## Radiological Hazard Control

CNL continued to maintain and implement RP program requirements for contamination monitoring and control at all of their facilities at the WL site.

CNL's RP program ensures there are adequate measures in place to monitor and control radiological hazards. This includes, but is not limited to: contamination control, radiation dose rate control, and airborne monitoring and control.

Contamination control at the WL site ensures contamination is prevented from leaving radiologically controlled areas, and the spread of contamination within these areas is minimized. This is achieved by establishing radiological zones with prescribed contamination limits, classifying areas according to their radiation hazard potential, restricting access to authorized personnel, ensuring each radiological area is posted, routine monitoring of workplaces for contamination, minimizing contamination levels, and monitoring personnel and material prior to leaving contaminated or potentially contaminated areas. During CNSC staff inspections of the site, inspectors have regularly verified the effectiveness of the licensee's program of radiological zone control.

Based on CNSC staff's assessments through inspection observations and record reviews, radiological hazards continued to be effectively controlled at the WL site.

**Estimated Dose to the Public**

There was no significant dose to the public during the previous licence period. Data on the maximum effective dose to a member of the public for the last 5 years is provide in Table 4.

**Table 4: Maximum effective dose to a member of the public, CNL-WL, 2014-18**

| Dose data | 2014 | 2015 | 2016 | 2017 | 2018 | Regulatory dose limit |
|---|---|---|---|---|---|---|
| **Maximum effective dose mSv)** | 1.4E-03 | 4.2E-05 | 7.5E-05 | 4.8E-05 | 3.6E-05 | 1 mSv/year |

### 3.7.3.2 Regulatory Focus

Since 2009, CNL focused on monitoring and improving the RP program documentation. CNSC staff will continue to evaluate the processes used by CNL to verify that the protection of the workers is optimized and that the radiological exposures remain ALARA. As CNL updates the RP program, CNSC staff conduct desktop reviews to ensure the requirements of the *Radiation Protection Regulations* continue to be met.

### 3.7.3.3 Proposed Improvements

CNL is in the process of revising some of the Action Levels for use at the WL site. These new Action Levels will be subject to CNSC staff review and acceptance. The revision of the Action Levels was initiated in 2017 in accordance with the guidance in section 9.1, Radiation Protection, of the current LCH. The

licensee is expected to conduct a documented review and, if necessary, revise Action Levels at least once per licence period in order to validate their effectiveness. The results of such reviews should be provided to the CNSC. CNL has had a productive on-going dialog with CNSC staff on the justification for the proposed revisions to the Action Levels. CNSC staff are confident that the new Action Levels s will be in effect prior to the end of the current licence period.

CNSC staff will continue to monitor CNL's performance in this SCA through regulatory oversight activities including onsite inspections and reviews of relevant program documentation.

### 3.7.4 Conclusion

There are no challenges with CNL's adherence with the RP regulations and CNL's implementation of RP requirements under this SCA.

Based on CNSC staff assessments of CNL's application, supporting documents and past performance, CNSC staff conclude that CNL continues to implement and maintain an effective radiation protection program at the WL site in accordance with regulatory requirements.

### 3.7.5 Recommendation

One licence condition is included in the proposed licence for this SCA. Licence condition 7.1 requires CNL to implement and maintain a radiation protection program, which includes a set of action levels. When the licensee becomes aware that an action level has been reached, the licensee shall notify the Commission within seven days. Compliance verification criteria for this licence condition are included in the draft LCH.

## 3.8 Conventional Health and Safety

The Conventional Health and Safety SCA relates to the implementation of a program to manage workplace safety hazards and to protect workers.

The specific areas that comprise this SCA at the WL site include:

- Performance
- Practices
- Awareness

### 3.8.1 Trends

The following table indicates the overall rating trends for the Conventional Health and Safety over the current licensing period:

| TRENDS FOR CONVENTIONAL HEALTH AND SAFETY | | | | |
|---|---|---|---|---|
| **Overall Compliance Ratings** | | | | |
| **2014** | **2015** | **2016** | **2017** | **2018** |
| SA | SA | SA | SA | SA |
| **Comments** | | | | |
| The ratings for the time period of 2009 to 2011 were SA for each year. These were reported in the CMD 12-M47, *Interim Status Report on the Progress of Decommissioning Activities at Whiteshell Laboratories* [3].<br>The ratings for 2012 and 2013 were both SA. These were reported in CMD 14-M79, *Annual Performance Report AECL's Nuclear Sites and Projects: 2013* [4].<br>CNL continues to be rated SA in this SCA at the Whiteshell Laboratories. CNSC staff conclude that CNL's Conventional Health and Safety performance meets regulatory requirements. | | | | |

### 3.8.2 Discussion

CNL has implemented and maintains a conventional health and safety program to manage workplace safety hazards and to protect personnel and equipment. The nature of the activities related to decommissioning, dismantlement and demolition of redundant structures at the WL site make conventional health and safety an important program, for this site.

CNSC staff on inspection routinely observe workers' compliance with requirements related to proper use of personal protective equipment (PPE), use of proper signage and barriers and the general state of work sites. CNSC staff conclude that CNL's Conventional Health and Safety SCA at the WL site met all applicable regulatory requirements and CNSC expectations.

### 3.8.3 Summary

A summary of the licensee's past performance, challenges and proposed improvements are presented in the following subsections.

#### 3.8.3.1 Past Performance

#### Practices

In addition to the NSCA [7] and its associated regulations, CNL's activities must comply with Part II: *Occupational Health and Safety* of the *Canada Labour Code* [11], its *Canada Occupational Health and Safety Regulations*, and other applicable federal and provincial health and safety acts and regulations.

CNL's occupational health and safety program applies to all work performed by CNL employees, and to work performed by others on sites and work places controlled by CNL.

CNSC staff verified CNL safety practices during compliance inspections. CNSC staff are satisfied with CNL's performance at the WL site in the aspects related to conventional health and safety.

### Awareness

CNL actively promotes conventional health and safety through the provision of information, training, instructions, and supervision. Employees are encouraged to participate, and to report concerns (e.g., unsafe conditions, non-compliances, or events) in order to identify hazards and ensure measures are put in place to prevent injury and illness.

On May 30, 2019 CNL conducted a company-wide full day Safety Stand Down. The Safety Stand Down was dedicated to raising safety awareness, strengthening work practices, and taking immediate action to address emergent safety issues, in effort to improve CNL's performance related to industrial safety. CNSC staff were present as observers at the Safety Stand Down event. In addition to the all-day event in May, CNL has held company-wide themed meetings in response to incidents at any of the CNL sites to increase awareness and incorporate lessons learned. CNSC staff routinely monitor these meetings, and as needed, follow up on corrective actions during inspections.

Since 2009, CNL improved aspects of the conventional health and safety program based on industry best practices and the results of internal focused audits, self-assessments, effectiveness reviews and health and safety inspections.

The findings from these reviews, audits, inspections and self-assessments resulted in internal actions being raised to improve site wide health and safety performance. These internal actions focused on continuing to increase awareness of occupational hazards and the potential for injury to workers, as well as on methodologies to reduce the frequency of occurrence.

CNSC staff monitors CNL employee reports of safety concerns through the initiation of ImpActs as stated in section 3.1.3.1. CNSC staff are satisfied with CNL's promotion of health and safety awareness at WL.

### Performance

The key performance indicators for conventional health and safety are the number of recordable lost-time injuries (RLTI) that occur per year, RLTI severity and RLTI frequency. An RLTI is defined as an injury that takes place at work, and results in the worker being unable to return to work and carry out their duties for a period of time. The RLTI frequency and RLTI severity are both based on 100 full time workers (100 FTE = 200,000 hours worked).

$$RLTI\ frequency = 200{,}000\ hrs\ X\ \frac{\#\ of\ lost\ time\ injuries}{person\ hours\ worked}$$

$$RLTI\ severity = 200{,}000\ hrs\ X\ \frac{\#\ of\ working\ days\ lost}{person\ hours\ worked}$$

Data on RLTI, RLTI Frequency and RLTI Severity since 2009 is included in table 5 below.

**Table 5: Recordable lost-time injuries (RLTI), frequency and severity at WL**

| Year | RLTIs | RLTI Frequency | RLTI Severity |
|---|---|---|---|
| **2009** | 5 | 1.6 | 8.5 |
| **2010** | 7 | 2.0 | 12.2 |
| **2011** | 8 | 2.1 | 13.1 |
| **2012** | 5 | 1.2 | 9.2 |
| **2013** | 7 | 1.6 | 14.4 |
| **2014** | 4 | 0.90 | 12.2 |
| **2015** | 0 | 0 | 0 |
| **2016** | 1 | 0.29 | 1.46 |
| **2017** | 3 | 0.86 | 7.67 |
| **2018** | 1 | 0.28 | 1.45 |

#### 3.8.3.2 Regulatory Focus

CNSC staff continue to monitor CNL's performance in this SCA through regulatory oversight activities including onsite inspections and desktop reviews of relevant program documentation.

CNSC staff continue to focus regulatory oversight in this area as decommissioning and demolition activities are planned by CNL. As the CNL occupational health and safety program is updated, CNSC staff conduct desktop reviews to ensure regulatory requirements continue to be met.

#### 3.8.3.3 Proposed Improvements

No improvements to this SCA are proposed.

### 3.8.4 Conclusion

There are no challenges to with CNL's implementation of this SCA.

Based on CNSC staff assessments of CNL's application, supporting documents and past performance, CNSC staff conclude that CNL continues to implement and

maintain an effective conventional health and safety program at the WL site in accordance with regulatory requirements.

### 3.8.5 Recommendation

One licence condition is included in the proposed licence for this SCA. Licence condition 8.1 requires CNL to implement and maintain a conventional health and safety program. Compliance verification criteria for this licence condition are included in the draft LCH.

## 3.9 Environmental Protection

The Environmental Protection SCA covers programs that identify, control and monitor all releases of radioactive and hazardous substances and effects on the environment from facilities or as the result of licensed activities.

The specific areas that comprise this SCA at the WL site include:

- Effluent and emissions control (releases)
- Environmental management system (EMS)
- Assessment and monitoring
- Protection of the public
- Environmental risk assessment

### 3.9.1 Trends

The following table indicates the overall rating trends for the Environmental Protection over the current licensing period:

| TRENDS FOR ENVIRONMENTAL PROTECTION | | | | |
|---|---|---|---|---|
| **Overall Compliance Ratings** | | | | |
| **2014** | **2015** | **2016** | **2017** | **2018** |
| SA | SA | SA | SA | SA |
| **Comments** | | | | |
| The ratings for the time period of 2009 to 2011 were SA for each year. These were reported in the CMD 12-M47, *Interim Status Report on the Progress of Decommissioning Activities at Whiteshell Laboratories* [3].<br>The ratings for 2012 and 2013 were both SA. These were reported in CMD 14-M79, *Annual Performance Report AECL's Nuclear Sites and Projects: 2013* [4].<br>Performance levels for Environmental Protection SCA have been consistent from year to year, with satisfactory ratings given from 2009 to 2018.<br>CNSC staff conclude that CNL's Environmental Protection performance meets regulatory requirements. | | | | |

### 3.9.2 Discussion

CNL submitted its Integrated Environmental Monitoring Program as the framework for its Environmental Protection Program (EnvP) at the WL site [12]. The basis for the program is the WL Comprehensive Study Report (CSR) [13] conducted in 2001 and the WL Site's Dose Model [14]. These two assessments generated conclusions which were used to design and update the monitoring program, as well as any recommendations for further work required to adequately determine WL's environmental risk.

CNL's Integrated Environmental Monitoring Program achieves three main tasks:

- Direct release monitoring
- Contaminant pathways monitoring and
- Biological effects monitoring as applicable to all individual monitoring

The Integrated Environmental Monitoring Program aligns with the principles of the associated CSA Standards and consists of the following three distinct programs:

- the Effluent Verification Monitoring Program (EVMP)
- the Environmental Monitoring Program (EMP)
- the Groundwater Monitoring Program (GWMP)

The WL Radiological and Non-radiological EMP, EVMP and GWMP are being revised to comply with CSA Standards N288.4-10 and N288.5-11. CNL has committed to the following implementation dates to update their EVMP and EMP to be in compliance with these CSA standards:

- CSA N288.4-10, Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills, by January 01, 2020
- CSA N288.5-11, Effluent monitoring programs at Class I nuclear facilities and uranium mines and mills, by January 01, 2020
- CSA N288.7-15, Groundwater protection programs at Class I nuclear facilities and uranium mines and mills, by January 01, 2020

CNL has established Derived Release Limits (DRLs) [14] and action levels [15], at the WL site, to ensure that the releases of radionuclides from the facility's operations would not exceed the established regulatory limit of 1 mSv/yr and the public and environment are protected.

To complement ongoing compliance activities, the CNSC has implemented its Independent Environmental Monitoring Program (IEMP). The IEMP results around the WL site indicate that the public and the environment in the vicinity of WL are protected. The IEMP report for the WL site is published on the CNSC's website *http://www.nuclearsafety.gc.ca/eng/resources/maps-of-nuclear-facilities/iemp/whiteshell.cfm*. Additional information on the IEMP is presented in Addendum D, Environmental Protection Review Report, of this CMD.

### 3.9.3 Summary

A summary of the licensee's past performance, challenges and proposed improvements are presented in the following subsections.

#### 3.9.3.1 Past Performance

#### Effluent and emissions control (releases)

CNL has implemented and maintained an EVMP at the WL site. CNL's EVMP provides details on WL's radioactive and non-radioactive release monitoring including the decision for the need and development of the program, as well as identifying the rationale behind the current monitoring schedule. The EVMP also provides the WL site specific details on the execution of the program.

As per CNSC reporting requirements in the current LCH, CNL provides its EVMP results through the issuance of the annual report, to confirm compliance with the applicable regulations. CNSC staff review of CNL's EVMP monitoring results [16 to 33] for WL for the licence period of 2009 to 2018, indicates that releases were below regulatory limits. The minimum and maximum weekly releases are included in tables 6 and 7.

**Table 6: The weekly releases to water from the WL site operations**

| Parameter | Releases (range Min & Max) (*Bq/wk*) | Release limits (*Bq/wk*) | |
|---|---|---|---|
| | | 2009-2015 | 2016*-2018 |
| Cs-137 | 1.22E+00-1.30E+07 | 2.41E+11 | 1.16E+10 |
| Sr-90 | 3.30E+06 -1.3E+07 | 1.46E+12 | 1.3E+10 |
| Gross Alpha Particulates | 2.90E+06 -9.50E+06 | 2.8E+11 | 1.1E+09 |

** = Release limits were revised in 2016 to meet CSA N288.1-08*

**Table 7: The weekly releases to air from the WL site operations**

| Parameter | Releases (range Min & Max) (*Bq/wk*) | Release limits (*Bq/wk*) | |
|---|---|---|---|
| | | 2009- 2015 | 2016*-2018 |
| Tritium | 4.00E+08-3.66E+09 | 7.64E+14 | 1.65E+14 |
| Gross Beta Particulates (Cs-137) | 4.31E+03 -1.5E+04 | 1.19E+10 | 6.92E+09 |
| Gross Alpha Particulates (Pu-239) | 1.70E+03 - 2.20E+03 | 7.6E+14 | 1.73E+09 |

** = Release limits were revised in 2016 to meet CSA N288.1-08*

Based on review and assessment of the EVMP results [16 to 33] presented in CNL's reports, CNSC staff conclude that the EVMP currently in place for the WL site continues to protect the public and the environment.

### Environmental Management System (EMS)

CNL has established and implemented an Environmental Management System (EMS) for the WL site that meets CNSC requirements outlined in REGDOC 2.9.1, *Environmental Principles, Assessment and Protection Measures*. The EMS assesses environmental risks associated with its nuclear activities to ensure these activities are conducted in a way that prevents or mitigates adverse environmental effects. CNL's EMS has been registered to International Standards Organization (ISO) 14001:2004 Standard, Environmental Management Systems – Requirements with Guidance for Use.

### Assessment and Monitoring

CNL has implemented a radiological environmental monitoring procedure that defines the requirements, responsibilities and process for radiological environmental monitoring at the WL site and in the surrounding areas. This procedure is in accordance with general requirements for radiological effluent and environmental monitoring of Management, Monitoring of Emissions and Environmental Monitoring Programs.

The purpose of CNL's environmental monitoring procedure is to:

- Measure contaminants in surrounding environmental media including ground water of the facility or site.
- Determine the impacts of the site or facility operation on people and the environment.
- Verify the effectiveness of emission controls and the adequacy of effluent monitoring.

CNL provides its environmental monitoring results through the issuance of the annual report. The annual report is reviewed by CNSC staff to confirm compliance with the applicable regulation. CNSC staff review of environmental monitoring results [16 to 33] for the licence period of 2009 to 2018, indicate that:

- Monitoring of potential atmospheric effluent exposure pathways did not indicate any significant dose contributions from the operations of the WL site.
- Radioactive contaminants in Winnipeg River water remained below allowable levels defined in the Canadian Drinking Water Guidelines [42].
- The groundwater monitoring program has demonstrated that there is no significant radioactive parameters (gross beta, gross alpha, tritium and uranium) migration from the waste management facilities.

This procedure follows and is consistent with CSA-N288.4-M90. CNL has committed to implement the new CSA standards N288.4-10 and N288.7-15 by January 01, 2020.

CNSC staff review of EMP monitoring results [16 to 33] for the licence period of 2009 to 2018, indicate that total estimated doses due to radioactivity in WL effluents were in the range of 4.8 x 10-5 mSv/yr and 1.8 x 10-3 mSv/yr (liquid pathway) and 2.0 x 10-6 and 8.0 x 10-6 mSv/yr (airborne pathway). This indicates that the releases of radionuclides in the environment resulted in a low level of dose to the public. The estimated maximum effective radiation dose to the public from WL's operations continues to be well below the regulatory dose limit of 1 mSv/yr. The detailed results of public dose are presented in section 3.7, Radiation Protection, of this CMD.

Based on review and assessment of the environmental monitoring results [16 to 33] presented in CNL's reports, CNSC staff conclude that the EVMP currently in place for WL continues to protect the public and the environment.

### Protection of the public

This specific area within the Environmental Protection SCA is related to ensuring that members of the public are not exposed to "unreasonable" risk with respect to hazardous substances discharged from the nuclear facilities.

CNSC staff conducted a review of EVMP non-radiological monitoring results [16 to 33] for the licence period of 2009 to 2018, which indicated that:

- 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), non-radiological emissions to air (greenhouse gases) dropped significantly. Overall airborne emission remained below the National Pollutant Release Inventory (NPRI) reporting threshold except for particulate matter (PM10 & 2.5) which was reported to NPRI.
- Liquid effluents non-radiological monitoring results have been consistent over the licence period and in general remained below the monthly CNL internal guidelines for chemical substances in liquid effluents.

Greenhouse gas (GHG) emissions from the WL site include carbon dioxide, methane and nitrous oxide. Emissions are primarily from the burning of propane, the use of diesel generators, the on-site transportation fleet, the on-site landfill and open-pit wood burning. They are measured in CO2 equivalent tonnes which is a measure used to compare between gases that have different Global Warming Potential (GWP).

The GHG emissions from the site have had a decreasing trend (from 8056 tonnes/yr in 2011 to 1678 tonnes/yr in 2018), which CNL has attributed to the decrease in fuel required to heat the site as buildings are decommissioned and elimination of the use of Number 2 Fuel in 2013, which was historically the

greatest contributor of GHG emissions at the WL site. Table 8 provides the total estimated annual greenhouse gas emissions from the WL site.

**Table 8: Total estimated annual greenhouse gas emissions from the WL site (2011-2018)**

| Year | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|---|
| Greenhouse Gas ($CO_2e$ tonnes/yr)* | 8,056 | 6,310 | 4,260 | 1,940 | 1,957 | 1,883 | 1,873 | 1,678 |

* $CO_2e$ tonnes: A unit of measure used to compare between greenhouse gases with different Global Warming Potentials. For example, the Global Warming Potentials for methane is 25. This means that emissions of one metric ton of methane are equivalent to emissions of 25 metric tons of $CO_2$. In 2013, the GWP for methane and nitrous oxide were changed from 21 to 25 and 310 to 298 respectively under the Canadian Environmental Protection Act Notice with Respect to Reporting of Greenhouse Gases for 2013.

## Environmental risk assessment

From the perspective of environmental risk assessment (ERA), CNSC staff have reviewed the CSR and the follow-up monitoring results as well as safety reports submitted annually for the Whiteshell Laboratories Decommissioning Project. The CSR concluded that the decommissioning project is not likely to cause significant adverse environmental effects taking into account the mitigation measures implemented by the licensee.

As part of future decommissioning activities, an updated ERA for the lagoon and landfill areas of the WL site is currently underway. CNSC staff will review this assessment, when submitted.

As required under CNL's licence, a series of annual safety reports were submitted for the WL site. CNSC staff review of these reports indicate that radiation levels and radioactive contamination from operations at the site resulted in radiation doses to members of the public below regulatory limits and guidelines.

Monitoring of pathways for exposure to potential liquid effluent(s) from operational and decommissioning activities at the WL site indicated very small contributions to downstream concentrations of radionuclides (Cs-137) in fish in the Winnipeg River. Similarly, radioactive contaminants in the Winnipeg River were well below the Canadian drinking water guidelines. Dose to members of the public from liquid effluents at WL was calculated to be 4.8 X 10-5 mSv/yr.

Levels of radioactivity in groundwater, soil and vegetation in the vicinity of the WL site indicated that there was no significant migration of radioactive contamination from the waste management facilities at the WL site.

Sampling and analysis of groundwater from the waste management areas and the lagoon and landfill areas for non-radiological parameters (chromium, copper, iron, lead, zinc, arsenic, mercury, nitrate, nitrite, ammonia, chloride, volatile organic compounds and HB-40) indicated that concentrations of these substances

were either below their respective limits of detection or were below guideline values.

Furthermore, monitoring of pathways for exposure to atmospheric emissions did not indicate any measurable dose contributions above background levels from operational and decommissioning activities at the WL site. Airborne contaminants that were monitored included ambient gamma, gross beta, gross alpha, Sr-90, Cs-137, and K-40. Airborne emissions were negligible, with an estimated public dose of 2 X 10-6 mSv/yr.

For non-human biota, dose modelling for aquatic species (fish, clams) and measured radionuclide concentrations in incidental animal road kill (deer, grouse) indicated dose levels below United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) benchmarks.

Finally, results of the CNSC's IEMP reported in 2018 indicated that there is no human health impact expected in the vicinity of the WL site. This sampling campaign included air, water, soil, sediment, vegetation and food stuffs (fish, vegetables, etc.) taken from publically accessible areas near the WL site and analyzed for a range of radiological contaminants such as gross alpha, gross beta, tritium, Cs-137, and Co-60. The detailed results of the IEMP are presented in Addendum D, Environmental Protection Review Report.

Based on the available information from the CSR, and the follow-up monitoring results as well as safety reports submitted annually for the site and the CNSC IEMP, CNSC staff conclude that risk to human health and the environment can be characterized as low, with an overall trend that indicates stable performance of the WL site.

#### 3.9.3.2 Regulatory Focus

CNSC staff will continue to monitor CNL's performance in the Environmental Protection SCA through regulatory oversight activities including onsite inspections and desktop reviews of relevant environmental protection program documentations.

CNSC staff will review the ERA for the lagoon and landfill sites at the WL site, once they are submitted by CNL. It is also expected that CNL will conduct a site-wide ERA in accordance with REGDOC-2.9.1-2017 and the CSA Standard N288.6-12 *Environmental Risk Assessment at Class I Nuclear Facilities and Uranium Mines and Mills* during the next licensing period.

#### 3.9.3.3 Proposed Improvements

CNL has noted that over the next licence period, through the implementation of the following standards/regulatory requirements, they expect to achieve, improvements in the WL Environmental Protection Program:

- REGDOC-2.9.1 (2017), Environmental Principles, Assessment and Protection Measures, version 1.1, section 4.6;

- CSA N288.4-10 (R2015), Environmental Monitoring Programs at Class I Nuclear Facilities and Uranium Mines and Mills;
- CSA N288.5-11 (R2016), Effluent Monitoring Programs at Class I Nuclear Facilities and Uranium Mines and Mills;
- CSA N288.6-12 (R2017), Environmental Risk Assessments at Class I Nuclear Facilities and Uranium Mines and Mills;
- CSA N288.7-15, Groundwater Protection Programs at Class I Nuclear Facilities and Uranium Mines and Mills; and
- CSA N288.8-17, Establishing and Implementing Action Levels for Releases to the Environment from Nuclear Facilities,
- 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 and exceed the new requirements.

CNSC staff have accepted CNL's plan and schedule for the implementation of these standards, and through regular program updates, CNSC staff track and monitor licensee's compliance with its commitments. There are no concerns with licensee's implementation schedule.

### 3.9.4 Conclusion

There are no challenges to with CNL's implementation of this SCA.

Based on the CNSC staff assessments of CNL's safety and control measures at the WL site regarding the specific areas of the Environmental Protection SCA and upon review of CNL's licensing applications, supporting documentation and past performance, CNSC staff conclude that there are no significant concerns related to the protection of the public and the environment. CNL continues to maintain and implement an environmental protection program at WL in accordance with CNSC requirements.

### 3.9.5 Recommendation

One licence condition is included in the proposed licence for this SCA. Licence condition 9.1 requires CNL to implement and maintain an environmental protection program, which includes a set of action levels. When the licensee becomes aware that an action level has been reached, the licensee shall notify the Commission within seven days. Compliance verification criteria for this licence condition are included in the draft LCH.

CNSC staff will include the following in the Environmental Protection section of the draft LCH; "The licensee shall conduct an updated site-wide environmental risk assessment (ERA) in accordance with the CSA Standard N288.6-12 *Environmental Risk Assessment at Class I Nuclear Facilities and Uranium Mines and Mills* taking into account current conditions at the WL site".

## 3.10 Emergency Management and Fire Protection

The Emergency Management and Fire Protection SCA covers emergency plans and emergency preparedness programs that exist for emergencies and for non-routine conditions.

The specific areas that comprise this SCA at the WL site include:

- Conventional emergency preparedness and response;
- Nuclear emergency preparedness and response; and
- Fire emergency preparedness and response.

### 3.10.1 Trends

The following table indicates the overall rating trends for the Emergency Management and Fire Protection over the current licensing period:

| TRENDS FOR EMERGENCY MANAGEMENT AND FIRE PROTECTION | | | | |
|---|---|---|---|---|
| **Overall Compliance Ratings** | | | | |
| **2014** | **2015** | **2016** | **2017** | **2018** |
| SA | SA | SA | SA | SA |
| **Comments** | | | | |
| The ratings for the time period of 2009 to 2011 were SA for each year. These were reported in the CMD 12-M47, *Interim Status Report on the Progress of Decommissioning Activities at Whiteshell Laboratories* [3].<br>The ratings for 2012 and 2013 were both SA. These were reported in CMD 14-M79, *Annual Performance Report AECL's Nuclear Sites and Projects: 2013* [4].<br>CNL continues to be rated SA in this SCA at the Whiteshell Laboratories. CNSC staff conclude CNL's Emergency Management and Fire Protection performance meets regulatory requirements. | | | | |

### 3.10.2 Discussion

The current licence requires CNL to implement and maintain an emergency preparedness program and a fire protection program. The approach to Emergency Preparedness and Fire Protection for the WL site is based on a combination of detailed planning and hazard identification and risk assessments at all facilities. This is complemented by drills and emergency exercises conducted in partnership with the emergency response teams in local municipalities. CNSC staff have assessed that the WL site continues to meet regulatory requirements and is performing satisfactorily with respect to this SCA.

## 3.10.3 Summary

A summary of the licensee's past performance, challenges and proposed improvements are presented in the following subsections.

### 3.10.3.1 Past Performance

CNL completes drills and exercises annually at the WL site, in accordance with the WL five-year drill and exercise plan. Drill and exercise topics include fires, active threats, hazardous goods events (e.g., PCBs, chlorine, fuel), radiation events, and transportation accidents involving radiological materials. The drill and exercise plan was revised during the previous licence period to reflect the current status of the site.

#### Nuclear Emergency Preparedness and Response

CNL is required to implement to requirements of REGDOC 2.10.1, *Nuclear Emergency Preparedness and Response*. REGDOC 2.10.1 has been incorporated into CNL's corporate-wide emergency preparedness program, as well as the WL site emergency procedures. To evaluate the emergency preparedness of a licensee, CNSC staff assess the licensee emergency plan and preparedness program as well as the results of emergency exercises. Emergency preparedness at the WL site is governed by the CNL document WL-508730-ERP-001, *Whiteshell Laboratories Emergency Response Plan*. The WL Site Emergency Response Plan includes, but is not limited to, radiological emergencies and outlines the interfaces with the Manitoba Emergency Plan.

#### Fire Emergency Preparedness and Response

The CNL Fire Protection program documentation identifies how fire response is achieved on the site. A gap analysis was performed in 2016 by CNL against the operational requirements of CSA-N393, *Fire Protection for Facilities that Process, Handle, or Store Nuclear Substances*, as requested by the CNSC. A corrective action plan to address the gaps identified was developed and implemented. This corrective action plan was reviewed and assessed by CNSC staff through a desktop review and found to be acceptable. The implementation of this corrective action plan is complete and will be verified by CNSC staff during upcoming inspections.

CNL has a multi-disciplinary emergency response force on site at WL and mutual aid partners (Pinawa and Lac Du Bonnet fire departments) off site.

CNSC staff confirm that the fire response program at the WL site meets regulatory requirements.

#### Conventional Emergency Preparedness and Response

CNL continues to maintain effective conventional emergency response programs. Emergency response personnel are available on site 24 hours a day to respond to any type of emergency. Training and equipment continue to be maintained for

medical response, hazardous materials and other conventional hazards that may be present. CNSC staff conclude CNL's conventional emergency response programs meet regulatory requirements.

#### 3.10.3.2 Regulatory Focus

CNSC staff continue to monitor CNL emergency response programs and their performance in drills and exercises to ensure continuous learning and improvement, and ensure that CNL's emergency response capabilities are maintained.

CNSC staff continue to focus on the site emergency plan during regular compliance activities to ensure the plan remains scalable and flexible to respond to any emergency at site and reflects changing infrastructure at site.

#### 3.10.3.3 Proposed Improvements

No additional changes are proposed for this SCA.

### 3.10.4 Conclusion

There are no challenges to with CNL's implementation of this SCA.

CNL has sufficient provisions in place for emergency preparedness and response capability that would mitigate the effects of accidental releases of nuclear substances and hazardous substances on the environment and the health and safety of persons. CNSC staff are satisfied that CNL has made sufficient preparations to respond to any emergency that may arise on the WL site.

Based on CNSC staff assessment, CNSC staff conclude that CNL emergency management and fire protection programs meet regulatory requirements.

### 3.10.5 Recommendation

Two licence conditions are included in the proposed licence for this SCA. Licence condition 10.1 requires CNL to implement and maintain an emergency preparedness program. Licence condition 10.2 requires CNL to implement and maintain a fire protection program. Compliance verification criteria for both licence conditions are included in the draft LCH.

## 3.11 Waste Management

The Waste Management SCA covers internal waste-related programs that form part of the facility's operations up to the point where the waste is removed from the facility to a separate waste management facility. This SCA also covers the planning for decommissioning.

The specific areas that comprise this SCA at the WL site includes:

- Waste characterization

- Waste minimization
- Waste management practices
- Decommissioning plans

### 3.11.1 Trends

The following table indicates the overall rating trends for the Waste Management over the current licensing period:

| TRENDS FOR WASTE MANAGEMENT | | | | |
|---|---|---|---|---|
| **Overall Compliance Ratings** | | | | |
| **2014** | **2015** | **2016** | **2017** | **2018** |
| SA | SA | SA | SA | SA |
| **Comments** | | | | |
| The ratings for the time period of 2009 to 2011 were SA for each year. These were reported in the CMD 12-M47, *Interim Status Report on the Progress of Decommissioning Activities at Whiteshell Laboratories* [3].<br>The ratings for 2012 and 2013 were both SA. These were reported in CMD 14-M79, *Annual Performance Report AECL's Nuclear Sites and Projects: 2013* [4].<br>CNL continues to be rated SA for their waste management performance at the Whiteshell Laboratories. CNSC staff conclude CNL's Waste Management performance meets performance objectives and applicable regulatory requirements. | | | | |

### 3.11.2 Discussion

The Waste Management SCA includes a waste management program and a plan for the decommissioning of the WL site. CNL has implemented and maintains a waste management program that documents the activities to control the safe management of radioactive waste during all steps of its management. CNL prepared a program overview decommissioning plan that describes the decommissioning strategy and final end-state planned. CNL has also implemented and maintains a decommissioning program.

The singular focus of CNL at the WL site has been decommissioning and demolition of redundant structures on the site, all of which generate waste; waste management is therefore an area of primary focus of CNSC's regulatory activities. CNSC staff have evaluated CNL's compliance through oversight activities such as desktop reviews and compliance inspections. CNSC staff conclude that CNL's Waste Management SCA at the WL site meets all applicable regulatory requirements.

CNSC staff recommendations related to this SCA did not consider the proposed ISD of WR1 reactor. Any proposed activities specifically related to the proposed ISD of WR1 are out of scope of this application and will potentially be considered by the commission in a separate hearing.

### 3.11.3 Summary

A summary of the licensee's past performance, challenges and proposed improvements are presented in the following subsections.

#### 3.11.3.1 Past Performance

Under CNL's waste management program at the WL site, wastes are generated from operational activities and decommissioning projects. Associated with their waste management program, CNL is segregating, packaging, storing and reusing or recycling radioactive, hazardous and conventional wastes. Waste management and decommissioning activities at the WL site were presented to the Commission most recently in the progress update (CMD 18-M30) [5], and the status update (CMD 16-M12) [6]. The following describes updates since these reports were presented.

**Waste Characterization and Waste Minimization**

CNL maintains a waste management program to control and minimize the volume for all waste streams of waste generated from licensed activities. Waste generated at the WL site are radiologically screened and segregated at the source as either "Likely Clean" or "Radiological Contaminated". Likely Clean waste is monitored for radiological clearance. If the waste is confirmed clean (i.e. not radiologically contaminated), the waste is either dispositioned for reuse or recycling where possible, or disposed of in the WL landfill or transferred to an appropriate storage or process facility for hazardous material. Radiologically contaminated waste is decontaminated to meet clearance criteria where feasible or characterized and sent to the Waste Management Area (WMA) for processing or storage.

CNSC staff confirmed through on-site inspections that CNL continues to characterize waste at the various steps in the management of radioactive waste to meet acceptance criteria of the receiver. CNSC staff verify licensee compliance with waste segregation and labelling requirements at the WL site as a standard part of site inspections.

**Waste Management Practices**

The WMA provides processing and storage facilities for radioactive waste. It consists of the Shielded Modular Above Ground Storage (SMAGS) building, bunkers and Quonset buildings used to store low-level waste (LLW) and intermediate-level waste (ILW) generated from WL decommissioning activities. CNL conducts projects to re-characterize radioactive waste as necessary, and to assess waste conditions, environmental conditions and potential environmental impacts. CNL performs inspections of WMA to confirm waste is stored in a safe manner.

CNL is executing the decommissioning of the WMA in accordance with detailed decommissioning plans. This work includes improving access to the area, reducing and repackaging existing waste, and preparing facilities to be decommissioned. The detailed decommissioning plans include the proposed waste management practices and are evaluated and approved by CNSC staff. Following the completion of decommissioning of a building or a location on site, the licensee is required to submit a post-decommissioning report called the end-state report to the CNSC. This report is reviewed by CNSC staff to verify licensee's compliance with the approved plans.

Some of the WL decommissioning activities that have been conducted by CNL at the WMA since the last update to the Commission (CMD 18-M30 [5]) are listed below:

- On-going preparation for the extraction of waste from the ILW bunkers and standpipes. This work began in 2017 and includes the design/construction of systems for remediating these facilities (60% design complete).
- The completion of the construction work for expansion of the protected area in the WMA that surrounds the standpipes. This is required to allow space for the extraction of wastes noted above. The expanded protected area encompasses the standpipes and the ILW bunkers.
- Completion of the development of a modular workspace complex at the entrance of the WMA to control and coordinate worker access to the WMA.
- In 2017, CNL completed waste segregation and repackaging. Since 2016, most WR-1 and some other WMA wastes have been sorted and repackaged, in order to reduce fire loading in storage buildings and to reduce waste volumes. Repackaged wastes have been placed into steel containers and transferred to storage in the SMAGS building.
- Completion of the shipment to CRL of over sixty Cs-137 and Cf-252 sources and approximately 1500 $m^3$ of soil waste from the former Experimental Cesium Pond.

CNSC staff have evaluated CNL's compliance through oversight activities such as desktop reviews and compliance inspections. CNSC staff are satisfied that CNL is carrying out waste management practices and decommissioning work in accordance with the licensing basis.

**Decommissioning Plans**

CNL is planning, preparing for, executing and completing decommissioning activities, in accordance with detailed decommissioning plans.

The WL site is undergoing decommissioning in a staged manner. CNL's planning for decommissioning includes all nuclear and non-nuclear facilities at the site and these decommissioning plans are submitted to the CNSC as separate volumes. 12 Volumes are planned for the entire decommissioning of the WL site. Volume 1 is the program overview document which describes the overall decommissioning strategy of the site and a general overview of individual facilities. The subsequent volumes are submitted to CNSC as separate decommissioning plans for each facility on the WL site. Not all volumes of the detailed decommissioning plan have been developed, as they are developed when so required by CNL.

As stated in the previous section, since the last licensing renewal in 2009 CNL has progressed with decommissioning at the WL site.

### 3.11.3.2 Regulatory Focus

CNSC staff will continue to carry out verification activities as CNL conducts decommissioning activities at the WL site. CNSC staff will continue to monitor

CNL's performance in this SCA through compliance verification activities including onsite inspections, desktop reviews of relevant program documentation. This SCA will remain an area of focus in the next licensing period, as CNL continues to pursue decommissioning activities generating radioactive waste that must be stored and managed at the WL site until a final solution is determined.

#### 3.11.3.3 Proposed Improvements

To better align with the current regulatory requirements and standards, CNL is updating their Volume 1 Program Overview DDP to align with CSA N294-09, *Decommissioning of Facilities Containing Nuclear Substances* and CNSC Regulatory Document, G-219, *Decommissioning Planning for Licensed Activities*.

### 3.11.4 Conclusion

There are no challenges to with CNL's implementation of this SCA.

Based on CNSC staff assessment of CNL's application, supporting documents and past performance, CNSC staff conclude that CNL continues to implement and maintain an effective waste management program at the WL site in accordance with regulatory requirements.

### 3.11.5 Recommendation

Two licence conditions are included in the proposed licence for this SCA. Licence condition 11.1 requires CNL to implement and maintain a waste management program. Licence condition 11.2 requires CNL to maintain a decommissioning plan. Compliance verification criteria for both licence conditions are included in the draft LCH.

## 3.12 Security

The Security SCA covers the programs required to implement and support the security requirements stipulated in the regulations, the licence, orders, or expectations for the facility or activity.

The specific areas that comprise this SCA at the WL site include:

- Facilities and equipment
- Response arrangements
- Security practices
- Drills and exercises

### 3.12.1 Trends

The following table indicates the overall rating trends for the Security over the current licensing period:

| TRENDS FOR SECURITY | | | | |
|---|---|---|---|---|
| **Overall Compliance Ratings** | | | | |
| **2014** | **2015** | **2016** | **2017** | **2018** |
| SA | SA | SA | SA | BE |
| **Comments** | | | | |
| The ratings for the time period of 2009 and 2010 were SA for each year. The rating for 2011 was FS. These were reported in the CMD 12-M47, *Interim Status Report on the Progress of Decommissioning Activities at Whiteshell Laboratories* [3].<br>The ratings for 2012 and 2013 were both FS. These were reported in CMD 14-M79, *Annual Performance Report AECL's Nuclear Sites and Projects: 2013* [4].<br>During 2018, CNSC staff identified a deficiency in the security arrangements at the WL site. These issues have been the subject of enforcement actions, including an Order against CNL, and have led CNSC staff to evaluate CNL's 2018 performance in the SCA of Security at the WL site as 'below expectations' (BE). | | | | |

### 3.12.2 Discussion

The information supporting the performance rating will be presented to the Commission in a separate classified document (CMD 19-H4.A). During 2018, CNSC staff identified a deficiency in the security arrangements at the WL site. These issues have been the subject of enforcement actions, including an Order against CNL, and have led CNSC staff to evaluate CNL's 2018 performance in the SCA of Security at the WL site as 'below expectations' (BE). CNL has proposed corrective actions that are acceptable to CNSC staff. CNSC staff continue to monitor implementation of these corrective actions.

### 3.12.3 Recommendation

One licence condition is included in the proposed licence for this SCA. Licence condition 12.1 requires CNL to implement and maintain a security program. Compliance verification criteria for this licence condition are included in the draft LCH.

## 3.13 Safeguards and Non-Proliferation

The Safeguards and Non-Proliferation SCA covers the programs and activities required for the successful implementation of the obligations arising from the Canada/International Atomic Energy Agency (IAEA) safeguards agreements as well as other measures arising from the Treaty on the Non-Proliferation of

Nuclear Weapons (NPT). This SCA comprises a safeguards program and a non-proliferation program.

The scope of the non-proliferation program for the WL site is limited to the tracking and reporting of foreign obligations and origins of nuclear material. This tracking and reporting assists the CNSC in the implementation of Canada's bilateral Nuclear Cooperation Agreements with other countries. The import and export of controlled nuclear substances, equipment and information identified in the *Nuclear Non-proliferation Import and Export Control Regulations* require separate authorization from the CNSC, consistent with section 3(2) of the *General Nuclear Safety and Control Regulations*.

The specific areas that comprise this SCA at the WL site includes:

- Nuclear material accountancy and control
- Access and assistance to the IAEA
- Operational and design information
- Safeguards equipment, containment and surveillance

### 3.13.1 Trends

The following table indicates the overall rating trends for the Safeguards and Non-Proliferation over the current licensing period:

| TRENDS FOR SAFEGUARDS AND NON-PROLIFERATION | | | | |
|---|---|---|---|---|
| **Overall Compliance Ratings** | | | | |
| **2014** | **2015** | **2016** | **2017** | **2018** |
| SA | SA | SA | SA | SA |
| **Comments** | | | | |
| The ratings for the time period of 2009 to 2011 were SA for each year. These were reported in the CMD 12-M47, *Interim Status Report on the Progress of Decommissioning Activities at Whiteshell Laboratories* [3].<br><br>The ratings for 2012 and 2013 were both SA. These were reported in CMD 14-M79, *Annual Performance Report AECL's Nuclear Sites and Projects: 2013* [4].<br><br>This SCA has been rated SA each year over the licensing period.<br><br>Non-Proliferation was added to this SCA in 2012. Compliance ratings from 2008-2011 are for the former Safeguards-only SCA.<br><br>CNSC staff conclude that CNL's Safeguards and Non-Proliferation performance meet regulatory requirements. | | | | |

### 3.13.2 Discussion

CNL has an effective safeguards program that conforms to measures required by the CNSC to meet Canada's international safeguards obligations as well as other measures arising from the *Treaty on the Non-Proliferation of Nuclear Weapons*.

The CNSC regulatory mandate includes ensuring conformity with measures required to implement Canada's international obligations on the peaceful uses of nuclear energy. Pursuant to the *Treaty on the Non-Proliferation of Nuclear Weapons*, Canada has entered into a Comprehensive Safeguards Agreement and Additional Protocol with the IAEA (hereafter, the safeguards agreements). The objective of the Canada/IAEA safeguards agreements is for the IAEA to provide annual assurance to Canada and to the international community that all declared nuclear material is in peaceful, non-explosive uses and that there is no indication of undeclared material.

The CNSC provides the mechanism, through the *Nuclear Safety and Control Act*, the regulations and a licence condition, for the IAEA to implement the safeguards agreements. Conditions for the application of IAEA safeguards are contained in the licence, and the criteria in order to meet the conditions are contained in the LCH.

### 3.13.3 Summary

A summary of the licensee's past performance, challenges and proposed improvements are presented in the following subsections. The compliance rating takes into consideration the CNSC staff assessment in all specific areas included for the WL site within this SCA. IAEA and CNSC's safeguards activities at the WL site were presented to the Commission most recently in the Interim Status Report on the Progress of Decommissioning activities (CMD 12-M47) , and the CNSC staff report on the performance of CNL sites for 2013 (CMD 14-M79), the following describes updates since these reports were presented.

#### 3.13.3.1 Past Performance

**Nuclear Material Accountancy and Control**

During the licensing periods under review, CNL provided the CNSC and IAEA with all reports and information necessary to comply with the safeguards regulatory requirements, including those related to nuclear material accounting and reporting. Reports are now submitted electronically through the CNSC's Nuclear Materials Accountancy Reporting (NMAR) portal. NMAR was fully implemented in 2016.

**Access and Assistance to the IAEA**

CNL continues to grant access and assistance to the IAEA for inspection activities at the WL site. Details of the IAEA inspections can be found in the following table:

**Table 9: IAEA inspection activities**

| Year | SNRI | PIV | DIV | Total |
|---|---|---|---|---|
| 2014 | 1 | 0 | 1 | 2 |
| 2015 | 0 | 1 | 1 | 2 |
| 2016 | 0 | 0 | 1 | 1 |
| 2017 | 0 | 0 | 0 | 0 |
| 2018 | 0 | 0 | 1 | 1 |
| Total Inspections | | | | 6 |

SNRI - Short Notice Random Inspection

PIV - Physical Inventory Verification

DIV - Design Information Verification

The IAEA indicated that the results from their inspection activities at the WL site were satisfactory and no actions were requested from CNL.

**Operational and Design Information**

During the licensing period, CNL submitted annual Operational Programs and quarterly updates as required. These documents provide a forward-looking plan of CNL's activities which assists the IAEA in planning inspections.

CNL has also provided timely annual Additional Protocol submissions to CNSC staff which include a description of each building on the WL site, the scale of its operations, and future plans for nuclear fuel research and development activities

**Safeguards Equipment, Containment and Surveillance**

CNL continues to provide assistance to the IAEA for the installation and maintenance of IAEA's containment measures at the WL site. During the licensing period, the IAEA performed a technical visit at the WL site to identify locations to install equipment which will become part of the equipment-based safeguards approach once CNL begins shipping out nuclear material from the WL site.

Overall, CNL programs for safeguards and non-proliferation at the WL site continued to meet CNSC requirements and expectations.

### 3.13.3.2 Regulatory Focus

CNSC staff will continue to monitor CNL's performance through participation in IAEA inspections, evaluations independent of the IAEA, and ongoing assessments of compliance with the various reporting requirements.

#### 3.13.3.3 Proposed Improvements

The regulatory document REGDOC-2.13.1, *Safeguards and Nuclear Material Accountancy*, is referenced in the proposed WL LCH. This document sets out requirements and guidance for safeguards programs for applicants and licensees who possess nuclear material, operate a uranium and/or thorium mine, carry out specified types of nuclear fuel-cycle related research and development work, and/or carry out specified types of nuclear-related manufacturing activities. The REGDOC-2.13.1 supersedes RD-336, which only sets out requirements and guidance for accounting and reporting of nuclear material.

### 3.13.4 Conclusion

There are no challenges with CNL's implementation of this SCA.

CNSC staff have assessed CNL documentation and analyses under the Safeguards and Non-Proliferation SCA, and have found them to be acceptable and compliant with regulatory requirements.

### 3.13.5 Recommendation

One licence condition is included in the proposed licence for this SCA. Licence condition 13.1 requires CNL to implement and maintain a safeguards program. Compliance verification criteria for this licence condition are included in the draft LCH.

## 3.14 Packaging and Transport

The Packaging and Transport SCA covers the safe packaging and transport of nuclear substances to and from the licensed facility.

The specific areas that comprise this SCA at the WL site include:

- Package design and maintenance;
- Packaging and transport; and
- Registration for use.

### 3.14.1 Trends

The following table indicates the overall rating trends for the Packaging and Transport over the current licensing period:

| TRENDS FOR PACKAGING AND TRANSPORT | | | | |
|---|---|---|---|---|
| **OVERALL COMPLIANCE RATINGS** | | | | |
| **2014** | **2015** | **2016** | **2017** | **2018** |
| SA | SA | SA | SA | SA |

**Comments**

The ratings for the period of 2008 to 2011 were SA for each year. These were reported in the CMD 12-M47, *Interim Status Report on the Progress of Decommissioning Activities at Whiteshell Laboratories* [3].

The ratings for 2012 and 2013 were both SA. These were reported in CMD 14-M79, *Annual Performance Report AECL's Nuclear Sites and Projects: 2013* [4].

CNL continues to be rated SA in this SCA at the Whiteshell Laboratories.

CNSC staff conclude that CNL's Packaging and Transport program ensures compliance with the regulations.

### 3.14.2 Discussion

CNSC regulates the transport of nuclear substances through a series of safety-centred regulatory requirements covering the entire journey of a shipment, from the time it is initially packaged to arrival at its destination.

Regulatory control of packaging and transport of nuclear substances is generally exerted through:

- certifying of packages used for transporting nuclear substances
- registering users of the certified packaging
- licensing the transport of nuclear substances
- issuing licences for the import and export of nuclear substances

Requirements for licensing vary depending on the type of nuclear substance being transported, and the origin and destination of the shipment. The type of package required depends on the nuclear substance being transported and its quantity, and the mode of transportation being used. To be certified by the CNSC, packages must meet stringent performance criteria for shielding, containment, ability to withstand impacts, and ability to withstand heat. Safety during transport relies heavily on the design of the transport package.

Package designs are combined with additional regulatory controls, including labelling, placarding, quality assurance and maintenance records, allowing

nuclear substances to be carried safely in all modes of transport such as road, rail, air and sea transportation. This philosophy is universally accepted for transport and has guided the development of the International Atomic Energy Agency (IAEA) and Canadian Nuclear Safety Commission (CNSC) regulations on the packaging and transport of nuclear substances. All nuclear substances are transported in packages that are selected based on the nature, form and quantity or activity of the nuclear substance. There are general design requirements that apply to all package types to ensure that they can be handled safely and easily, secured properly and are able to withstand routine conditions of transport.

CNL has developed and implemented a packaging and transport program to ensure compliance with the *Packaging and Transport of Nuclear Substances Regulations*, *2015* and the *Transportation of Dangerous Goods Regulations* for all shipments to and from the WL site. This program covers elements of package design, package maintenance, and the registration for use of certified packages as required by the regulations. CNSC's compliance activities in this SCA have included desktop reviews of the companywide corporate program as well as inspections at both the WL site and at CNL's Chalk River Laboratories site, which is the primary destination for nuclear substances transported from the WL site. There are no concerns with CNL's implementation of its packaging and transport program.

### 3.14.3 Summary

A summary of the licensee's past performance, challenges and proposed improvements are presented in the following subsections.

#### 3.14.3.1 Past Performance

CNL has developed and implemented a packaging and transport program that ensures compliance with the *Packaging and Transport of Nuclear Substances Regulations, 2015* and the *Transportation of Dangerous Goods Regulations* for all shipments leaving their sites, including WL. CNL's packaging and transport program also covers elements of package design and maintenance as well as the registration for use of certified packages as required by the regulations.

The *Packaging and Transport of Nuclear Substances Regulations, 2015* apply to the packaging and transport of nuclear substances, including the design, production, use, inspection, maintenance and repair of packages, and the preparation, consigning, handling, loading, carriage and unloading of packages.

CNL is required to have appropriate training for personnel involved in the handling, offering for transport and transport of dangerous goods at their facility, and is required to issue a training certificate to those workers in accordance with the *Transportation of Dangerous Goods Regulations*. During inspections, CNSC inspectors verify that licensee personnel involved in transport hold valid training certificates.

There were no events reported under the *Packaging and Transport of Nuclear Substances Regulations, 2015* for consignments transported from the WL site.

The transportation of nuclear substances has been a frequent and routine activity at the WL site during the current licence period. In 2018 alone, 303 radioactive transport packages were safely sent offsite [43]. This included the transportation of 1,333.8 m³ of low-level waste and 7.9 m³ intermediate-level waste to CRL.

CNL's packaging and transport program is corporate-wide. In 2019, CNSC staff conducted packaging and transport inspections at both the Chalk River Laboratories (which receives shipments from the WL site) and at the WL site itself. CNSC staff were satisfied that CNL's packaging and transport program ensures compliance with the regulations.

#### 3.14.3.2 Regulatory Focus

CNSC staff will continue to monitor and evaluate CNL's performance in this SCA through regulatory oversight activities including inspections and reviews of compliance reports and other licensee submissions. This SCA will remain an area of focus in the next licensing period, as CNL develops a final long-term solution to the radioactive waste stored and generated at the WL site.

#### 3.14.3.3 Proposed Improvements

No improvements within this SCA are proposed.

### 3.14.4 Conclusion

There are no challenges to with CNL's implementation of this SCA.

Based on CNSC staff assessments of the licence renewal application, supporting documents and past performance, CNSC staff conclude that CNL's packaging and transport program is effectively implemented at the WL site and ensures compliance with the *Packaging and Transport of Nuclear Substances Regulations, 2015* and the *Transportation of Dangerous Goods Regulations*.

### 3.14.5 Recommendation

One licence condition is included in the proposed licence for this SCA. Licence condition 14.1 requires CNL to implement and maintain a packaging and transport program. Compliance verification criteria for this licence condition is included in the draft LCH.

# 4. OTHER MATTERS OF REGULATORY INTEREST

## 4.1 Indigenous Consultation and Engagement

The common law duty to consult with Indigenous groups applies when the Crown contemplates actions that may adversely impact potential or established Indigenous and/or treaty rights. The CNSC ensures that all of its licensing decisions under the NSCA [7] uphold the honour of the Crown and consider Indigenous peoples' potential or established Indigenous and/or treaty rights pursuant to section 35 of the Constitution Act, 1982 [44].

### 4.1.1 Discussion

CNSC staff have identified the First Nation and Métis groups who may have an interest in the proposed relicensing of CNL's decommissioning activities at Whiteshell Laboratories in Pinawa, Manitoba. These groups include the Sagkeeng Anicinabe, Brokenhead Ojibway Nation, Black River First Nation, Hollow Water First Nation, Manitoba Metis Federation, Northwest Angle No.33, Shoal Lake #40 First Nation, Iskatewizaagegan #39 Independent First Nation, Wabaseemoong Independent Nations, and Grand Council of Treaty 3.

These groups were identified due to the proximity of their communities, treaty areas and/or traditional territories to the WL site, or due to previously expressed interest in being kept informed of CNSC licensed activities occurring in or proximal to their traditional territories.

CNSC staff sent letters of notification for this proceeding in January 2019 to the Indigenous groups identified above, providing information regarding the proposed licence renewal application, the availability of participant funding to facilitate participation in the hearing process, and details on how to participate in the Commission's public hearing process. Follow-up phone calls were conducted with the identified groups in March 2019 to ensure they had received the letters and to answer any questions about the regulatory process and how to get involved in the Commission proceedings.

CNSC REGDOC-3.2.2 *Indigenous Engagement*, published in February 2016, sets out requirements and guidance for licensees whose proposed projects may raise the Crown's duty to consult. While the CNSC cannot delegate its obligation, it can delegate procedural aspects of the consultation process to licensees. The information collected and measures proposed by licensees to avoid, mitigate or offset adverse impacts from the proposed licence renewal may be used by CNSC staff in meeting its consultation obligations.

Based on the information received and reviewed, CNSC staff determined that CNL's continuation of decommissioning operations at the WL site will not result in novel impacts. All proposed decommissioning activities under this license will occur in the existing project footprint and there is a low probability of emissions or waste being produced that could adversely impact the surrounding environment. This licence renewal application is not anticipated to result in adverse impacts on any potential or established Indigenous and/or treaty rights.

Therefore, CNSC staff are of the opinion that the decision on the licence renewal for CNL's WL decommissioning activities does not raise the duty to consult.

### 4.1.2 Conclusion

This licence application by CNL does not raise a duty to consult, therefore the guidance set out in CNSC REGDOC-3.2.2 pertaining to formal engagement do not apply. However, CNSC staff encourage CNL to continue to engage with interested Indigenous communities on the licence application and on-going activities of interest to the communities.

The CNSC ensures that all of its licensing decisions under the NSCA [7] uphold the honour of the Crown and consider the broader interests of Indigenous peoples who exercise Indigenous and/or treaty rights within proximity to the licensed activities or facilities. On this basis CNSC staff continue to pursue an approach of meaningful Indigenous engagement integrated into the licence application review and hearing process.

Indigenous groups (Sagkeeng Anicinabe and the Manitoba Metis Federation) have provided the CNSC with Indigenous Knowledge (IK) studies pertaining to the WL site and the proposed WR1 in-situ decommissioning project.

For more information regarding these IK studies, please see the Environmental Protection Review Report (appendix D).

## 4.2 Other Consultation

The CNSC made available up to $50,000 through its PFP to Indigenous peoples, members of the public and stakeholders in providing value-added information to the Commission through informed and topic-specific interventions. This funding was offered to review CNL's application and associated documents and to prepare for and participate in the Commission's public hearing.

### 4.2.1 Discussion

The deadline for applications was May 10, 2019. A Funding Review Committee (FRC), independent from CNSC staff, reviewed the funding applications received, and made recommendations on the allocation of funding to eligible applicants. Based on recommendations from the FRC, the CNSC awarded participants up to 63,299.50 in funding to the following recipients, who are required to submit a written intervention and make an oral presentation at the Commission's public hearing in October 2019:

- Canadian Environmental Law Association
- Concerned Citizens of Renfrew County
- Northwatch
- Sagkeeng First Nation
- Manitoba Metis Federation

### 4.2.2 Conclusion

The CNSC continues to actively promote ongoing communication and dissemination of regulatory and scientific information through social media channels, webinars, outreach in the local communities and postings on the CNSC web site. The CNSC has various mechanisms and processes such as the PFP and mail outs to encourage the public to participate in the Commission's public hearing, as described above. The CNSC has offered assistance to interested members of the public, Indigenous groups, and other stakeholders, through the PFP, to prepare for and participate in the Commission's public hearing.

## 4.3 Cost Recovery

A Class I licensed nuclear facility is subject to the requirements of Part 2 of the CNSC *Cost Recovery Fees Regulations* (CRFR). CNSC staff have concluded that CNL is compliant with the CNSC's CRFR for the WL site.

### 4.3.1 Discussion

Through review of CNSC records, CNSC staff have determined that CNL is in good standing with respect to CRFR requirements for the WL site. CNL has paid their cost recovery fees in full.

### 4.3.2 Conclusion

CNSC staff confirm that CNL is in good standing with respect to CRFR requirements for the WL site.

## 4.4 Financial Guarantees

The WL licence requires CNL to maintain in effect a financial guarantee for decommissioning of the WL site that is acceptable to the Commission. CNSC Regulatory Guides G-219, *Decommissioning Planning for Licensed Activities* and G-206, *Financial Guarantees for Decommissioning of Licensed Activities* provides guidance on calculating the financial guarantees.

### 4.4.1 Discussion

With respect to a financial guarantee required by the paragraph 3(1)(l) of the *General Nuclear Safety and Control Regulations* (GNSCR), CNSC Regulatory Document, G-206, *Financial Guarantees for the Decommissioning of Licensed Activities*, (2000) states that an expressed commitment from a federal or provincial government is an acceptable form of financial guarantee.

This commitment was last expressed to the CNSC in a letter from the Federal Minister of Natural Resources to Dr. Binder dated July 31, 2015 [45]. This letter states that AECL will retain ownership of the lands, assets and liabilities associated with CNL's licences, including the Whiteshell Licence, and states that the liabilities of AECL are the liabilities of Her Majesty in Right of Canada.

### 4.4.2 Conclusion

CNSC staff confirm that a financial guarantees in a format that meets G-206 requirements is in place for the WL site.

## 4.5 Licensee Public Information Program

A public information and disclosure program (PIDP) is a regulatory requirement for licence applicants. CNSC document RD/GD-99.3 *Public Information and Disclosure*, sets out the requirements for public information and disclosure. The primary goal of the program, as it relates to the licensed activities, is to ensure that information related to the health, safety and security of persons and the environment, and other issues associated with the lifecycle of nuclear facilities are effectively communicated to the public.

This information promotes transparency and improves the public's understanding of the licensed activities and operations. The program includes a commitment to and protocol for ongoing, timely communication of information related to the licensed facility during the course of the licence period.

CNSC expectations of a licensee's public information program and disclosure protocol are commensurate with the level of risk of the facility and the level of public interest in the licensed activities. The program and protocol may be further influenced by the complexity of the nuclear facility's lifecycle and activities, and the risks to public health and safety and the environment perceived to be associated with the facility and activities.

### 4.5.1 Discussion

The WL licence requires CNL to implement and maintain a PIDP. CNSC staff have reviewed CNL's PIDP and determined that it:

- identifies clear goals and measurable objectives in terms of dissemination of information to targeted audiences
- is available to the public and is posted on the licensee's web site
- targets multiple audiences such as local residents, elected and government representatives, media, business leaders, youth, interest groups, and community organizations
- provides contact information for members of the public who want to obtain additional information

CNL presents their public outreach and Indigenous engagement activities to CNSC staff each month at regularly scheduled meetings. CNSC staff have attended a sample of CNL outreach activities, including the WL Public Liaison committee meetings and the Whiteshell Site Open House.

CNSC staff will continue to monitor CNL's compliance with CNSC RD/GD-99.3 and ongoing implementation of the PIDP.

### 4.5.2 Conclusion

CNSC staff conclude that CNL's PIDP meets the regulatory requirements of RD/GD-99.3 *Public Information and Disclosure*. CNSC staff continue to oversee CNL's implementation of the PIDP to ensure that CNL meets its obligations regarding dissemination and notifying the public and Indigenous communities on its licensed activities. CNSC staff have also communicated with CNL to refine

and update the PIDP on a regular basis to meet the changing information needs of their target audiences.

## 4.6 Nuclear Liability Insurance

The WL site is currently designated, pursuant to section 7 of the *Nuclear Liability and Compensation Act* (NLCA) [46], as a nuclear installation in Item 17 of the Schedule (Section 2) of the *Nuclear Liability and Compensation Regulations* (NLCR) [47].

### 4.6.1 Discussion

The WL site contains several facilities which are authorized to contain nuclear material as defined in the NLCA. These facilities fall under various risk categories, as defined in paragraph 4(1) of the NLCR, and are listed in Column 4 of Item 17 in the Schedule.

Because the Concrete Canister Storage Facility is a "Nuclear Fuel Waste Management Facility", it is the facility in this list with the highest risk. As a result, the WL site falls under the "Nuclear Fuel Waste Management Facility Class" pursuant to paragraph 4(2) of the NLCR, and the operator's liability amount is prescribed at $13 million pursuant to paragraph 5(c) of the NLCR.

### 4.6.2 Conclusion

CNL has maintained nuclear liability insurance for WL under the *Nuclear Liability Act* [46] and continues to maintain nuclear liability insurance under the *Nuclear Liability and Compensation Act* (NLCA) [47] which came into force on January 1, 2017.

## 4.7 Delegation of Authority

The Commission may include in a licence any condition it considers necessary for the purposes of the NSCA. The Commission may delegate authority to CNSC staff with respect to the administration of licence conditions, or portions thereof.

There is one proposed licence condition in the proposed licence that contains the phrase "the Commission or a person authorized by the Commission": LC 3.2 Operating Performance.

Licence condition 3.2 states "The licensee shall implement and maintain a program for reporting to the Commission or a person authorized by the Commission."

CNSC staff recommend the Commission delegate its authority for the purposes described in the above licence conditions to the following staff:

- Director, Canadian Nuclear Laboratories Regulatory Program Division
- Director General, Directorate of Nuclear Cycles and Facilities Regulation
- Executive Vice-President and Chief Regulatory Operations Officer, Regulatory Operations Branch

# 5. OVERALL CONCLUSIONS AND RECOMMENDATIONS

CNSC staff have concluded the following with respect to paragraphs 24(4)(a) and (b) of the *Nuclear Safety and Control Act* (NSCA) [7], in that CNL:

1. is qualified to carry out the activities authorized by the licence; and
2. will in carrying out the licensed activities, has made, and will continue to make adequate provision for the protection of the environment, the health and safety of persons and the maintenance of national security and measures required to implement international obligations to which Canada has agreed.

Therefore, CNSC staff recommend that the Commission:

1. accept CNSC staff's conclusions and exercise its authority under the NSCA [7] to renew the licence to authorize Canadian Nuclear Laboratories to continue to decommission the Whiteshell Laboratories from January 1, 2020 to December 31, 2029
2. authorize the delegation of authority as set out in subsection 4.7 of this CMD

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# ACRONYMS

| Acronym | Definition |
|---|---|
| AECL | Atomic Energy of Canada Limited |
| AL | Action Levels |
| ALARA | As Low As Reasonably Achievable |
| CAP | Corrective Action Program |
| CCSF | Concrete Canister Storage Facility |
| CEAA | *Canadian Environmental Assessment Act* |
| CMD | Commission Member Document |
| CNL | Canadian Nuclear Laboratories |
| CRL | Chalk River Laboratories |
| CRFR | Cost Recovery Fees Regulations |
| CSA | Canada Standards Association |
| CSD | Criticality Safety Documents |
| CSR | Comprehensive Study Report |
| DDP | Detailed Decommissioning Plan |
| EA | Environmental Assessment |
| EIR | Event Initial Report |
| EMS | Environmental Management System |
| EnvP | Environmental Protection Program |
| EPR | Environmental Protection Review |
| ERA | Environmental Risk Assessment |
| EVMP | Effluent Verification Monitoring Program |
| FTE | Full Time Equivalent |
| GHG | Greenhouse Gas |
| Go-Co | Government Owned Contractor Operated |
| GWMP | Groundwater Monitoring Program |
| GWP | Global Warming Potential |
| IAEA | International Atomic Energy Agency |

| Acronym | Definition |
|---|---|
| IEMP | Independent Environmental Monitoring Program |
| ILW | Intermediate-Level Waste |
| ISO | International Standards Organization |
| LCH | Licence Conditions Handbook |
| LLW | Low-Level Waste |
| MCP | Management Control Procedures |
| NEW | Nuclear Energy Worker |
| NFPA | National Fire Protection Act |
| NLCA | *Nuclear Liability and Compensation Act* |
| NLCR | *Nuclear Liability and Compensation Regulations* |
| NPRI | National Pollutant Release Inventory |
| NPT | Treaty on the Non-Proliferation of Nuclear Weapons |
| NRTEDL | Nuclear Research and Test Establishment Decommissioning Licence |
| NSCA | *Nuclear Safety and Control Act* |
| OPEX | Operating Experience |
| PIDP | Public Information and Disclosure Program |
| PFP | Participant Funding Program |
| RLTI | Recordable Lost-Time Injuries |
| ROR | Regulatory Oversight Reports |
| RP | Radiation Protection |
| SAR | Safety Analysis Reports |
| SCAs | Safety and Control Areas |
| SMAGS | Shielded Modular Above Ground Storage |
| SSC | Structures, Systems and Components |
| UNSCEAR | United Nations Scientific Committee on the Effects of Atomic Radiation |
| WL | Whiteshell Laboratories |
| WMA | Waste Management Area |
| WR-1 | Whiteshell Reactor |

# GLOSSARY

For definitions of terms used in this document, see REGDOC-3.6 Glossary of CNSC Terminology, which includes terms and definitions used in the *Nuclear Safety and Control Act* (NSCA) [7] and the regulations made under it, and in CNSC regulatory documents and other publications. REGDOC-3.6 is provided for reference and information.

# A. RATING LEVELS

**Fully Satisfactory (FS)**

Safety and control measures implemented by the licensee are highly effective. In addition, compliance with regulatory requirements is fully satisfactory, and compliance within the safety and control area (SCA) or specific area exceeds requirements and CNSC expectations. Overall, compliance is stable or improving, and any problems or issues that arise are promptly addressed.

**Satisfactory (SA)**

Safety and control measures implemented by the licensee are sufficiently effective. In addition, compliance with regulatory requirements is satisfactory. Compliance within the SCA meets requirements and CNSC expectations. Any deviation is minor and any issues are considered to pose a low risk to the achievement of regulatory objectives and CNSC expectations. Appropriate improvements are planned.

**Below Expectations (BE)**

Safety and control measures implemented by the licensee are marginally ineffective. In addition, compliance with regulatory requirements falls below expectations. Compliance within the SCA deviates from requirements or CNSC expectations to the extent that there is a moderate risk of ultimate failure to comply. Improvements are required to address identified weaknesses. The licensee is taking appropriate corrective action.

**Unacceptable (UA)**

Safety and control measures implemented by the licensee are significantly ineffective. In addition, compliance with regulatory requirements is unacceptable and is seriously compromised. Compliance within the SCA is significantly below requirements or CNSC expectations, or there is evidence of overall non-compliance. Without corrective action, there is a high probability that the deficiencies will lead to unreasonable risk. Issues are not being addressed effectively, no appropriate corrective measures have been taken and no alternative plan of action has been provided. Immediate action is required.

# B. BASIS FOR THE RECOMMENDATION(S)

## B.1 Regulatory Basis

The recommendations presented in this CMD are based on compliance objectives and expectations associated with the relevant SCAs and other matters. The regulatory basis for the matters that are relevant to this CMD are as follows.

### Management System

- It is a requirement of the *Class I Nuclear Facilities Regulations* under paragraph 3(d) that an application for a licence for a Class I nuclear facility shall contain the proposed management system for the activity to be licensed, including measures to promote and support safety culture.
- The *General Nuclear Safety and Control Regulations* require that an application for a licence shall contain, under the following paragraph:
  - 3(1)(k), the applicant's organizational management structure insofar as it may bear on the applicant's compliance with the NSCA [7] and the Regulations made under the NSCA, including the internal allocation of functions, responsibilities and authority.
  - 15(a), the persons who have the authority to act for them (the applicant/licensee) in their dealings with the Commission.
  - 15(b), the names and position titles of the persons who are responsible for the management and control of the licensed activity and the nuclear substance, nuclear facility, prescribed equipment or prescribed information encompassed by the licence.

### Human Performance Management

- It is a requirement of the *General Nuclear Safety and Control Regulations* under section 12, that the licensee shall:
  - 12(1)(a), ensure the presence of a sufficient number of qualified workers to carry on the licensed activity safely and in accordance with the NCSA, the Regulations made under the NSCA [7], and the licence.
  - 12(1)(b), train the workers to carry on the licensed activity in accordance with the NSCA, the Regulations made under the NSCA, and the licence.
  - 12(1)(e), require that every person at the site of the licensed activity to use equipment, devices, clothing, and procedures in accordance with the NSCA, the Regulations made under the NSCA, and the licence.
- It is a requirement of the *Class I Nuclear Facilities Regulations* under paragraph 3(d.1) that a licence application contain the proposed human performance program for the activity to be licensed, including measures to ensure workers' fitness for duty.
- It is a requirement of the *Class I Nuclear Facilities Regulations* under paragraph 6(m) that a licence application contain information on the proposed responsibilities, qualification requirements, and training program for workers including the procedures for the requalification of workers.

- It is a requirement of the *Class I Nuclear Facilities Regulations* under paragraph 6(n) that a licence application contain information on the results that have been achieved in implementing the program for recruiting, training, and qualifying workers in respect of the operation and maintenance of the nuclear facility.

### Operating Performance

- Paragraph 6(d) of the *Class I Nuclear Facilities Regulations* requires that an application for a licence to operate a Class I nuclear facility contains the proposed measures, policies, methods and procedures for operating and maintaining the nuclear facility.
- Subsection 24(5) of the *Nuclear Safety and Control Act* (NSCA) [7] states that the licence may contain any term or condition that the Commission considers necessary for the purpose of the NSCA.

### Safety Analysis

- 3(1)(i) of the *General Nuclear Safety and Control Regulations* requires that an application for a licence shall contain a description and the results of any test, analysis, or calculation performed to substantiate the information included in the application.
- It is a requirement of the *Class I Nuclear Facilities Regulations* that an application for a licence to operate a Class I nuclear facility shall contain the following information under paragraph:
  - 6(c), a final safety analysis report demonstrating the adequacy of the design of the nuclear facility.
  - 6(h), the effects on the environment and the health and safety of persons that may result from the operation and decommissioning of the nuclear facility, and the measures that will be taken to prevent or mitigate those effects.

### Physical Design

- Paragraph 3(1)(d) of the *General Nuclear Safety and Control Regulations* requires that an application for a licence shall contain a description of any nuclear facility, prescribed equipment, or prescribed information to be encompassed by the licence.
- Other requirements set out in paragraphs 3(a), 3(b), 6(a) and 6(b) of the *Class I Nuclear Facilities Regulations* require more specific information to be submitted in the licence application related to the site and design of the facility and the final safety analysis report.
- Paragraphs 6(c) and 6(d) of the *Class I Nuclear Facilities Regulations* require that an application for a licence contain a final safety analysis report demonstrating the adequacy of the design of the facility and proposed measures, policies, methods, and procedures for operating and maintaining the facility.

### Fitness for Service

- It is a requirement of the *Class I Nuclear Facilities Regulations* under paragraph 6(d) that an application for a licence to operate a Class I nuclear facility contain the proposed measures, policies, methods, and procedures for operating and maintaining the nuclear facility.

### Radiation Protection

- The *General Nuclear Safety and Control Regulations* require, under subsection 3(1) that a licence application contain the following information under paragraph:
  - 3(1)(e), the proposed measures to ensure compliance with the *Radiation Protection Regulations*.
  - 3(1)(f), any proposed action level for the purpose of section 6 of the *Radiation Protection Regulations*.
- The *Radiation Protection Regulations* require, under sections 4 to 6 that the licensee implements a radiation protection program, ascertain and record doses, and take the required actions in the case that an action level has been reached.
- The *Class I Nuclear Facilities Regulations* require that an application for a licence to operate a Class I nuclear facility contain the following information under paragraph:
  - 6(e), the proposed procedures for handling, storing, loading, and transporting nuclear substances and hazardous substances.
  - 6(h), the effects on the environment and the health and safety of persons that may result from the operation and decommissioning of the nuclear facility, and the measure that will be taken to prevent or mitigate those effects.

### Conventional Health and Safety

- It is a requirement of the C*lass I Nuclear Facilities Regulations* under paragraph 3(f) that an application for a licence in respect of a Class I nuclear facility, other than a licence to abandon, shall contain the proposed worker health and safety policies and procedures.
- The WL's activities and operations must comply with the *Canada Labour Code* [11], *Part II: Occupational Health and Safety*.

### Environmental Protection

- The *General Nuclear Safety and Control Regulations*, under paragraphs 12(1)(c) and (f) require that each licensee take all reasonable precautions to protect the environment and the health and safety of persons, and to control the release of radioactive nuclear substances and hazardous substances within the site of the licensed activity and into the environment.
- The *Radiation Protection Regulations* prescribe the dose limit for the general public, which under subsection 1(3) is 1mSv per calendar year.
- In addition, Sections 3 and 6 of the *Class I Nuclear Facilities Regulations* must be met by the applicant. The application for a licence shall contain under paragraph:

- 3(e), the name, form, characteristics, and quantity of any hazardous substances that may be on the site while the activity to be licensed is carried on.
- 3(g), the proposed environmental protection policies and procedures.
- 3(h), the proposed effluent and environmental monitoring programs.
- 6(e), the proposed procedures for handling, storing, loading, and transporting nuclear substances and hazardous substances.
- 6(h), the effects on the environment and the health and safety of persons that may result from the operation and decommissioning of the nuclear facility, and the measures that will be taken to prevent or mitigate those effects.
- 6(i), the proposed location of points of release, the proposed maximum quantities and concentrations, and the anticipated volume and flow rate of releases of nuclear substances and hazardous substances into the environment, including their physical, chemical, and radiological characteristics.
- 6(j), the proposed measures to control releases of nuclear substances and hazardous substances into the environment.

**Emergency Management and Fire Protection**

- 12(1)(c) of the *General Nuclear Safety and Control Regulations* states that every licensee shall "take all reasonable precautions to protect the environment and the health and safety of persons and to maintain the security of nuclear facilities, and of nuclear substances".
- 12(1)(f) of the *General Nuclear Safety and Control Regulations* states that every licensee shall "take all reasonable precautions to control the release of radioactive nuclear substances or hazardous substances within the site of the licensed activity and into the environment of the licensed activity…".
- It is a requirement of the *Class I Nuclear Facilities Regulations* under paragraph 6(k) that a licence application contain information on the licensee's proposed measures to prevent or mitigate the effects of accidental releases of nuclear substances and hazardous substances on the environment, the health and safety of persons and the maintenance of national security, including measures to:
  - Assist offsite authorities in planning and preparing to limit the effects of an accidental release.
  - Notify offsite authorities of an accidental release or the imminence of an accidental release.
  - Report information to offsite authorities during and after an accidental release.
  - Assist offsite authorities in dealing with the effects of an accidental release.
  - Test the implementation of the measures to prevent or mitigate the effects of an accidental release.

### Waste Management

- It is a requirement of the *General Nuclear Safety and Control Regulations* under paragraph 3(1)(j) that an application for a licence include the name, origin, quantity, form, and volume of any radioactive waste or hazardous waste that may result from the activity to be licensed, including waste that may be stored, managed, processed, or disposed of at the site of the activity to be licensed, and the proposed method for managing and disposing of that waste.

### Security

- Paragraph 3(1)(e) of the *General Nuclear Safety and Control Regulations* requires that an application for a licence contains the proposed measures to ensure compliance with the *Radiation Protection Regulations*, the *Nuclear Security Regulations* and the *Packaging and Transport of Nuclear Substances Regulations, 2015*.
- Paragraph 12(1)(c) of the *General Nuclear Safety and Control Regulations* requires the licensee to take all reasonable precautions to protect the environment and the health and safety of persons and to maintain the security of nuclear facilities and of nuclear substances.
- Paragraph 6(k) of the *Class I Nuclear Facilities Regulations* requires that an application for a licence to operate a Class I nuclear facility contains the proposed measures to prevent or mitigate the effects of accidental releases of nuclear substances and hazardous substances to the environment, the health and safety of persons and the maintenance of national security.
- Paragraph 2(a) of Part 1 of *Nuclear Security Regulations* states that Part 1 applies to Category I, II or III nuclear material.
- Subsection 24(5) of the *Nuclear Safety and Control Act* (NSCA) [7] states that the licence may contain any term or condition that the Commission considers necessary for the purpose of the NSCA.

### Safeguards and Non-Proliferation

- Subsection 24(5) of the *Nuclear Safety and Control Act* (NSCA) states that the licence may contain any term or condition that the Commission considers necessary for the purpose of the NSCA.
- Paragraph 12(1)(i) of the *General Nuclear Safety and Control Regulations* requires the licensee to take all necessary measures to facilitate Canada's compliance with any applicable safeguard agreement.
- Paragraph 6(f) of the *Class I Nuclear Facilities Regulations* requires that an application for a licence to operate a Class I nuclear facility contains the proposed measures to facilitate Canada's compliance with any applicable safeguards agreement. The applicable safeguards agreements are:
    - *Agreement Between the Government of Canada and the International Atomic Energy Agency for the Application of Safeguards in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons* (INFCIRC/164); and

- *Protocol Additional to the Agreement Between Canada and the International Atomic Energy Agency for the Application of Safeguards in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons* (INFCIRC/164/Add. 1).

### Packaging and Transport

- CNL is required to comply with the *Packaging and Transport of Nuclear Substances Regulations, 2015*, and Transport Canada's *Transportation of Dangerous Goods Regulations*.

### Cost Recovery

- Paragraph 24(2)(*c*) of the *Nuclear Safety and Control Act* requires that a licence application is accompanied by the prescribed fee.
- The *Canadian Nuclear Safety Commission Cost Recovery Fees Regulations* (CRFR) set out the specific requirements based on the activities to be licensed.

### Financial Guarantee

- The *General Nuclear Safety and Control Regulations* requires under paragraph 3(1)(l) that a licence application contains a description of any proposed financial guarantee relating to the activity to be licensed.

### Licensee Public Information Program

- It is a requirement of the *Class I Nuclear Facilities Regulations* under paragraph 3(j) that an application for a licence in respect of a Class I nuclear facility, other than a licence to abandon, shall contain information on the licensee's public information program.

## B.2 Technical Basis

The technical basis for the recommendations presented in this CMD are as follows. The following CNSC regulatory documents and CSA standards are relevant to WL.

### Management System

- CSA N286 *Management system requirements for nuclear facilities*
- REGDOC-2.1.2 *Management System: Safety Culture*
- CSA N286.0.1 *Commentary on N286-12, Management system requirements for nuclear facilities*

### Human Performance Management

- REGDOC-2.2.4 *Fitness for Duty: Managing Worker Fatigue*
- RD-363 *Nuclear Security Officer Medical, Physical, and Psychological Fitness*
- REGDOC-2.2.4 *Fitness for Duty, Volume II: Managing Alcohol and Drug Use, version 2*
- G-323 *Ensuring Presence of Sufficient Qualified Staff at Class I Nuclear Facilities: Minimum Staff Complement*
- REGDOC-2.2.2 *Personnel Training, version 2*

### Operating Performance

- REGDOC-3.1.2 *Reporting Requirements, Volume I: Non-Power Reactor Class I Nuclear Facilities and Uranium Mines and Mills*

### Safety Analysis

- IAEA SSR-4 *Safety of Nuclear Fuel Cycling Facilities*
- IAEA TECDOC-1267 *Procedures for Conducting Probabilistic Safety Assessment for Non-reactor Nuclear Facilities*
- IAEA GSR Part 4, Rev. 1 *Safety Assessment for Facilities and Activities*
- RD-327 *Nuclear Criticality Safety*
- REGDOC 2.4.3 *Nuclear Criticality Safety*
- GD-327 *Guidance for Nuclear Criticality Safety*

### Physical Design

- NFPA-801 *Standard for Fire Protection for Facilities Handling Radioactive Materials*
- CSA-N393 *Fire Protection for Facilities that Process, Handle, or Store Nuclear Substances*
- *National Fire Code of Canada*
- *National Building Code of Canada*
- G-276 *Human Factors Engineering Program Plans*
- G-278 *Human Factors Verification and Validation Plans*
- CSA N285.0 *General requirements for pressure-retaining system and components in CANDU nuclear power plants*
- CSA B51 *Boiler, Pressure Vessel and Pressure Piping Code*
- CSA N285.0.1 *Commentary on CSA N285.0-12, General requirements for pressure-retaining systems and components in CANDU nuclear power plants*

### Fitness for Service

- REGDOC-2.6.3 *Aging Management*
- REGDOC-2.6.2 *Maintenance Programs for Nuclear Power Plants*

### Radiation Protection

- G-129, Rev. 1 *Keeping Radiation Exposures and Doses "As Low as Reasonably Achievable* (ALARA)*"*
- G-228 *Developing and Using Action Levels*
- G-91 *Ascertaining and Recording Radiation Doses to Individuals*
- GD-150 *Designing and Implementing a Bioassay Program*

### Conventional Health and Safety

- None provided

### Environmental Protection

- REGDOC-2.9.1 *Environmental Principles, Assessments and Protection Measures, version 1.1*
- CSA N288.4 *Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills*
- CSA N288.5 *Effluent monitoring programs at Class I nuclear facilities and uranium mines and mills*
- CSA N288.6 *Environmental risk assessment at Class I nuclear facilities and uranium mines and mills*
- CSA N288.7 *Groundwater protection programs at Class I nuclear facilities and uranium mines and mills*
- CSA N288.8 *Establishing and implementing action levels to control releases to the environment from nuclear facilities*
- CSA N288.1 *Guidelines for calculating derived release limits for radioactive material in airborne and liquid effluents for normal operation of nuclear facilities*
- CSA N288.2 *Guidelines for calculating the radiological consequences to the public of a release of airborne radioactive material for nuclear reactor accidents*

### Emergency Management and Fire Protection

- REGDOC-2.10.1 *Nuclear Emergency Preparedness and Response, Version 2*
- CSA N1600 *General requirements for nuclear emergency management programs*
- *Canadian Guidelines for Intervention During a Nuclear Emergency*
- *Canadian Guidelines for the Restriction of Radioactively Contaminated Food and Water Following a Nuclear Emergency*
- CSA-N393*Fire protection for Facilities that Process, Handle, or Store Nuclear Substances*
- *National Fire Code of Canada*
- *National Building Code of Canada*

### Waste Management

- CSA N292.0 *General principles for the management of radioactive waste and irradiated fuel*
- CSA N292.2 *Interim dry storage of irradiated fuel*
- CSA N292.3 *Management of low- and intermediate-level radioactive waste*
- CSA N292.6 *Long-term management of radioactive waste and irradiated fuel*
- REGDOC-2.11.1 *Waste Management, Volume III: Assessing the Long-Term Safety of Radioactive Waste Management*

- CSA N292.5 *Guideline for the exemption or clearance from regulatory control of materials that contain, or potentially contain, nuclear substances*
- CSA N294*Decommissioning of Facilities Containing Nuclear Substances*
- G-219 *Decommissioning Planning for Licensed Activities*

### Security

- REGDOC-2.12.1 *High-Security Facilities, Volume II: Criteria for Nuclear Security Systems and Devices*
- REGDOC-2.12.2 *Site Access Security Clearance*
- REGDOC-2.12.3 *Security of Nuclear Substances: Sealed Sources*
- CSA N290.7 *Cyber-security for nuclear power plants and small reactor facilities*
- G-208 *Transportation Security Plans for Category I, II or III Nuclear Material*
- G-274 *Security Programs for Category I or II Nuclear Material or Certain Nuclear Facilities*

### Safeguards and Non-proliferation

- REGDOC-2.13.1 *Safeguards and Nuclear Material Accountancy*

### Packaging and Transport

- IAEA SSR-6 *Regulations for the Safe Transport of Radioactive Material (2012 Edition)*
- RD-364 *Joint Canada-United States Guide for Approval of Type B(U) and Fissile Material Transportation Packages*
- REGDOC-2.14.1 *Information Incorporated by Reference in Canada's Packaging and Transport of Nuclear Substances Regulations, 2015*

# C. SAFETY AND CONTROL AREA FRAMEWORK

## C.1 Safety and Control Areas Defined

The safety and control areas identified in section 2.2, and discussed in summary in sections 3.1 through 3.14 are comprised of specific areas of regulatory interest which vary between facility types.

The following table provides a high-level definition of each SCA. The specific areas within each SCA are to be identified by the CMD preparation team in the respective areas within section 3 of this CMD

| SAFETY AND CONTROL AREA FRAMEWORK | | |
|---|---|---|
| **Functional Area** | **Safety and Control Area** | **Definition** |
| **Management** | Management System | Covers the framework which establishes the processes and programs required to ensure an organization achieves its safety objectives and continuously monitors its performance against these objectives and fostering a healthy safety culture. |
| | Human Performance Management | Covers activities that enable effective human performance through the development and implementation of processes that ensure that licensee staff is sufficient in number in all relevant job areas and that licensee staff have the necessary knowledge, skills, procedures and tools in place to safely carry out their duties. |
| | Operating Performance | This includes an overall review of the conduct of the licensed activities and the activities that enable effective performance. |
| **Facility and Equipment** | Safety Analysis | Maintenance of the safety analysis that supports that overall safety case for the facility. Safety analysis is a systematic evaluation of the potential hazards associated with the conduct of a proposed activity or facility and considers the effectiveness of preventative measures and strategies in reducing the effects of such hazards. |
| | Physical Design | Relates to activities that impact on the ability of systems, components and structures to meet and maintain their design basis given new information arising over time and taking changes in the external environment into account. |
| | Fitness for Service | Covers activities that impact on the physical condition of systems, components and structures to ensure that they remain effective over time. This includes programs that ensure all equipment is available to perform its intended design function when called upon to do so. |

| SAFETY AND CONTROL AREA FRAMEWORK | | |
|---|---|---|
| **Functional Area** | **Safety and Control Area** | **Definition** |
| **Core Control Processes** | Radiation Protection | Covers the implementation of a radiation protection program in accordance with the RP Regulations. This program must ensure that contamination and radiation doses received are monitored and controlled. |
| | Conventional Health and Safety | Covers the implementation of a program to manage workplace safety hazards and to protect personnel and equipment. |
| | Environmental Protection | Covers programs that identify, control and monitor all releases of radioactive and hazardous substances and effects on the environment from facilities or as the result of licensed activities. |
| | Emergency Management and Fire Protection | Covers emergency plans and emergency preparedness programs which exist for emergencies and for non-routine conditions. This also includes any results of exercise participation. |
| | Waste Management | Covers internal waste-related programs which form part of the facility's operations up to the point where the waste is removed from the facility to a separate waste management facility. Also covers the planning for decommissioning. |
| | Security | Covers the programs required to implement and support the security requirements stipulated in the regulations, in their licence, in orders, or in expectations for their facility or activity. |
| | Safeguards and Non-Proliferation | Covers the programs and activities required for the successful implementation of the obligations arising from the Canada/IAEA safeguards agreements as well as all other measures arising from the *Treaty on the Non-Proliferation of Nuclear Weapons*. |
| | Packaging and Transport | Programs that cover the safe packaging and transport of nuclear substances and radiation devices to and from the licensed facility. |

## C.2 Specific Areas for this Facility Type

The following table identifies the specific areas that comprise each SCA for the Whiteshell Laboratories site:

| SPECIFIC AREAS FOR THIS FACILITY TYPE | | |
|---|---|---|
| **Functional Area** | **Safety and Control Area** | **Specific Areas** |
| Management | Management System | ▪ Management System<br>▪ Organization<br>▪ Performance Assessment, Improvement and Management Review<br>▪ Operating Experience (OPEX)<br>▪ Change Management<br>▪ Configuration Management<br>▪ Records Management<br>▪ Management of Contractors |
| | Human Performance Management | ▪ Human Performance Programs<br>▪ Personnel Training<br>▪ Fitness for Duty |
| | Operating Performance | ▪ Conduct of Licensed Activity<br>▪ Procedures<br>▪ Reporting and Trending |
| Facility and Equipment | Safety Analysis | ▪ Deterministic Safety Analysis<br>▪ Hazard Analysis<br>▪ Criticality Safety |
| | Physical Design | ▪ Design Governance<br>▪ Site Characterization<br>▪ Facility Design<br>▪ Structure Design<br>▪ System Design<br>▪ Components Design |
| | Fitness for Service | ▪ Maintenance<br>▪ Structural Integrity |

| SPECIFIC AREAS FOR THIS FACILITY TYPE | | |
|---|---|---|
| **Functional Area** | **Safety and Control Area** | **Specific Areas** |
| Core Control Processes | Radiation Protection | ▪ Application of ALARA<br>▪ Worker Dose Control<br>▪ Radiation Protection Program Performance<br>▪ Radiological Hazard Control<br>▪ Estimated Dose to Public |
| | Conventional Health and Safety | ▪ Performance<br>▪ Practices<br>▪ Awareness |
| | Environmental Protection | ▪ Effluent and Emissions Control (releases)<br>▪ Environmental Management System (EMS)<br>▪ Assessment and Monitoring<br>▪ Protection to the Public<br>▪ Environmental Risk Assessment |
| | Emergency Management and Fire Protection | ▪ Conventional Emergency Preparedness and Response<br>▪ Nuclear Emergency Preparedness and Response<br>▪ Fire Emergency Preparedness and Response |
| | Waste Management | ▪ Waste Characterization<br>▪ Waste Minimization<br>▪ Waste Management Practices<br>▪ Decommissioning Plans |
| | Security | ▪ Facilities and Equipment<br>▪ Response Arrangements<br>▪ Security Practices<br>▪ Drills and Exercises |

| SPECIFIC AREAS FOR THIS FACILITY TYPE | | |
|---|---|---|
| **Functional Area** | **Safety and Control Area** | **Specific Areas** |
| | Safeguards and Non-Proliferation | ▪ Nuclear Material Accountancy and Control<br>▪ Access and Assistance to the IAEA<br>▪ Operational and Design Information<br>▪ Safeguards Equipment, Containment and Surveillance |
| | Packaging and Transport | ▪ Package Design and Maintenance<br>▪ Packaging and Transport<br>▪ Registration for Use |

# D. ENVIRONMENTAL PROTECTION REVIEW REPORT

e-Doc 5753726 (Word)

e-Doc 5933012 (PDF)

Canada's Nuclear Regulator

# Environmental Protection Review Report:
# Canadian Nuclear Laboratories
# Whiteshell Laboratories – NRTEDL-W5-8.05/2019
# Licence Renewal

**JULY 2019**

**e-Doc: 5753726 (Word)**
**e-Doc: 5933012 (PDF)**

Canadian Nuclear Safety Commission
Commission canadienne de sûreté nucléaire

Canada

# REVISION HISTORY

The following table identifies the revision history of this document.

| Revision number | Change | Summary of changes | Date |
|---|---|---|---|
| 000 | Initial release | N/A | |
| 001 | | | |
| | | | |

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# EXECUTIVE SUMMARY

The Canadian Nuclear Safety Commission (CNSC) conducts Environmental Protection Reviews (EPRs) for all licence applications with potential environmental interactions, in accordance with its mandate under the *Nuclear Safety and Control Act* (NSCA), to ensure the protection of the environment and the health of persons. An EPR is a science-based environmental technical assessment by CNSC staff as set out in the NSCA. The fulfillment of other aspects of the CNSC's mandate, such as safety and security, are met through other regulatory oversight activities.

This EPR Report was written by CNSC staff for the Commission, Indigenous peoples and the public. It describes the scientific, evidence-based findings from CNSC staff review of the application by Canadian Nuclear Laboratories (CNL) to renew the Whiteshell Laboratories (WL) Nuclear Research and Test Establishment Decommissioning Licence NRTEDL-W5-8.05/2019. The licence application proposes the continued operations of the WL site over a period of 10 years, from January 1, 2020 to December 31, 2029. During this licensing period, CNL is proposing to continue the decommissioning activities planned for the WL site, including the decommissioning of the Concrete Canister Storage Facility, Waste Management Area, Shielded Facilities and other remaining buildings and infrastructure.

This EPR Report does not consider CNL's proposed *In Situ* Decommissioning of the Whiteshell Reactor #1 (WR-1) Project, which is undergoing a separate regulatory review process under both the *Canadian Environmental Assessment Act, 2012* and the NSCA. Hence, the proposed *in situ* strategy to decommission the WR-1 facility is outside the scope of this licence renewal.

The CNSC's EPR Report can be read as a stand-alone document that focuses on items that are of current public and regulatory interest such as releases of radiological and hazardous substances to the receiving environment, as well as effects on valued ecosystem components and species at risk, during ongoing operations and decommissioning activities.

This EPR Report includes CNSC staff's assessment of the documents submitted in support of the licence application, as well as but not limited to, the following:

- predictions of radionuclides and hazardous substances in the receiving environment, as presented in the 2001 Comprehensive Study Report (CSR) for the Whiteshell Laboratories Decommissioning Project, previously accepted by the Commission
- CNSC staff verification that environmental monitoring data reported by CNL are within those predicted in the 2001 CSR
- CNL's environmental monitoring and reporting requirements including:
    - Annual Compliance Monitoring Reports
    - Progress Reports on the Environmental Assessment Follow-Up Program for WL
- the results of CNSC's Independent Environmental Monitoring Program
- the results from other regional monitoring programs and/or health studies completed by other levels of government in proximity to the WL site
- the results of the Manitoba Metis Federation's Indigenous knowledge study submitted to the CNSC

The information provided in this EPR Report supports the environmental protection conclusions made by CNSC staff in CMD 19-H4 that CNL has made, and will continue to make adequate provision for the protection of the environment, the health and safety of persons as decommissioning activities continue.

# TABLE OF CONTENTS

# LIST OF TABLES

# LIST OF FIGURES

# 1.0 INTRODUCTION

## 1.1 Purpose

The purpose of this Environmental Protection Review (EPR) is to report the outcome of Canadian Nuclear Safety Commission (CNSC) staff review of licensing and environmental compliance activities conducted under the *Nuclear Safety and Control Act* (NSCA). This review serves to assess whether Canadian Nuclear Laboratories (CNL) has made, and will continue to make, adequate provisions to protect the environment and health and safety of persons at the WL site.

This EPR Report presents information that supports CNSC staff's recommendations in CMD 19-H4 regarding the proposed licence renewal of the Whiteshell Laboratories (WL) Nuclear Research and Test Establishment Decommissioning Licence, NRTEDL-W5-8.05/2019, as it pertains to environmental protection. CNL has requested to renew the licence for a period of 10 years, from January 1, 2020 to December 31, 2029 [1]. The current licence expires on December 31, 2019 [2].

This EPR Report does not consider CNL's proposed *In Situ* Decommissioning of the Whiteshell Reactor #1 (WR-1) Project, which is undergoing a separate regulatory review process under both the *Canadian Environmental Assessment Act, 2012* and the NSCA. Hence, the proposed *in situ* strategy to decommission the WR-1 facility is outside the scope of this licence renewal.

CNSC staff assess the health of persons and the environment at every phase of a project and its activities, and throughout all phases of a facility's lifecycle. EPR Reports are prepared to provide science-based transparent information to the public and that supports staff's recommendations to the Commission. The fulfillment of other aspects of the CNSC's mandate, such as safety and security, are met through other regulatory oversight activities that are outside the scope of this report.

This EPR Report is based on information submitted by CNL, compliance and technical assessment activities completed by the CNSC staff, and independent verification activities, including the following:

- regulatory oversight (section 2.0)
- CNSC staff review of the WL decommissioning strategy and program overview [3] (section 1.2)
- CNSC staff review of CNL's Environmental Assessment (EA) Follow-Up Program (FUP) (section 2.2) [4]
- CNSC staff review of CNL's Annual Compliance Monitoring Reports (formerly referred to as Annual Safety Reports) [5 to 33], and other supplementary documents provided by CNL in support of the 2019 Application for Renewal [34 to 35]
- Independent Environmental Monitoring Program (IEMP) results (section 4.0) [36]
- health studies and other regional monitoring programs in proximity to the WL site (sections 5.0 and 6.0)
- an Indigenous knowledge (IK) study submitted by the Manitoba Metis Federation (MMF) [37 to 38], which focused on the *In Situ* Decommissioning of the WR-1 Project but also

provided relevant information on the Indigenous perspectives of the impact of the WL site on MMF Citizens (section 7.0)

A review has been conducted for all environmental components related to the project, but only a selection of topics related to environmental performance of the facility are presented in detail in this report. These were selected based on licensing requirements, as well as those that have historically been of interest to the Commission, Indigenous peoples and the public.

This EPR Report can be read as a stand-alone document that focuses on topics related to the environmental performance of the facility include emissions (atmospheric releases) and liquid releases to the environment, their potential transfer through key environmental pathways and associated potential exposures and or effects on valued ecosystem components including human and non-human biota. The focus is on nuclear and hazardous substances associated with WL site activities, with additional information provided on other substances of public and/or regulatory interest such as greenhouse gas (GHG) emissions. CNSC staff also present information on any relevant regional environmental or health monitoring or studies conducted by the CNSC (i.e., IEMP) or other levels of government.

Additionally, the IK study produced by MMF, while produced for the proposed *In Situ* Decommissioning of the WR-1 Project, identified a number of site-wide valued components (VCs) of significance to their rights, culture and interests, in and around the WL site. Indigenous perspectives and cultural context enhance the CNSC's understanding of potential impacts of projects, strengthening the rigour of project reviews and regulatory oversight. This information was considered in this review, and is presented in later sections of this report.

## 1.2 Project Background

This section of the report provides general information on the WL site. This includes a description of the site location and a basic history of the WL site activities and licensing. More detailed information is provided with respect to the proposed decommissioning strategy for the WL facility and activities completed over the previous licensing period, followed by information on activities planned for the proposed licence period.

This information is intended to provide context for later sections of this report, which discuss completed and ongoing decommissioning activities.

### 1.2.1 Site Description

The WL site is located in Pinawa, Manitoba, approximately 100 kilometres (km) northeast of Winnipeg, on the shore of the Winnipeg River. Historically owned and operated by Atomic Energy Canada Limited (AECL) and comprised of 4,375 hectares of land, the WL site was established in the 1960s in order to conduct nuclear research activities.

The WL site was commissioned in 1964 and operated for approximately 40 years under a Nuclear Research and Test Establishment Operating Licence (NRTEOL) [39]. CNL took over management of the WL site in 2015, and although AECL remains the site owner, operations are managed by CNL under a government-owned, contractor-operated ("Go-Co") model.

See figures 1.1 and 1.2, for maps of the site location.

**Figure 1.1: Overview of site and surrounding features (figure adapted from Whiteshell Reactor #1 EIS figure 1.0-1) [40]**

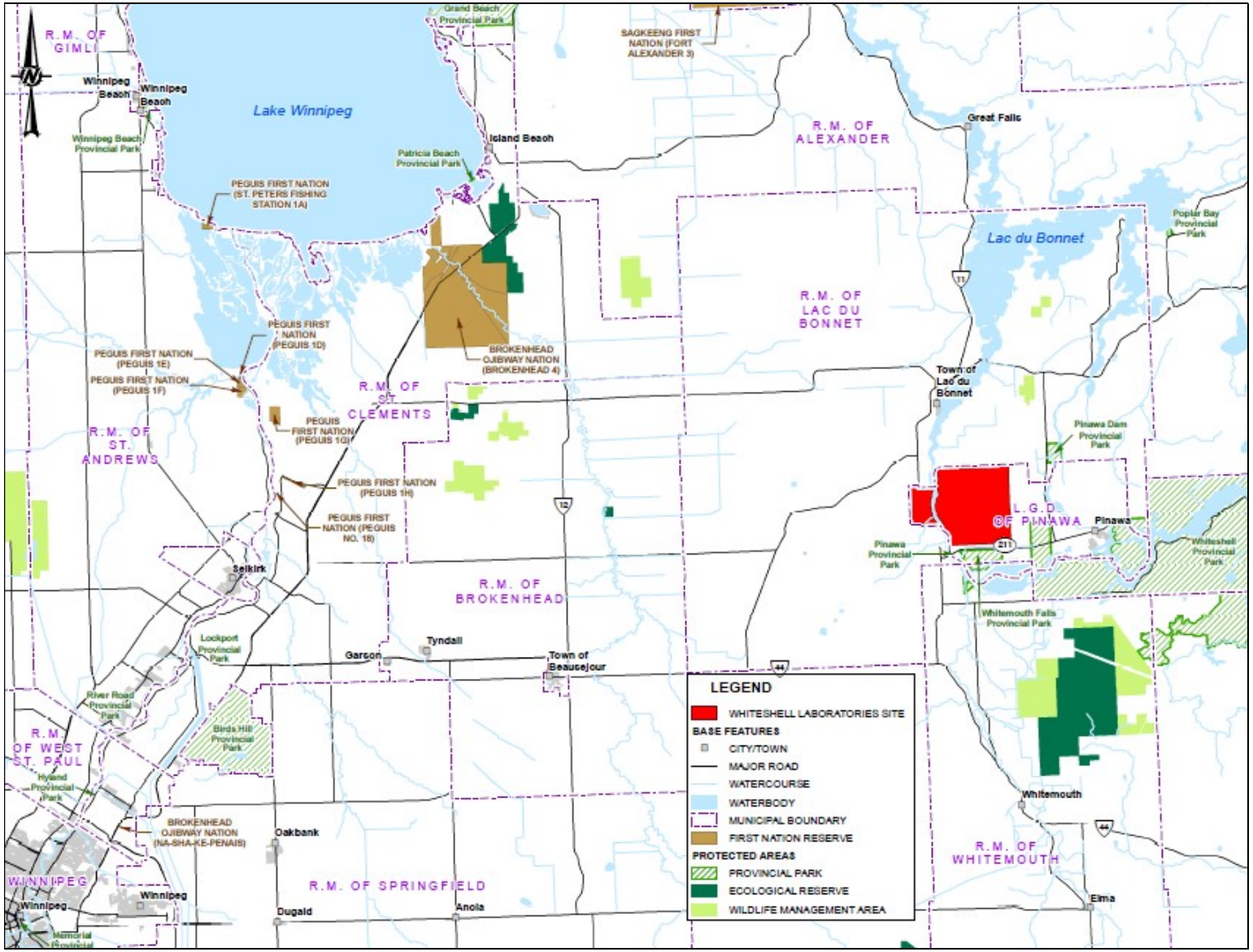
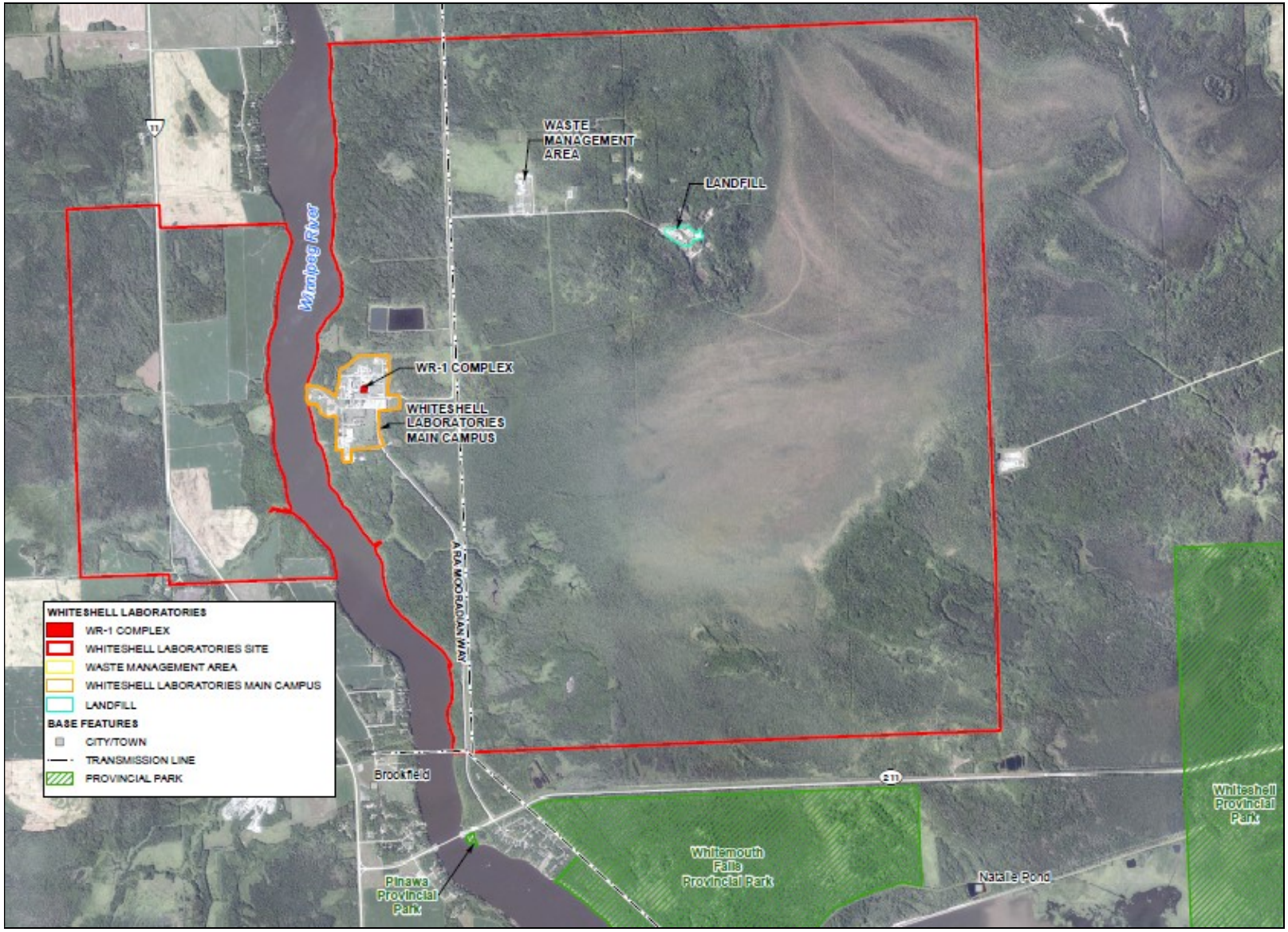


**Figure 1.2: Aerial view of the WL site, including WMA, Inactive Landfill, Lagoon, and Main Campus relative to the Winnipeg River (figure adapted from WR-1 EIS figure 1.0-2) [40]**



The following is a description of the buildings and infrastructure that were originally located on the WL site along with their purpose [41]:

- **Active Liquid Waste Treatment Center (ALWTC), Building (B) 200**: Historically used for receiving low-level liquid waste effluent (transferred from WR-1, Research laboratories in B300, and laundry / decontamination via underground piping), as well as processing and solidification of medium-level liquid waste (concentrating waste steam originating from the Shielded Facility (SF) building), which was eventually transported to and stored in the Waste Management Area (WMA).
- **Concrete Canister Storage Facility (CCSF)**: Used as part of the Concrete Canister Fuel Storage Program in order to demonstrate dry storage as a feasible alternative to water pool storage for irradiated reactor fuel, and eventually to store remaining used fuel from the WR-1.
- **Decontamination Centre, B411**: Used to provide decontamination services for equipment and tools, including laundry services for radioactively contaminated clothing.
- **Neutron Generator Facility, B300**: Originally located in the Research and Development Complex, this facility was used in the development of methods for the assay of fissile and fertile materials in reactor fuels and components, and eventually fast neutron activation analysis.
- **Sewage Lagoon**[1]: The Lagoon is comprised of a primary settling pond and a secondary pond (connected via a culvert), an outlet and a sewage lift station (B907), constructed of low permeability clay embankments placed on a prepared clay surface. The Lagoon was historically used to receive liquid wastes from lavatories, showers and non-active drains. It is located just north of the main laboratory site.
- **Shielded Facility (SF), B300**: Also located in the Research and Development Complex and comprised of the Hot Cells facility, the SF was used to provide shielded, remote handling facilities in support of the CANDU Reactor Safety research programs and other activities involving radioactive materials. The Immobilized Fuel Test Facilities were used for experiments involving radioactive materials, in support of the Canadian Nuclear Fuel Waste Management and CANDU Reactor Safety research programs.
- **Van de Graff Accelerator Facility, B300 (four rooms)**: This facility housed the accelerator, a target room and a control room. The Van de Graff Accelerator operated from 1970 to 1997.
- **Waste Management Area (WMA)**: Used for storage of low level radioactive wastes (LLW) and intermediate radioactive wastes (ILW), irradiated fuel waste, high level wastes (HLW), and other hazardous chemicals, the WMA includes a variety of buildings, unlined earth trenches, in-ground concrete bunkers and other storage bunkers, concrete stand pipes, and amine storage tanks (see figure 3.3 in section 3.2.4).

[1] Referred to henceforth as the Lagoon.

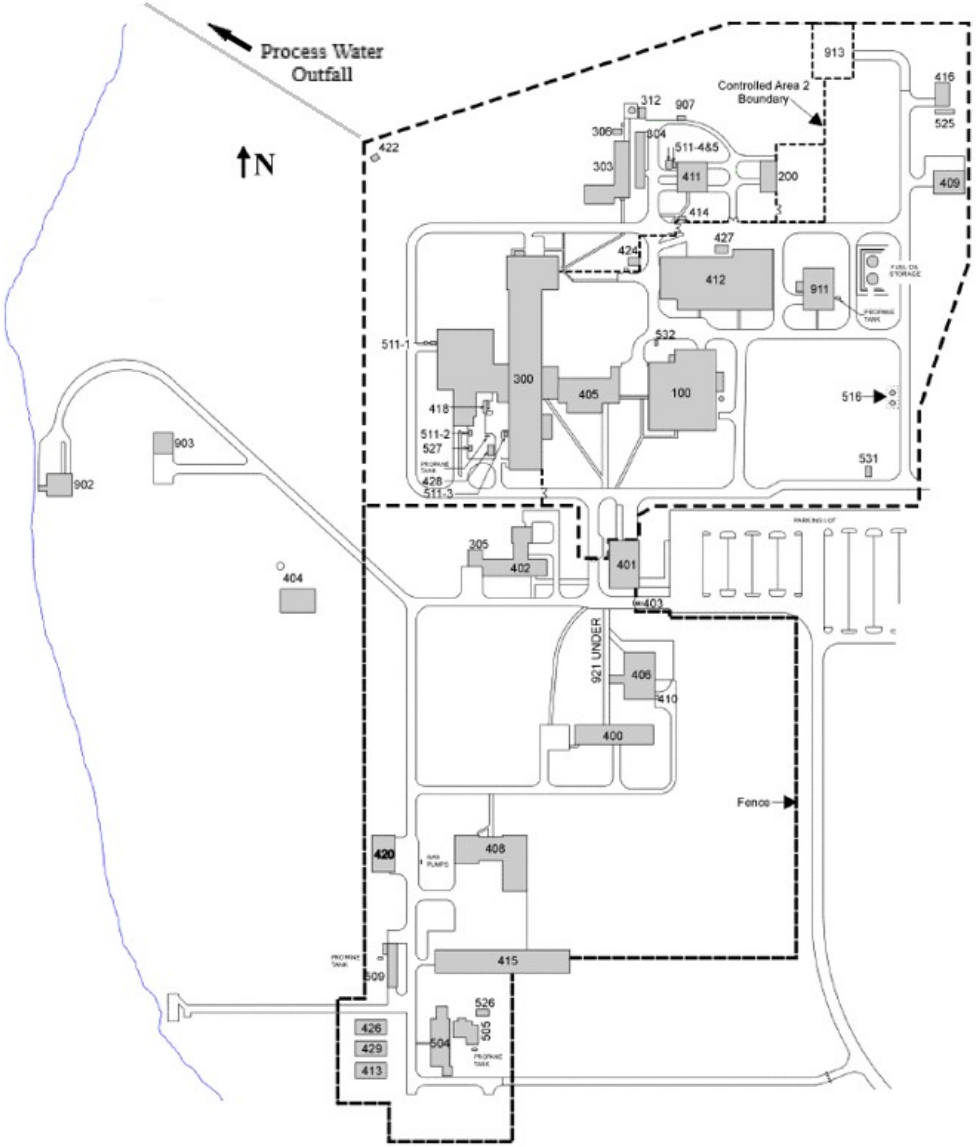
- **Whiteshell Reactor #1 (WR-1), B100**: Used from 1965 to 1985 to demonstrate the organic-cooled reactor concept, using heavy water as the moderator. The facility was also used for engineering tests on fuels, fuel channels and reactor coolants. After shutdown in 1985, the reactor was defueled and placed in a safe, secure, shutdown state. The irradiated fuel from WR-1 is currently stored in the CCSF.

The WL site has one main continuous liquid effluent discharge point into the Winnipeg River, the Process Water Outfall[2], located about 8 meters offshore on east side of the river.

See figure 1.3 for the original WL site layout and location of the Process Outfall. Detail on the progress of the decommissioning activities related to the buildings and infrastructure at the WL site can be found in section 1.2.3.

[2] Referred to henceforth as the Process Outfall.

**Figure 1.3: Original WL site layout (Provided by CNL)**




| | |
|---|---|
| 100 | Reactor Operations |
| 200 | Active Liquid Treatment Center |
| 300 | Research and Development |
| 303 | Gas Dynamics Research Laboratories |
| 304 | Gas Dynamics Research Laboratories |
| 305 | Accelerator Application Research Facility |
| 306 | Gas Dynamics Equipment Storage |
| 307 | Diffusion Flame Facility |
| 312 | Steam Generator Storage |
| 400 | Engineering and Administration |
| 401 | Security and Reception |
| 402 | Health and Safety |
| 403 | Vehicle Gate House |
| 404 | Meteorological Tower |
| 405 | Technical Information Center |
| 406 | Cafeteria |
| 408 | Material handling |
| 409 | Active Area Stores |
| 411 | Decontamination Center |
| 412 | Machine Shop and Maintenance |
| 413 | Waste Chemical Storage |
| 414 | Controlled Area 2 Entrance |
| 415 | Material Warehouse |
| 416 | Storage |
| 420 | Mobile Equipment Storage |
| 422 | Outfall Monitoring Station |
| 424 | WR-1 Organic Monitor Building |
| 426 | Civil Storage #1 |
| 427 | Mechanical Shop Storage #1 |
| 428 | Mechanical Shop Storage #2 |
| 429 | Civil Storage #2 |
| 500 | Internal Friction Laboratory |
| 501 | Aquatic Toxicology Laboratory |
| 504 | Engineering Development and test |
| 505 | Soils Research Laboratory |
| 509 | Civil utility Building |
| 511-1 | Active Waste Storage #1 (Bldg 100) |
| 511-2 | Active Waste Storage #2 (Shield Facility) |
| 511-3 | Active Waste Storage #3 (Bldg 300) |
| 511-4 | Active Waste Storage #4 (Bldg 411) |
| 511-5 | Active Waste Storage #5 (Bldg 411) |
| 525 | Meteorology Trailer #2 |
| 526 | Borehole Instrumentation Test Facility |
| 527 | Inflammable Liquid Storage building |
| 529 | Exercise Facility |
| 530 | Internal Friction Laboratory Annex 500 |
| 902 | Pump House |
| 903 | Water Filtration Plant |
| 907 | Sewage Lift Station and Lagoons |
| 911 | Power House |
| 913 | Main Substation |
| 921 | Pedestrian Links Between Buildings |

### 1.2.2 Project Overview

As described in CMD 19-H4, following AECL's 1997 decision to discontinue operations and close the WL site, an initial strategy for decommissioning was developed [41]. The proposed strategy included the following stages:

- ***Decontamination and clean up*:** Bringing nuclear and radioisotope buildings and facilities into a safe, secure, interim end state and completely decommissioning the Van de Graaf Accelerator and Neutron Generator.
- ***Storage-with-Surveillance:*** Conducting monitoring and surveillance of remaining buildings and facilities, placing most waste management facilities in the WMA into a passive control state, as well as establishing interim processing, handling and storage facilities (required for monitoring, surveillance and decommissioning project activities).
- ***Final decommissioning*:** Completely decommissioning the WL site to the final end state. During this stage, infrastructure refurbishment and rebuilding were expected to be required, in order to maintain the facilities under monitoring and surveillance.

This strategy explained that a safety case for the *in situ* disposal of 21 LLW trenches in the WMA and river sediments downstream of the Process Outfall would be provided to, and assessed by the CNSC at a future date [34][41]. These activities were also expected to be followed by a 200 year period of institutional control, during which performance of any *in situ* disposal components would be monitored and controlled by CNL, with regulatory oversight by the CNSC [41 to 42].

In April of 2002, AECL submitted an application to the CNSC to replace their existing NRTEOL with a six–year decommissioning licence, in order to begin implementing their proposed decommissioning strategy. In a two-part public hearing, held on September 12th and November 14th of the same year, the Commission considered submissions from intervenors, CNSC staff and AECL, including the *Whiteshell Laboratories Decommissioning Project Comprehensive Study Report* [41] which was produced in accordance with the EA requirements under the *Canadian Environmental Assessment Act, 1992* (CEAA 1992) (see section 2.2 for more information on this EA). The Commission accepted CNSC staff recommendations and concluded that the approved activities to be carried out under the initial licence would result in the safe shutdown of facilities and gathering of information necessary for the planning, preparation and assessment of future decommissioning activities. In 2003, the Commission granted a decommissioning licence (NRTEDL) that was valid until December 31, 2008 [43].

In April of 2008, AECL submitted an application to renew this decommissioning licence for a 10 year licence period, in order to complete ongoing decommissioning activities, based on an accelerated schedule. Although the original decommissioning plan had not been fundamentally altered, deferment periods[3] had been eliminated wherever possible, allowing AECL to reduce the number of years for storage-with-surveillance activities [44]. In a public hearing held on November 5th of the same year, the Commission renewed the WL site NRTEDL from January 1, 2009 until December 31, 2018 [45].

[3] A period of monitoring and surveillance when no significant decommissioning work is in progress.

Following the restructuring of AECL in 2014, several administrative changes were made to the NRTEDL. In November 2014, the licence was transferred to CNL from AECL. In January 2016, the address of the facility was changed, and a new licence in the updated licence format and a Licence Condition Handbook (LCH) were issued to CNL. No changes to authorized activities were introduced in the updated licence or LCH [46].

On May 16, 2016, the CNSC received a Project Description from CNL proposing an alternative strategy (*in situ*) to decommissioning the WR-1 reactor, to the existing decommissioning strategy of dismantlement. The CNSC determined that the proposed project to *in situ* decommission the WR-1 reactor would require a federal EA, pursuant to *Canadian Environmental Assessment Act, 2012* (CEAA 2012). The official public record of this EA process can found on the Canadian Environmental Assessment Registry website (reference no: 80124). The regulatory review process for the proposed *in situ* strategy under the CEAA 2012 and the NSCA are still underway. The proposed *in situ* strategy for the WR-1 project is thus out of scope from this licence renewal.

Given that more time is needed by CNL to address public, Indigenous and federal comments in the ongoing EA for the proposed *in situ* WR-1 reactor and the need to continue approved decommissioning activities for the site, on March 13, 2018 CNL submitted a request for a one year licence renewal. This request included no changes to the existing activities or licence conditions, and was approved by the Commission on August 1, 2018. The licence was extended until December 31, 2019 [47].

According to the accelerated project plan, CNL plans to have the entire WL site decommissioned to its final end-state within the requested 10 year licence period. Furthermore, in addition to the ongoing EA and associated documents related to the proposed *in situ* strategy for the WR-1, CNL intend to develop and present a safety case to CNSC staff, in order to gain authorization for *in situ* disposal of 21 underground LLW trenches. The concept for *in situ* disposal of these trenches was included under the decommissioning licence in 2003 by the Commission, but the safety case must still be approved. This is expected to be completed and submitted to the CNSC over the next licencing period [34].

### 1.2.3 Decommissioning Progress

Since the granting of the initial decommissioning licence in 2003, many planned activities have been completed. Table 1.1 provides a summary of decommissioning activities to date [1][14][34][35][44].

**Table 1.1: Decommissioning activities completed to date**

| Facility | Activities and components completed | Completed |
|---|---|---|
| Active Liquid Waste Treatment Center (B200) | • Cementation of Active Liquid Wastes from historical fuel reprocessing experiments completed<br>• Building shut down, operationally cleaned up and final decommissioning commenced | Previous licence period |
| Concrete Canister Storage Facility (CCFS) | • No activities - continued operations, in support of decommissioning | - |

| Facility | Activities and components completed | Completed |
|---|---|---|
| Decontamination Center (B411) | • Relocation and reconfiguration of laundry and decontamination services<br>• Building decommissioned and demolished<br>• Building debris packaged and transported off site | Previous licence period |
| Neutron Generator | • Dismantled and removed | Prior to 2005 |
| Sewage Lagoon | • No activities. Continued operations, in support of decommissioning | - |
| Shielded Facilities (SF) (B300) and other Main Campus nuclear facilities | • Decommissioning and demolition of hot cell 12 (hot cells 6-11 share ventilation with cells 1-5) and storage blocks dismantled and sealed<br>• Decommissioning and demolition of SF warm cells 14 to 18 | Between 2005 and 2007 |
| | • Decommissioning and demolition of radioisotope laboratories (including main radioisotope Research and Development complex)<br>• Thermal Hydraulics Test Facility shut down and clean up commenced | Previous Licence period |
| Van de Graff Accelerator | • Dismantled and removed | Prior to 2005 |
| Waste Management Area | • Shielded Modular Above-Ground Storage (SMAGs) building constructed and brought to operational status, in order to enable future decommissioning plans<br>• Contaminated Soil Storage Facility constructed | Previous Licence period |
| | • Remaining Experimental Cesium Pond soil waste excavated, packaged and transported offsite | Between 2017 and 2018 |
| WR-1 Building (B100) | • Remaining unirradiated WR-1 fuel material removed from the WL site<br>• Planning and design activities for later activities | Previous Licence period |
| Other site activities | • Central oil-fired heating system shut down and transition of building heating to electric/propane; related fuel storage tanks also removed<br>• Final decommissioning of SLOWPOKE Demonstration Reactor completed - all major components were removed<br>• Shutdown and demolishment of various non-nuclear buildings | Previous Licence period |

CNSC staff regularly report on the performance of licensees to the Commission. In 2012, an update was provided on the status of the decommissioning progress [48] at the WL site, as well as in 2014 [49] and 2016 [50]. In 2018, the WL site was included in the 2017 *CNL Progress Update for CNL's Prototype Waste Facilities, Whiteshell Laboratories and Port Hope Area Initiative* (CMD 18-M30) [51]. As noted in these updates, CNL has planned, implemented and completed decommissioning activities in accordance with CNSC approved decommissioning plans, and CNSC staff have been satisfied with the overall performance.

The planned activities for the requested 10 year licence period are outlined in table 1.2.

**Table 1.2: Remaining facilities to be decommissioned and related activities**

| Facility to be decommissioned | Proposed activities and components |
|---|---|
| Active Liquid Waste Treatment Center (B200) | • Decommissioning of remaining ALWTC equipment (in progress), and demolition of the building |
| Concrete Canister Storage Facility (CCFS) | • Complete defueling and decommissioning/demolition of the CCSF and the Demonstration Canister Storage Site and remediation of the area<br>• Retrieval of fuel baskets from canisters, transfer to a certified shipping container for transport to CRL for storage<br>• Decontamination of empty canisters with radioactive contamination as needed, and demolishment |
| Sewage Lagoon | • Options for decommissioning the Lagoon are currently being evaluated, and an Environmental and Human Health Risk Assessment is underway |
| Shielded Facilities (B300) and other Main Campus nuclear facilities | • Decommissioning of remaining Hot Cells and associated active exhaust ducting, active drain systems, and radioisotope laboratories (maintained to support future decommissioning activities)<br>• Decommissioning of remaining facilities and systems in B300 and demolition of buildings, once operations have ceased |
| Waste Management Area | • Deactivation, demolishment and/or remediation of all buildings, structures, and grounds within the WL site WMA (with the exception of 21 LLW trenches – See figure 1.4)<br>• Retrieval, characterization and re-packaging of LLW, ILW, and HLW from underground trenches and waste bunkers (as necessary), for shipment to a suitable licensed storage/disposal facility |
| WR-1 Building (B100) | • Complete remediation and removal of the building<br>• All activated and contaminated components removed, packaged and dispositioned at off-site facilities<br>• Facility structure decontaminated and demolished |
| Other site activities | • Decommissioning and demolition of all remaining non-nuclear buildings and support infrastructure (e.g., administrative offices, non-active laboratories, workshops, storage buildings, vehicle garages, shipping and receiving areas) |

# 2.0 REGULATORY OVERSIGHT

The CNSC regulates nuclear facilities and activities in Canada to protect the environment and the health and safety of persons in a manner that is consistent with Canadian environmental policies, acts and regulations and with Canada's international obligations. The CNSC assesses the environmental effects of nuclear facilities and activities at every phase of their lifecycle. This section of the EPR Report discusses the CNSC's regulatory oversight of environmental protection (EP) measures at the WL site.

To meet CNSC's regulatory requirements, CNL is responsible for implementing and maintaining EP measures that identify, control and (where necessary) monitor all releases of radiological and hazardous substances and effects on human health and the environment, from the WL site. These EP measures must comply with, or have implementation plans in place to comply with, the

regulatory requirements included in the WL decommissioning licence. The regulatory requirements for the WL site can be found throughout the Regulatory Oversight section.

## 2.1 Environmental Protection Reviews and Assessments

Under the NSCA, an assessment of the environment is part of the ongoing lifecycle EP framework, whereby EPR Reports such as this one, are produced. No decision is made on the EPR itself, as the information is intended to inform and support the regulatory decision being sought from the Commission by the licensing matter explained in the body of the staff CMD 19-H4.

Depending on the scope and impact of project activities, legislation such as the CEAA 2012 and the former CEAA 1992 may require the completion of an EA [52]. The purpose of an EA is to identify the possible environmental effects of a proposed project, and determine whether these effects can be adequately mitigated to protect the environment and heath of persons. A positive EA decision, by the commission, concluding no significant adverse effects is required before a licence can be granted.

The following section provides information on the Comprehensive Study EA [53] completed under the former CEAA 1992, as well as information regarding elements of the EA FUP. The EA FUP verifies the accuracy of the predictions of the EA and the effectiveness of the mitigation measures. The CNSC ensures that EA FUPs within the CNSC's mandate are incorporated into the licensing process.

### 2.1.1 Comprehensive Study EA under CEAA 1992

Under the former CEAA 1992 [52], an EA was conducted for the currently licensed decommissioning activities at the WL site. In 1999, AECL began to prepare plans for decommissioning of the facilities located on the WL site, and as described in section 1.2, later applied to the CNSC for a decommissioning licence. Under CEAA 1992, the CNSC determined that a Comprehensive Study EA was required. This EA was carried out by the CNSC and the Department of Fisheries and Oceans Canada (DFO), who were designated as Responsible Authorities (RAs) under this former Act.

A document outlining the scope of the project and assessment was issued by the CNSC in December 1999, following consultation with the public and other federal and provincial government departments. In 2001, the *Whiteshell Laboratories Decommissioning Project Comprehensive Study Report* (CSR) [41] was produced by AECL, in accordance with the requirements of the EA process.

Following CNSC and DFO staff findings that all of the CEAA 1992 requirements had been adequately fulfilled, in 2002 the Minister of the Environment agreed that the project was not likely to cause significant adverse environmental effects, taking into account the implementation of mitigation measures [554]. CNSC rendered a licensing decision in December 2002, and the decommissioning licence was granted [43].

The EA process identified the need for an EA FUP [4] designed to validate the predicted environmental effects and effectiveness of the mitigation measures. Further details of this are provided in section 2.1.2.

### 2.1.2 EA Follow-Up Program

In May 2002, CNL submitted a draft EA FUP for the WL site, to the CNSC and DFO. Following incorporation of feedback from both RAs, the program was finalized in June 2002. AECL has submitted Annual Progress Reports on the EA FUP since the 2002 approval of the EA FUP, and CNL continues to meet this commitment.

The objectives of the EA FUP are as follows [4]:

- verify the accuracy of the EA
- determine the effectiveness of any mitigation measures that have been implemented
- optimize the monitoring and surveillance program at the WL site
- confirm that appropriate mitigation measures are implemented
- develop appropriate responses to unforeseen events
- identify effects of the project that may not have been predicted

Achievement of these objectives continues to be accomplished using monitoring, surveillance and inspection activities, which are supported by planning, data collection, analysis, evaluation and reporting. The program is structured around nine themes of work, referred to as Work Packages. These Work Packages are shown in table 2.1, along with the associated Work Tasks and overall status.

**Table 2.1: Environmental assessment Follow-Up Program elements and status [4][25][55]**

| # | Work package | Component | Description | Completed activities and status |
|---|---|---|---|---|
| 1 | Routine environmental monitoring program (EMP) | Environmental | Establishment of an EMP in order to confirm the CSR EA conclusions, as well as ensure remediation measures are effective throughout all phases. | Monitoring has continued over the entirety of the project life-cycle, and these activities are ongoing.<br>As decommissioning activities continue, this program adapts as needed. |
| 2 | Air and meteorology | Environmental | Collection of monitoring data, in order to establish a site baseline, as well as ongoing collection and monitoring of data (during building demolition), in order to ensure effectiveness of mitigation measures, and that environmental effects remain insignificant. | Monitoring stations related to air and meteorology were established, collection of baseline data has been completed, and various buildings have been demolished.<br>The collection of data and monitoring continues. |
| 3 | Fitness for service (FFS) of WMA Facilities | Interim Storage and End state Support | An initial assessment of the fitness-for–service of structures where storage would continue during decommissioning activities, including validation of facility integrity and geological/ hydrogeological conditions around facilities. | Various activities have been completed, including: confirmation of structural integrity of buildings, evaluation of potential impact of containment transport from individual storage facilities / areas, establishment of remediation criteria related to containment transport impacts, relative to waste removal to final disposal.<br>CNL continues to evaluate potential impacts of containment transport from storage facilities and areas, as well as remediation requirements and timeframes, where appropriate. |
| 4 | Confirmation of hydrogeological conditions at the WMA | Interim Storage and End state Support | Enhanced hydrogeological monitoring in order to evaluate fitness-for–service of interim storage structures, as well as collect detailed information needed in order to develop safety case for *in situ* disposal of LLW trenches. | Detailed planning for enhanced monitoring system completed.<br>Although many activities have been completed, installation and refurbishment of monitoring wells, evaluation and reporting on interim storage environment, as well as monitoring and data collection for the safety analysis to support LLW *in situ* end state are all ongoing. |

| | | | | |
|---|---|---|---|---|
| 5 | Interim remediation of WMA Facilities | Interim Storage and End state Support | Interim remediation plans for structures and areas of the site where facility life-cycle would not be adequate to manage the wastes. | The following activities are and have been ongoing: recovery of, processing, packaging and provision of enhanced interim storage of irradiated fuel (from standpipes), and other wastes; retrieval of LLW from trenches not suitable for *in situ* disposal (irradiator reactor components in trench #6, soil and waste contaminated by WR-1 waste water in trench #10, arsenic from trench #1 and others). |
| 6 | Inactive Landfill Enhanced Monitoring | Interim Storage and End state Support | Enhanced monitoring in order to confirm the integrity of hydrogeological environment, control groundwater impacts and collect data in preparation for site closure. | Detailed planning for enhanced monitoring system completed, along with installation and refurbishment of monitoring wells.<br>Evaluation of interim storage environment, monitoring and data collection, as well as preparation of a closure plan will continue over the decommissioning period. |
| 7 | Sewage Lagoons Enhanced Monitoring | Interim Storage and End state Support | Enhanced monitoring in order to confirm compliance of discharges, assess impacts to groundwater and the Winnipeg river, as well as development of a closure plan. | Detailed planning for enhanced monitoring system completed, along with installation and refurbishment of monitoring wells.<br>Monitoring and collection of data, compliance evaluation, assessment of groundwater impacts, as well as preparation of a closure plan are all ongoing. |
| 8 | River Sediments Enhanced Monitoring | Interim Storage and End state Support | Enhanced monitoring of river sediments in order to ensure the CSR assessment remains valid, as decommissioning activities continue. | Identification of depositional areas above the hydroelectric dam sites for core sampling completed, agreement signed with DFO and CNSC for target sampling locations, as well as collection and analyzation of Caesium-137, following which a baseline was established.<br>Re-sampling will continue at 20, 40 and 60 year marks (years 2026, 2046 and 2066, respectively), in order to validate CSR conclusions. |
| 9 | Establish and maintain project communications mechanisms | Public communication | Interactive public communication activities in order to continue communications with stakeholders, including municipal governments, Indigenous people, other interested parties and members of the public in the WL site region. | Communication contact list was assembled and verified, input was solicited from stakeholders in the contact list, in order to establish formal and informal communication measures and communication processes, based on this feedback.<br>Communications will be ongoing for the remainder of project activities. |

CNSC staff continue to review the follow-up activities, in order to ensure that the EA FUP objectives are being met. To date, CNL has continued to implement follow-up activities as required. EA FUP elements associated with the monitoring of emissions and effluents or the receiving environment are incorporated within the environmental management program, as needed.

## 2.2 Detailed Decommissioning Plan

Decommissioning activities for research and test facilities such as those at the WL site are regulated by the CNSC. The following sub-section provides high level information with respect to the Detailed Decommissioning Plan.

Decommissioning plans document the decommissioning strategy and end-state objectives; the major decontamination, disassembly and remediation steps; the approximate quantities and types of waste generated; an overview of the principal hazards and protection strategies; and an estimate of cost. As a full lifecycle regulator, the CNSC will continue to monitor and remain aware of the end state of the WL site. As decommissioning activities are completed, they are expected to result in a decrease in both radiological and hazardous releases to the environment, as the WL site reaches its eventual end state.

The decommissioning strategy for the WL site is documented in the *Whiteshell Laboratories Detailed Decommissioning Plan: Volume 1 – Program Overview* [3] (along with 11 subsequent volumes).

CNL is planning, implementing and completing decommissioning activities, in accordance with detailed decommissioning plans. Revisions to the program overview are currently underway, and subsequent volumes are developed when so required by CNL. Through analysis of these plans, staff can provide a high level assessment of how the project/environmental interactions will change over time.

Progress on activities at the WL site can be found in section 1.2.2 of this report, and in further detail in the Waste Management SCA of the CMD 19-H4.

## 2.3 Regulatory Framework

The EP program at the WL site was designed and implemented in accordance with REGDOC 2.9.1-2013, and includes derived release limits (DRLs) (N288.1-08) and public dose modelling. The licensee has also re-evaluated their EP program against the latest version of REGDOC 2.9.1-2017 and the associated CSA standards. Specific implementation dates are shown in table 2.2 below.

**Table 2.2: Status of WL site Environmental Protection Measures with respect to implementation of regulatory documents and standards**

| Regulatory document or standard | Status |
|---|---|
| CNSC Regulatory Document REGDOC 2.9.1 *Environmental Protection: Policies, Programs and Procedures* (2013) [56] | Implemented |
| CSA N288.1-08, G*uidelines for calculating derived release limits for radioactive material in airborne and liquid effluents for normal operation of nuclear facilities* [57] | Implemented |
| CSA N294-09 (reaffirmed 2014), *Decommissioning of Facilities Containing Nuclear Substances* [58] | Implemented. |
| CSA N288.4-10, *Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills* [59] | Scheduled: January 1, 2020 |
| CSA N288.5-11, *Effluent Monitoring Program at Class I Nuclear Facilities and Uranium Mines and Mills* [60] | Scheduled: January 1, 2020 |
| CSA N288.6-12, *Environmental risk assessment at Class I nuclear facilities and uranium mines and mills* [61] | Scheduled: January 1, 2020 |
| CSA N288.7-15, *Groundwater protection programs at class I nuclear facilities and uranium mines and mills* [62] | Scheduled January 1, 2020 |
| CSA N288.8-17, *Establishing and implementing action levels to control releases to the environment from nuclear facilities* [63] | Scheduled: January 1, 2020 |
| CNSC Regulatory Document REGDOC 2.9.1, *Environmental Principles, Assessments and Protection Measures, version 1.1* (2017) [64] | Scheduled: January 1, 2020 |

CNSC staff confirm that CNL has either implemented programs in accordance with the relevant EP regulatory documents or standards, or has implementation plans in place [34]. CNL has committed to a schedule such that their programs will be designed and implemented, in accordance with REGDOC-2.9.1-2017 [64] and the full range of associated CSA standards within the initial year of relicensing (i.e., January 1, 2020).

In addition to requiring the evaluation of programs against regulatory documents and standards and the submission of these programs to the CNSC, licensees are also required to regularly report on the results of these programs. Reporting requirements are specified within the *Radiation Protection Regulations* [65] (public dose), the licensees accepted programs or as specified within the LCH.

CNL is required to submit Annual Compliance Monitoring Reports, including an environmental monitoring report that details the results of the environmental protection measures related to the decommissioning of the WL site. These annual reports and any associated special studies are reviewed by CNSC staff for compliance and verification as well as trending. The 2018 annual report summary is available on CNL's website [66].

As noted in section 1.2.3 of this EPR Report, CNSC staff provided updates to the Commission on the status of the decommissioning progress at the WL site, which included reports on the performance of activities conducted at CNL sites, in 2012 [48], 2014 [49], 2016 [50] and in 2018 [51]. Furthermore, Regulatory Oversight Reports (ROR) are the CNSC's standard mechanism for updating the Commission on the operation and regulatory performance of licensed facilities. A ROR addressing CNL operated facilities in Canada, including the WL site, will be reported to the Commission in November of 2019.

### 2.3.1 Environmental Protection Measures

To meet CNSC's regulatory requirements under REGDOC-2.9.1 [56][64], CNL is responsible for implementing and maintaining EP measures that identify, control and monitor releases of radioactive and hazardous substances and effects on human health and the environment, from the WL site. EP measures are an important component of the overall requirement for licensees to make adequate provision for protection of the environment.

This and the following sub-sections provide a brief summary of the WL site EP framework and the status of each specific EP measure, relative to the latest regulatory document or CSA standard. Section 3.0 of this EPR Report summarizes the results of these programs/measures against relevant regulatory limits, environmental quality objectives/guidelines and discusses any trends of interest.

CNL was required to update the Environmental Protection Program (EnvP) during the previous licence period, in order to conform to REGDOC-2.9.1-2013 [56]. The program includes the following elements:

- Environmental Management System (EMS)
- Effluent Emissions Control and Monitoring:
    - derivation of Derived Release Limits (DRLs) in accordance with CSA N288.1-08
    - Effluent Verification Monitoring Program (EVMP)
- Receiving Environment Monitoring Program:
    - Environmental Monitoring Program (EMP)
    - Groundwater Monitoring Program (GWMP)
- EA FUP (section 2.2)

Further details on these programs can be found in the following sub-sections.

### 2.3.2 Environmental Management System

An EMS refers to the management of an organization's environmental policies, programs and procedures in a comprehensive, systematic, planned and documented manner. It includes the organizational structure, planning and resources for developing, implementing and maintaining policy for environmental protection. The EMS serves as a management tool for integrating all of a licensees EP measures in a documented, managed and auditable process by:

- identifying and managing non-compliances and corrective actions within the activities, through internal and external inspections and audits
- summarizing and reporting the performance of these activities both internally (licensee management) and externally (Commission and public)
- training of personnel involved in these activities
- ensuring the availability of resources (i.e., qualified personnel, organizational infrastructure, technology and financial resources)
- defining and delegating roles, responsibilities and authorities essential to effective management

CNL has established and implemented an EMS for the WL site in accordance with REGOC-2.9.1-2013 [56]. The WL site has an EMS that has been registered to CAN/ISO 14001-2004 *Environmental Management Systems – Requirements with Guidance for Use* [67] since 2010. In 2018, the WL site EMS was recertified to ISO 14001-2015 [68]. CNSC staff have concluded that CNL has developed and implemented an EMS program at the WL site in compliance with CNSC regulatory requirements.

### 2.3.3 Environmental Risk Assessment

An environmental risk assessment (ERA) of nuclear facilities is a systematic process used to identify, quantify and characterize the risk posed by contaminants and physical stressors in the environment on human and other biological receptors, including the magnitude and extent of the potential effects associated with a facility. The ERA serves as the basis for the development of site-specific effluent and EMPs. These programs in turn inform and refine future revisions of the ERA.

As required by REGDOC-2.9.1-2013 [56], the 2001 CSR was used to inform the WL site EP measures for the previous licencing period. For the proposed licence period, CNL will be updating their EP measures in order to meet the requirements of REGDOC-2.9.1-2017 [64], which requires the establishment and maintenance of a site wide ERA, in accordance with CSA N288.6-12 *Environmental risk assessment at Class I nuclear facilities and uranium mines and mills* [61].

ERAs for the Lagoon and WMA are currently underway [35] in order to support future CNL decision-making related to site activities, and will be provided within the upcoming licence period. These will be followed by a site-wide ERA, prior to the January 2020 implementation date as outlined in table 2.2. The outcomes of these ERAs will help inform the updating of EP measures as needed and will be reported on through the Regulatory Oversight Report for CNL sites.

### 2.3.4 Effluent and Emissions Control and Monitoring

Controls on environmental releases are established in order to provide protection to the environment, as well as respect the principles of sustainable development and pollution prevention. The effluent and emissions prevention and control measures are established on the basis of industry best practice, the application of principles of optimization (e.g., in design) and as low as reasonably achievable (ALARA) principles, respect of legislated limits and results of an ERA (or in this case, the CSR produced under CEAA 1992 [41]).

The WL LCH contains site-specific DRLs [69] and Action Levels (ALs) [70], in order to control radiological effluents and emissions. The DRLs have been calculated using CSA N288.1-08, a radionuclide transport and exposure model that can be used to back-calculate release rates based on limiting exposure to a specified member of the public (representative person) to a dose less than the 1 mSv per year, the regulatory dose limit (as prescribed within the *Radiation Protection Regulations* [65]). The ALs in place at the WL site are set at a fraction of the DRL, in order to serve as an early warning of potential loss of control.

The most recent DRLs were provided for the WL site in 2016 [69], developed in accordance with CSA N288.1-08. In January 2020, CNL plans to transition to new ALs, with the implementation of CSA N288.8-17, scheduled for January 2020. These new ALs will be derived from actual

operating expectations and performance, in accordance with CSA N288.8. This will likely result in significantly lower ALs than those currently in use.

CNL has established an Effluent Verification Monitoring Plan [71] at the WL site, which is in compliance with REGDOC-2.9.1-2013 [56]. CNL has indicated that it will be revised to address the additional requirements and guidance associated with REGDOC 2.9.1-2017 [64] and CSA Standard N288.5-11*, Effluent Monitoring Programs at Class I Nuclear Facilities and Uranium Mines and Mills* [60].

Based on review and assessment of the EVMP results presented in CNL's reports, CNSC staff conclude that the EVMP currently in place for the WL site continues to protect the public and the environment.

### 2.3.5 Environmental Monitoring Program

CNSC requires licensees to design and implement an EMP specific to the monitoring and assessment requirements associated with their facility, and the environment within which the facility is situated. The program is required to:

- measure contaminants in surrounding environmental media of the facility or site
- determine the effects if any on the of the site or facility operation on people and the environment
- serve as a secondary support to the EVMP to demonstrate the effectiveness of emission controls and the adequacy of effluent monitoring

More specifically, the program must obtain the environmental data necessary for the calculation of public dose, in order to demonstrate compliance with the public dose limit (1 mSv per year). The program design must also address the potential environmental interactions identified at the site (as identified in the CSR produced under CEAA 1992 [41]). The major focus at the WL site is on radiation and radionuclides, though hazardous substances are included within monitoring activities associated with the sewage lagoons and site groundwater. Section 3.0 of this EPR Report provides a summary of the results of site monitoring activities and an evaluation of the current state of the environment at the WL site, including dose to the public.

CNSC staff confirm that for the previous licence period, CNL conducted their EMP as per their current licensing basis, and were in compliance with REGDOC-2.9.1-2013 [56].

## 2.4 Greenhouse Gas Emissions

A core element of the CNSC requirement for an EMS is the identification of all regulatory requirements applicable to the facility whether under the NSCA or other federal or provincial legislation. The EMS must ensure that programs are in place to respect these requirements.

While there are a range of broadly applicable federal environmental regulations (e.g., petroleum products storage tanks, environmental emergency regulations), the management of GHG emissions has been identified as a national priority.

Under the federal *Canadian Environmental Protection Act, 1999* (CEPA, 1999) [72], CNL is required to monitor and report on GHG emissions [73]. Since 2013, nuclear facilities that emit more than the 50,000 tons of $CO_2$ equivalent ($CO_2e$) emission reporting threshold on an annual

basis must report their GHG emissions. The WL site has been well below all GHG emission thresholds since 2013; however, CNL continues to report GHG emissions from the site in their Annual Compliance Monitoring Report. Information on GHG emissions at the WL site can be found in section 3.1.1.2.

The CNSC maintains a collaborative working relationship with Environment and Climate Change Canada through a formal Memorandum of Understanding. This ensures a coordinated regulatory approach is achieved with respect to meeting all federal requirements associated with environmental protection.

# 3.0 STATUS OF THE ENVIRONMENT

The following sections of this EPR Report include summaries of project-environment interactions that were assessed by CNSC staff and deemed to be of specific public, Indigenous and/or regulatory interest including atmospheric, aquatic, terrestrial and hydrogeological environments and human health, for the licence application by CNL to renew the WL site licence.

It should be noted that environmental components are regularly reviewed through annual reporting requirements and CNSC compliance verification activities, as detailed in other areas of this report. These are reported to the Commission in the environmental protection safety and control areas of licensing Commission Member Documents and RORs.

This section provides a summary of the status of the environment around the WL site. It first includes a description of the radiological and hazardous releases to the environment (section 3.2), followed by an assessment of any potential effects to human health and the environment, as a result of exposure to these contaminants (section 3.3). Further, sub-sections of section 3.3 provide general descriptions of the environment itself, at and around the WL site.

## 3.1 Releases to the Environment

### 3.1.1 Airborne Releases

#### 3.1.1.1 Radiological Emissions

As part of the WL site EVMP, releases to the atmosphere are continuously monitored throughout the year. The main sources of radiological emissions at the site are from the WR-1 Building (B100) stack, the ALWTC (B200) roof vent, and the Hot Cells Facility and Immobilized Fuel Facility (B300) roof vent. For each of these facilities, radiological emissions are measured for gross alpha and gross beta. Additionally, tritium releases from the reactor building as a result of continuous airflow purging of the moderator system are also routinely collected and analyzed.

Table 3.1 provides annual release of radionuclides to the atmosphere for the licence period of 2009 to 2018, compared against DRLs developed by CNL and accepted by CNSC to ensure releases to the environment will not exceed the annual regulatory public dose limit of 1 mSv per year, which is recognized to be protective of human health. As shown in table 3.1, the radiological emissions from the WL site remain at a very small fraction of the DRLs.

**Table 3.1: Annual radionuclide airborne releases from the WL site compared with applicable release limits (2009 – 2018) [5 to 14]**

| Emission | Tritium (Bq/yr) | Gross beta particulates (Caesium-137) (Bq/yr) | Gross alpha particulates (Pu-239) (Bq/yr) |
|---|---|---|---|
| **DRL** *(2009-2015)** | 3.97E+16 | 6.19E+11 | 3.95E+16 |
| 2009 | 2.08E+10 | 6.24E+05 | 1.09E+05 |
| 2010 | 2.86E+10 | 7.80E+05 | 1.04E+05 |
| 2011 | 3.12E+10 | 3.38E+05 | 1.14E+05 |
| 2012 | 1.87E+11 | 4.06E+05 | 1.04E+05 |
| 2013 | 3.48E+10 | 3.95E+05 | 8.84E+04 |
| 2014 | 3.48E+10 | 3.95E+05 | 8.84E+04 |
| 2015 | 9.88E+10 | 2.29E+05 | 9.88E+04 |
| **DRL** *(2016-2018)* | 8.58E+15 | 3.60E+11 | 9.00E+10 |
| 2016 | 3.24E+10 | 2.12E+05 | 9.46E+04 |
| 2017 | 5.04E+10 | 2.24E+05 | 9.36E+04 |
| 2018 | 1.30E+10 | 1.70E+05 | 9.36E+04 |

*As described in section 2.3.4, DRLs ensure emissions do not exceed the public dose limit of 1 mSv per year.

#### 3.1.1.2 Hazardous Emissions

The main sources of non-radiological emissions at the WL site are from the use of Number 2 fuel oil for heating, diesel fuel for site generators, and dust generation from sandblasting, excavation projects and vehicle traffic on site. It should be noted that in 2013, Number 2 fuel oil was replaced with propane. These sources release small quantities of carbon monoxide, nitrogen oxides, sulphur dioxide, hydrocarbons, and particulate matter. These substances are monitored for trending and continuous improvement purposes and are reportable to the National Pollutant Release Inventory (NPRI) if reporting thresholds are exceeded [74]. Table 3.2 provides the total annual hazardous emissions from the WL site and the NPRI reporting thresholds.

**Table 3.2: Total annual hazardous emissions from the WL site (2009 to 2018) [15 to 24]**

| Parameter (Mg/year) | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | NPRI reporting threshold (Mg/year) [75] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Nitrogen oxides (NOx as $NO_2$) | 9.06 | 7.86 | 7.24 | 6.20 | 3.65 | 1.03 | 1.04 | 0.91 | 0.75 | 0.54 | 20 |
| Sulphur dioxide ($SO_2$) | 2.67 | 2.32 | 2.14 | 1.66 | 0.89 | 0.02 | 0.03 | 0.02 | 0.02 | 0.01 | 20 |
| Carbon monoxide (CO) | 1.89 | 1.64 | 1.51 | 1.30 | 0.88 | 0.47 | 0.46 | 0.40 | 0.35 | 0.23 | 20 |
| Total particulate matter ($PM_{10\ \&\ 2.5}$) | 0.75 | 0.65 | 0.6 | 39.69* | 42.51* | 19.57 | 16.36 | 15.02 | 13.65 | 14.56 | 20 |
| $PM_{10}$ | 0.38 | 0.33 | 0.30 | 10.26* | 10.92* | 5.01* | 4.20* | 3.85* | 3.50* | 3.72* | 0.5 |
| $PM_{2.5}$ | 0.09 | 0.08 | 0.07 | 1.11* | 1.14* | 0.53* | 0.54* | 0.41* | 0.38* | 0.39* | 0.3 |
| Volatile organic compounds | 0.08 | 0.07 | 0.06 | 0.11 | 0.08 | 0.08 | 0.08 | 0.07 | 0.06 | 0.04 | 10 |

* As TPM, PM10 and PM2.5 were over the threshold, these were reported to NPRI. Increases in these parameters are a result of increased road dust from gravel roads and periods of dry weather.

GHG emissions from the WL site consist primarily of carbon dioxide, methane and nitrous oxides as a result of burning propane, use of diesel generators, on-site transportation, on-site landfill, and open-pit wood burning. They are measured in $CO_2e$ tonnes which is a measure used to compare between gases that have different Global Warming Potential (GWP). Eliminating the use of Number 2 fuel for heating in 2013 reduced the average GHG emissions by 43%.

Hazardous emissions to air are reduced as decommissioning activities continue and demolished buildings no longer require heating (table 3.3). This decline is expected to continue with ongoing decommissioning activities. During the previous licence period, GHG releases remained below the reporting requirement of 10,000 $CO_2e$ tonnes/a [76].

**Table 3.3: Total estimated annual greenhouse gas emissions from the WL site (2009-2018) [15 to 24]**

| Year | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|---|---|---|
| Greenhouse Gas ($CO_2e$ tonnes/a)* | 8,596 | 7,463 | 8,056 | 6,310 | 4,260 | 1,940 | 1,957 | 1,883 | 1,873 | 1,678 |

* $CO_2e$ tonnes: A unit of measure used to compare between GHGs with different GWPs. For example, the GWP for methane is 25. This means that emissions of one metric ton of methane are equivalent to emissions of 25 metric tons of $CO_2$. In 2013, the GWP for methane and nitrous oxide were changed from 21 to 25 and 310 to 298 respectively under the *CEPA, 1999* Notice with Respect to Reporting of GHGs for 2013.

#### 3.1.1.3 Conclusions

Based on CNSC staff's review of the results of CNL's EVMP, CNSC staff conclude that CNL's reported releases of nuclear substances to the atmospheric environment from the WL site have remained below CNSC approved DRLs for air emissions during the current licensing period. Additionally, CNL continues to monitor and report on hazardous substances released to the atmosphere, including the monitoring of GHG emissions. CNL continues to provide adequate protection of people and the environment from atmospheric releases.

### 3.1.2 Waterborne Releases

As part of the WL site EVMP, releases of radiological and hazardous contaminants to surface water are monitored on a weekly basis throughout the year. The main sources of effluent releases at the WL site are from the Process Outfall and the Lagoon. The Outfall effluent is composed of stormwater runoff from paved roadways around buildings, cooling water used in process and experimental facilities, and holding tank discharges including those from the ALWTC. The discharge locations are shown in figure 3.1.

**Figure 3.1: WL site and discharge locations Process Outfall and, Lagoon (modified from figure 11-1 [14])**

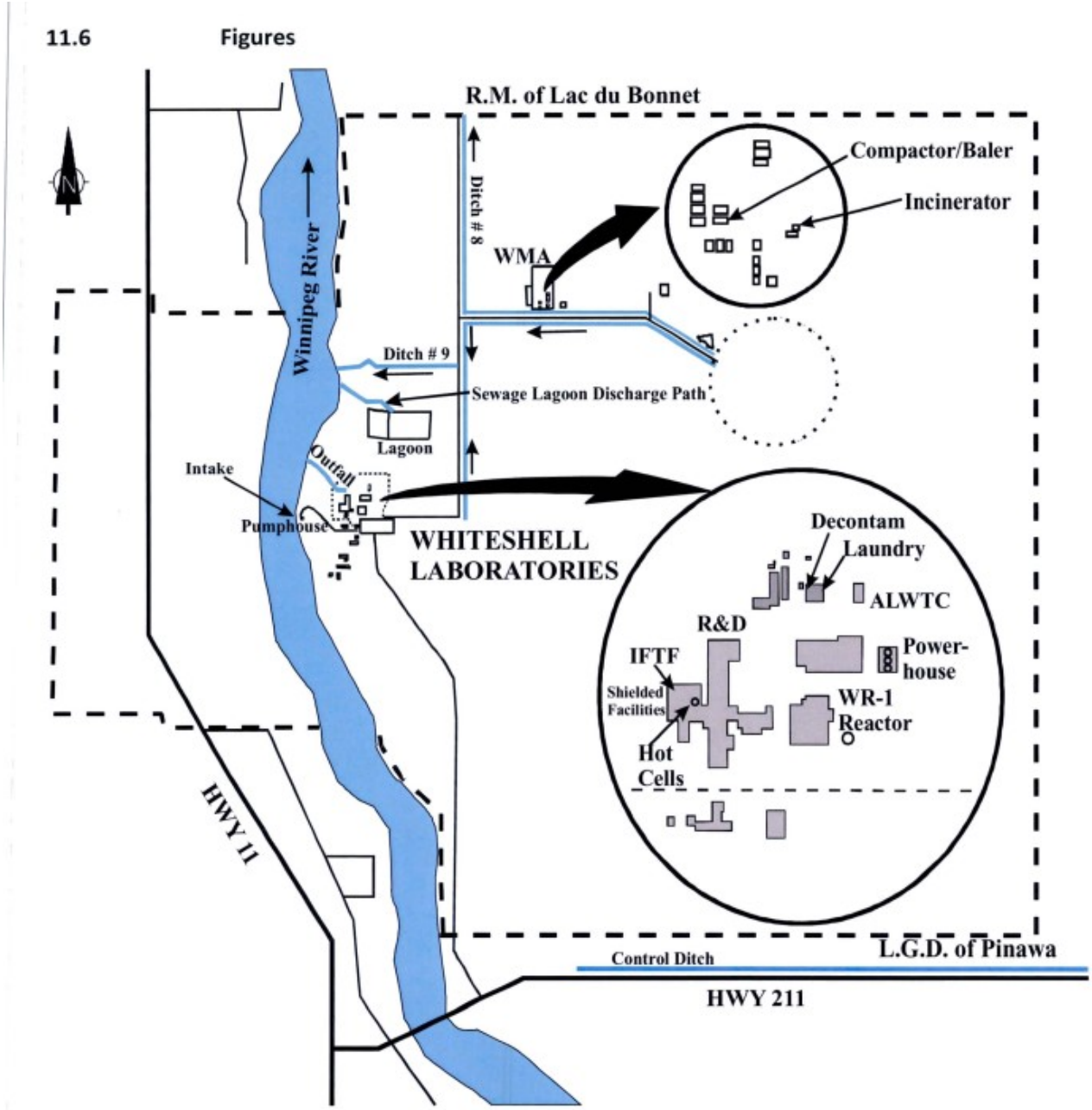



Figure 11-1
Effluent Monitoring Locations

The Lagoon collects and treats prior to discharge, sanitary and wastewater from most buildings on the site, as well as from the laundry facility.

#### 3.1.2.1 Radiological Effluent

Radiological effluent releases are measured for gross alpha and beta, total uranium, plutonium-239/240, americium-241, strontium-90 and caesium-137. Table 3.4 provides the total annual releases of radionuclides to the Winnipeg River for the licence period 2009-2018. The total annual releases are compared against DRLs developed by CNL and accepted by CNSC to ensure releases to the environment will not exceed the annual regulatory public dose limit of 1 mSv per year. As shown in table 3.4, the total annual releases of radionuclides from the WL site remain at a very small fraction of the DRLs.

**Table 3.4: Total annual waterborne releases of radionuclides from the Process Outfall and Lagoon at the WL site (2009 – 2018) [15 to 24]**

| Effluent | Gross Alpha (Bq/yr) | Strontium-90 (Bq/yr) | Caesium-137 (Bq/yr) |
|---|---|---|---|
| **DRL** *(2009-2015)* | 3.36E+12[1] | 1.75E+13 | 2.89E+12 |
| 2009 | 9.84E+07 | 1.44E+08 | 1.56E+08 |
| 2010 | 1.13E+08 | 1.56E+08 | 1.32E+08 |
| 2011 | 9.60E+07 | 1.20E+08 | 9.60E+07 |
| 2012 | 1.08E+08 | 1.19E+08 | 9.12E+07 |
| 2013 | 1.14E+08 | 6.96E+07 | 6.36E+07 |
| 2014 | 3.48E+07 | 4.68E+07 | 4.32E+07 |
| 2015 | 4.08E+07 | 3.96E+07 | 1.68E+07 |
| **DRL** *(2016-2018)* | 1.33E+10[2] | 1.56E+11 | 1.39E+11 |
| 2016 | 4.68E+07 | 6.00E+07 | 1.44E+07 |
| 2017 | 3.84E+07 | 6.72E+07 | 1.92E+07 |
| 2018 | 3.96E+06 | 3.20E+07 | 1.51E+07 |

[1] DRL for gross alpha is that for Am-241, which was identified as the radionuclide with the most restrictive DRL.
[2] DRL for gross alpha is that for Pu-239/Pu-240, which is identified as the radionuclide with the most restrictive DRL.

#### 3.1.2.2 Hazardous Effluent

As with radiological contaminants, the main sources of hazardous substances from liquid effluent at the WL site are from the Process Outfall and the Lagoon. Table 3.5 provides annual monthly average concentrations of hazardous contaminants released from the Process Outfall into the Winnipeg River for the licence period 2009-2018. With the decrease in site activities and completion of decommissioning work, discharges at the Process Outfall have consistently decreased since 2009. CNSC staff conduct routine compliance verification of the Process Outfall releases by comparing against CNL non-radioactive effluent limits, also provided in table 3.5 [77]. As shown in table 3.5, the hazardous effluent releases from the Process Outfall remain well below the effluent limits.

The Lagoon is a second contributor of hazardous substances to the Winnipeg River, discharging approximately 25 times less water than the Process Outfall in 2017. Table 3.6 provides annual

monthly average concentrations of hazardous contaminants released from the Lagoon into the Winnipeg River for the licence period 2009-2018. CNSC staff conduct compliance verification of the lagoon effluent by comparing against CNL's non-radioactive effluent limits, which include those required under the Federal Wastewater System Effluent Regulations (FWSERs). As shown in table 3.6, the hazardous effluent from the Lagoon remain below the effluent limits [77].

**Table 3.5: Annual monthly average concentrations of hazardous releases from the WL site Process Outfall (2009 – 2018) [15 to 24][77]**

| Parameter | (Unit) | Effluent limit[1,2] | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| pH | | 6-9 | 7.54 | 7.60 | 7.10 | 7.40 | 7.47 | 7.57 | 7.54 | 7.50 | 7.81 | 7.76 |
| Phosphorus | µg/L | 1000 | 43 | 29 | 28 | 29 | 66 | 119 | 120 | 40 | 35 | 30 |
| TSS | mg/L | 25 | 2.5 | 2.6 | 2.5 | 6.1 | 3.8 | 2.1 | 7.6 | 2.4 | 2.97 | 1.5 |
| Chromium | µg/L | 500 | 1.9 | 1.0 | 1.4 | 0.9 | 0.7 | 1 | 2.4 | 0.1 | 0 | 0.1 |
| Copper | µg/L | 500 | 17 | 21 | 18 | 17 | 12 | 9 | 10 | 6 | 6 | 5 |
| Iron | mg/L | 1 | 0.38 | 0.34 | 0.29 | 0.33 | 0.26 | 0.29 | 0.36 | 0.32 | 0.26 | 0.19 |
| Lead | µg/L | 100 | 0 | 1.5 | 1.7 | 1.1 | 0.3 | 0.5 | 2.3 | 0.4 | 0.3 | 0.2 |
| Nickel | µg/L | 500 | 1.7 | 1.6 | 2.6 | 2.7 | 1.9 | 1.3 | 2.7 | 0.9 | 2 | 0.6 |
| Zinc | µg/L | 500 | 10 | 11 | 10 | 13 | 13 | 25 | 4 | 3 | 1 | 1 |
| Mercury | µg/L | 1[3] | 0.047 | 0.015 | 0.01 | 0.009 | 0.008 | 0.019 | 0.012 | 0.001 | 0 | 0.005 |
| Phenolics | µg/L | 20 | 2.2 | 1.9 | 0.6 | 0.3 | 0.7 | 0.8 | 1.1 | 1.7 | 4 | 0.1 |
| Oil & grease | mg/L | 15 | 1.7 | 1.7 | 1.4 | 1.3 | 1.6 | 1.5 | 2.4 | 0.8 | 0.2 | 0.1 |
| **Total yearly discharge of effluent** | $m^3$ | - | 1,780,000 | 1,740,000 | 1,550,000 | 1,760,000 | 1,460,000 | 1,380,000 | 1,330,000 | 1,410,000 | 1,130,000 | 1,160,000 |

[1] CNL, Procedure - WL Non-Radioactive Effluent Limits, WL-509244-PRO-002 Revision 0, 2015.
[2] Effluent limits apply to the monthly average release concentrations.
[3] Daily Internal Control Level.

**Table 3.6: Total annual monthly average hazardous releases for the WL site Lagoon (2009 – 2018) [15 to 24][77]**

| Parameter | (Unit) | Effluent limit[1,2] | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COBD | mg/L | 25 | - | - | 0 | 1.47 | 8.08 | 6.67 | 0.211 | 0 | 9 | 14.2 |
| Un-ionized ammonia | µg/L as N | 1250 | - | - | 1.7 | 3.0 | 30 | 120 | 120 | 9.9 | 35 | 9.7 |
| Total residual chlorine | µg/L | 20 | - | - | 34 | 20 | 9 | 34 | 23 | 35 | 24 | 18 |
| Fecal coliform | MPNU/100mL | 400 | 7.3 | 3.5 | 33.8 | 12.6 | 7.7 | 4.2 | 1.3 | 5 | 6.2 | 5 |
| pH | pH | 6 to 9 | 6.85 | 7.87 | 7.34 | 7.61 | 8.31 | 7.96 | 8.41 | 7.01 | 7.81 | 8.68 |
| Phosphorus | µg/L | 1000 | 123 | 147 | 176 | 267 | 324 | 273 | 171 | 83 | 69 | 131 |
| TSS | mg/L | 25 | 2.4 | 4.8 | 4.7 | 11.74 | 5.9 | 9.2 | 3.89 | 1.92 | 4.807 | 3.8 |
| Chromium | µg/L | 500 | 1.0 | 0.7 | 3.1 | 4.4 | 0.3 | 0.6 | 0.5 | 0 | 0 | 0 |
| Copper | µg/L | 500 | 7 | 9.5 | 3.5 | 1.8 | 1.5 | 1.1 | 1.0 | 1.6 | 1.4 | 1.5 |
| Iron | mg/L | 1 | 0.06 | 0.165 | 0.175 | 0.234 | 0.233 | 0.243 | 0.216 | 0.245 | 0.283 | 0.370 |
| Lead | µg/L | 100 | 1 | 0.9 | 0.2 | 0.2 | 0 | 0 | 0 | 0 | 0.0005 | 0 |
| Nickel | µg/L | 500 | 1.9 | 0.5 | 1.4 | 2.1 | 1.4 | 0 | 4 | 5 | 1.9 | 1.5 |
| Zinc | µg/L | 500 | 4.6 | 5.5 | 14 | 4.5 | 2.5 | 1.1 | 0.5 | 0.3 | 0 | 0 |
| Mercury | µg/L | 1[2] | 0.025 | 0.015 | 0.005 | 0.146 | 0.0117 | 0.077 | 0.003 | 0.0006 | 0 | 0 |
| Phenolics | µg/L | 20 | 1.3 | 1.9 | 1 | 0.3 | 1.4 | 0.7 | 1.5 | 1.7 | 5.5 | 0 |
| Oil & grease | mg/L | 15 | 1.7 | 1.1 | 1.56 | 1.31 | 1.76 | 2.53 | 0.45 | 0.78 | 1.6 | 0 |
| **Total yearly discharge of effluent** | $m^3$ | | 124,000 | 132,000 | 104,000 | 119,000 | 103,000 | 83,500 | 52,600 | 74,600 | 47,200 | 12,200 |

[1] CNL, Procedure - WL Non-Radioactive Effluent Limits, WL-509244-PRO-002 Revision 0, 2015.
[2] Effluent limits apply to the monthly average release concentrations, with the exception of COBD, TSS, total residual chlorine, and un-ionized ammonia, which apply to annual average release concentrations as per Section 6(2) of the FWTSRs.
[3] Daily Internal Control Level.

### 3.1.3 Conclusions

CNSC staff have assessed radiological and hazardous releases to the environment from the WL site during the licensing period. Radiological releases to the atmosphere and to the Winnipeg River were below their respective DRLs. With the exception of chlorine, hazardous releases to the Winnipeg River were below release limits. Chlorine is discussed in section 3.2.2.1.

## 3.2 Environmental Effects Assessment – Licensing Activities

As noted in section 2.2 of this report, a CSR was produced for the WL site in 2001 [41]. This CSR, along with the support of Annual Safety Reports submitted by the licensee, were reviewed and assessed, and inform this section of the EPR Report.

The following sub-sections discuss the impacts of decommissioning activities at the WL site and provide CNSC staff's conclusions on whether CNL will continue to make adequate provision for the protection of the environment and human health.

Each sub-section also presents an overview and assessment of the predicted effects, using the results of both environmental monitoring and modelling as documented in the CSR and annual reports, in order to determine whether the environment and human health are, and will continue to be, protected as decommissioning continues.

The assessment of predicted effects of the project was carried out in a step-wise manner as follows:

- identifying potential environmental and health effects
- determining whether the environment and health of persons are protected

A review was conducted for all components related to the project, but only a selection of topics are presented in detail in this section.

### 3.2.1 Atmospheric Environment

An assessment of the atmospheric environment at the WL site consists of characterizing both the meteorological conditions around the WL site, as well as assessing the ambient air quality. Meteorological conditions such as wind speed, wind direction and precipitation are monitored in order to assess the extent of the atmospheric dispersion of contaminants released to the atmosphere, the rates of contaminant deposition, and to determine predominant wind directions which are used to identify critical receptor locations from the air pathway. Based on extensive meteorological data collected, the predominant wind directions are both to and from the north northwest and from the northwest with average annual wind speeds of approximately10 km/h [78].

Ambient air monitoring is used to confirm that ambient air quality as a result of atmospheric releases from the facility due to decommissioning and demolition activities remain at levels protective of human health and the environment. As part of the EMP, CNL conducts monitoring of ambient gamma radiation, as well as ambient dust during demolition activities.

#### 3.2.1.1 Ambient Gamma Dose Monitoring

As part of the EA FUP, ambient gamma dose monitoring is conducted at the WL site, in order to ensure gamma levels within the controlled area fence, site perimeter, and in the town of Pinawa are within regional background levels. Table 3.7 provides the 5-year average total gamma dose rate levels. Over this period, gamma dose rates have remained within the expected regional background.

**Table 3.7: Total gamma dose rates from the WL site [15 to 33]**

| Location | 5-year average (mSv/a) |
|---|---|
| Average background dose in Winnipeg [79] | 4.1 |
| Controlled area fence | 0.54 |
| Facility perimeter | 0.53 |
| Pinawa area | |
| Town yard | 0.53 |
| Pinawa golf course | 0.50 |
| Hospital | 0.43 |

#### 3.2.1.2 Airborne Dust Monitoring

CNL initiates dust control measures during building demolition activities. These measures include the use of containment and suppression techniques, such as wetting, as well as restricting activities during high wind conditions. During demolition activities, CNL also conducts ambient monitoring for total suspended particulates (TSP) to ensure that the release of fine dust is minimized and controlled to levels below Canada's National Ambient Air Quality Objectives (NAAQO) [80].

The TSP concentrations during all 2017 demolition activities ranged between 0.7 – 831 µg/m$^3$, with the average daily TSP concentrations at 150 µg/m$^3$, compared to the tolerable daily NAAQO of 400 µg/m$^3$. Although there were occasional exceedances of the NAAQO, these were attributed primarily to elevated background concentrations caused by forest fires and the use of gas generators, and any residual risk to people or the environment from demolition activities is unlikely.

#### 3.2.1.3 Conclusion

Based on CNSC staff's review of the CSR, the annual EMP results and EA FUP results for the licensing period of 2009-2018, CNSC staff conclude that ambient air quality remains at levels protective of human health and the environment.

### 3.2.2 Aquatic Environment

An assessment of the aquatic environment at the WL site consists of characterizing water conditions, sediment quality and the health of aquatic ecosystems (including the consideration of species at risk) around the WL site. This includes assessing the possibility of exposure of aquatic species to contaminated sediments in the Winnipeg River, which supports a diverse fish community with spawning, rearing and foraging habitats. Walleye, northern pike, lake whitefish, white sucker and shorthead redhorse are routinely captured upstream and downstream of the WL site, where various forage fish species can also be found.

CNL monitors radionuclide concentrations in water and sediments of the Winnipeg River as well as in fish tissue to evaluate any potential impacts that decommissioning and demolition activities may have on the environment and the public. Since releases of hazardous substances from the Process Outfall and the Lagoon are low (section 3.1.2), monitoring of hazardous substances in surface water and fish in Winnipeg River is not part of the EMP (see section 3.3.2.1).

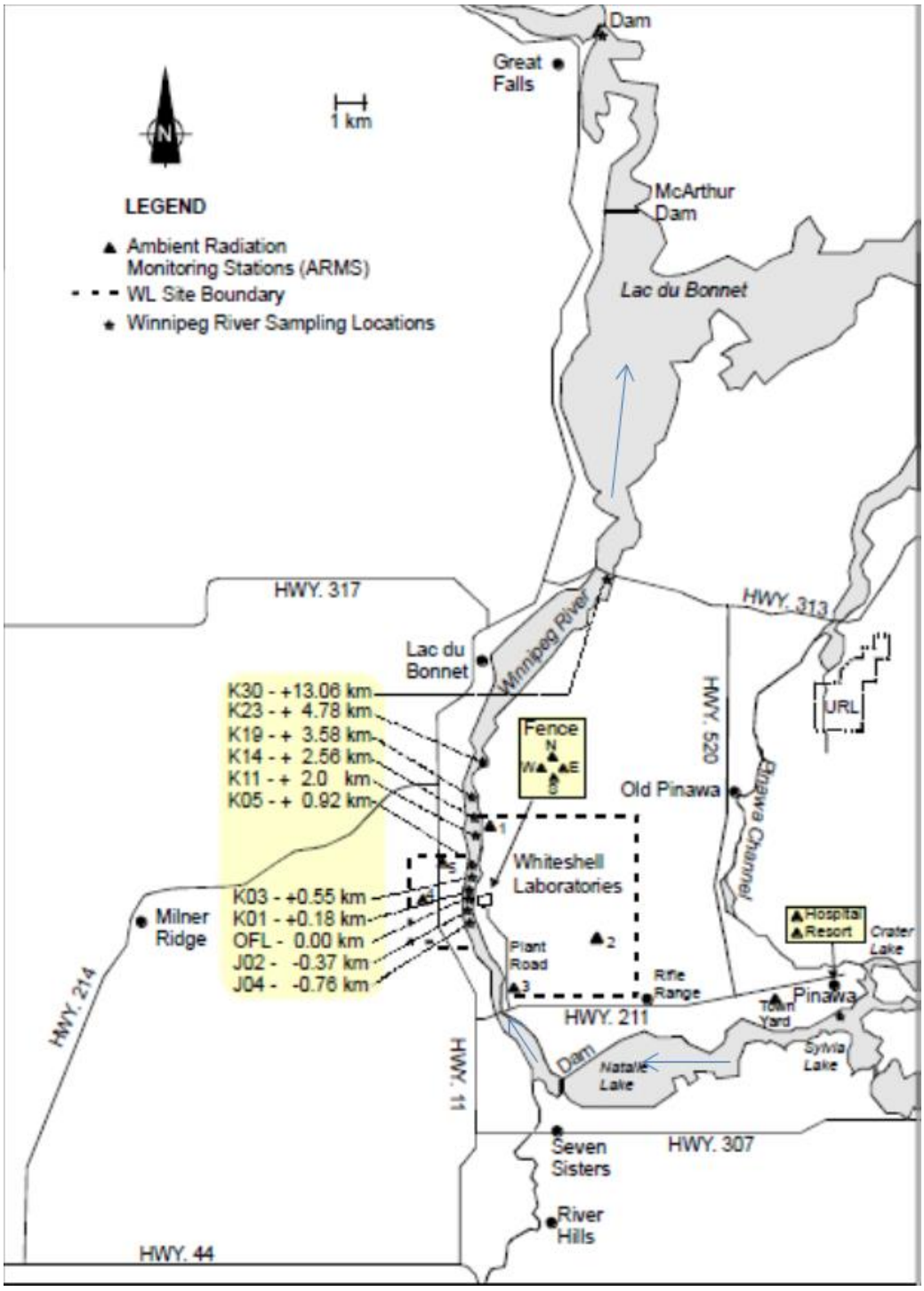
#### 3.2.2.1 Water quality in the Winnipeg River

***Radiological Substances***

As part of their EMP, CNSC requires CNL to collect monthly composite samples of Winnipeg River water from four locations: near Pinawa, which is approximately 17 km upstream of the Process Outfall; 2 km downstream at the WL site property boundary; 10 km downstream at the Lac du Bonnet water intake; and 28 km downstream at the Great Falls generating station (figure 3.2).

The upstream monitoring station is a reference location because it is not exposed to releases from the WL site. Levels of radiological substance at this upstream site near Pinawa are thus considered ambient levels. These ambient levels are used for comparison with radiological levels in the Winnipeg River, downstream of the site, in order to determine if the WL site discharge increases levels of radiological substances. Water samples are analysed for tritium, strontium-90, gross beta, caesium-137 and potassium-40 [23], which were identified in the 2001 CSR. Sample locations are shown in figure 3.2.

**Figure 3.2: Sediment and water monitoring locations on the Winnipeg River upstream and downstream of the WL site[4] [23]**




[4] Water quality locations are identified as black circles and sediment sampling locations are highlighted in yellow and blue arrows indicate direction of the Winnipeg River flow.

Temporal trends in radiological substances concentrations are shown in table 3.8. Two kilometers downstream from the Process Outfall, gross beta, potassium-40 and strontium-90 are higher than upstream. Activity concentrations of these radionuclides return to levels measured upstream at 10 and 28 km downstream of the Process Outfall. It should be noted that gross beta activity concentrations have decreased since 2009 (table 3.8), likely because of reduction in operations. Caesium-137 (table 3.8), tritium and gross alpha (for which data are not shown because concentrations downstream were similar to upstream) activity concentrations in the Winnipeg River downstream of the Process Outfall remain similar to ambient levels upstream. This confirms that the WL site operations are not an important source of alpha emitting radionuclides, caesium-137 or tritium. The assessment of environmental risk from these surface water concentrations are discussed in section 3.2.2.3.

**Table 3.8: Temporal trends in mean activity concentrations (mBq/L*) in Winnipeg River upstream and downstream of the WL site (2009 – 2017) [23]**

| Location ID | Site | Distance | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Caesium-137 | | | | | | | | | | | |
| Pinawa | upstream | | 4 | 3 | 4 | 4 | 6 | 4 | 5 | 4 | 4 |
| K11 | downstream | 2 km | 5 | 11 | 5 | 5 | 6 | 5 | 5 | 5 | 4 |
| Lac du Bonnet | downstream | 10 km | 3 | 3 | 4 | 4 | 5 | 4 | 3 | 2 | 3 |
| Great Falls | downstream | 28 km | 3 | 4 | 4 | 4 | 5 | 3 | 2 | 2 | 2 |
| Strontium-90 | | | | | | | | | | | |
| Pinawa | upstream | | 6 | 7 | 7 | 7 | 7 | 9 | 7 | 6 | 7 |
| K11 | downstream | 2 km | 11 | 16 | 11 | 11 | 7 | 9 | 7 | 7 | 13 |
| Lac du Bonnet | downstream | 10 km | 8 | 9 | 7 | 7 | 8 | 10 | 6 | 6 | 8 |
| Great Falls | downstream | 28 km | 9 | 8 | 8 | 9 | 8 | 7 | 7 | 6 | 8 |
| Potassium-40 | | | | | | | | | | | |
| Pinawa | upstream | | 62 | 36 | 53 | 53 | 60 | 59 | 78 | 62 | 86 |
| K11 | downstream | 2 km | 82 | 120 | 82 | 68 | 72 | 76 | 113 | 80 | 95 |
| Lac du Bonnet | downstream | 10 km | 41 | 41 | 46 | 53 | 51 | 69 | 67 | 59 | 49 |
| Great Falls | downstream | 28 km | 45 | 56 | 52 | 54 | 84 | 56 | 61 | 54 | 50 |
| Gross beta | | | | | | | | | | | |
| Pinawa | upstream | | 78 | 75 | 77 | 77 | 74 | 62 | 87 | 66 | 85 |
| K11 | downstream | 2 km | 142 | 130 | 142 | 134 | 86 | 86 | 105 | 101 | 107 |
| Lac du Bonnet | downstream | 10 km | 78 | 75 | 85 | 78 | 80 | 81 | 80 | 69 | 65 |
| Great Falls | downstream | 28 km | 91 | 81 | 84 | 93 | 73 | 83 | 72 | 72 | 64 |

*For illustrative purposes, mBq/L was used instead of Bq/L, in order to fit the table into this report.

### *Hazardous Substances*

As presented in section 3.1.2 above, CNSC requires CNL to measure hazardous substances in the Process Outfall and the Lagoon. However, CNSC does not require CNL to measure hazardous substances in the Winnipeg River, because hazardous substances concentrations in the liquid effluent are generally below the Canadian Council of Ministers of the Environment (CCME) water quality guideline for the protection of aquatic life. Comparisons of liquid effluent concentrations to the CCME water quality guideline are presented in the following section, in order to explain why hazardous substances are not monitored in the Winnipeg River.

The Process Outfall discharges continuously to the Winnipeg River and is the main effluent in terms of volume (table 3.5). Levels of hazardous substances (pH, chromium, nickel, and phenolics) in effluent are currently below the CCME water quality guideline for the protection of aquatic life [81]. Other substances such as copper and mercury have been consistently above the CCME water quality guideline in the effluent. Copper levels were approximately 10 times the CCME guideline from 2009 to 2012. Since then, these levels have decreased, but remain slightly above the guideline. Also, mercury was consistently higher than the CCME water quality guideline prior to 2017 (table 3.5), but has since been below 0.1 µg/L. Below this level, bioaccumulation of mercury in fish is low and not of concern [82].

On occasion, zinc, iron, lead and phosphorus have been above the CCME water quality guideline. From 2009 to 2014, zinc was found to be slightly above the CCME water quality guideline, but has since decreased below the guideline. On occasion, iron and phosphorus have been above the CCME water quality guideline. These rare exceedances of iron are not of environmental concern because it is an essential element to aquatic life. With regards to phosphorus exceedances in 2014 and 2015, it is not expected to contribute significantly to eutrophication of the Winnipeg River.

The Lagoon water is discharged occasionally to the Winnipeg River, but frequency and volumes have decreased over the years (table 3.6). The Winnipeg River discharges a million times more water than the Lagoon. Levels of hazardous substances (pH, total suspended solids, chromium, iron, lead, nickel and, phenolics) in the Lagoon effluent have been consistently below the CCME water quality guideline for the protection of aquatic life [81]. Other substances are consistently or on occasion above the CCME water quality guideline in the Lagoon effluent.

For instance, mercury has been consistently above the CCME water quality guideline but decreased to below detection limits in 2017 and 2018. Similarly, phosphorus has consistently decreased in the effluent to levels seen in aquatic environment with average productivity. Copper was above the CCME guideline from 2009 to 2013 and zinc was above the CCME water quality guideline in 2011, but both have since decreased to below their respective CCME water quality guideline. Finally, iron was above the CCME water quality guideline in 2018, but is not of environmental concern because it is an essential element to aquatic life.

Total residual chlorine was often above the CNL effluent limit (table 3.6). CNSC staff does not have concerns with these frequent exceedances because the water flow rate of the Winnipeg River is a millions times higher than what the Lagoon discharges annually, which provides ample potential for dilution of chlorine [83] in the Winnipeg River. Total residual chlorine is therefore not a concern to the health of the Winnipeg River ecosystem.

In contrast to the Winnipeg River, CNSC requires CNL to monitor hazardous substances in the north and west ditches (ditch 8 and ditch 9, respectively), similar to the Process Outfall and the

Lagoon. These are intermittent streams during rain events. Ditch 9 flows to the Winnipeg River, whereas ditch 8 flows to the north. Tables 3.9 and 3.10 provide annual average concentrations of hazardous substances in surface water of the ditches from 2009 to 2018. Hazardous substances concentrations are compared against the CCME guideline for the protection of the aquatic life. As shown in these tables, the concentrations in ditches 8 and 9 were similar to those measured in a nearby unaffected creek. On occasion, copper and mercury were above the CCME water quality guideline and ambient levels measured in a nearby unaffected creek.

**Table 3.9: Total annual average hazardous substances concentration for WL site Ditch 8 (northbound) (2009 – 2018) [15 to 24] compared against *Federal Water Quality* (CCME) Guidelines [81] ***

| Parameter | (Unit) | CCME Guideline | Background* | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| pH | | 6 to 9 | 6.98-7.81 | 7.36 | 7.56 | 7.51 | 7.55 | 7.41 | 7.24 | 7.46 | 7.50 | 7.88 | 7.81 |
| Phosphorus | µg/L | 100 | 71-192 | 85 | 120 | 89 | 70 | 81 | 168 | 116 | 49 | 71 | 45 |
| Conductivity | µs/cm | N/A | 197-736 | 577 | 484 | 434 | 560 | 374 | 348 | 554 | 571 | 445 | 690 |
| TSS | mg/L | 25 | 1-14 | 2.6 | 8.0 | 18.5 | 4.6 | 2.5 | 1.5 | 2.4 | 2.3 | 2.7 | 1.7 |
| Chromium | µg/L | 9 | 0.3-1.3 | 2.9 | 1.8 | 1.9 | 0.3 | 0.3 | 0.8 | 1.2 | 0.4 | 0 | 0 |
| Copper | µg/L | 2 | 0.5-2.5 | 5 | 11 | 3 | 4 | 2 | 2 | 3 | 2 | 3 | 1.5 |
| Iron | mg/L | 0.30 | 0.26-1.02 | 0.22 | 0.47 | 0.67 | 0.22 | 0.17 | 0.26 | 0.19 | 0.21 | 0.19 | 0.08 |
| Lead | µg/L | 1 | 0.5-3.6 | 0 | 1.0 | 1.0 | 0.03 | 0 | 0.4 | 0.9 | 0.2 | 0 | 0 |
| Nickel | µg/L | 25 | 1.6-3.2 | 4.8 | 5.7 | 4 | 5 | 0.3 | 2 | 4 | 5 | 4 | 2.6 |
| Zinc | µg/L | 7 | 3-12 | 10 | 8 | 8 | 11 | 5 | 7 | 4 | 4 | 2 | 1.4 |
| Mercury | µg/L | 0.000026 | 0.008-0.052 | 0.220 | 0.016 | 0.007 | 0.009 | 0.006 | 0.165 | 0.006 | 0.006 | 0 | 0.002 |
| Phenolics | µg/L | 4 | 0.6-7.4 | 1.4 | 1.7 | 0.9 | 0.7 | 2 | 1.6 | 0.6 | 2.2 | 7 | 0.2 |
| Oil & grease | mg/L | N/A | 0.8-1.5 | 1.1 | 0.9 | 1.5 | 1.6 | 1.7 | 1.9 | 1.4 | 0.9 | 0.4 | 0.1 |

* Values in red are above CCME guidelines for protection of aquatic life and natural background concentrations measured in an unaffected ditch, which are discussed in more detail in section 3.2.2.

**Table 3.10: Total annual average hazardous substances concentrations for WL site Ditch 9 (Westbound) (2009 – 2018) [15 to 24] Compared against *Federal Water Quality* (CCME) Guidelines [81] ***

| Parameter | (Unit) | CCME Guideline | Background* | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| pH | | 6 to 9 | 6.98-7.81 | 7.01 | 7.26 | 7.28 | 7.37 | 7.06 | 6.93 | 7.14 | 7.05 | 7.67 | 7.81 |
| Phosphorus | µg/L | 100 | 71-192 | 82 | 98 | 76 | 63 | 73 | 181 | 136 | 53 | 45 | 45 |
| conductivity | µs/cm | N/A | 197-736 | 144 | 142 | 182 | 405 | 205 | 195 | 216 | 193 | 214 | 690 |
| TSS | mg/L | 25 | 1-14 | 8.7 | 14 | 18 | 8 | 5 | 5 | 2 | 2 | 2 | 2 |
| Chromium | µg/L | 9 | 0.3-1.3 | 3.5 | 2.0 | 1.4 | 0.7 | 3.0 | 0.6 | 1.8 | 0.3 | 0 | 0 |
| Copper | µg/L | 2 | 0.5-2.5 | 18 | 9 | 3 | 3 | 1 | 2 | 3 | 1 | 1 | 1.5 |
| Iron | mg/L | 0.300 | 0.26-1.02 | 0.75 | 0.86 | 0.79 | 0.47 | 0.35 | 0.52 | 0.45 | 0.58 | 0.33 | 0.08 |
| Lead | µg/L | 1 | 0.5-3.6 | 0 | 2 | 2 | 0.4 | 0 | 0.1 | 0.9 | 0 | 0 | 0 |
| Nickel | µg/L | 25 | 1.6-3.2 | 5.2 | 2.9 | 3.8 | 3.4 | 0.2 | 1.8 | 2.7 | 3.0 | 2.2 | 2.6 |
| Zinc | µg/L | 7 | 3-12 | 11 | 8 | 10 | 12 | 8 | 10 | 5 | 6 | 2.2 | 1.4 |
| Mercury | µg/L | 0.000026 | 0.008-0.052 | 0.068 | 0.011 | 0.007 | 0.007 | 0.008 | 0.034 | 0.008 | 0.009 | 0 | 0.002 |
| Phenolics | µg/L | 4 | 0.6-7.4 | 1.7 | 2.4 | 0.9 | 0.7 | 1.8 | 2.3 | 0.9 | 2.1 | 1.6 | 0.2 |
| Oil & grease | mg/L | N/A | 0.8-1.5 | 1.0 | 1.0 | 1.2 | 2.0 | 1.4 | 0.9 | 1.6 | 1.1 | 0.4 | 0.1 |

* Values in red are above CCME guidelines for protection of aquatic life and natural background concentrations measured in an unaffected ditch, which are discussed in more detail in section 3.2.2.

As explained above, CNL is not required to measure hazardous substances in water of the Winnipeg River. However, the province of Manitoba does monitor water quality for hazardous substances at the Powerview Dam, 30 km downstream of the WL site. Table 3.11 indicates that the maximum concentrations of metals are all below the CCME water quality guideline for the protection of the environment, except for aluminum.

For aluminum, naturally present amounts of aluminum in North American rivers range from 12 µg/L to 2250 µg/L [84]. Recent American studies [84 to 85] on aluminum toxicity suggest that a water quality guideline of 100 µg/L is very protective of the environment. In rivers with high organic matter like the Winnipeg River, CNSC staff concur with the American studies [85] that a safe level of aluminum is around 300 µg/L [85]. In 2017, aluminum levels in the WL site water intake was at 150 µg/L, similar to the effluent concentrations [86], which indicates that the WL site does not contribute to an increase in aluminum levels in the Winnipeg River. It is CNSC staff's conclusion that there is no risk to aquatic ecosystems from current levels of aluminum in the Winnipeg River. Although far from the site, provincial monitoring indicates the risk to aquatic organisms living in the water column of the Winnipeg River is negligible.

**Table 3.11 Average (maximum) concentrations of metals from 2009 to 2018 at the Powerview Dam on Winnipeg River, 30 km downstream of the WL site [15 to 24]**

| Metal | Al | As | Cd | Cu | Cr | Mo | Ni | Se | U | Zn |
|---|---|---|---|---|---|---|---|---|---|---|
| Value (µg/L) | 163 (239) | 0.8 (1.7) | 0.007 (0.008) | 1.2 (1.3) | 0.1 (0.1) | 0.2 (0.2) | 0.8 (1.0) | 0.1 (0.2) | 0.1 (0.2) | 0.2 (0.3) |
| CCME Guideline [81] | 100 | 5 | 0.09 | 2 | 1 | 73 | 25 | 1 | 15 | 7 |

Overall, most hazardous substances in wastewater from the Process Outfall and the Lagoon, as well as surface water in ditches 8 and 9, were below the CCME water quality guideline for the protection of aquatic life. Despite the occasional levels of aluminum above the CCME water quality guideline, considering that the annual water flow of the Winnipeg River is 100,000 and 1,000,000 times the annual Process Outfall and lagoon discharge, levels of hazardous substances are expected to be well below the CCME water quality guideline for the protection of aquatic life. CNSC staff therefore conclude that the Winnipeg River is adequately protected from releases of hazardous substances. For this reason, CNL is not required to monitor hazardous substances in the Winnipeg River.

As for ditch 8, for which runoff water drains to the north only during rain events, levels of hazardous substances were all below CCME guidelines in 2018 (table 3.9). While there were some exceedances of the CCME guidelines prior to 2018, these exceedances are not of concern because ditches are not aquatic habitats since water only flows during rain events.

#### 3.2.2.2 Sediment quality in the Winnipeg River

As radiological and hazardous substances have accumulated in sediments downstream of the WL site since 1964, CNSC requires CNL to monitor radiological substances in the sediments of the Winnipeg River to assess environmental risk associated with historical releases. This section discusses potential risk of radiological and hazardous substances in sediments.

### *Radiological Substances*

Winnipeg River sediments are collected on an annual basis [87] from 11 locations ranging from 0.8 km upstream to 13.1 km downstream of the WL site Process Outfall, as shown in figure 3.2. Results from the latest 2017 sampling campaign are detailed in table 3.12.

Gross alpha is similar between upstream and downstream sediments as it was the case in surface water. However, gross beta activity is higher at the Process Outfall, as well as 0.5 and 13 km downstream, compared to upstream samples. Gross beta activity was also higher in surface water 2 km downstream of the Process Outfall.

Caesium-137, is also higher at the Process Outfall, as well as 0.8, 3 and 13 kilometers downstream, in comparison to upstream (table 3.12) [23]. This is in contrast with surface water where caesium-137 concentrations downstream were similar to upstream of the Process Outfall from 2009 to 2017. This higher concentration of caesium-137 in sediments is the result of historical higher releases of caesium-137, prior to 2009 [15][88].

Caesium-137 is a mobile element, and the sediment monitoring data suggest that some caesium-137 is recirculated downstream in the Winnipeg River. Since caesium-137 is a beta-emitter, it also explains the similar gross beta pattern in sediments. Strontium-90, which was elevated in surface water 2 km downstream of the Process Outfall (table 3.8), was below the detection limit of 0.0001 Bq/Kg (data are not shown because concentrations are below detection limits). Potassium-40 appears slightly higher a kilometer downstream of the Process Outfall, similar to surface water concentrations. The risk to aquatic biota from radiological substances concentration in sediment is not of concern, as is further discussed in section 3.2.2.3, Dose Assessment to Non-Human Biota.

**Table 3.12: Radionuclide activities in sediment (Bq/Kg dry weight) upstream and downstream of the WL site [23]**

| Location (see figure 3.2) | Distance (Km) | Gross alpha | Gross beta | Potassium-40 | Caesium-137 |
|---|---|---|---|---|---|
| J04 | -0.76* | 396 | 655 | 606 | 10 |
| J06 | -0.37* | 348 | 616 | 550 | 10 |
| Process Outfall | 0 | 350 | 817 | 580 | 183 |
| K01 | 0.15 | 291 | 562 | 645 | 9 |
| K03 | 0.52 | 407 | 864 | 588 | 49 |
| K05 | 0.79 | 365 | 662 | 580 | 179 |
| K14 | 2.56 | 386 | 600 | 580 | 15 |
| K30 | 13.06 | 346 | 725 | 614 | 24 |

*A (-) indicates a upstream measurement.

### *Hazardous Substances*

In support of the CSR in 2001, CNSC staff requested that CNL sample sediments twice within the center of the plume, in a background area and downstream of the operations. Metal concentrations were enriched in sediment exposed to discharge from the Process Outfall, compared to background sediments (table 3.13). Despite this enrichment, none of the metal

concentrations were above sediment quality guidelines [85]. Next sediment monitoring for hazardous substances is expected in 2021.

Note that the sediment quality guideline for cadmium is below measurable levels and levels in the outfall area were similar to background. Hence, cadmium is not a concern at the site.

**Table 3.13: Hazardous substance concentrations (mg/kg) in the Winnipeg River sediments directly in the Process Outfall and downstream of the WL site in 2001**

| Substance | Background[1] | Plume[1] | Downstream[1] | ISQG[2] | PEL[3] | LEL[4] |
|---|---|---|---|---|---|---|
| Cadmium | 1.3 | 1.3 | 1.6 | 0.6 | 3.5 | - |
| Chromium | 4.9 | 6 | 11 | 37 | 90 | 37 |
| Copper | 2.4 | 5.8 | 8 | 36 | 200 | 12 |
| Molybdenum | 2.8 | 4.6 | 2.3 | - | - | 8 |
| Nickel | 4.7 | 7.8 | 12.3 | - | - | 21 |
| Zinc | 10.8 | 15.7 | 28 | 120 | 320 | - |

1 Concentrations [88]
2 Interim sediment quality guideline [89]
3 Probable effects level [89]
4 Lowest effect levels [90]

#### 3.2.2.3 Aquatic ecosystem health in the Winnipeg River

***Consideration of Species at Risk***

The Winnipeg River supports a diverse fish community with spawning, rearing and foraging habitats. CNL has identified fish and fish habitat in and around the WL site [40].

Fish species occurring in the Winnipeg River and within the vicinity of the WL site are forage fish including minnows, suckers, sculpins and darters. Predatory fish species reported in the area include Walleye, Northern Pike and Smallmouth Bass. Walleye, northern pike, lake whitefish, white sucker and shorthead redhorse, are routinely captured upstream and downstream of the WL site, during annual environmental monitoring [2][40].

The carmine shiner is the only fish species listed on schedule 1 of the *Species at Risk Act* (SARA) living in the Winnipeg River and in the vicinity of the WL site [91]. The known distribution of the carmine shiner is limited to the Winnipeg River, at the base of Whitemouth Falls (located approximately 7 km upstream of the WL site), and its tributaries [92]. DFO has published an Action Plan for the Carmine Shiner in Canada in order to help this species recover, as part of their SARA Action Plan Series [93].

***Radiological Levels in Fish Tissue***

As part of their EMP, CNL caught three species of fish (white sucker, walleye and northern Pike) in the Winnipeg River at a location upstream and four species (white sucker, walleye and northern pike and whitefish) downstream during the fall period on an annual basis. In 2017, three individual fish were caught per species and per location. The flesh was analysed for gross beta activity and scanned by gamma spectroscopy, which provided values for caesium-137 and potassium-40. The downstream locations and the upstream Sylvia Lake location are identified in figure 3.2.

A five year average of caesium-137, potassium-40, and gross beta activity in fish flesh is provided in table 3.14 for the years 2012 to 2017. This table indicates that caesium-137 is enriched in all fish species downstream of the WL site, compared to fish caught upstream in Sylvia Lake. This result supports the observed accumulation of caesium-137 in sediments (see section 3.2.2.2). Caesium-137 has accumulated in sediments as a result of historical releases prior to 2009 [15][88]. The contribution of caesium-137 to dose to these fish and the implication on their health is discussed in the next section.

**Table 3.14 Five year average of radionuclide activities in fish flesh (2012 – 2017) (Bq/Kg fresh weight) for three species upstream and downstream of WL site [23]**

| | Upstream | 2 km downstream | 5 km downstream |
|---|---|---|---|
| **White sucker** | | | |
| Caesium-137 | 0.77 | 0.48 | 1.70 |
| Potassium-40 | 137 | 135 | 121 |
| Gross Beta | 142 | 135 | 135 |
| **Walleye** | | | |
| Caesium-137 | 0.61 | 0.87 | 0.81 |
| Potassium-40 | 130 | 125 | 138 |
| Gross Beta | 132 | 141 | 143 |
| **Pike** | | | |
| Caesium-137 | 0.40 | 0.54 | 0.44 |
| Potassium-40 | 126 | 115 | 133 |
| Gross Beta | 136 | 130 | 137 |
| **Whitefish** | | | |
| Caesium-137 | 0.33 | 0.44 | 0.48 |
| Potassium-40 | 141 | 133 | 141 |
| Gross Beta | 148 | 137 | 141 |

### *Dose Assessment to Non-Human Biota*

In 1973, benthic invertebrate community monitoring upstream and downstream of the WL site indicated that organisms dwelling in the Winnipeg River sediment were not affected by releases from the site [94]. In 2001, CNL calculated radiological doses to organisms dwelling in the Winnipeg River sediment. Maximum predicted dose was 0.76 µGy/hr, which is lower than the 10 µGy/hr benchmark [95]. CNSC staff reviewed CNL dose calculations and concluded that organisms living in the Winnipeg River sediments directly downstream of the Process Outfall and Lagoon were not affected by radiological exposure at that time [88].

For this EPR Report, CNSC staff modelled radiological dose to aquatic biota using the ERICA tool [95]. In their assessment, CNSC staff considered maximum activities of tritium, strontium-90 and most importantly, caesium-137 in water and sediments. Maximum modelled dose to organisms dwelling into sediments was 1.4 µGy/h, which is lower than the 10 µGy/hr benchmark, demonstrating no adverse effects on biota. The modelled dose to benthic and pelagic fish was below the dose predicted to organisms inhabiting sediments. Caesium-137 accumulation in fish tissue is therefore not of concern.

CNSC staff confirm that aquatic organisms living in the Winnipeg River downstream of the WL site, including species at risk, remain protected from historical and current radiological exposure.

#### 3.2.2.4 Conclusion

Based on annual monitoring of fish, water and sediment, CNSC staff confirm that aquatic organisms living in the Winnipeg River downstream of the WL site remain protected. CNL continues to provide adequate protection of the environment from releases to surface water.

### 3.2.3 Terrestrial Environment

An assessment of potential effects on terrestrial biota at the WL site consists of characterizing local terrestrial habitat and terrestrial species and consideration of terrestrial species at risk. This includes assessing the possibility of exposure to radioactivity in native vegetation and wildlife, radiological and hazardous soil quality along with physical stressors that may be disruptive to both human and ecological receptors.

In the immediate vicinity of the WL site, there are approximately 10 to 20 m of surficial overburden soils overlying the Precambrian bedrock. These overburden soils include glacial, glaciofluvial and alluvial deposits. At the WMA, where extensive test hole drilling has taken place prior to and since site development, the overburden soils were found to comprise 0.5 m of organic-rich soil horizon overlying 1.5 m of silt, 2.5 m of clay, 5 m of clayey till, and 3 to 5 m of stratified sand.

The terrestrial habitat in and around the WL site consists of wetland areas to the east, and forest species and abandoned farm fields vegetated with grasses and shrubs to the west.

Over 50 species of mammals can be expected to be found around the WL site, along with a large variety of bird species and amphibians. A wide diversity of amphibians are also present in the vicinity of the WL site,

CNL monitors radionuclide concentrations in soils around the WMA, in order to evaluate any potential impacts that decommissioning and demolition activities may have on terrestrial biota, including vegetation and wildlife.

#### 3.2.3.1 Soil Quality at the Perimeter of WMA

In general, the surficial soil distribution in the low-lying areas to the northwest and west, as well as away from major streams, comprise peats in areas of poor drainage. Improved drainage conditions in these areas leads to the development of humic gleysols and brunisols, while underlying outwash sands and gravels lead to the development of brunisols. Soil development near the Winnipeg River includes peaty humic gleysols on lacustrine silts and clays, but the inherently more effective surface drainage at these locations generally retards peat development. Precambrian bedrock outcrops generally have only partial lichen and moss cover, although peat soil is common in depressions.

***Radiological Substances***

The WL site EMP includes measurements of radioactivity in soils. Table 3.15 provides a summary of the radioactivity found in the surface soils collected in 2017 at the perimeter locations of Standpipe Rows E, F, and G in the WMA (refer to figure 1.4 for Standpipe locations).

**Table 3.15: Radioactivity in surface soil near Standpipe Rows of WL WMA, 2017 [23, table B-13]**

| Location | Gross beta (Bq/g) | Gross alpha (Bq/g) | Potassium-40 (Bq/g) | Strontium-90 (Bq/g) | Caesium-137 (Bq/g) |
|---|---|---|---|---|---|
| Location E (1 m East of WMA Fence at Standpipe Row E) | | | | | |
| Perimeter (7m south) | 1.00 | 0.70 | 0.54 | 0.10 | 0.01 |
| Perimeter (8m south) | 1.90 | 0.80 | 0.71 | 0.31 | 0.09 |
| Perimeter (9m south) | 1.99 | 1.00 | 0.66 | 0.12 | 0.06 |
| Perimeter (9m west) | 2.45 | 1.20 | 0.68 | 0.12 | 0.12 |
| Location F (1 m East of WMA Fence at Standpipe Row F) | | | | | |
| Perimeter (9m west) | 1.47 | 0.90 | 0.62 | 0.05 | 0.01 |
| Location G (1 m East of WMA Fence at Standpipe Row G) | | | | | |
| Perimeter (9m north) | 1.70 | 0.70 | 0.73 | 0.09 | 0.06 |
| Perimeter (9m west) | 0.95 | 0.64 | 0.54 | 0.04 | 0.01 |
| NSRDR clearance level | NA | 1.0 | 10 | 1.0 | 0.1 |

The alpha activity detected in the 2017 soil samples is most likely from naturally occurring alpha emitters such as uranium and thorium present in the soil. Two samples were at or slightly above the *Nuclear Substance and Radiation Devices Regulation (NSRDR) Clearance Level* [96] of 1.0 Bq/g (not including Potassium-40). The strontium-90 levels at the perimeter locations were below the NSRDR Clearance Level of 1.0 Bq/g. Caesium-137 activity at the perimeter locations were similar to the normal background levels for this radionuclide (0.02 to 0.11 Bq/g for this part of Manitoba) and at the NSRDR Clearance Level of 0.1 Bq/g. Therefore, there is negligible risk to members of the public.

Core samples were collected from the perimeter of the standpipe area in 2005 and additional work was conducted in 2011 and 2012. Radioactivity of groundwater (from routine environmental monitoring), and the soil samples from this study indicate there is no significant radioactive migration from the waste management facilities. Refinement and supplementary monitoring of the groundwater continues to support this finding.

### *Hazardous Substances*

In 2008, AECL documented the nine sampling campaigns conducted at the Inactive Landfill and Lagoon in order to obtain the baseline conditions for these areas, and to identify the need for remediation that may be required. Soil samples were collected at locations where there was potential for radiological and hazardous contamination.

Most of the soil samples collected at the landfill and Lagoon areas demonstrated background levels of metals. Some concentrations of nickel, boron, cadmium, molybdenum, beryllium, aluminum, cobalt, chromium, copper and iron were above the background and/or above the most restrictive CCME Soil Quality Guidelines for agricultural land use [97]. It was concluded that the hazardous levels are such that there is no serious detriment to the local environment other than the fact that the land is probably not suitable for use as farmland. However, these levels in general meet the guidance criteria for residential/parkland, commercial and industrial land use.

#### 3.2.3.2 Terrestrial Habitat and Terrestrial Biota

Black spruce is the common plant species in the easterly portions of the WL site, however jack pine is also present in this area, along a ridge of well drained sandy soil. The forest species to the west of the site consist of ash and poplar growing in poorly drained clay plains. Blueberries are common along the sides of the plant road south of the site.

Mammalian species that are common and widespread in the area include the snowshoe hare, American red squirrel, meadow vole, red fox and white-tailed deer. Not only is the white-tailed deer present on WL site, they have also established a wintering area. The white-tailed deer is considered to be an important species for the traditional communities and game species in the area. Recently, moose have also been sighted on the south-east portion of the WL property.

A bat survey conducted in 2015 at the WL site indicated that bats were not roosting within buildings at the site, but rather can be found roosting in the forested areas of the site.

A large variety of bird species can be expected to occur in the vicinity of the WL site. Bird migratory staging areas are present on and near the site, and the Winnipeg River is an important migratory corridor for many bird species including: common loon, red-necked grebe, horned grebe, double-crested cormorant, American white pelican, Bonaparte's gull, common tern, Caspian tern, lesser scaup, greater scaup and bald eagle.

Despite the generally harsh winter conditions of the WL site, about 10 species of amphibians can be found, the majority of which are frogs. These include the spring peeper, grey tree frog, striped chorus frog, wood frog and northern leopard frog, which are common and widespread, as well as the green frog and the mink frog, which are less common and widespread. Only four reptile species can be found on site; two turtle and two snake species, both of which are common and widespread. The common garter snake is widely distributed and prevalent in the region, but little is known about the exact status of the redbelly snake found in the area. All the reptile species hibernate to survive the harsh winters and hibernacula are a potentially important ecological feature in the region. None are known to exist on the WL site. In spring, the reptiles become active and enter their breeding cycle, which may involve special areas for egg-laying; none are known to be located in the WL controlled area.

***Consideration of Terrestrial Species at Risk***

Table 3.16 lists a number of threatened and endangered species under the federal *SARA*, and Manitoba's *Endangered Species and Ecosystems Act* (ESEA) that are likely to be present in the vicinity of the site, or the Winnipeg River. The possible presence of these species on the site was also indicated by the Manitoba Conversation Data Centre.

**Table 3.16: Status for terrestrial Species at Risk (ESEA and SARA)**

| Species | Status | |
|---|---|---|
| | ESEA [98] | SARA [99] |
| **Birds** | | |
| Bank swallow | Not Listed | Threatened |
| Barn swallow | Not Listed | Threatened |
| Bobolink | Not Listed | Threatened |
| Canada warbler | Threatened | Threatened |
| Chimney swift | Threatened | Threatened |
| Common nighthawk | Threatened | Threatened |
| Eastern wood pewee | Not Listed | Special Concern |
| Golden-winged warbler | Threatened | Threatened |
| Horned grebe | Not Listed | Special Concern |
| Least bittern | Endangered | Threatened |
| Loggerhead shrike | Endangered | Endangered |
| Olive-sided flycatcher | Threatened | Threatened |
| Peregrine falcon | Endangered | Special Concern |
| Piping plover | Endangered | Endangered |
| Red-headed woodpecker | Threatened | Threatened |
| Short Eared owl | Threatened | Special Concern |
| Trumpeter swan | Endangered | Not Listed |
| Whip-poor-will | Threatened | Threatened |
| Yellow rail | Not Listed | Special Concern |
| **Mammals** | | |
| Grey fox | Not Listed | Threatened |
| Little brown myotis | Endangered | Endangered |
| Northern myotis | Endangered | Endangered |
| **Reptiles** | | |
| Snapping turtle | Not Listed | Special Concern |
| **Insects** | | |
| Monarch | Not Listed | Special Concern |
| Yellow banded bumble bee | Not Listed | Special concern |
| **Plants** | | |
| Gattinger's agalinis | Endangered | Endangered |
| Rough agalinis | Endangered | Endangered |
| Western silvery aster | Threatened | Threatened |
| Ironweed | Endangered | Not listed |

CNL have recently placed netting on buildings in the WMA, in order to discourage nesting of barn swallows and bats. New structures have also been constructed on site, in order to support the nesting of these species in alternative locations, as well as to prevent future nesting in buildings that are undergoing demolition. CNL plans to monitor these structures.

Species at risk can be difficult to include in dose and risk calculations due to incomplete knowledge of their exposure factors. While not all species at risk are specifically assessed, an effort was made to by CNL ensure that the species selected have similar feeding habits, so that surrogate species can be used to infer dose and risk for the species at risk either present or potentially present on the WL site.

### *Physical Stressors*

Physical stressors, such as noise and vibration, are relevant to both human and ecological receptors, and are generated during decommissioning and demolition activities. As part of the CSR, impacts of noise and vibration from decommissioning activities were assessed. It was identified that any noise generated would be short-term and sporadic, confined during daytime activities, and that affected wildlife, such as deer and moose, could temporarily relocate to other suitable habitats. Additionally, dense tree coverage across the site provides a natural noise barrier between site activities and potential noise receptors around the WL site. CNSC staff reviewed CNL's assessment and concluded that no residual effects, including habitat loss, from noise and vibration would be expected.

During the current licensing period, decommissioning and demolition activities were not continuous but performed intermittently. Due to the above factors, CNSC staff conclude that are likely no residual effects from physical stressors including noise and vibration to the terrestrial environment.

### *Assessment of Potential Effects on Terrestrial Biota*

The WL site EMP includes measurements of radioactivity in vegetation and in wildlife. Trends of concentrations for caesium-137, strontium-90, potassium-40, gross beta and gross alpha activities in vegetation and wildlife samples are presented in tables 3.17 and 3.18, respectively, along with the Ambient Radiation Monitoring Stations (ARMS) where they were taken.

**Table 3.17: Radioactivity in vegetation [23]**

| Radioactivity (Bq/kg fresh weight) | | | | | | |
|---|---|---|---|---|---|---|
| **Parameter** | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** |
| **WL perimeter, 3.2 km N (ARMS #1)** | | | | | | |
| Caesium-137 | < 11 | < 4 | < 14 | < 12 | < 7 | < 5 |
| Strontium-90 | 5.2 | 1.3 | 2.5 | 2.1 | 3.0 | 2.4 |
| Potassium-40 | 399 | 308 | 524 | 785 | 648 | 350 |
| Gross Beta | 502 | 347 | 547 | 668 | 594 | 429 |
| Gross Alpha | 31 | 20 | 110 | 55 | 45 | 95 |
| **WL perimeter, 3.4 km SSE (ARMS #3)** | | | | | | |
| Caesium-137 | < 11 | < 5 | < 6 | < 9 | <4 | < 3 |
| Strontium-90 | 2.8 | 2.0 | 5.5 | 2.3 | 3.2 | 13.2 |
| Potassium-40 | 211 | 206 | 395 | 789 | 899 | 301 |
| Gross Beta | 299 | 319 | 547 | 686 | 734 | 375 |
| Gross Alpha | 18 | 27 | 41 | 87 | 27 | 51 |
| **WL perimeter, 2.2 km W (ARMS #4)** | | | | | | |
| Caesium-137 | < 7 | < 6 | < 7 | < 8 | < 4 | < 5 |
| Strontium-90 | 4.1 | 1.0 | 1.9 | 2.6 | 1.7 | 1.9 |
| Potassium-40 | 322 | 554 | 593 | 671 | 584 | 464 |
| Gross Beta | 438 | 333 | 411 | 589 | 500 | 488 |
| Gross Alpha | 4 | 25 | 61 | 32 | 49 | 28 |
| **WL perimeter, 2.4 km NW (ARMS #5)** | | | | | | |
| Caesium-137 | < 9 | < 3 | < 7 | < 5 | < 9 | < 5 |
| Strontium-90 | 4.6 | 0.5 | 1.1 | 1.3 | 0.6 | < 0.8 |
| Potassium-40 | 314 | 213 | 423 | 736 | 1140 | 400 |
| Gross Beta | 486 | 274 | 701 | 613 | 972 | 383 |
| Gross Alpha | 60 | 25 | 26 | 34 | 46 | 42 |
| **West of WMA and north of Canister Area (WMA #1)** | | | | | | |
| Caesium-137 | < 8 | < 3 | < 6 | < 6 | < 5 | < 4 |
| Strontium-90 | 5.3 | 1 | 2.1 | 2.4 | 11.5 | 1.8 |
| Potassium-40 | 328 | 551 | 306 | 481 | 912 | 370 |
| Gross Beta | 447 | 374 | 334 | 481 | 795 | 379 |
| Gross Alpha | 68 | 40 | 27 | 98 | 41 | 43 |
| **East of WMA near incinerator (WMA #7)** | | | | | | |
| Caesium-137 | - | - | < 4 | < 11 | < 4 | < 4 |
| Strontium-90 | - | - | 7.4 | 9.6 | 6.4 | 2.7 |
| Potassium-40 | - | - | 581 | 502 | 640 | 312 |
| Gross Beta | - | - | 465 | 493 | 662 | 342 |
| Gross Alpha | - | - | 37 | 28 | 23 | 33 |

**Table 3.18: Radioactivity in wildlife (collected and analyzed road kills) [23 to 24]**

| Year | Gross beta | Potassium-40 | Caesium-137 |
|---|---|---|---|
| **Grouse** | | | |
| 1998* | 67 | 89 | 2.6 |
| 1998* | 91 | 135 | 0.9 |
| 2003 | 72 | 112 | 0.8 |
| 2005 | 20 | 28 | 0.2 |
| 2006 | 172 | 214 | 3.9 |
| 2015 | 83 | 151 | < 0.3 |
| 2016 | 177 | 130 | 1.0 |
| Average | 97 | 123 | 1.4 |
| Method detection limit | 2 | 6 | 0.3 |
| **Deer** | | | |
| 2011 | 129 | 135 | 0.7 |
| 2013 | 92 | 63 | 0.2 |
| 2014 | 119 | 98 | 7 |
| 2016 | 120 | 101 | 1.5 |
| 2018* | 130 | 101 | 18 |
| 2018* | 131 | 100 | 1.0 |
| Average | 115 | 99 | 2.4 |
| Method detection limit | 2 | 6 | 0.3 |

*Data occurs twice, due to two road kills in 1998 (grouse) and 2018 (deer).

These data indicate that in many instances the total radioactivity measured in vegetation and wildlife samples is due to natural radionuclides (for example Potassium-40). Caesium-137 levels in wildlife samples were below the detection limits, which ranged between 3 and 14 Bq/kg over the 2009-2018 licence period. They were also generally below the background level of 4 Bq/kg in all vegetation samples. Levels of strontium-90 and alpha activity in vegetation were detectable and in general within the range of previous years. The caesium-137 activity in the flesh of grouse and deer was relatively low (for example, the background level of caesium-137 in deer flesh is 2 Bq/kg) [23]. CNSC staff used the RESRAD model to estimate potential doses to the vegetation and wildlife based on the maximum measured radioactivity in the samples collected at the WL site. These estimates were several orders of magnitude below the most conservative radiation dose screening criteria for terrestrial biota.

#### 3.2.3.3 Conclusion

Based on CNSC staff's review of the results of the EMP at the WL site and assessment of potential radiological dose to terrestrial receptors, CNSC staff confirm that terrestrial biota and soil quality remain protected from radiological exposures and no significant adverse effects are likely as a result of radioactive releases from the WL site. The hazardous contamination of soil within the WL site is mostly localized to the WMA, Inactive Landfill and Lagoon areas and is

not expected to result in significant adverse effects to terrestrial biota since metal concentrations in general do not exceed the respective CCME soil environmental quality guidelines.

## 3.2.4 Hydrogeological Environment

An assessment of the hydrogeological environment at the WL site consists of identifying potential sources of groundwater contamination on the site, determining the extent of contamination, if any, which could lead to a pathway for exposure to human and/or non-human receptors, and determining the significance of any exposure from this pathway. Additionally, the hydrogeological assessment confirms whether control measures in place continue to remain effective in protecting the environment.

Potential sources of radiological and hazardous groundwater contamination include contamination of groundwater from the WMA, Inactive Landfill and Lagoon, as well as from two groundwater and surface water drainage ditches around the site.

Groundwater from the WL site flows from east to west towards the Winnipeg River. The surficial overburden soils on the WL site consist of layers of silt, clay, clay till, and basal sand overlaying Precambrian bedrock. The water table is located within the silt layer (0 to 3 m below ground surface) and fluctuates seasonally as a result of snow melt, precipitation and evapotranspiration. Figure 1.2 in section 1.2 provides an aerial view of the WMA, Inactive Landfill, Lagoon, and Main Campus relative to the Winnipeg River.

The north and west drainage ditches (ditch 8 and ditch 9) are also used to collect and divert shallow groundwater around the WMA. Water from the recharge area east of the WMA is diverted around the WMA towards the west and discharges into the Winnipeg River, while water north of the WMA is diverted through the second ditch towards the north site boundary. The presence of the ditches does promote some lateral flow in the silt, clay, and clay till units. This water is sampled as part of the WL site EMP, and monitoring results show levels to be at background.

### 3.2.4.1 Groundwater Quality

Groundwater is monitored for radiological and hazardous substances around the WMA, the Lagoon, and the Inactive Landfill to assess the extent and significance of any contamination around these structures and ensure that any contamination is localized. Groundwater is not used as a source of potable water on the WL site.

#### *Radiological Contaminants in Groundwater*

Radiological contaminants are monitored in groundwater as part of the WL site EMP and include gross beta, gross alpha, and tritium.

#### *Waste Management Area*

Groundwater quality is monitored from 70 groundwater monitoring wells around the WMA (see figure 3.3). Around the WMA, groundwater monitoring wells within the clay, clay-till, and basal sand layers and bedrock are sampled and analyzed. Table 3.19 provides a summary of the radiological groundwater quality monitoring results from all wells in and surrounding the WMA. The *Guidelines for Canadian Drinking Water Quality* [100] are also provided, for comparison only. As stated previously, groundwater on the WL site is not used as a source of drinking water.

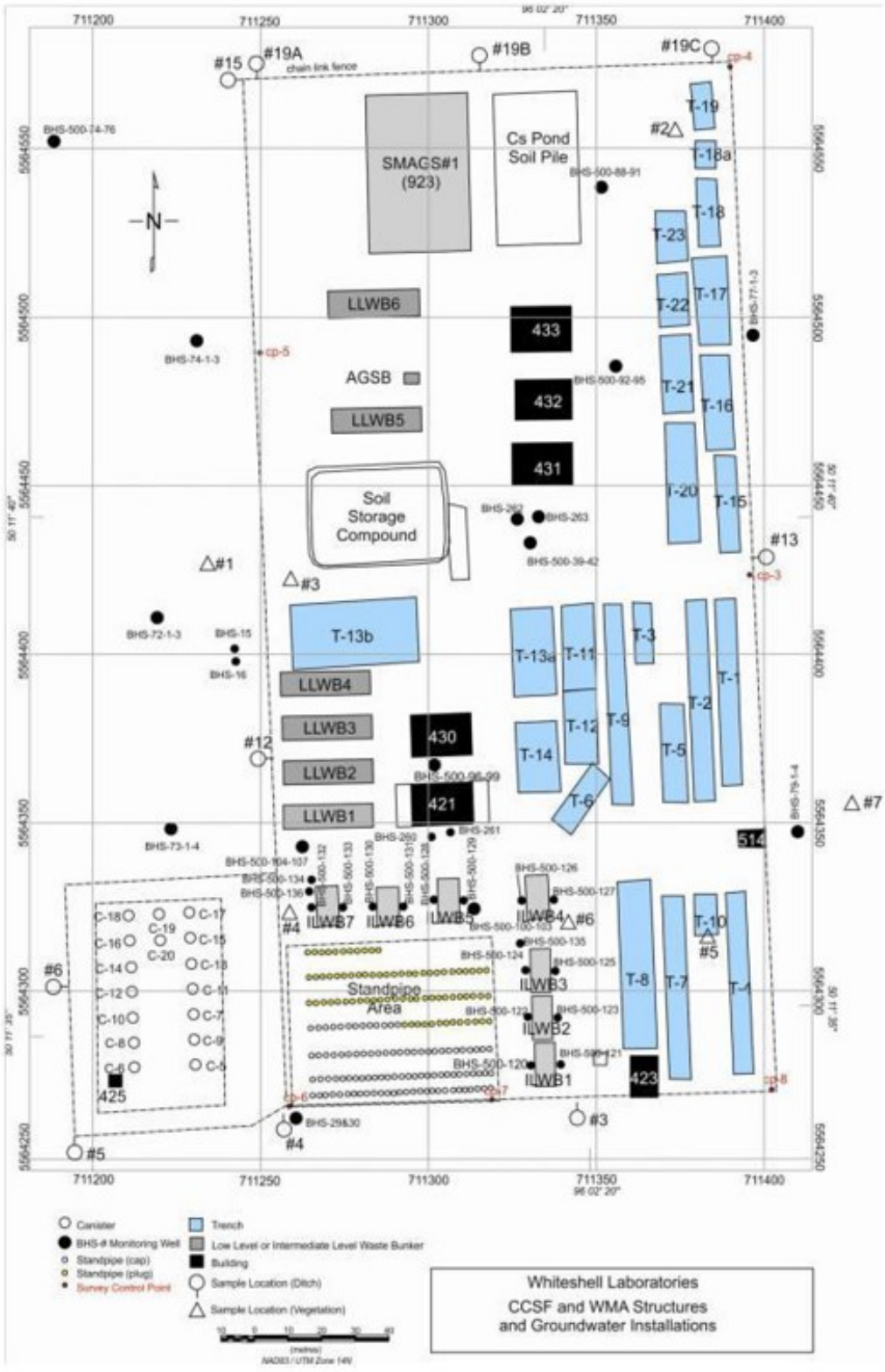
**Table 3.19: Average radionuclide concentrations in groundwater around the WMA (2013-2017) [15 to 33]**

| Surficial layer | Gross beta (Bq/L) | Gross alpha (Bq/L) | Tritium (Bq/L) |
|---|---|---|---|
| *Drinking Water Guidelines* [100] | 1 | 0.5 | 7000 |
| Clay | 0.35 – 1.21 | 0.54 – 1.05 | 7.2 – 12.4 |
| Clay till | 0.36 – 0.86 | 0.35 – 0.77 | 9.0 – 13.4 |
| Basal sand aquifer | 0.16 – 0.65 | 0.1 – 0.2 | 3.4 – 5.2 |
| Bedrock | 0.15 – 0.82 | 0.17 – 0.55 | 3.4 – 4.4 |

A number of below-grade ILW bunkers are known to have groundwater inflow. Groundwater in the vicinity of these structures is monitored for caesium-137, strontium-90 and tritium as indicators of potential contaminant migration. Monitoring results over the past licensing period have shown elevated concentrations of tritium adjacent to a number of the ILW bunkers; however, these results have also shown that this contamination is localized within the clay and clay till layers. Given the low hydraulic conductivity, migration is limited. CNL will continue monitoring to confirm the extent of tritium migration. Slightly elevated concentrations of strontium-90 have also been measured in the groundwater adjacent to the ILW Bunker 1, but concentrations remain orders of magnitude below those measured in water samples within the bunker itself, demonstrating that migration is limited. In all cases groundwater contamination around the ILW bunkers remains localized, and the bunkers and surrounding clay layer are serving as an effective means of containment.

Within the WMA, water from the Soil Storage Compound and SMAGS waste facilities is collected by sumps. Monitoring results during the licensing period confirm that no leaks have been detected and that these structures are operating as designed.

**Figure 3.3: WL site WMA Wells [23, figure A.2]**




Note: Map not to scale.

Groundwater monitored from other structures around the WMA site, including the CCSF provide no evidence that indicate there has been any contamination of groundwater as a result of operations.

### *Lagoon*

The Lagoon is located in the area adjacent to the Winnipeg River. Groundwater is sampled from 10 wells located in the water table and basal sand aquifer around the Lagoon during the spring. There is no impact from this groundwater to the Winnipeg River. Monitoring results of radiological contaminants in groundwater around the Lagoon are summarized in table 3.20.

**Table 3.20: Average radionuclide concentrations in groundwater around the Lagoon (2013-2017) [15 to 33]**

| Surficial layer | Gross beta (Bq/L) | Gross alpha (Bq/L) | Tritium (Bq/L) |
|---|---|---|---|
| *Drinking Water Guidelines* [100] | 1 | 0.5 | 7000 |
| Water table | 0.14 – 0.93 | 0.24 – 0.53 | 3.4 – 4.1 |
| Basal sand aquifer | 0.79 – 2.4 | 1.0 – 3.3 | 3.3 – 4.1 |

### *Inactive Landfill*

The Inactive Landfill is located in the upland recharge area to the east of the WMA. Groundwater samples are collected from 13 wells located in the water table and basal sand aquifer around the Landfill area during the spring. Groundwater quality results have shown that contaminant levels are consistent with regional background concentrations. There is no impact from this groundwater to the Winnipeg River. Table 3.21 provides a summary of the groundwater quality monitoring results around the Inactive Landfill.

**Table 3.21: Average radionuclide concentrations in groundwater around the Inactive Landfill (2013-2017) [15 to 33]**

| Surficial Layer | Gross beta (Bq/L) | Gross alpha (Bq/L) | Tritium (Bq/L) |
|---|---|---|---|
| *Drinking Water Guidelines* [100] | 1 | 0.5 | 7000 |
| Water table | 0.1 – 0.44 | 0.08 – 0.19 | 4.2 – 8.4 |
| Basal Sand Aquifer | 0.16 – 0.71 | 0.07 – 0.78 | 3.3 – 4.0 |

### *WL Site Main Campus*

Currently there are 29 groundwater monitoring wells around the WL Main Campus. In 2018 groundwater quality monitoring was initiated, and will be reported on in future annual reports. CNCS staff will assess these results as they become available.

### *Hazardous Contaminants in Groundwater*

Hazardous substance parameters are also measured in groundwater wells around the WMA, Lagoon, and inactive landfill. Samples are analyzed for a range of metals, volatile organic compounds and hydrocarbons, which may be present in groundwater originating from stored waste on site. These include chromium, copper, iron, lead, zinc, arsenic, uranium, mercury, nitrate, nitrite, ammonia, chloride, volatile organic compounds (such as benzene, toluene,

ethylbenzene, xylene, and acetone) and HB40 (organic coolant oil used during the operation of the WR-1 reactor). Results from groundwater well sampling around the WMA, Lagoon, and Inactive Landfill show that with the exception of uranium, iron and sulphate, concentrations of contaminants are within federal and provincial water quality guidelines and are consistent with previous groundwater assessments. In Manitoba, background concentrations of uranium, iron and sulphate are naturally high, and the results have shown these levels to be within expected regional background [97][101 to 102]. Considering that groundwater on site is not used as a source of drinking water, there is no expected impact from hazardous contaminants in groundwater to people or the environment.

Table 3.22 provides a summary of uranium concentrations in groundwater around the WMA, Lagoon and Inactive Landfill. The drinking water quality guideline for uranium is provided for comparison only. As stated previously, groundwater on the WL site is not used as a source of drinking water. Water from the Winnipeg River, may be a source of drinking water, and an assessment of surface water quality in the Winnipeg River (table 3.11), shows concentrations of uranium to be at 0.0002 mg/L, which is below the drinking water quality guideline of 0.02 mg/L.

**Table 3.22: Average uranium concentrations in groundwater around the WMA, Lagoon, and Inactive Landfill (2013-2017) [15 to 33]**

| Surficial layer | WMA (mg/L) | Lagoon (mg/L) | Inactive landfill (mg/L) | *Uranium Drinking Water Guideline* (mg/L) [100] |
|---|---|---|---|---|
| Water table | - | 0.012 – 0.013 | 0.001 – 0.002 | 0.02 |
| Clay | 0.032 – 0.040 | - | - | |
| Clay Till | 0.02 – 0.022 | - | - | |
| Basal Sand Aquifer | 0.0003 – 0.0004 | 0.056 – 0.090 | 0.0022 – 0.0036 | |
| Bedrock | 0.0008 – 0.0036 | - | - | |

### 3.2.4.2 Conclusion

CNSC staff have reviewed and assessed the hydrogeological environment around the WL site. Groundwater quality monitoring results around the WMA, Lagoon, and Inactive Landfill confirm that with the exception of localized contamination within the WMA, concentrations of radiological and hazardous contaminants in groundwater are below provincial and federal guidelines or within background.

Annual groundwater monitoring data indicate that there are elevated tritium concentrations at certain locations on the WL site, specifically around the WMA. However, tritium in groundwater does not extend beyond the WMA as contaminant migration is reduced by the clay and clay till layers. CNSC staff will continue to review CNL's groundwater monitoring results around the WL site, including areas around the WMA, Lagoon and Inactive Landfill.

As onsite groundwater is not used as a source of drinking water, there is no direct human health risk from this pathway. Based on a review of the most recent annual reports and the results from CNL's GWMP and annual environmental monitoring data, CNSC staff conclude that there are no adverse effects on the groundwater from the WL site and CNL continues to provide adequate protection of the hydrogeological environment.

### 3.2.5 Human Environment

An assessment of the human environment at the WL site consists of identifying critical groups located in proximity to the WL site, and whether the aforementioned environmental pathways will have an impact on these human receptors. Critical groups included residents of farms that are located in proximity to the WL site, as well as individuals engaging in harvesting of country foods (particularly local Indigenous communities, which continue to use the WL for traditional activities – see section 7.0). It is also acknowledged that humans perform other recreational activities in proximity to the WL site (swimming, fishing, hiking, camping and others), including hunting and trapping, however these activities are not considered representative of critical population groups [40].

Radiological and hazardous substance releases to the environment are monitored by CNL's EVMP and further assessed through the EMP. For radiological dose assessment, results of these monitoring and control activities are used to determine doses to members of the public and to ensure that doses remain below the regulatory limit.

For hazardous substance exposures, an approach encompassing a semi-quantitative pathways analysis was used to determine if members of the public would likely be exposed through air, water or the food chain.

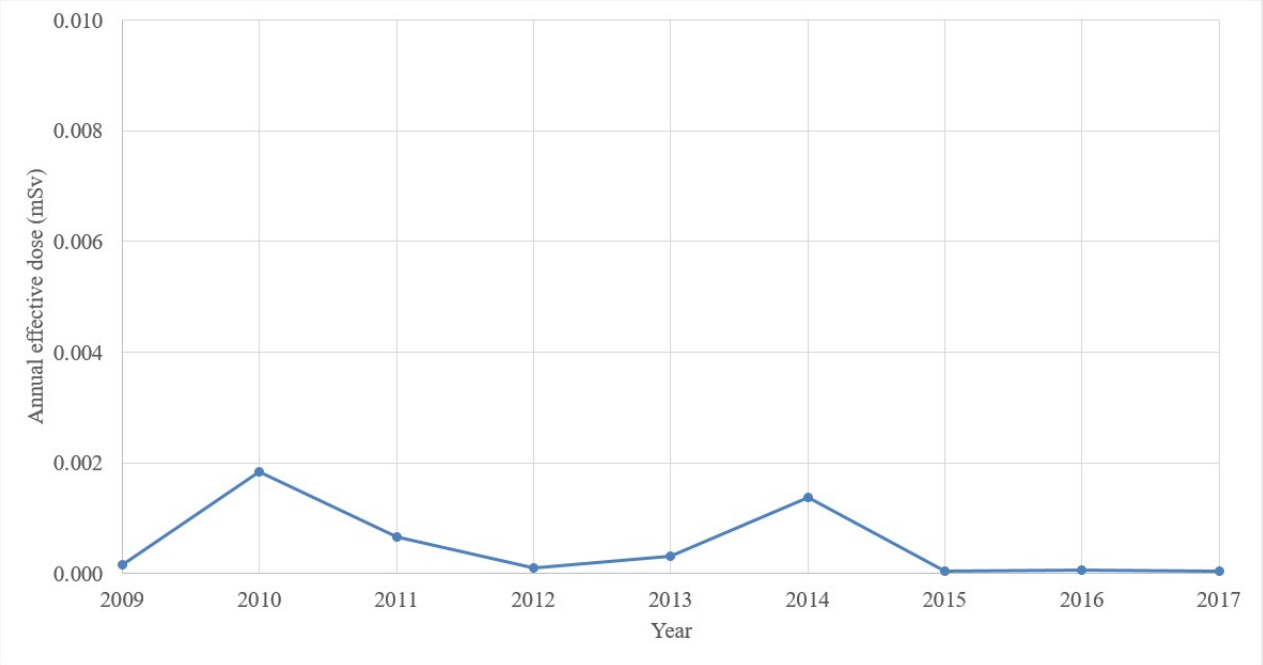
#### 3.2.5.1 Public Exposure - Radiological

The CNSC's *Radiation Protection Regulations* [65] prescribe radiation dose limits to protect the public from exposure to radiation as a result of licensed activities. The annual effective dose limit for a member of the public is 1 mSv per year.

The annual doses to persons residing in the vicinity of the WL site are due to releases of radiological substances to the Winnipeg River, as well as from airborne emissions from various facilities on the site. The members of the public with the highest calculated exposure are residents located at a farm 3 km north of Building 200. These residents are assumed to reside year-round at the farm, to consume a significant fraction of fruits and vegetables grown at the farm, and are assumed to obtain all of their drinking water from the Winnipeg River, downstream of the WL site. Liquid effluents contribute almost entirely to the annual dose to these residents. They mainly originate from the Process Outfall, which consists of stormwater runoff from roadways and around buildings on the site, cooling water used in process and experimental faculties, water from holding tank discharges, as well as the active liquid waste treatment system tanks at Buildings 100 and 300. The remainder of liquid effluents originates from the sewage Lagoon, which collects sanitary and wastewater from most buildings on the site as well as from the laundry facility.

The annual doses to residents in vicinity of the WL site have been calculated based on environmental monitoring data as well as from measurements of airborne effluents. The dose to these farm residents in 2017, based on environmental monitoring, was 0.05 μSv ($5 \times 10^{-5}$ mSv) per year. The trend from 2009 to 2017 is shown in figure 3.4. During that period, the annual dose to the public did not exceed 0.002 mSv. The annual dose limit for members of the public, as stipulated in the *Radiation Protection Regulations* is 1 mSv. The annual dose from background radiation in the Winnipeg area is 4.1 mSv. This includes exposures from cosmic radiation, natural radioactivity in the ground and in food, as well as from radon.

**Figure 3.4: Maximum calculated annual effective dose for a member of the public due to site releases of nuclear substances: 2009 to 2017 [15 to 23][25 to 33]***




* Annual effective dose over the previous licence period has remained consistently well below the annual public dose limit of 1 mSv per year. The variance shown in figure 3.4 is not considered by CNSC staff to be significant, and presents no concern with respect to risk to members of the public.

The 2017 dose to the public from the WL site remained well below the regulatory limit of 1mSv per year. Over the licensing period, CNL continued to ensure protection of members of the public in accordance with the *Radiation Protection Regulations* [65].

#### 3.2.5.2 Public Exposure – Hazardous Substances

Effects on public health were assessed to determine if there was potential for exposure of members of the public to contaminants through several routes of exposure such as air, water or the food chain. This assessment included an evaluation of air quality, drinking water quality (surface water and groundwater), water quality of the Winnipeg River for recreational activities, and exposure to contaminants. The assessment did not include exposure to hazardous substances through consumption of food in the vicinity of the WL site, although the potential for exposure through this pathway is expected to be limited.

As onsite groundwater is not a source of drinking water, there is no direct exposure of humans from this pathway.

Measurements of hazardous substances contaminants in WL site effluents from the Lagoon and Process Outfall discharging to the Winnipeg River also indicated that concentrations of these substances did not exceed the monthly guideline limits. Monitoring of water quality of the Winnipeg River 40 km downstream from the WL site for hazardous substance parameters also indicated that, with the exception of aluminium, levels of metals are well below the Canadian drinking water quality guidelines (table 3.23). However, aluminum is an abundant element in the Earth's crust (about 8 %) and elevated levels of this element in natural waters is not uncommon

[103][104]. Varying amounts of aluminum in North American rivers has been reported in the literature [105]. It is also unclear what, if any, aluminum contribution to the Winnipeg River has been made through operations at the WL site. Overall, it can be surmised that risk to human health via the drinking water ingestion pathway would be negligible.

**Table 3.23: Average (and maximum) concentrations of metals from 2008 to 2018 measured at the water sampling station near the Powerview Dam on Winnipeg River, downstream of the WL site, from Manitoba Department of Sustainable Development [106]**

| Metal | Al | As | Cd | Cu | Cr | Mo | Ni | Se | U | Zn |
|---|---|---|---|---|---|---|---|---|---|---|
| Value (µg/L) | 163 (239) | 0.8 (1.7) | 0.007 (0.008) | 1.2 (1.3) | 0.1 (0.1) | 0.2 (0.2) | 0.8 (1.0) | 0.1(0.2) | 0.1 (0.2) | 0.2 (0.3) |
| *Canadian Drinking Water Quality Guideline* (µg/L) [107] | 100 | 10 | 5 | 1000 | 5 | - | - | 5 | 20 | 5000 |
| WHO *Drinking Water Quality Guideline* (µg/L) [108] | 900 | 10 | 3 | 2000 | 50 | 70 | 70 | 40 | 30 | 3000 |

Monitoring of hazardous substances atmospheric emissions from the WL site included contaminants such as nitrogen oxides, sulphur dioxide, carbon monoxide, particular matter ($PM_{10}$ and $PM_{2.5}$), and volatile organic compounds. Results of this monitoring suggest that risk to human health via the inhalation route of exposure would be negligible.

Characterization of hazardous substances contaminants in soil media and food near the site is not available. However, based on data reported for atmospheric emissions, which is the dominant source of deposition onto soil and food resources, exposure of humans to these contaminants via the ingestion pathway is likely to be limited.

Given that decommissioning activities are not expected to result in increased emissions of hazardous substances to air and surface water, it can be inferred that overall risk to human health is characterized as low.

#### 3.2.5.3 Conclusion

Results of environmental monitoring indicated that dose to members of the public are well below the regulatory dose limit of 1 mSv per year. CNL ascertained to annual dose using the results of the effluent and EMPs at the WL site. These are described in section 3 of this report. The dose to residents living year-round on a farm near the WL site was calculated to be 0.05 µSv in 2017. A 10-year trend of the annual effective dose to exposed members of the public showed a downward trend. An evaluation of the routes of exposure to human receptors from groundwater, surface water, airborne emission, soil and food suggested that overall risk to health of members of the public from radiation was low.

Given that the decommissioning activities at WL are not expected to increase emission of radiological and hazardous substances to air and surface water, it can be inferred that the overall risk to human health is characterized as low.

# 4.0 CNSC INDEPENDENT ENVIRONMENTAL MONITORING PROGRAM

The CNSC has implemented its IEMP to verify that the public and the environment around licensed nuclear facilities are protected. It is separate from, but complementary to the CNSC's ongoing compliance verification program. The IEMP involves taking samples from public areas around the facilities, and measuring and analyzing the amount of radiological and hazardous contaminant substances in those samples. CNSC staff collect the samples and send them to the CNSC's laboratory for testing and analysis.

## 4.1 IEMP at the Whiteshell Laboratories Site

The IEMP was completed in 2017 around the WL site. The 2017 IEMP sampling plan for the WL site focused on radioactive contaminants. A site-specific sampling plan was developed based on the CNL's approved EMP and the CNSC's regulatory experience with the site. In 2017, CNSC staff collected air, soil, sediment, vegetation, food and water samples in publicly accessible areas outside the WL site perimeter.

CNSC staff sampled the following in the vicinity of the WL site:

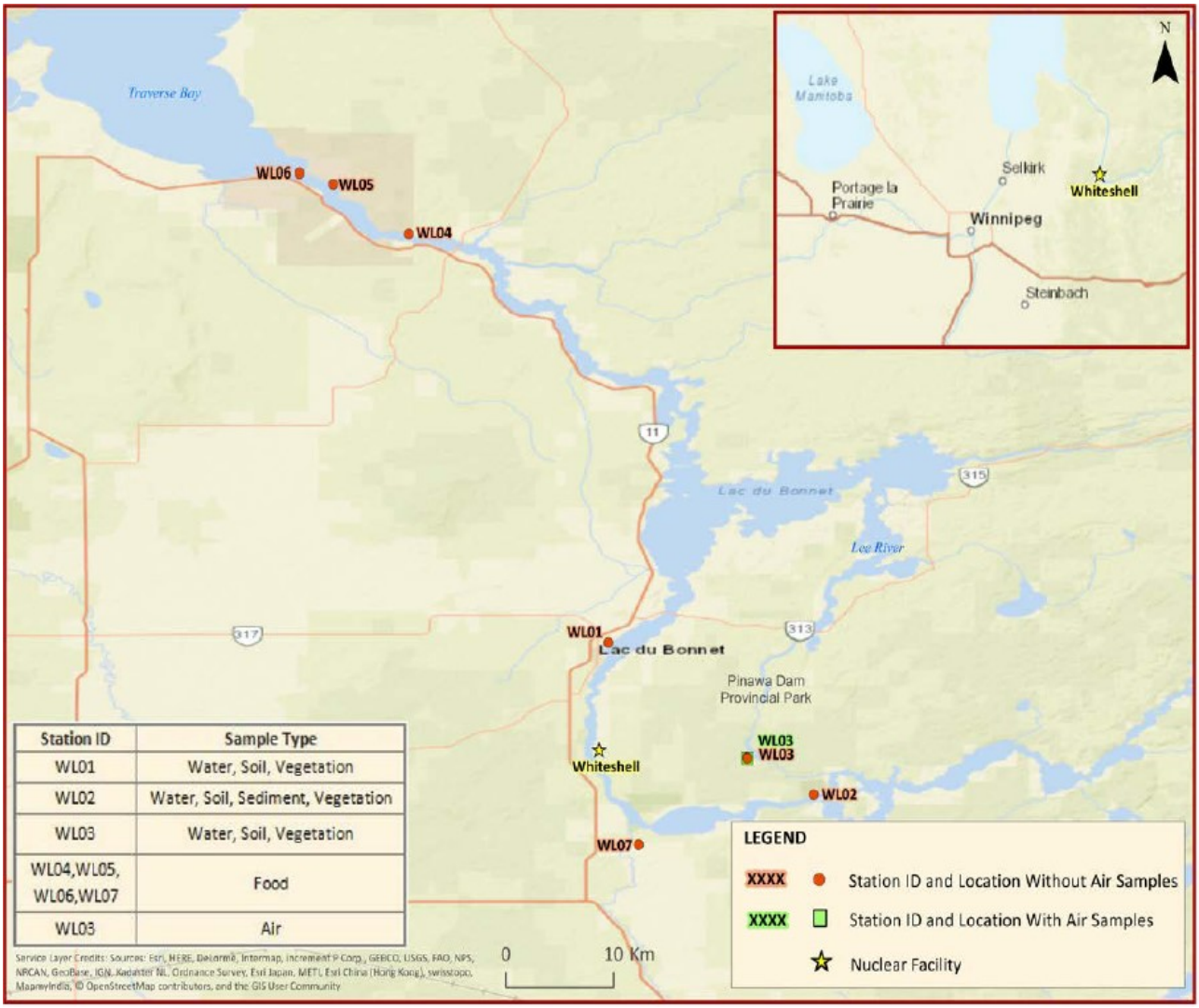
- air (1 location)
- water (3 locations)
- soil and sediment (4 locations)
- grass and wild vegetation (3 locations)
- food (6 locations)

Samples collected were analyzed by qualified laboratory specialists in the CNSC's laboratory in Ottawa, using appropriate protocols. CNSC staff measured the following:

- radioactive particulates, including caesium-137, cobalt-60, organically bound tritium, tritiated water, gross alpha and gross beta

Figure 4.1 provides an overview of the WL site and sample locations for the 2017 IEMP sampling campaign, and the IEMP results are published on the CNSC's website [36].

**Figure 4.1: Location overview of the sample locations [36]**




## 4.2 Sampling with Sagkeeng Anicinabe

It is a priority for the CNSC that IEMP sampling reflects Indigenous traditional land use, values and knowledge where possible. In addition to planned IEMP sampling activities, three fish were sampled on this trip, in collaboration with the Sagkeeng Anicinabe (Sagkeeng).

In May 2017, Sagkeeng and CNSC staff met to discuss the proposed *in situ* decommissioning of the WR-1 and IEMP. During that meeting Sagkeeng requested that fish from the Winnipeg River be sampled. Together, CNSC staff and Sagkeeng caught a northern pike sample, downstream from the WL site. Sampling results were provided to Sagkeeng in April 2018 and CNSC staff have made themselves available to discuss the results with the community. CNSC staff will continue to work with Indigenous communities in future sampling campaigns and will take into account any available IK studies to ensure meaningful results are obtained.

## 4.3 Summary of Results

The levels of radioactivity in all of the aforementioned samples were below available guidelines and CNSC screening levels, details of which can be found in the IEMP Technical Information Fact Sheet [109]. These screening levels are based on conservative assumptions about the exposure that would result in a dose of 0.1 mSv per year, which represents one tenth of the CNSC's public dose limit of 1 mSv per year. No health or environmental impacts are expected at these levels.

The IEMP results for 2017 indicate that the public and the environment in the vicinity of WL site are protected and that there are no expected health impacts. These results are consistent with the results submitted by CNL, demonstrating that the licensee's environmental protection program protects the health and safety of people and the environment.

# 5.0 HEALTH STUDIES

The following section draws from the results of regional health studies to provide further independent verification that the health of people living near the WL site is protected. The health of populations around the WL site are monitored by various organizations and institutions in Manitoba and disease rates are compared to other populations to detect any potential health outcomes that may be of concern. CNSC staff keep abreast of any new publications related to the health of populations living near nuclear facilities.

There are several health studies and reports that assessed the health of populations living the near WL site. The CNSC continues to carefully monitor and conduct health studies to ensure the protection of human health. Additional information on health studies related to nuclear facilities is available on the CNSC webpage on Health Studies [110].

The following sections provide a list of health studies carried out in the region.

## 5.1 Population and Community Health Studies and Reports

### 5.1.1 Interlake-Eastern Regional Health Authority (2014)

The Interlake-Eastern Regional Health Authority (RHA) and Community Health Assessment (2014) examines factors that affect the health of people living in areas serviced by the Interlake-Eastern Regional RHA and health outcomes within the populations, including those near the WL site [111]. Cardiovascular diseases (i.e., heart disease and stroke) are the leading cause of death in the region, followed by cancer. The region’s cancer incidence rates are similar to the whole of Manitoba. The prevalence of related key risk factors was also assessed. The percentage of regional residents who currently smoke (23%) was slightly higher than that of Manitoba (20%). Similarly, the proportion of residents who are overweight or obese (62.3%) was slightly higher than the Manitoba average (56.4%).

This community health assessment also provides data on First Nations living in the region. The majority of the data are for First Nations living on reserve, which represents 80% of the First Nations population in the region. The Interlake-Eastern RHA summarizes data from CancerCare Manitoba 2013-2014 [112], and the First Nations Regional Health Survey 2008–2010 [113], which are also further described below. The cancer incidence rate for First Nations living on reserve within the Interlake-Eastern RHA was 629.6 cases per 100,000 people which was

statistically significantly higher than the Manitoba average of 471.2 cases per 100,000 people and the regional average of 471.8 cases per 100,000 people. Furthermore, cancer survival rates were statistically significantly lower for First Nations living on reserve in the region compared to the provincial average.

First Nations in the region were well below the regional average for breast cancer, cervical, and colorectal cancer screening. Cancer screening increases the likelihood of early detection and treatment, and can improve cancer survival. The daily smoking rate for First Nations adults on reserve in the region (48.1%) was higher than the rate of First Nations living off reserve (16.4%), Manitoba (19.6%) and Canada (19.0%). Tobacco smoking is the main cause of cancer, especially lung cancer.

### 5.1.2 Manitoba Health (2016–2017)

The Manitoba Health, Seniors and Active Living's Annual Statistics Report describes Manitoba's population, health utilization and health status using key health indicators [114]. In Manitoba, the five most common causes of death include: heart disease (27.7%), cancer (27.1%), respiratory disease (8.6%), mental/behavioural issues (7.9%), and injuries (7.5%). The population within the Interlake-Eastern RHA have a slightly higher premature death rate compared to the Manitoba average, but also have higher rates of heart attacks, which may account for this increase [114]. However, there is no information provided on whether these differences are statistically significant.

### 5.1.3 CancerCare Manitoba Reports (2013–2014), (2015)

CancerCare Manitoba released a Community Health Assessment Report (2013–14) that examines cancer risk factors (such as smoking and limited physical activity), wait times for screening and treatment, and incidence, mortality and survival rates. Risk factors for cancer such as obesity, smoking and alcohol consumption, show considerable variation by region and are frequently higher in the North. In Manitoba, 23.4 % of the population are obese (this does not include individuals who are overweight), and 19.6 % are smokers [112].

The 2015 Annual Statistics Report, based on data from the Manitoba Cancer Registry, found lung cancer to be the most commonly diagnosed cancer site in Manitoba, followed by breast cancer. This is consistent with the leading cancer sites for Canada in 2015 [114]; however, the cancer mortality rate in Manitoba is slightly lower than the national rate [116].

### 5.1.4 Cancer Incidence in First Nations living in Manitoba

In Manitoba, First Nations people constitute almost 10% of the population. A study by Decker et al. (2016) looked at the prevalence of breast cancer and colorectal cancer incidence in First Nations in Manitoba compared to the provincial rate from 1984–2008 [117]. Historically, First Nations in Manitoba have had lower rates of cancer and chronic diseases than other Manitoba residents. However, the rate of cancer incidence and cancer mortality appears to be increasing due to changes in behavioural, environmental, other social factors and lower rates of participation in early cancer screening activities. Further, as life expectancy increases and people live into old age, we see an increase in cancer incidence and mortality rates.

Although overall breast cancer incidence remains lower for First Nations women compared to the provincial rate, the rate among First Nations women increased more rapidly from 1984–2008.

Likewise, the breast cancer mortality rate increased among First Nations women, whereas the provincial mortality rate decreased [117]. Similar increases in breast cancer incidence and mortality among Indigenous peoples has been observed elsewhere, in Greenland, New Zealand, United States and elsewhere in Canada. One of the factors that may influence this increase is breast cancer screening among First Nations women. Demers et al. (2015) assessed breast cancer screening rates among First Nations women compared to all other Manitoba women [117]. First Nations women had lower rates of mammography (a method to screen for breast cancer) compared to all other Manitoba women [118].

The incidence of colorectal cancer among First Nations people has also increased, and in 1999–2003, it surpassed the rate for all Manitobans. Although colorectal cancer mortality rate for all Manitobans declined over time, the colorectal cancer mortality rate for First Nations people increased by a factor of eight. Similarly, another study by Decker et al. (2015), found that First Nations living in Manitoba were less likely to have colorectal cancer screening [119].

### 5.1.5 First Nations Regional Health Survey (2008–2010)

The First Nations Regional Health Survey (RHS) Phase 2 (2008-2010): Manitoba Regional Report [120] was designed, developed, and delivered by Indigenous peoples across Canada. The self-report survey was supported by the Manitoba Chiefs-in Assembly. The report presents a snapshot of a variety of health indicators, including self-assessment of health, access to care, and socio-economic factors in First Nations people of Manitoba for 2008–2010, as well as providing data on involvement in traditional activities on lands, and related culturally based indicators.

For health outcomes the two most prevalent chronic diseases amongst Manitoba First Nation adults are hypertension (high blood pressure) and diabetes, with the vast majority being type 2 diabetes. In terms of health risk factors, approximately 50% of young adults (18–34) and adults (35–54) are daily smokers with lower rates for those age 55 and older. Access to health care is also a major issue; 55.8% of adults indicate that they have less access to health services compared to the general Canadian population, mainly due to long wait times and lack of health care providers [120].

## 5.2 Summary of Health Studies

Reviewing and conducting health studies and reports is an important component of ensuring that the people living near nuclear facilities are protected. The population and community health studies and reports indicate that common causes of death among the Manitoba populations (provincial, Interlake-Eastern RHA, and First Nations) include heart disease and cancer. This is similar to other provinces in Canada where heart disease and cancers are the two leading causes of death, aside from Nunavut, where heart disease and respiratory diseases are the leading causes of death [121].

The above health studies are descriptive studies which compare the occurrence of health outcomes within a population at a certain time in a given geographical area to the “expected” occurrence of the disease in a stable reference population (such as the general population of the province or Canada). Descriptive studies have some limitations, such as: 1) the results are averaged over a group and do not look at the individual level, and 2) individual exposures are not known, and they cannot be used to determine the cause of a health outcome, however they are used to generate hypotheses regarding potential risk factors for health outcomes. For further

information regarding advantages and disadvantages of health study designs please see INFO-0812 [122].

These health studies and reports provide a snapshot of the health of people living near the WL site. CNL currently meets CNSC's regulatory requirements. Based on exposure and health data, CNSC staff have not observed and do not expect to observe any adverse health outcomes due to the presence of the WL site.

# 6.0 OTHER REGIONAL MONITORING PROGRAMS

There are several regional monitoring programs carried out by other levels of government, which the CNSC has reviewed to confirm that the environment and the health of persons around the WL site are protected. A summary of the findings of these programs are provided below.

The Radiation Protection Bureau of Health Canada manages the Canadian Radiological Monitoring Network (CRMN) [123]. The CRMN routinely collects drinking water, precipitation, atmospheric water vapour, air particulate, and external gamma dose for radioactivity analysis at 26 monitoring locations. The closest CRMN monitoring location to the WL site is in Winnipeg. The results at the Winnipeg station for 2017 and 2018 are consistent with data from previous years and are well below the acceptable public dose limit.

In addition, Health Canada has complemented its CRMN network with a Fixed Point Surveillance (FPS) system [124]. The FPS functions as a real-time radiation detection system designed to monitor public dose from radioactive materials in the air, including atmospheric releases associated with nuclear facilities and activities both nationally and internationally. Monitoring stations continuously measure gamma radioactivity levels from ground-deposited (ground-shine) and airborne contaminants.

Health Canada measures the radiation dose rate as Air KERMA (Kinetic Energy Released in unit MAss of Material) reported as nanoGray per hour (nGy/h) of absorbed dose. These measurements are conducted every 15 minutes at 79 sites of its FPS network across the country. Air KERMA is also measured for three radioactive noble gases associated with nuclear fission which may escape into the atmosphere during normal operation of nuclear facilities. These three noble gases are Argon-41, Xenon-133 and Xenon-135. CNSC staff converted the absorbed dose rate to an effective dose, reported in mSv per year, which allows for comparison to annual background dose estimates and the regulatory public dose limit.

The 2017 and 2018 total external gamma doses reported for the FPS network near Winnipeg are similar to the Canadian average for natural background from gamma (the range is 0.007 – 0.027 mSv per year). These results indicate that total external gamma dose at these stations is not significantly influenced by activities at the WL site. Further evidence of this is provided by the extremely low activity levels reported for the noble gases, as outlined in table 6.1. All of the results are significantly below the public dose limit of 1 mSv.

**Table 6.1: Annual external gamma doses (mSv per year[1]) for 2017 and 2018 at the Fixed Point Surveillance network monitoring stations associated with the WL site.**

| Monitoring stations near Whiteshell | External gamma dose | | | | |
|---|---|---|---|---|---|
| | Year | All gamma sources | Monitored noble gases (Fission products) | | |
| | | | Argon-41 | Xenon-133 | Xenon-135 |
| Winnipeg | 2017 | 0.011 | * | * | * |
| Winnipeg | 2018 | 0.011 | * | * | * |

*No data is reported when results were below the minimum detectable dose

[1] Assumptions: adult located at monitoring station for 24 hours a day, 365 days per year. Air KERMA in nanoGray corrected. Total Dose: 0.69 mSv for every Gray of absorbed dose measured: Argon-41: 0.74; Xenon-133: 0.75; Xenon-135: 0.67.

# 7.0 INDIGENOUS KNOWLEDGE STUDIES

The CNSC acknowledges the importance of working with and integrating IK into staff assessments and regulatory activities, when provided to the CNSC by Indigenous communities. One way in which the CNSC integrates IK is through collaboration and understanding of IK studies pertaining to CNSC regulated facilities and activities. These studies provide community-specific knowledge of the land, waters, and resources where CNSC-regulated facilities are located and of the potential or existing interactions of those facilities with Indigenous communities' historic and current land use, values, rights and interests. The studies and IK contained within them, represent the distinct Indigenous perspective on their specific interests, exercise of their rights, and potential impacts on the same.

In January 2019, CNSC staff received an IK study from the Manitoba Metis Federation (the MMF, which is the democratically elected, self government representative of the Manitoba Metis Community) [37][38] pertaining to the proposed *in situ* decommissioning activities for the WR-1 reactor at the WL site, located within their traditional territories. This study was supported by the CNSC's Participant Funding Program (PFP), as part of the WR-1 EA and licensing review process (which is separate from this licence renewal process), and conducted in order to provide CNSC staff and CNL with Indigenous-specific knowledge and perspectives of the proposed decommissioning activities for the WR-1 reactor. This study also assessed the potential impacts of the newly proposed *In Situ* Decommissioning of the WR-1 Project to Manitoba Metis Community's historic connection to, contemporary use of, and occupancy of this portion of their traditional territory.

CNSC staff are currently reviewing the MMF's study in detail and are working with the MMF on how to best incorporate and reflect the information into CNSC's regulatory review processes and activities pertaining to the WL site, including the ongoing review of the proposed *In Situ* Decommissioning of the WR-1 Project that is the subject of a separate EA and licensing review process. For the purposes of the WL site licence renewal and this EPR, the information provided in the study has not been incorporated into the Environmental Effects Assessment section of this report (section 3.2). CNSC staff require more time to adequately consult and collaborate with the MMF, in order to ensure the contents of their study is appropriately and respectfully integrated into CNSC regulatory processes and assessments, and that potential impacts on rights and concerns identified in the studies are adequately addressed, mitigated and resolved.

CNSC staff recognize that MMF has unique values and interests. Their IK study provides a distinct set of data and perspectives that help the CNSC better understand how the MMF view the proposed WR-1 decommissioning activities and the WL site's interaction with their traditional territory, along with key VCs that are considered vital to their citizens, in exercising their Indigenous rights. The relevant VCs and baseline conditions detailed in the study has been summarized at a high level in this EPR Report, in order to acknowledge all information available to CNSC staff, which will be fulsomely examined and incorporated in collaboration with MMF moving forward.

The CNSC endeavours to collaborate with Indigenous communities in order to ensure IK is appropriately protected, managed and reflected in resulting documentation, where appropriate. The following section discussing the MMF study has been reviewed by the MMF, in advance of publishing this EPR Report. MMF has given CNSC staff permission to include this content and have collaborated in compiling the respective portions of Section 7.

Notwithstanding this collaborative approach, it is important to read their report in its entirety for the full context of the information provided below, including the distinct Indigenous-perspectives captured in each study, and acknowledge that this section reflects a high-level summary of the information.

In addition, CNSC staff received in January 2019 an IK study from Sagkeeng pertaining to the proposed *in situ* decommissioning activities for the WR-1 reactor at the WL site, located within their traditional territory. This study was also supported by the CNSC's Participant Funding Program (PFP), as part of the WR-1 EA and licensing review process (which is separate from this licence renewal process), and conducted in order to provide CNSC staff and CNL with Indigenous-specific knowledge and perspectives of the proposed *In Situ* Decommissioning of the WR-1 Project. This study also assessed the potential impacts of the newly proposed *In Situ* Decommissioning of the WR-1 Project to Sagkeeng's historic connection to, contemporary use of, and occupancy of this portion of their traditional territory.

Sagkeeng has clarified with CNSC staff that the scope of their study is specific to the *In Situ* Decommissioning of the WR-1 Project and does not include inputs from Sagkeeng members on the management of the whole WL site or anything beyond WR-1. This was a project-specific Land Use and Occupancy Study and its results cannot be automatically interpolated to extend and encompass other issues relating to the WL site, or Sagkeeng territory. Therefore, CNSC staff have not included a summary of the Sagkeeng study in this EPR Report, which is specific to the WL site licence renewal process.

The concerns raised in Sagkeeng's study are primarily focused on the proposed *In Situ* Decommissioning of the WR-1 Project and not specific to the renewal of the WL site. CNSC staff are committed to working with Sagkeeng leadership and community members to help address the concerns raised in their study, with relation to the proposed *In Situ* Decommissioning of the WR-1 Project. CNSC staff will continue to work to meaningfully incorporate the values and information provided by Sagkeeng into CNSC's regulatory processes and activities, including the EA and licensing process for the proposed *In Situ* Decommissioning of the WR-1 Project and to fulfill its obligations related to the duty to consult and accommodate, where appropriate, and uphold the honour of the Crown in relation to the proposed activities.

## 7.1 Manitoba Metis Federation

In 2018, the MMF undertook a Traditional Knowledge, Occupancy and Land Use Study, in collaboration with Shared Value Solutions (SVS), related to the proposed *In Situ* Decommissioning of the WR-1 Project [37]. The study had three stated main goals:

1. Provide evidentiary data of how Metis harvesters who participated in the study are using the lands and waters around the WR-1 Reactor site;
2. Provide information on consumption frequency and quantity as it relates to harvested country foods relied on by Metis harvesters within a 50 km area around the WR-1 Reactor site;
3. Provide this information in a format that is consistent with the current MMF Metis Land Use and Occupancy data so that the study can build upon this existing information.

Although the focus of the study was primarily on the *In Situ* Decommissioning of the WR-1 Project, the scope of this study is relevant to the WL site under consideration for licence renewal as it highlights various concerns of MMF community members (also known as MMF Citizens) and includes evidence about MMF Citizens past and present use of the WL site and surrounding area to exercise their Metis specific rights, practices and traditions. However, it is important to note that the study is specific to the proposed decommissioning activities for the WR-1 project and the building in which it resides[5], not the WL site as a whole.

### 7.1.1 Study Scope and Valued Ecosystem Components

The information in the study is based on interviews with 10 citizens and harvesters from the Manitoba Metis Community, conducted between November 19 and 23, 2018. Participants were selected through self-identification on a consumption survey mailed to Metis citizens that attended a MMF information and engagement meeting held in Lac Du Bonnet, MB, as well as through phone contact with MMF Citizens holding Metis harvesting cards.

The data collected for this study was obtained using a map biography process, involving the marking of locations of features identified during interview discussion on digital maps using the ESRI Arc Geographic Information System program. At the same time, interview participants provided descriptions associated with the data points. This information was augmented by oral interviews, where participants shared traditional knowledge of the land through direct recollections, family stories, perceptions of the areas in question, and future hopes for the study areas.

The data provided in these interviews are discussed and analyzed as site-specific use values, geographically located within a particular proximity to the proposed *In Situ* Decommissioning of the WR-1 Project according to two scales (as described in table 7.1). Furthermore, table 7.2 contains the details of the number of site-specific use values, according to location type including observed changes to the environment.

[5]Referred to in this section, for purposes of this study, as the WR-1 facility.

**Table 7.1: Manitoba Metis Federation Study Areas [37]**

| Study area | Description |
|---|---|
| **100 m Study Area** | This area includes the Winnipeg River, between Seven Sisters to the mouth of Lake Winnipeg, as well as Lac du Bonnet and the Lee River. In addition to these water bodies, a 100 m buffer on either side of these bodies are included in this Study Area. |
| **25 km Study Area** | This area represents a 25 km buffer around the WR-1 site. |

**Table 7.2: Manitoba Metis Federation locations of Land Use and Occupancy [37]**

| Location types | 100 m Study area | 25 km Study Area (including 100 m Study Area) |
|---|---|---|
| **Access routes** | 12 | 23 |
| **Fishing locations** | 38 | 44 |
| **Trapping / snaring locations** | - | 3 |
| **Gathering locations** | - | 18 |
| **Commercial guiding or other commercial land use** | - | 3 |
| **Changes to environment** | 15 | 32 |
| **Hunting locations** | 2 | 8 |
| **Demographic locations** | 2 | 41 |
| **Locations of cultural significance** | 2 | 11 |
| **Other land use (Ice-fishing huts)** | 2 | 2 |
| **Total** | **75** | **192** |

In addition to the 192 sites of land use and occupancy (LUO) identified within the 25 km study area, an additional 232 locations of LUO were identified by participants, for a total of 424 Metis LUO locations. Each of these identified Metis LUO locations represents evidence of the exercise of Metis specific s. 35 rights, practices, or traditions in the study area. The temporal scope of this use is according to "current use", which is defined as within the lifetime of the interview participant. These results cannot be considered a comprehensive representation of all Manitoba Metis Community LUO in the study areas, but rather provide a reasonable representation of the information that is available from a small sample of the Manitoba Metis Community, based on the limited interviews undertaken and study scope.

In addition to the detailed description of these LUO locations identified in this study, MMF produced a *Review of Draft Valued Components (VCs) and Related Measurement Endpoints and Indicators for the Project Environmental Impact Statement (EIS)* [38]. Table 7.3 contains all of the VCs identified in both documents. The VCs identified by the MMF specifically relate to environmental components that, if affected by the *In Situ* Decommissioning of the WR-1 Project activities, could potentially have corresponding impacts on s. 35 Metis rights. Many of the specific biota VC species were identified based upon MMF Citizens providing evidence in the interviews and study of direct consumption and reliance on these species for substance purposes.

In addition, the *Review of Draft Valued Components (VCs) and Related Measurement Endpoints and Indicators for the Project Environmental Impact Statement (EIS)* highlighted that a distinctions-based approach, which considers the Manitoba Metis Community's VCs as distinct from other Indigenous and non-Indigenous VCs, would more accurately and meaningfully identify, measure, and consider impacts on MMF Citizens. CNSC will be working with the MMF through the WR-1 EA and licensing process to ensure the different impacts, uses, and considerations for each VC are considered through a Metis-specific lens as the CNSC acknowledges the distinct knowledge, perspective, and experience of MMF Citizens.

**Table 7.3: Valued components identified by the Manitoba Metis Federation [37][38]**

| Category | Valued components |
|---|---|
| **Air** | Air Quality |
| **Water** | Surface water and groundwater quality (drinking water) |
| **Sediment** | Sediment quality |
| **Soil** | Soil quality and quantity |
| **Biota** | Fish: walleye / pickerel, lake sturgeon, carmine shiner, lake whitefish, smallmouth bass, jackfish / northern pike, suckers, goldeye, mooneye, perch, and catfish<br>Aquatic Invertebrates: benthic invertebrates |
| | Birds: geese, ducks, ruffed grouse, spruce grouse, partridge, horned grebe, trumpeter swan, mallard, barn swallow, and golden-winged warbler, American robin, loggerhead shrike<br>Mammals: moose, white-tailed deer, marten, rabbit, squirrel, weasel, mink, meadow vole, common shrew, snowshoe hare, white-tailed deer, red fox, northern myotis and little brown myotis<br>Invertebrates: earthworm<br>Reptiles: snapping turtle |
| | Plants: wild rice, berries (blueberries, pin cherries, cranberries, Saskatoon berries, chokecherries, gooseberries, strawberries, raspberries and wild plums); Labrador tea, fiddleheads and hawthorn nuts; other aquatic and terrestrial plants, including grasses and shrubs, including flowers; trees including poplar, spruce, jackpine, birch; flowers |
| **Ecosystem** | Various areas that serve as habitat, including: marsh habitat, for wild rice, as well as jackfish and water fowl; fish habitat for sturgeon and jackfish, in order to ensure self-sustaining and ecologically effective fish populations; plant and berry, bird, mammal and reptile habitat, more generally |
| **Human** | Socioeconomic: government finances, business opportunities, community well-being, infrastructure and services, employment and income |
| | Human Health: public health and safety, worker health |
| | Traditional land and resource use: hunting, fishing, trapping, plant and berry gathering, as well as outdoor recreation and tourism, capacity for continued land tenure and use, tubing on the water, access to boat launches, land and water trails, gathering of firewood |
| | Cultural and Archaeological Sites: protection and preservation of cultural and archaeological sites; gathering places, picnic areas, swimming areas |
| | Sense of well-being: connection to the land, spiritual practices |

### 7.1.2 Reported Impacts to Manitoba Metis Federation Citizens

Overall, the study demonstrated that MMF Citizens rely on and use the land and waters around the WL site for various cultural and traditional activities, and have done so both prior to the construction of the WR-1 and WL site and continue to do so in the present day. MMF Citizens interviewed for the study expressed concerns about degradation of water quality and resources, and the impacts of extreme weather events on the WL site leading to potential impacts to human and environmental health in the 100m and 25km study areas and beyond. Study participants stressed how contamination of the land, waters and species that they value and rely on to maintain their Metis specific traditions, exercise their rights, and feed their families, both in and around the WL site, could have cascading impacts on MMF Citizens (through impacts to aquatic and terrestrial resources, contamination of resources relied on, and their cultural ways of life).

The MMF interviewees expressed a desire to have a better understanding of all activities taking place on the WL site, potential impacts of these activities, and the mitigation measures in place. The study expressly recommended further engagement between CNSC and the MMF to further address these potential impacts and concerns.

The study concluded that many MMF Citizens have concerns based on their harvesting experience about contamination and the quality of water, plants, fish, wild rice, medicines, berries, wildlife and plant species in their traditional territory, including the WL site. MMF Citizens expressed that they would like further information regarding the safety of these resources to help address their perception of potential or real contamination or risk of traditional resources. The study also provided evidence by Metis Citizens that a perception of a contamination risk associated with the WL site could impact their s. 35 harvesting activities in the study area and result in avoidance behaviours that affect Metis Citizens preferred means of exercising their s. 35 rights.

The study also provided evidence of outstanding questions regarding the progress of decommissioning activities at the WL site and overall timelines. Interviewees requested more frequent communication on these topics from CNL and the CNSC, and wish to participate in the planning and oversight of these activities in order to ensure that Metis laws of harvest and harvesting timeframes are adequately considered. Throughout the upcoming WR-1 EA process and the lifecycle regulation of the WL site, the CNSC will continue to work with the MMF to address these concerns and perceptions, including providing regular updates on the WL site and decommissioning activities and assessing potential impacts and VCs identified in their IK study and through consultation.

Given the concerns raised and desire for continued stewardship of Metis traditional territories, interviewees demonstrated an interest in serving as equal partners in problem solving and decision-making regarding land use and decommissioning activities on and around the WL site, to help contribute to the sustainability of their traditional territories, including preservation and accessibility for future generations.

### 7.1.3 Conclusion

The experiences and values of the Metis Citizens interviewed in the Metis Traditional Knowledge, Occupancy and Land Use Study describe the importance of various sites in proximity to the WL site relating to hunting, trapping and fishing activities, harvesting activities, as well as overall well-being and way of life of the Manitoba Metis Community.

The data collected in this study demonstrates how in and around the WL site has been, and continues to be, used by MMF Citizens for activities that are important to the Manitoba Metis Community's culture, traditions, rights and ongoing livelihood. Furthermore, the detailed accounts reveal evidence of the participants' concern that these cultural practices and exercise of their Metis-specific s. 35 rights have been impacted by activities at the WL site and that there are ongoing concerns regarding potential impacts associated with the decommissioning and other proposed activities.

Through this study MMF has identified a number of VCs of significance to their rights, culture and interests, in and around the WL site. These include resources such as water, medicines and subsistence resources (plants, berries, fish and game), the associated traditional activities, such as harvesting, hunting, and trapping, as well as Metis ways of life, incorporating concepts such as sense of place, identity, connection to the land, psychological well-being, ceremonial practices, and methods of knowledge-sharing.

CNSC staff are committed to working with MMF leadership and Citizens to help address the concerns raised in the study, with relation to the WL site. CNSC staff will continue to work meaningfully with the MMF to incorporate the values and information provided in their IK study into CNSC's regulatory processes and activities, including the EA and licensing process for the proposed *In Situ* Decommissioning of the WR-1 Project and to fulfill its related duty to consult and accommodate, where appropriate, and uphold the honour of the Crown in relation to the proposed activities.

# 8.0 RECOMMENDATIONS AND CONCLUSIONS

The EPR conducted for the WL Nuclear Research and Test Establishment Decommissioning Licence concludes that CNL has taken adequate provisions for the health of persons and the protection of the environment and will continue to do so in the future.

CNSC staff reviewed CNL's licence application and the documents submitted in support of the application, as well as the CSR, annual reports, and compliance verification activities conducted at the WL site. CNSC staff conclude the licence application and supporting documents submitted in support of the application are satisfactory and meet CNSC's regulatory requirements.

CNSC staff also reviewed the results from other regional monitoring programs conducted by other levels of government, which substantiate CNSC staff's conclusion that the environment and health of persons are protected from operations at the WL site. CNSC staff also conducted IEMP sampling around the WL site in 2017. Both the regional monitoring results and IEMP results confirm that the public and the environment around the WL site are protected and that there are no health impacts as a result of ongoing activities. These results are consistent with the results submitted by CNL, demonstrating that the licensee's environmental programs protect the health of persons and the environment.

CNSC staff acknowledge the concerns raised by MMF in information they have provided to the CNSC, including through their IK study. CNSC staff are committed to working with MMF leadership and citizens to help address the concerns raised. The values and information provided by this IK study will be meaningfully incorporated into CNSC's regulatory work and activities, including, but not limited to the EA for the *In Situ* Decommissioning of the WR-1 Project.

This EPR focused on items of current public and regulatory interest, including physical stressors, releases to air, groundwater and surface water from ongoing operations and activities related to

ongoing decommissioning activities. CNSC staff conclude that the potential risk from physical stressors and radiological and hazardous releases to the atmospheric, terrestrial, hydrogeological, aquatic and human environment are low to negligible. However, CNSC staff expect that CNL will conduct a site-wide ERA in accordance with REGDOC-2.9.1 and the CSA Standard N288.6-12, *Environmental Risk Assessment at Class I Nuclear Facilities and Uranium Mines and Mills* during the next licensing period

This EPR conducted for the renewal of the WL NRTEDL concludes that CNL has and will continue to make adequate provision for the protection of the environment and the health of persons. CNSC staff will continue to verify and ensure that, through ongoing licensing and compliance activities and reviews, the environment and the health of persons are protected and will continue to be protected over the proposed licence period.

The information provided in this EPR Report supports the recommendation by CNSC staff in CMD 19-H4 to renew CNL's Nuclear Research and Test Establishment Decommissioning Licence for the WL site (NRTEDL-W5-8.05/2019) for a period of ten years.

# ACRONYMS

| Acronym | Term |
|---|---|
| AECL | Atomic Energy Canada Limited |
| AL | Action Level |
| ALARA | As Low As Reasonably Achievable |
| ALWTC | Active Liquid Waste Treatment Center |
| ARMS | Ambient Radiation Monitoring Stations |
| B | Building |
| CCME | Canadian Council of Ministers of the Environment |
| CCSF | Concrete Canister Storage Facility |
| CEAA | *Canadian Environmental Assessment Act* |
| CEPA | *Canadian Environmental Protection Act* |
| CNL | Canadian Nuclear Laboratories |
| CNSC | Canadian Nuclear Safety Commission |
| CO2e | CO2 equivalent |
| CRMN | Canadian Radiological Monitoring Network |
| CSR | Comprehensive Study Report |
| DFO | Department of Fisheries and Oceans Canada |
| DRL | Derived Release Limit |
| EA | Environmental Assessment |
| EA FUP | Environmental Assessment Follow-Up Program |
| EMP | Environmental Monitoring Program |
| EMS | Environmental Management System |
| EnvP | Environmental Protection Program |
| EP | Environmental Protection |

| | |
|---|---|
| EPR | Environmental Protection Review |
| ERA | Environmental Risk Assessment |
| ESEA | Endangered Species and Ecosystems Act (Manitoba) |
| EVMP | Effluent Verification Monitoring Program |
| FFS | Fitness for Service |
| FPS | Fixed Point Surveillance |
| FWSER | Federal Wastewater System Effluent Regulations |
| Go-Co | Government-owned, Contractor-operated |
| GHG | Greenhouse Gas |
| GMP | Groundwater Monitoring Program |
| GWP | Global Warming Potential |
| HLW | High Level Waste |
| IEMP | Independent Environmental Monitoring Program |
| IK | Indigenous Knowledge |
| ILW | Intermediate Level Waste |
| KERMA | Kinetic Energy Released in unit MAss of Material |
| LCH | Licence Condition Handbook |
| LLW | Low Level Waste |
| LUO | Land Use and Occupancy |
| mSv | Millisievert |
| MMF | Manitoba Metis Federation |
| NAAQO | National Ambient Air Quality Objectives |
| NPRI | National Pollutant Release Inventory |
| NRTEOL | Nuclear Research and Test Establishment Operating Licence |
| NRTEDL | Nuclear Research and Test Establishment Decommissioning |

| | |
|---|---|
| | Licence |
| NSCA | *Nuclear Safety and Control Act* |
| NSRDR | Nuclear Substance and Radiation Devices Regulation |
| PFP | Participant Funding Program |
| PM | Particulate Matter |
| RA | Responsible Authority |
| ROR | Regulatory Oversight Report |
| Sagkeeng | Sagkeeng Anicinabe |
| SARA | *Species at Risk Act* |
| SF | Shielded Facility |
| SVS | Shared Value Solutions |
| TSP | Total suspended particulates |
| VCs | Valued Components |
| WL | Whiteshell Laboratories |
| WMA | Waste Management Area |
| WR-1 | Whiteshell Reactor #1 |

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# PART TWO

Part two provides all relevant information pertaining directly to the licence, including:

[1] Any proposed changes to the conditions, licensing period, or formatting of an existing licence;

[2] The proposed licence;

[3] The draft licence conditions handbook; and

[4] The current licence.

# PROPOSED LICENCE CHANGES

## Overview

CNL currently operates Whiteshell Laboratories under the Nuclear Research and Test Establishment Decommissioning Licence, NRTEDL-W5-8.05/2019[1]. The proposed licence incorporates the standard licence conditions and standard format.

## Licence Conditions

The proposed licence incorporates the standard licence conditions applicable to the WL site.

## Licence Format

The proposed licence uses the standard format.

## Licence Period

CNL has requested a renewal of the WL licence for a period of 10 years until December 31, 2029. Based on CNSC staff review of the CNL application, performance history, and supporting information, CNSC staff support CNL's request for a licence period of 10 years. Over the proposed 10 year period, CNSC staff would provide regular reporting on regulatory oversight conducted at the WL site in public Commission proceedings.

# PROPOSED LICENCE

The proposed Licence is provided on the following pages of the document.

e-Doc 5768606 (WORD)

e-Doc 59632032 (PDF)

Canadian Nuclear Safety Commission | Commission canadienne de sûreté nucléaire

PDF Ref: e-Doc 5962032
Word Ref: e-Doc 5768606
File: 2.14

# NUCLEAR RESEARCH AND TEST ESTABLISHMENT DECOMMISSIONING LICENCE

# WHITESHELL LABORATORIES

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**I) LICENCE NUMBER:** **NRTEDL-W5-8.06/2029**

**II) LICENSEE:** Pursuant to section 24 of the *Nuclear Safety and Control Act*, this licence is issued to

**Canadian Nuclear Laboratories Ltd**
**Laboratoires Nucléaires Canadiens Ltée**
**286 Plant Road**
**Chalk River, Ontario**
**K0J 1J0**

**III) LICENCE PERIOD:** This licence is valid from January 1, 2020 and remains in effect until December 31, 2029 unless otherwise suspended, amended, revoked or replaced.

**IV) LICENSED ACTIVITIES:**

This licence authorizes the licensee to:

a) operate and decommission the Whiteshell Laboratories (hereinafter "WL") located in Pinawa, Province of Manitoba as further described in the Whiteshell Laboratories *Licence Conditions Handbook* (LCH) ,

b) produce, possess, process, refine, transfer, use, package, manage, and store the nuclear substances that are required for, associated with or arise from the activities described in a),

c) possess, use, produce and transfer prescribed equipment that is required for, associated with, or arises from the activities described in a),

d) possess, use and transfer prescribed information that is required for, associated with, or arises from the activities described in a),

e) carry out the site preparation, construction or construction modification or undertaking that is required for, associated with or arise from the activities described in a).

## V) EXPLANATORY NOTES:

(i) Nothing in this licence shall be construed to authorize non-compliance with any other applicable legal obligation or restriction.

(ii) Unless otherwise provided for in this licence, words and expressions used in this licence have the same meaning as in the *Nuclear Safety and Control Act* and associated Regulations.

(iii) The Whiteshell Laboratories Licence Conditions Handbook (LCH) provides compliance verification criteria used to verify compliance with the conditions set out in this licence, including information regarding delegation of authority and applicable versions of documents and a process for version control of codes, standards or other documents that are used as compliance verification criteria.

## VI) CONDITIONS:

### G GENERAL

G.1 The licensee shall conduct the activities described in Part IV of this licence in accordance with the licensing basis, defined as:

(i) the regulatory requirements set out in the applicable laws and regulations;

(ii) the conditions and safety and control measures described in the facility's or activity's licence and the documents directly referenced in that licence; and

(iii) the safety and control measures described in the licence application and the documents needed to support that licence application;

unless otherwise approved in writing by the Canadian Nuclear Safety Commission (hereinafter "the Commission").

G.2 The licensee shall give written notification of changes to the facility or its operation, including deviation from design, operating conditions, policies, programs and methods referred to in the licensing basis.

G.3 The licensee shall maintain a financial guarantee for decommissioning that is acceptable to the Commission.

G.4 The licensee shall implement and maintain a public information and disclosure program.

## 1 MANAGEMENT SYSTEM

1.1 The licensee shall implement and maintain a management system.

## 2 HUMAN PERFORMANCE MANAGEMENT

2.1 The licensee shall implement and maintain a human performance program.

2.2 The licensee shall implement and maintain a training program.

## 3 OPERATING PERFORMANCE

3.1 The licensee shall implement and maintain an operating program, which includes a set of operating limits.

3.2 The licensee shall implement and maintain a program for reporting to the Commission or a person authorized by the Commission.

## 4 SAFETY ANALYSIS

4.1 The licensee shall implement and maintain a safety analysis program.

4.2 The licensee shall implement and maintain a nuclear criticality safety program.

## 5 PHYSICAL DESIGN

5.1 The licensee shall implement and maintain a design program.

5.2 The licensee shall implement and maintain a pressure boundary program.

## 6 FITNESS FOR SERVICE

6.1 The licensee shall implement and maintain a fitness for service program.

## 7 RADIATION PROTECTION

7.1 The licensee shall implement and maintain a radiation protection program, which includes a set of action levels. When the licensee becomes aware that an action level has been reached, the licensee shall notify the Commission within seven days.

## 8 CONVENTIONAL HEALTH AND SAFETY

8.1 The licensee shall implement and maintain a conventional health and safety program.

## 9 ENVIRONMENTAL PROTECTION

9.1 The licensee shall implement and maintain an environmental protection program, which includes a set of action levels. When the licensee becomes aware that an action level has been reached, the licensee shall notify the Commission within seven days.

## 10 EMERGENCY MANAGEMENT AND FIRE PROTECTION

10.1 The licensee shall implement and maintain an emergency preparedness program.

10.2 The licensee shall implement and maintain a fire protection program.

## 11 WASTE MANAGEMENT

11.1 The licensee shall implement and maintain a waste management program.

11.2 The licensee shall implement and maintain a decommissioning plan.

## 12 SECURITY

12.1 The licensee shall implement and maintain a security program.

## 13 SAFEGUARDS AND NON-PROLIFERATION

13.1 The licensee shall implement and maintain a safeguards program.

## 14 PACKAGING AND TRANSPORT

14.1 The licensee shall implement and maintain a packaging and transport program.

SIGNED at OTTAWA, _____.

_____
Rumina Velshi, President
on behalf of the Canadian Nuclear Safety Commission

# DRAFT LICENCE CONDITIONS HANDBOOK

The draft Licence Conditions Handbook is provided on the following pages of the document.

e-Doc 5776240 (WORD)

e-Doc 5961981 (PDF)

Canada's Nuclear Regulator

e-Doc 5776240 (WORD)
e-Doc 5961981 (PDF)
File: 2.14

# LICENCE CONDITIONS HANDBOOK

# NRTEDL-LCH-08.06/2029

**Revision 0**

**Draft**

# WHITESHELL LABORATORIES NUCLEAR RESEARCH AND TEST ESTABLISHMENT DECOMMISSIONING LICENCE

# NRTEDL-W5-8.06/2029

Canadian Nuclear Safety Commission
Commission canadienne de sûreté nucléaire
Canada

**Licence Conditions Handbook** **Effective: Month day, year**

**(NRTEDL-LCH-08.06/2029, Revision 0)**

# Whiteshell Laboratories Nuclear Research and Test Establishment Decommissioning Licence

## NRTEDL-W5-8.06/2029 (Effective: Month day, year)



SIGNED at OTTAWA this___day of Month, 2019

_____

**Kavita Murthy, Director**

**Canadian Nuclear Laboratories Regulatory Program Division**
**Directorate of Nuclear Cycle and Facilities Regulations**
**CANADIAN NUCLEAR SAFETY COMMISSION**

## REVISION HISTORY:

| Effective Date | Rev. # | e-Doc # | Description | CAF e-Doc # |
|---|---|---|---|---|
| Month day, year | 0 | 5776240 | New document | N/A |
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# TABLE OF CONTENTS

# INTRODUCTION

The general purpose of the Licence Conditions Handbook (LCH) is to identify and clarify the relevant parts of the licensing basis for each licence condition. This will help ensure that the licensee performs the licensed activities at the Whiteshell Laboratories (WL) in accordance with the licensing basis for WL and the intent of the WL licence. The LCH should be read in conjunction with the licence.

The LCH typically has three parts under each licence condition: the Preamble, Compliance Verification Criteria (CVC), and Guidance. The Preamble explains, as needed, the regulatory context, background, and/or history related to the licence condition. CVC are criteria used by CNSC staff to verify and oversee compliance with the licence condition. Guidance is non-mandatory information, including direction, on how to comply with the licence condition.

The documents referenced in the LCH by e-Access numbers are not publicly available. The links provided in the LCH are references to the internal CNSC electronic filing system, and those documents cannot be opened from outside of the CNSC network.

Current versions of the licensing basis publications, licensee documents that require notification of change, and guidance documents referenced in the LCH are tracked in the document *Licensing Documents for Whiteshell Laboratories-WL-Specific* (e-Doc 5776580) and -*Company-Wide* (e-Doc 5507946), which are controlled by the Canadian Nuclear Laboratories Regulatory Program Division and are available to the licensee upon request.

Most CNSC documents referenced in the LCH are available through the CNSC public website. Documents listed on the CNSC website may contain prescribed information as defined by the *General Nuclear Safety and Control Regulations*. Information in these documents will be made available only to stakeholders with appropriate security clearance on a valid need to know basis.

The licensee documents referenced in the LCH are not publicly available; they contain proprietary information or prescribed information as defined by the *General Nuclear Safety and Control Regulations*.

Domestic and international standards (in particular consensus standards produced by the CSA Group) are an important component of the CNSC's regulatory framework. Standards support the regulatory requirements established through the *Nuclear Safety and Control Act* (NSCA), its regulations and licences by setting out the necessary elements for acceptable design and performance at a regulated facility or a regulated activity. Standards are one of the tools used by the CNSC to evaluate whether licensees are qualified to carry out licensed activities.

The CNSC offers complimentary access to the CSA Group suite of nuclear standards through the CNSC website. This access platform allows interested stakeholders to view these standards online through any device that can access the Internet.

Up to date lists of the nuclear and support facilities at WL that are subject to CNSC regulatory oversight, and legacy facilities that were placed under care and maintenance or undergoing decommissioning under buildings removal plans, are maintained in the CNL document 900-514300-LST-001, *Site Licences, Certificates, Permits, Facilities and Representatives*.

Appendix A to the LCH provides definitions of terms and a list of acronyms used throughout it.

More information on the LCH is available in the CNSC document titled *How to Write a Licence Conditions Handbook* (LCH) (e-Doc 4967591).

# G. GENERAL

## Licence Condition G.1: Licensing Basis

**The licensee shall conduct the activities described in Part IV of this licence in accordance with the licensing basis, defined as:**

**(i) the regulatory requirements set out in the applicable laws and regulations;**

**(ii) the conditions and safety and control measures described in the facility's or activity's licence and the documents directly referenced in that licence; and**

**(iii) the safety and control measures described in the licence application and the documents needed to support that licence application;**

**unless otherwise approved in writing by the Canadian Nuclear Safety Commission (hereinafter "the Commission").**

### Preamble:

The licensing basis sets the boundary conditions for acceptable performance at a regulated facility or activity, and thus establishes the basis for the CNSC's compliance program in respect of that regulated facility or activity. The degree to which the regulatory requirements are applied to WL facilities and activities should reflect their importance to health and safety of persons, environment, national security, international obligations to which Canada has agreed, licensee's quality and economic expectations, the complexity of facility or activity, and the possible consequences if accidents occur or the activity is carried out incorrectly.

Where the licence condition requires the licensee to implement and maintain a particular program, the licensee documents that describe and implement the program are part of the licensing basis. Programs required by licence conditions or referred to in the LCH may or may not be health, safety, security, environment, and quality programs as defined in the Canadian Nuclear Laboratories Ltd. (CNL)'s management system.

### Compliance Verification Criteria:

***Part (i) of the Licensing Basis***

Part (i) of the licensing basis refers to applicable laws and regulations. There are many federal and provincial acts and regulations, and international laws, agreements, guidelines, etc., applicable to activities performed at WL.

The laws, regulations and international agreements for which CNSC has a regulatory role are:

- *Nuclear Safety and Control Act* (NSCA) and its regulations;
- *Canadian Environmental Assessment Act*, 2012 (CEAA, 2012) and its regulations;
- *Transportation of Dangerous Goods Act* and its regulations;
- *Canada Labour Code* and *Canada Occupational Health and Safety Regulations*;
- *Nuclear Liability and Compensation Act* and its regulations;
- *Fisheries Act* (CNSC responsibilities are defined in the *Memorandum of Understanding between the CNSC and Fisheries and Oceans Canada*); and
- Canada/IAEA safeguards agreements.

All Memoranda of Understandings between the CNSC and other regulatory agencies or government departments are available on the CNSC Webpage under Acts and Regulations/Domestic Arrangements.

Through its decision of October 22, 2014, the Commission, pursuant to section 7 of the NSCA, exempted CNL from the requirements of sections 15.01 and 15.02 of the CNSC *Class II Nuclear Facilities and Prescribed Equipment Regulations* in relation to the requirement for a certified radiation safety officer (e-Doc 4543516).

***Part (ii) of the Licensing Basis***

Part (ii) of the licensing basis refers to the conditions and the safety and control measures included in the WL licence and in the documents directly referenced in the licence.

Under the standardized format and content, the WL licence requires the licensee to implement and maintain certain programs. For the purpose of meeting a licence requirement, a program may be a series of documented, coordinated activities, not necessarily a single document.

***Part (iii) of the Licensing Basis***

Part (iii) of the licensing basis refers to the safety and control measures described in the licence application and the documents needed to support that licence application. The safety and control measures include important aspects of that documentation such as, but not limited to: the facility-specific design basis and operational information documented in the most recent safety analysis and operational limits and conditions documents.

Part (iii) of the licensing basis also includes safety and control measures outlined in CNSC regulatory documents, CSA standards, and other standards, codes and references that are cited in the application or in the licensee's supporting documentation.

Applicable licensee documents are listed in the LCH under the heading "Licensee Documents that Require Notification of Change". Applicable CNSC regulatory documents, CSA standards and other documents are listed in the LCH under the heading "Licensing Basis Publications". The licensee documents listed in the LCH could cite other documents that also contain safety and control measures (i.e., there may be safety and control measures in "nested" references in the application). The licensee documents listed in the LCH and their "nested" references define the licensing basis for the programs required by the WL licence as long as they include safety and control measures.

***Regulatory Role of the Licensing Basis***

The licensing basis is established when the Commission renders its decision regarding the licence application.

Licence condition G.1 requires the licensee to conduct the licensed activities in accordance with the licensing basis. For activities that are found to be not in accordance with the licensing basis, the licensee shall take action as soon as practicable to return to a state consistent with the licensing basis, taking into account the risk significance of the situation.

The applicability of the licensing basis publications may be graded based on the specific of activity being considered.

***CNSC Staff's Approach to Assessing the Licensing Basis for Whiteshell Laboratories***

The licence condition G.1 is not intended to unduly inhibit the ongoing management and operation of the facility or the licensee's ability to adapt to changing circumstances and continuously improve, in accordance with its management system. Where the licensing basis refers to specific configurations, methods, solutions, designs, etc., the licensee is free to propose alternate approaches as long as they remain, overall, in accordance with the licensing basis and have a neutral or positive impact on health, safety, the environment, security, and safeguards. However, the licensee shall assess changes to confirm that operations remain in accordance with the licensing basis. The assessment shall be documented and made available to CNSC staff upon request.

For any proposed activity to be carried out on the WL, CNSC staff will review the information submitted by CNL to independently determine if the proposed activity remains within the licensing basis. CNSC staff assess a proposed activity as being within the licensing basis based on the hazard and risk of the change, and its impact on the overall safety of the WL.

CNSC staff will submit to the Commission for consideration any proposed activity which CNSC staff consider to be outside the licensing basis. If the Commission grants approval to such an activity, it will become part of the licensing basis for WL and reflected in updates to LCH as appropriate.

***Activities Included in the Whiteshell Laboratories Licensing Basis***

Conduct of licensed activities at WL includes:

a) operate and decommission the Whiteshell Laboratories (hereinafter "WL") located in Pinawa, Province of Manitoba as further described in the Whiteshell Laboratories Licence Conditions Handbook (LCH) ,

b) produce, possess, process, refine, transfer, use, package, manage, and store the nuclear substances that are required for, associated with or arise from the activities described in a),

c) possess, use, produce and transfer prescribed equipment that is required for, associated with, or arises from the activities described in a),

d) possess, use and transfer prescribed information that is required for, associated with, or arises from the activities described in a),

e) carry out the site preparation, construction or construction modification or undertaking that is required for, associated with or arise from the activities described in a).

A complete list of all nuclear facilities at WL is found in 900-514300-LST-001, "Site Licences, Certificates, Permits, Facilities and Representatives".

**Licence Application Documents and Supporting Documents**

| Document Number | Document Title | e-Doc |
|---|---|---|
| WLD-CNNO-18-0033-L | Application for Renewal of the Nuclear Research and Test Establishment Decommissioning Licence for the Whiteshell Laboratories | 5715784 |
| WLD-CNNO-18-0034-L | Application for Renewal of the Nuclear Research and Test Establishment Decommissioning Licence for the Whiteshell Laboratories (Supporting Information for CNSC Staff) | 5715800 |

## Guidance:

The CNSC regulatory document REGDOC-3.5.3, *Regulatory Fundamentals*, outlines the CNSC's regulatory philosophy and approach to applying the *Nuclear Safety and Control Act*. It provides information for licensees, applicants and the public, and contains neither guidance nor requirements. In particular, subsection 6.1.1 of the REGDOC-3.5.3 provides information about the licensing basis.

When the licensee becomes aware that a proposed change or activity might be outside the licensing basis, it should first seek direction from CNSC staff regarding the potential acceptability of this change or activity. The licensee should take into account that certain types of proposed changes might require significant lead times before CNSC staff can make recommendations and/or the Commission can properly consider them.

# Licence Condition G.2: Notification of Changes

**The licensee shall give written notification of changes to the facility or its operation, including deviation from design, operating conditions, policies, programs and methods referred to in the licensing basis.**

## Preamble:

Most changes to the WL and its facilities are captured as changes to corresponding licensee's documents. The LCH identifies licensee documents that require written notification of changes to the CNSC.

## Compliance Verification Criteria:

The licensee shall, as a minimum, notify CNSC staff of changes to licensee's documents identified in the LCH. The written notification of change shall include a copy of the revised document and a description of the change.

CNL program requirements documents (PRDs) and program description documents (PDDs) are accompanied by governing document indices (GDIs). The licensee shall provide updated versions of PDDs quarterly and GDIs annually or upon request from CNSC.

Licensee documents listed in the LCH are subdivided into groups having different requirements for notification of change.

| **Prior Notification Requirement** | **Definition** |
|---|---|
| Requires prior notification | The licensee shall submit the revised document to the CNSC as far in advance of planned implementation as practicable, but not less than 30 days prior to planned implementation. The licensee shall allow sufficient time for the CNSC to review the change proportionate to its complexity and the importance of the safety and control measures being affected. This is denoted by a Y in the column "prior notification".<br><br>Where a document or some part of it requires acceptance by CNSC staff prior to implementation, a footnote has been added to the notification column. |
| Requires notification at time of implementation | The licensee shall notify the CNSC at the time of implementing a revised document. This is denoted by a N in the column "prior notification". |

Changes that may affect the licensing basis, including any change that is not captured as a change to a document listed in the LCH (e.g., construction of new facilities/buildings, transitioning any facility/building from one phase of its life cycle to another, or infrastructure improvements at WL), requires written prior notification to the CNSC to verify they are in accordance with the licensing basis.

For any change that is outside the licensing basis defined in subsection G.1 of the LCH, the licensee shall obtain Commission approval before proceeding with the change.

## Guidance:

For proposed changes that would not be in accordance with the licensing basis, the guidance for licence condition G.1 applies.

# Licence Condition G.3: Financial Guarantee

**The licensee shall maintain a financial guarantee for decommissioning that is acceptable to the Commission.**

## Preamble:

The *General Nuclear Safety and Control Regulations* requires that a licence application contains "*a description of any proposed financial guarantee relating to the activity to be licensed*".

The financial guarantee for decommissioning is to be reviewed and revised by the licensee every 5 years, or; when required by the Commission or person authorized by the Commission, or; following a revision to the cost estimate for decommissioning if it significantly impacts the financial guarantee.

The financial guarantee for WL is in the form of an expressed commitment from Atomic Energy of Canada Ltd (AECL) which is a Schedule III, Part 1 Crown Corporation under the *Financial Administration Act* and an agent of Her Majesty in Right of Canada. As an agent of Her Majesty in Right of Canada, AECL's liabilities are ultimately liabilities of Her Majesty in Right of Canada. While the restructuring of AECL has seen the ownership of Canadian Nuclear Laboratories Ltd. (CNL) transferred to a private-sector contractor, the Canadian National Energy Alliance (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 July 31, 2015 (e-Doc 4803454, 4815508).

## Compliance Verification Criteria:

The financial guarantee for decommissioning shall be reviewed and revised by the licensee every 5 years, when requested by the CNSC, or following a revision to the cost estimate for decommissioning or changes to the decommissioning strategy which significantly impacts the financial guarantee.

### Licensee Documents that Require Notification of Change

| Document Number | Document Title | e-Doc | Prior Notification |
|---|---|---|---|
| 145-NRCANNO-15-0.001 | Relating to Provision of Financial Guarantees for AECL Sites | 5794303 | N/A |

## Guidance:

### Guidance Documents

| Document Number | Document Title | Version |
|---|---|---|
| G-206 | Financial Guarantee for the Decommissioning of Licensed Activities | 2000 |

# Licence Condition G.4: Public Information and Disclosure Program

**The licensee shall implement and maintain a public information and disclosure program.**

## Preamble:

*Class I Nuclear Facilities Regulations* require that an application for a licence shall contain the proposed program to inform persons living in the vicinity of the site of the general nature and characteristics of the anticipated effects on the environment and the health and safety of persons that may result from the activity to be licensed.

The primary goal of the public information program, as it relates to the licensed activities, is to ensure that information related to the health, safety and security of persons and the environment, and other issues associated with the lifecycle of nuclear facilities are effectively communicated to the public. The public information program includes a public disclosure protocol describing the information and the medium of disclosure in regard to information and reports of interest to the public.

## Compliance Verification Criteria:

### Licensing Basis Publications

| Document Number | Document Title | Version | Effective Date |
|---|---|---|---|
| RD/GD-99.3 | Public Information and Disclosure | 2012 | January 1, 2020 |

### Licensee Documents that Require Notification of Change

| Document Number | Document Title | e-Doc | Prior Notice |
|---|---|---|---|
| CW-513430-REPT-001 | Public Information Program for Canadian Nuclear Laboratories (CNL) | 5507946 | N |

## Guidance:

None provided.

# SCA – MANAGEMENT SYSTEM

## Licence Condition 1.1: Management System

**The licensee shall implement and maintain a management system.**

## Preamble:

Safe and reliable operation of nuclear facilities requires a commitment and adherence to a set of management system principles and, consistent with those principles, the implementation of planned and systematic processes that achieve expected results. The management system focuses on safety in all business activities and supports the safe conduct of licensed activities at CNL.

The *Class I Nuclear Facilities Regulations* require that an application for a licence shall contain the proposed management system for the activity to be licensed, including measures to promote and support safety culture.

The *General Nuclear Safety and Control Regulations* require that a licence application contain the applicant's organizational management structure, including the internal allocation of functions, responsibilities and authority.

The management system is in place to satisfy the requirements set out in the NSCA, regulations made pursuant to the NSCA, the licence and the measures necessary to ensure that safety is of paramount consideration in the implementation of the management system. The management system promotes and supports a healthy safety culture. Characteristics of a healthy safety culture are as follows:

- Safety is a clearly recognized value;
- Accountability for safety is clear;
- Safety is integrated into all activities;
- A safety leadership process exists; and
- Safety culture is learning driven

## Compliance Verification Criteria:

### Licensing Basis Publications

| Document Number | Document Title | Version | Effective Date |
|---|---|---|---|
| CSA N286 | Management system requirements for nuclear facilities | 2012 (R2017) | January 1, 2020 |
| CSA N286.6 | Decommissioning Quality Assurance for Nuclear Power Plants | 1998 (R2003) | January 1, 2020 |
| REGDOC-2.1.2 | Management System: Safety Culture | 2018 | January 1, 2020 |

### Licensee Documents that Require Notification of Change

| Document Number | Document Title | e-Doc | Prior Notice |
|---|---|---|---|
| 900-514100-MAN-001 | Management System Manual | 5507946 | Y |
| 900-514200-MAN-001 | Quality Assurance | 5507946 | N |
| 900-514100-LST-001 | Functional Authorities | 5507946 | N |

| | | | |
|---|---|---|---|
| 900-514300-LST-001 | Site Licences, Certificates, Permits, Facilities and Licence Representatives | 5507946 | N |
| 900-513000-LST-001 | Codes, Regulations, Standards, and other Documents | 5507946 | N |
| WLD-508300-QAP-001 | Whiteshell Laboratories Decommissioning QA Plan | 5776580 | Y |

## Guidance:

### Guidance Documents

| Document Number | Document Title | Version |
|---|---|---|
| CSA N286.0.1 | Commentary on N286-12, Management system requirements for nuclear facilities | 2014 |

# SCA – HUMAN PERFORMANCE MANAGEMENT

## Licence Condition 2.1: Human Performance Program

**The licensee shall implement and maintain a human performance program.**

## Preamble:

Human performance is the outcome of human behaviours, functions and actions in a specified environment, reflecting the ability of workers and management to meet the system's defined performance under the conditions in which the system will be employed.

Human factors are factors that influence human performance as it relates to the safety of a nuclear facility or activity over all the phases, including design, operation, maintenance, and decommissioning. These factors may include the characteristics of the person, task, equipment, organization, environment, and training. The application of human factors to issues such as interface design, training, procedures, organization and job design may affect the reliability of humans performing tasks under various conditions.

The human performance program addresses and integrates the range of human factors that influence human performance, including but not limited to:

- The provision of qualified workers;
- The reduction of human error;
- Organizational support for safe work activities;
- The continuous improvement of human performance; and
- Monitoring hours of work.

The *General Nuclear Safety and Control Regulations* require the licensee to: ensure the presence of sufficient number of qualified staff; train the workers; and ensure the workers follow procedures and safe work practices.

The *Class I Nuclear Facilities Regulations* require that an application for a licence shall contain the proposed human performance program for the activity to be licensed, including measures ensure workers fitness for duty.

## Compliance Verification Criteria:

### Licensing Basis Publications

| Document Number | Document Title | Version | Effective Date |
|---|---|---|---|
| REGDOC-2.2.4 | Fitness for Duty: Managing Worker Fatigue | 2017 | January 1, 2020 |
| RD-363 | Nuclear Security Officer Medical, Physical, and Psychological Fitness | 2008 | January 1, 2020 |
| REGDOC-2.2.4 | Fitness for Duty, Volume II: Managing Alcohol and Drug Use, version 2 | 2017 | TBD |

### Licensee Documents that Require Notification of Change

| Document Number | Document Title | e-Doc | Prior Notice |
|---|---|---|---|
| 900-514000-PDD-001 | Program Description Document: Performance Assurance | 5507946 | N |

| | | | |
|---|---|---|---|
| 900-514000-PRD-001 | Program Requirements Document: Performance Assurance | 5507946 | Y |

## Guidance:

### Guidance Documents

| Document Number | Document Title | Version |
|---|---|---|
| G-323 | Ensuring Presence of Sufficient Qualified Staff at Class I Nuclear Facilities: Minimum Staff Complement | 2007 |

# Licence Condition 2.2: Training Program

**The licensee shall implement and maintain a training program.**

## Preamble:

This licence condition requires the licensee to develop and implement training programs for workers.

It also provides the requirements regarding the program and processes necessary to support responsibilities of, qualifications and requalification training of persons at the nuclear facility.

As defined by the *General Nuclear Safety and Control Regulations*, a worker is a person who performs work that is referred to in a licence. This includes contractors and temporary employees. Training requirements apply equally to these types of workers as to the licensee's own employees.

The *General Nuclear Safety and Control Regulations* require that licensees ensure that there are a sufficient number of properly trained and qualified workers to safely conduct the licensed activities.

The *Class I Nuclear Facilities Regulations* require that applicants for a Class I facility licence describe the training programs which have been implemented, and that licence applications include the proposed responsibilities, qualification requirements, training program and requalification program for workers; along with the results that have been achieved in implementing the program for recruiting, training and qualifying workers.

## Compliance Verification Criteria:

### Licensing Basis Publications

| Document Number | Document Title | Version | Effective Date |
|---|---|---|---|
| REGDOC-2.2.2 | Personnel Training, version 2 | 2016 | January 1, 2020 |

### Licensee Documents that Require Notification of Change

| Document Number | Document Title | e-Doc | Prior Notice |
|---|---|---|---|
| 900-510200-PDD-001 | Program Description Document: Training and Development | 5507946 | N |
| 900-510200-PRD-001 | Program Requirements Document: Training and Development | 5507946 | Y |

The licensee shall ensure that all workers are qualified to perform the duties and tasks required of their position.

## Guidance:

None provided.

# SCA – OPERATING PERFORMANCE

## Licence Condition 3.1: Operating Program

**The licensee shall implement and maintain an operating program, which includes a set of operating limits.**

## Preamble:

The *Class I Nuclear Facilities Regulations* require that a licence application contain the proposed measures, policies, methods and procedures for safely operating and maintaining the nuclear facility.

The operational limits and conditions for WL are currently documented in

- Facility Authorizations, and
- laboratory protocols, criticality safety documents and other documents for other workplaces where operations with fissionable materials are performed involving handling, use, processing, movement and storage

## Compliance Verification Criteria:

### Licensee Documents that Require Notification of Change

| Document Number | Document Title | e-Doc | Prior Notice |
|---|---|---|---|
| 900-505240-PDD-001 | Program Description Document: Construction | 5507946 | N |
| 900-505240-PRD-001 | Program Requirements Document: Construction | 5507946 | Y |
| 900-505250-PDD-001 | Program Description Document: Commissioning | 5507946 | N |
| 900-505250-PRD-001 | Program Requirements Document: Commissioning | 5507946 | Y |
| AECL-FA-22 | Facility Authorization for the Operation of the Concrete Canister Storage Facility at Whiteshell Laboratories | 5776580 | Y[1] |
| AECL-FA-25 | Facility Authorization for the Operation of the Active Liquid Waste Treatment Centre at Whiteshell Laboratories | 5776580 | Y[1] |
| WLSF-00583-FA-001 | Facility Authorization for the Operation of the Shielded Facilities at Whiteshell Laboratories | 5776580 | Y[1] |
| WLWMA-00583-FA-001 | Facility Authorization for the Operation of the Waste Management Area at Whiteshell Laboratories | 5776580 | Y[1] |

[1] Notification is required only for non-administrative changes. If administrative changes are made, the licensee shall provide updated facility authorizations to CNSC staff at the end of the next quarter.

***WL Facilities Operations***

The operational limits and conditions shall define the conditions that must be met to prevent situations or events that might lead to accidents, or to mitigate the consequences of accidents should they occur. The updated operational limits and conditions shall be based on safety analyses.

Limits and conditions for normal operation shall include limits on operating parameters, stipulation for minimum amount of operable equipment, actions to be taken by the operating staff in the event of deviations from the operational limits and conditions, and the time allowed for completing these actions.

The licensee shall review, revise and reissue as appropriate the operational limits and conditions when required due to changes in technologies, regulations, operational information or physical configuration.

***Construction and operation of New Nuclear Facilities***

The licensee may construct or install facilities, buildings, structures, components or equipment only if that construction or installation is compliant with the licensing basis.

***Facilities in Permanent Safe Shutdown State***

The licensee shall develop and maintain storage-with-surveillance plans (SWS plans) for Class I and Class II nuclear facilities in permanent safe shutdown state. The licensee shall maintain those facilities in permanent safe shutdown state according to the SWS plan for the facility. The SWS plans may also be combined with DDPs when the decommissioning is taking place in several phases.

***Facilities under Decommissioning***

See LCH Section 11.2 for details regarding the decommissioning of individual facilities at WL.

***Modifications to Facilities and Processes***

The licensee shall ensure that modifications to WL facilities do not negatively impact safe operation of the facility. The licensee shall define the process for making permanent or temporary modifications to operational limits and conditions. Such modifications shall be justified by analyses and safety reviews.

The licensee may only modify facilities, buildings, structures, components or equipment in compliance with the licensing basis.

The licensee shall ensure that:

(a) all temporary modifications are identified at the point of application and at any relevant control positions;
(b) operating personnel are informed of any modifications and their consequences for facility operations;
(c) the temporary modifications are reviewed and approved before installation; the review shall be documented to demonstrate the scope and conclusion of the review;
(d) the number of simultaneous temporary modifications is kept to a minimum;
(e) the duration of temporary modifications is limited and specified prior to implementation;
(f) testing is performed after installation and removal of the temporary modification;
(g) temporary modifications are shown on affected documents; and
(h) the facility is returned to the original state when the temporary modification is no longer needed.

***Sealed Sources***

The licensee shall ensure the sealed sources are controlled (by maintaining an inventory of sealed sources, and tracking and reporting their transfer) in order to achieve the objectives stated in paragraph 5.(a) of section II of IAEA's *Code of Conduct on the Safety and Security of Radioactive Sources*.

The inventory of sealed sources shall contain all sealed sources, both in use and in storage, of any category of sources as defined in Table 1 of the IAEA safety guide RS-G-1.9 *Categorization of Radioactive Sources*. The licensee shall provide details of their inventory at the CNSC staff's request.

## Guidance:

None provided.

# Licence Condition 3.2: Reporting Requirements

**The licensee shall implement and maintain a program for reporting to the Commission or a person authorized by the Commission.**

## Preamble:

This licence condition sets the requirements for reporting information to CNSC, including compliance monitoring and operational performance, event reporting, and various types of notifications.

Many reportable occurrences included in REGDOC-3.1.2 do not necessarily show a degradation of licensee's performance, and do not fall under CNSC definition of a "reportable event" as included in REGDOC-3.6 Glossary of CNSC Terminology.

## Compliance Verification Criteria:

### Licensing Basis Publications

| Document Number | Document Title | Version | Effective Date |
|---|---|---|---|
| REGDOC-3.1.2 | Reporting Requirements, Volume I: Non-Power Reactor Class I Nuclear Facilities and Uranium Mines and Mills | 2018 | January 1, 2020 |

### Licensee Documents that Require Notification of Change

| Document Number | Document Title | e-Doc | Prior Notice |
|---|---|---|---|
| 900-514300-MCP-006 | CNL Reporting to Regulatory Agencies | 5507946 | N |

***Compliance Monitoring: Annual Reporting***

The licensee shall by the following dates submit to the Commission or any person authorized by the Commission, the following reports covering the preceding calendar year as follows:

1) By April 30th of each year:

   a) the operation and maintenance of the following facilities: Concrete Canister Storage Facility, Active-Liquid Waste Treatment Centre, Shielded Facilities, Waste Management Area, Building 300 (Research and Development) and Building 402 (Health and Safety), summarizing facility and equipment performance and changes, changes to operating policies, changes in organization, reportable events, personnel radiation exposures, releases of nuclear substances from the facilities, and releases of hazardous substances from the facilities;

   b) the status of the WR-1 Reactor, summarizing facility and equipment performance and changes, changes to operating policies, changes in organization, reportable events, personnel radiation exposures, releases of nuclear substances from the facilities, and releases of hazardous substances from the facilities;

   c) a summary of changes to non-nuclear facilities and structures;

   d) decommissioning activities associated with the following facilities: Concrete Canister Storage Facility, Active-Liquid Waste Treatment Centre, Shielded Facilities, Waste Management Area, Building 300 (Research and Development), Building 402 (Health and Safety) and WR-1 reactor, summarizing facility and equipment performance and changes, changes to operating policies, changes in organization, reportable events, personnel radiation exposures,

releases of nuclear substances from the facilities, and release of hazardous substances from the facilities;

e) changes to emergency authorities and organization, updates or changes to the radiation emergency procedures, status/changes in other program documentation, training activities, drill and exercise activities, status of emergency resources and facilities, interactions with outside agencies, and unplanned events in which the emergency response organization has been tested;

f) the results of the effluent monitoring for nuclear substances, hazardous substances and personnel radiation exposures for WL.

2) By June 30th of each year:

a) the results of environmental monitoring for nuclear and hazardous substances;

b) the results and activities of the Environmental Assessment Follow-Up Program for Whiteshell Laboratories.

3) If an action level has been reached as set out in LC 7.1 and 9.1, the licensee shall submit a final written report of the matter within 45 days of becoming aware of the matter.

## Guidance:

***Event Reporting***

To encourage reporting of situations or events that may result in improvement actions, event reporting should not be used as a tool for assessing or measurement of nuclear safety, or as a basis for assessing the licensee's performance.

For low safety significance events where CNL has already provided a preliminary report verbally and where no significant additional information is likely to be determined from further investigation, CNL may elect to combine the submission of a written preliminary report with a written full report. CNSC staff may request additional information to be provided in order to achieve regulatory close out.

***Compliance Monitoring: Annual Reporting***

The annual reports should follow, where appropriate, the format and content presented in Appendix B of REGDOC-3.1.2.

# SCA – SAFETY ANALYSIS

## Licence Condition 4.1: Safety Analysis Program

**The licensee shall implement and maintain a safety analysis program.**

## Preamble:

All event sequences which can occur in a nuclear facility must be analyzed to ensure safe operation. A deterministic safety analysis evaluates the facility's responses to such events by using predetermined rules and assumptions. The objectives of the deterministic safety analysis are stated in CSA N292.0.

The *General Nuclear Safety and Control Regulations* require that a licence application contain a description and the results of any analyses performed.

The *Class I Nuclear Facilities Regulations* require, amongst other requirements, that an application for a licence to operate a Class I nuclear facility contains a final safety analysis report, and additional supporting information.

The licensee holds the responsibility for ensuring that the safety analysis is accurate and meets the regulatory requirements, and shall maintain adequate capability to perform or procure safety analysis and to train safety analysts.

## Compliance Verification Criteria:

### Licensing Basis Publications

For compliance verification criteria for Safety Analysis refer to the CSA N292 series documents in LCH Section 11.1.

### Licensee Documents that Require Notification of Change

| Document Number | Document Title | e-Doc | Prior Notice |
|---|---|---|---|
| 900-508770-PDD-001 | Program Description Document: Safety Analysis | 5507946 | N |
| 900-508770-PRD-001 | Program Requirements Document: Safety Analysis | 5507946 | Y |
| RC-1021 | Whiteshell Laboratories Active Liquid Waste Treatment Centre Safety Analysis Report | 5507946 | Y[1] |
| RC-983 | Whiteshell Laboratories Concrete Canister Storage Facility Safety Analysis Report | 5507946 | Y[1] |
| WLSF-03500-SAR-001 | Safety Analysis Report Whiteshell Laboratories Shielded Facilities | 5507946 | Y[1] |
| WLWMA-508640-SAR-001 | Safety Analysis Report for the Whiteshell Laboratories Waste Management Area | 5507946 | Y[1] |
| WLDP-36410-SAR-001 | Safety and Hazards Analysis for the Shielded Modular Above-Ground Storage Facilities at Whiteshell Laboratories | 5507946 | Y[1] |

[1] Notification is required only for non-administrative changes. If administrative changes are made, the licensee shall provide updated safety analyses to CNSC staff at the end of the next quarter.

## Guidance:

**Guidance Documents**

| Document Number | Document Title | Version |
|---|---|---|
| IAEA SSR-4 | Safety of Nuclear Fuel Cycling Facilities | 2017 |
| IAEA TECDOC-1267 | Procedures for Conducting Probabilistic Safety Assessment for Non-reactor Nuclear Facilities | 2002 |
| IAEA GSR Part 4, Rev. 1 | Safety Assessment for Facilities and Activities | 2016 |

# Licence Condition 4.2: Nuclear Criticality Safety Program

**The licensee shall implement and maintain a nuclear criticality safety program.**

## Preamble:

This licence condition requires the licensee to develop, implement and maintain a nuclear criticality safety program to ensure that the upper subcritical limits established in the criticality safety documents will not be exceeded under both normal and credible abnormal conditions (events or event sequences having the frequency of occurrence equal to or more than $10^{-6}$/year) during operations with fissionable materials outside reactors.

## Compliance Verification Criteria:

### Licensing Basis Publications

| Document Number | Document Title | Version | Effective Date |
|---|---|---|---|
| REGDOC 2.4.3 | Nuclear Criticality Safety | 2018 | January 1, 2020 |

### Licensee Documents that Require Notification of Change

| Document Number | Document Title | e-Doc | Prior Notice |
|---|---|---|---|
| 900-508550-PDD-001 | Program Description Document: Nuclear Criticality Safety | 5507946 | N |
| 900-508550-PRD-001 | Program Requirements Document: Nuclear Criticality Safety | 5507946 | Y |

For legacy activities or projects, the licensee may implement the requirements of the nuclear criticality safety on a graded approach, with appropriate criteria for categorization according to their safety significance. The legacy items are those nuclear criticality safety related activities and projects where work has begun prior to November 1, 2011.

## Guidance:

None provided.

# SCA – PHYSICAL DESIGN

## Licence Condition 5.1: Design Program

**The licensee shall implement and maintain a design program.**

## Preamble:

The *Class I Nuclear Facilities Regulations* require that a licence application contain a description of the structures, systems and components, and relevant documentation of the facility design.

A design program ensures that the facility design is managed using a well-defined systematic approach.

Implementing and maintaining a design program confirms that safety-related SSCs and any modifications to them continue to meet their design bases given new information arising over time and taking changes in the external environment into account. It also confirms that SSCs continue to be able to perform their safety functions under all facility states. An important cross-cutting element of a design program is design basis management.

## Compliance Verification Criteria:

### Licensing Basis Publications

| Document Number | Document Title | Version | Effective Date |
|---|---|---|---|
| CSA N393 | Fire Protection for Facilities that Process, Handle, or Store Nuclear Substances | 2013 (2016) | January 1, 2020 |
| | National Fire Code of Canada | 2010 | January 1, 2020 |
| | National Fire Code of Canada | 2015 | TBD |
| | National Building Code of Canada | 2010 | January 1, 2020 |
| | National Building Code of Canada | 2015 | TBD |

### Licensee Documents that Require Notification of Change

| Document Number | Document Title | e-Doc | Prior Notice |
|---|---|---|---|
| 900-508120-PDD-001 | Program Description Document: Design Authority and Design Engineering | 5507946 | N |
| 900-508120-PRD-001 | Program Requirements Document: Design Authority and Design Engineering | 5507946 | Y |
| 900-508120-LST-001 | Design Authorities | 5507946 | N |

## Guidance:

### Guidance Documents

| Document Number | Document Title | Version |
|---|---|---|
| G-276 | Human Factors Engineering Program Plans | 2003 |
| G-278 | Human Factors Verification and Validation Plans | 2003 |

# Licence Condition 5.2: Pressure Boundary Program

**The licensee shall implement and maintain a pressure boundary program.**

## Preamble:

A pressure boundary program is comprised of the many programs, processes and procedures and associated controls that are required to ensure compliance with CSA standard N285.0, which defines the technical requirements for the design, procurement, fabrication, installation, modification, repair, replacement, testing, examination and inspection of pressure-retaining and containment systems, including their components and supports.

## Compliance Verification Criteria:

### Licensing Basis Publications

| Document Number | Document Title | Revision | Effective Date |
|---|---|---|---|
| CSA N285.0 | General requirements for pressure-retaining system and components in CANDU nuclear power plants | 2008 | January 1, 2020 |
| CSA N285.0 | General requirements for pressure-retaining system and components in CANDU nuclear power plants | 2017 | TBD |
| CSA B51 | Boiler, Pressure Vessel and Pressure Piping Code | 2003 (R2014) | |

### Licensee Documents that Require Notification of Change

| Document Number | Document Title | e-Doc | Prior Notice |
|---|---|---|---|
| 900-508140-PDD-001 | Program Description Document: Pressure Boundary | 5507946 | N |
| 900-508140-PRD-001 | Program Requirements Document: Pressure Boundary | 5507946 | Y |
| WLD-508140-PRO-001 | Code Classification and Design Registration of Pressure – Retaining System/Components | 5776580 | Y |
| WL-508140-QAM-001 | Pressure Boundary Quality Assurance Manual | 5776580 | Y |

For the Whiteshell Laboratories, compliance with this licence condition will be assessed by the following;

a) Subject to b) and c) below, the licensee shall design, manufacture, fabricate, procure, install, modify, repair, test, examine, inspect or otherwise perform work related to vessels, boilers, systems, piping, fittings, parts, components and supports according to the specifications in CSA standards N285.0-08, B51-03 (R2014) or other codes and standards approved or prescribed by the Commission.

Where indicated by these standards, the licensee shall obtain the following regulatory approvals for this work:

i) registered designs;

ii) accepted overpressure protection reports;

iii) approval of applicable standards and code classification;

iv) registered welding and brazing procedures;

v) qualified welders, welding operators, brazers and examination personnel;

vi) accepted quality assurance programs; and

vii) accepted plans and procedures (certificate(s) of authorization).

b) CNL may classify as Class 6 systems or sections of systems that contain tritium or other radioactive substances, if the consequence of failure limit of 20 mSv effective acute whole body dose is not exceeded.

c) CNL shall carry out the activities listed in a) above in accordance with B51-03 (R2014), or other codes and standards approved or prescribed by the Commission, for pressure boundary systems and components that do not contain nuclear substances, do not adversely impact a nuclear safety system, or do not cause an unreasonable risk involving nuclear substances at WL.

d) CNL shall operate vessels, boilers, systems, piping, fittings, parts, components, and supports safely and keep them in a safe condition. The licensee shall:

i) follow accepted plans and procedures to test, maintain, or alter overpressure protection devices;

ii) comply with operating limits specified in certificates, orders, designs, overpressure protection reports, and applicable codes and standards;

iii) inspect and perform material surveillance according to accepted schedules, plans and procedures;

iv) have any certified boiler or vessel that is in operation or use inspected and certified by an authorized inspector according to an accepted schedule; and

v) ensure that vessels, boilers, systems, piping, fittings, parts, components and supports have markings, as specified in the applicable standards.

e) CNL shall keep proper records of regulatory approvals and other documents required as set out in a) through d), and the standards applicable to the work or equipment.

f) In addition to any reporting requirements of the *Nuclear Safety and Control Act* and its associated Regulations, CNL shall report promptly to the Commission and to the Manitoba Department of Labour and Immigration when the licensee learns of any failure of a pressure boundary that has caused injury, death or property damage.

## Guidance:

**Guidance Documents**

| Document Number | Document Title | Version |
|---|---|---|
| CSA N285.0.1 | Commentary on CSA N285.0-12, General requirements for pressure-retaining systems and components in CANDU nuclear power plants | 2016 |

# SCA – FITNESS FOR SERVICE

## Licence Condition 6.1: Fitness for Service Program

**The licensee shall implement and maintain a fitness for service program.**

## Preamble:

The *Class I Nuclear Facilities Regulations* requires that a licence application contain the proposed measures, policies, methods and procedures to maintain the nuclear facility.

## Compliance Verification Criteria:

### Licensee Documents that Require Notification of Change

| Document Number | Document Title | e-Doc | Prior Notice |
|---|---|---|---|
| 900-508230-PDD-001 | Program Description Document: Maintenance and Work Management | 5507946 | N |
| 900-508230-PRD-001 | Program Requirements Document: Maintenance and Work Management | 5507946 | Y |
| WLD-106100-PLA-001 | Periodic Inspection Plan for Whiteshell Laboratories Waste Management Area Concrete Bunkers | 5776580 | Y |

## Guidance:

### Guidance Documents

| Document Number | Document Title | Version |
|---|---|---|
| REGDOC-2.6.3 | Aging Management | 2014 |

# SCA – RADIATION PROTECTION

## Licence Condition 7.1: Radiation Protection Program

**The licensee shall implement and maintain a radiation protection program, which includes a set of action levels. When the licensee becomes aware that an action level has been reached, the licensee shall notify the Commission within seven days.**

## Preamble:

The Radiation Protection Regulations (RPR) requires that the licensee implement a radiation protection program and also ascertain and record doses for each person who performs any duties in connection with any activity that is authorized by the NSCA or is present at a place where that activity is carried out. This program must ensure that doses to persons do not exceed prescribed dose limits and are kept as low as reasonably achievable (ALARA), social and economic factors being taken into account. Also, the program ensures that occupational exposures are ascertained and recorded in accordance with the Radiation Protection Regulations through the establishment of dosimetry requirements.

The regulatory dose limits to workers and the public are explicitly provided in the RPR. The RPR also specifies the requirements related to action levels (ALs) and indicate that the licence will be used to identify their notification timeframes. ALs relate to the parameters of dose to workers.

ALs are designed to alert licensees before regulatory dose limits are reached. By definition, if an AL is reached, a loss of control of some part of the associated radiation protection program may have occurred, and specific action is required, as defined in the RPR and the licence. ALs are not intended to be static and are to reflect prevailing circumstances at the WL site.

## Compliance Verification Criteria:

### Licensee Documents that Require Notification of Change

| Document Number | Document Title | e-Doc | Prior Notice |
|---|---|---|---|
| 900-508740-PDD-001 | Program Description Document: Radiation Protection | 5507946 | N |
| 900-508740-PRD-001 | Program Requirements Document: Radiation Protection | 5507946 | Y |
| 900-508740-MCP-006 | Action Levels for Internal and External Exposures | 5507946 | Y |
| 900-508740-MCP-007 | Dose Control Points | 5507946 | N |
| 900-508740-MCP-026 | ALARA Review and Assessment - Planning and Control of Radiation Work | 5507946 | N |
| 900-508740-STD-005 | Design and Modification Considerations | 5507946 | N |
| 900-508740-STD-012 | Contamination Levels | 5507946 | N |

## Guidance:

### Guidance Documents

| Document Number | Document Title | Version |
|---|---|---|

| | | |
|---|---|---|
| G-129, Rev. 1 | Keeping Radiation Exposures and Doses "As Low as Reasonably Achievable (ALARA)" | 2004 |
| G-228 | Developing and Using Action Levels | 2001 |
| G-91 | Ascertaining and Recording Radiation Doses to Individuals | 2003 |
| GD-150 | Designing and Implementing a Bioassay Program | 2014 |

The licensee should conduct a documented review and, if necessary, revise the ALs at least once every five years in order to validate their effectiveness. The results of such reviews should be provided to CNSC staff.

# SCA – CONVENTIONAL HEALTH AND SAFETY

## Licence Condition 8.1: Conventional Health and Safety Program

**The licensee shall implement and maintain a conventional health and safety program.**

## Preamble:

The *Class I Nuclear Facilities Regulations* requires that a licence application contain the proposed worker health and safety policies and procedures.

As a federal regulated site, WL is also subject to the requirements of *Canada Labour Code* and *Canada Occupational Health and Safety Regulations*.

## Compliance Verification Criteria:

**Licensee Documents that Require Notification of Change**

| Document Number | Document Title | e-Doc | Prior Notice |
|---|---|---|---|
| 900-510400-PDD-001 | Program Description Document: Occupational Safety and Health | 5507946 | N |
| 900-510400-PRD-001 | Program Requirements Document: Occupational Safety and Health | 5507946 | Y |

The *Ministry of Employment, Workforce Development and Labour* is mandated with overseeing and enforcing compliance with the *Canada Labour Code* and its regulations.

## Guidance:

None provided.

# SCA – ENVIRONMENTAL PROTECTION

## Licence Condition 9.1: Environmental Protection Program

**The licensee shall implement and maintain an environmental protection program, which includes a set of action levels. When the licensee becomes aware that an action level has been reached, the licensee shall notify the Commission within seven days.**

## Preamble:

The *Class I Nuclear Facilities Regulations* requires that a licence application contain information related to environmental protection. The *General Nuclear Safety and Control Regulations* requires every licensee to take all reasonable precautions to protect the environment. The *Radiation Protection Regulations* prescribe the radiation dose limits for the general public of 1 mSv per calendar year.

The *Radiation Protection Regulations* specify requirements related to "Action Levels" and indicate that the licence will be used to identify the action levels and the notification timeframes.

The release of hazardous substances is regulated by Environment and Climate Change Canada through various acts and regulations, as well as by the CNSC.

The environmental protection SCA includes the following:

- Effluent and emissions control (releases);
- Environmental management system (EMS);
- Assessment and monitoring;
- Protection of the public; and
- Environmental Risk Assessment.

Action levels (ALs) for environmental releases are calculated by the licensees and aim to alert licensees of a potential loss of control of their environmental protection program. By definition, if an action level is reached, a loss of control of some part of the associated environmental protection program may have occurred, and specific action is required. ALs are not intended to be static and are to reflect operating conditions at the WL site.

## Compliance Verification Criteria:

The licensee will implement and maintain programs to ensure environmental protection as set out in licensing basis (LCH Section 1.1).

CSA N286, included in LCH Section 1.1, defines other specific compliance verification criteria that support environmental protection.

### Licensing Basis Publications

| Document Number | Document Title | Version | Effective Date |
|---|---|---|---|
| REGDOC-2.9.1 | Environmental Principles, Assessments and Protection Measures, version 1.1 | 2017 | Jan 1, 2020 |
| N288.4 | Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills | 2010 (R2015) | Jan 1, 2020 |
| N288.5 | Effluent monitoring programs at Class I nuclear facilities and uranium mines and mills | 2011 (R2016) | Jan 1, 2020 |

| Document Number | Document Title | Version | Effective Date |
|---|---|---|---|
| N288.6 | Environmental risk assessment at Class I nuclear facilities and uranium mines and mills | 2012 (R2017) | January 1, 2020 |
| N288.7 | Groundwater protection programs at Class I nuclear facilities and uranium mines and mills | 2015 | Jan 1, 2020 |
| N288.8 | Establishing and implementing action levels to control releases to the environment from nuclear facilities | 2017 | Jan 1, 2020 |

**Licensee Documents that Require Notification of Change**

| Document Number | Document Title | e-Doc | Prior Notice |
|---|---|---|---|
| 900-509200-PDD-001 | Program Description Document: Environnemental Protection | 5507946 | N |
| 900-509200-PRD-001 | Program Requirements Document: Environnemental Protection | 5507946 | Y |
| WL-509200-PRO-001 | Administrative Levels and Action Levels for WL Air and Liquid Radioactive Effluents | 5776580 | Y |
| WL-509211-RRD-001 | Derived Release Limits for AECL's Whiteshell Laboratories | 5776580 | Y |
| WL-509200-OV-001 | Whiteshell Laboratories Integrated Monitoring Program Framework | 5776580 | N |
| WL-509200-PLA-001 | WL Effluent Verification Monitoring Plan | 5776580 | Y |
| AECL Document No 03704 001 | Environmental Assessment Follow up Program for Whiteshell Laboratories | 5776580 | Y |

The licensee will implement all follow-up actions identified as a result of environmental assessments, and shall report the progress to CNSC staff on an annual basis.

The licensee will ensure effluent monitoring for nuclear and hazardous substances is designed, implemented and managed to respect applicable laws/regulation and to incorporate best practices. The effluent monitoring program will provide for control of airborne and waterborne effluents. The licensee will control, monitor and record releases of radioactive and/or hazardous substances such that the releases do not exceed the reference levels (limits).

The licensee will establish the DRLs in accordance with CSA N288.1. The dose to the critical group due to the sum of all radioactive releases shall not exceed 1 mSv.

The licensee will conduct an updated site-wide environmental risk assessment (ERA) in accordance with the CSA Standard N288.6-12 *Environmental Risk Assessment at Class I Nuclear Facilities and Uranium Mines and Mills* taking into account current conditions at the WL site.

The licensee will control radiological releases to ALARA, within the DRLs, and take action to investigate and correct the cause(s) of increased releases should they occur. The licensee shall report the releases in accordance with LCH Section 3.2.

## Guidance:

**Guidance Documents**

| Document Number | Document Title | Version |
|---|---|---|
| CSA N288.1 | Guidelines for calculating derived release limits for radioactive material in airborne and liquid effluents for normal operation of nuclear facilities | 2014 (Update 3) |
| CSA N288.2 | Guidelines for calculating the radiological consequences to the public of a release of airborne radioactive material for nuclear reactor accidents | 2014 |

# SCA – EMERGENCY MANAGEMENT AND FIRE PROTECTION

## Licence Condition 10.1: Emergency Preparedness Program

**The licensee shall implement and maintain an emergency preparedness program.**

## Preamble:

This licence condition requires the licensee to establish an emergency preparedness program to prepare for, to respond to, and to recover from the effects of accidental radiological/nuclear and/or hazardous substance release. As part of the emergency preparedness program, the licensee establishes an onsite emergency response plan and an emergency response organization and makes arrangements for coordinating off-site activities and cooperating with external response organizations throughout all phases of an emergency.

The Class I *Nuclear* Facilities Regulations requires measures to prevent or mitigate the effects of accidental releases of nuclear substances and hazardous substances on the environment, the health and safety of persons and the maintenance of national security, including measures to assist, notify, report to off-site authorities including the testing of the implementation of these measures.

A security response to malevolent acts is governed by a separate plan under the Nuclear Security program (see LCH Section 12.1) but provisions of the licensee site security report apply to any associated potential threat of release of radioactive material - for example, the need for off-site notification, situation updates and confirmation of any radioactive releases.

Liquid release response and radioactive materials transportation emergency response plan are also governed by separate plans (See LCH Sections 9.1 and 14.1, respectively).

WL has a communication program that covers a broad spectrum – community interface meetings, newsletters, websites, committees and various panels.

WL provides the local municipalities and the province (as required, federal) with hazard information that can be used for community communications during an emergency.

## Compliance Verification Criteria:

### Licensing Basis Publications

| Document Number | Document Title | Version | Effective Date |
|---|---|---|---|
| REGDOC-2.10.1 | Nuclear Emergency Preparedness and Response, Version 2 | 2016 | Jan 1, 2020 |

### Licensee Documents that Require Notification of Change

| Document Number | Document Title | e-Doc | Prior Notice |
|---|---|---|---|
| 900-508730-PDD-001 | Program Description Document: Emergency Preparedness | 5507946 | N |
| 900-508730-PRD-001 | Program Requirements Document: Emergency Preparedness | 5507946 | Y |
| WL-508730-ERP-001 | Whiteshell Laboratories Emergency Response Plan | 5776580 | Y |

REGDOC-2.10.1 shall be applied to WL as a whole, not to individual facilities on site. Requirements for reactor facilities with a thermal capacity greater than 10MW are not applicable.

## Guidance:

### Guidance Documents

| Document Number | Document Title | Version |
|---|---|---|
| CSA N1600 | General requirements for nuclear emergency management programs | 2016 |
| | *Canadian Guidelines for Intervention During a Nuclear Emergency* | 2003 |
| | *Canadian Guidelines for the Restriction of Radioactively Contaminated Food and Water Following a Nuclear Emergency* | 2000 |

# Licence Condition 10.2: Fire Protection Program

**The licensee shall implement and maintain a fire protection program.**

## Preamble:

Licensees require a comprehensive fire protection program to ensure the licensed activities do not result in unreasonable risk to the health and safety of persons and to the environment due to fire and to ensure that the licensee is able to efficiently and effectively respond to emergency fire situations.

Fire protection provisions, including response, are required for the design, construction, commissioning, operation, and decommissioning of nuclear facilities, including structures, systems, and components (SSCs) that directly support the plant and the protected area. External events such as an aircraft crash or security threats are addressed in LCH Section 12.1.

The *National Fire Code of Canada* sets out technical provisions regulating (a) activities related to the construction, use or demolition of buildings and facilities; (b) the condition of specific elements of buildings and facilities; (c) the design or construction of specific elements of facilities related to certain hazards; and (d) protection measures for the current or intended use of buildings.

The *National Building Code of Canada* sets out technical provisions for the design and construction of new buildings. It also applies to the alteration, change of use and demolition of existing buildings.

## Compliance Verification Criteria:

### Licensing Basis Publications

| Document Number | Document Title | Version | Effective Date |
|---|---|---|---|
| CSA N393 | Fire protection for facilities that process, handle, or store nuclear substances | 2013 (R2016) | Jan 1, 2020 |
| | *National Fire Code of Canada* | 2010 | Jan 1, 2020 |
| | *National Fire Code of Canada* | 2015 | TBD |
| | *National Building Code of Canada* | 2010 | Jan 1, 2020 |
| | *National Building Code of Canada* | 2015 | TBD |

### Licensee Documents that Require Notification of Change

| Document Number | Document Title | e-Doc | Prior Notice |
|---|---|---|---|
| 900-508720-PDD-001 | Program Description Document: Fire Protection | 5507946 | N |
| 900-508720-PRD-001 | Program Requirements Document: Fire Protection | 5507946 | Y |
| 900-508720-MCP-006 | Impairment, Notification and Compensatory Measures | 5507946 | N |

Where CSA standard N393 requires items to be submitted to CNSC for review and/or acceptance, the licensee shall document the item in sufficient detail to ensure it is safe to proceed. The licensee may implement that item without prior review and/or acceptance from CNSC staff. Changes of use or modifications for which the fire screening assessment indicates no potential impact on fire protection design basis, goals or criteria may not be subject to any further third-party review or require submission to the CNSC.

The licensee shall submit the results of third-party reviews required by CSA N393 (review of modifications, review of performance-based design or operation, fire protection program audit, and evaluation of fire response capability). The results of these reviews shall be submitted to CNSC staff no later than six months after the review together with any corrective action plans with compensatory measures for identified non-compliances.

**Fire Response**

In accordance with N393, the licensee shall arrange for third party audits of the fire response capability at the frequencies stated in N393. The purpose of a Third Party Audit is to provide an in-depth analysis of the Industrial Fire Brigade (IFB) fire response performance against applicable regulatory criteria. A fire response is a planned, coordinated and controlled activity to provide emergency response to a fire. The audit is to analyze and ensure competencies of the IFB against CSA N393 standard and the referred NFPA 600 and 1081 standards.

An independent third party auditor is required to be an expert in the discipline, normally firefighting and qualified through specific education and relevant experience. The third party auditor is required to be independent or at "arm's length" from the facility to ensure impartiality. The review shall be of sufficient depth and detail to allow the reviewer to attest with reasonable confidence on the competencies of the IFB at the facility.

## Guidance:

Where CSA N393 does not address a fire protection topic or issue in whole, or where additional guidance is beneficial, the standards and recommended practices set out by the NFPA are used as guidance by CNSC staff in determining the adequacy of a fire protection measure. The results of the Third Party Audit report will typically consist of a report which compares the requirements of the applicable codes and standards against the implementation of the fire protection program or the Fire Response exercised (based on the scope of the audit). The report should identify any non-compliance and formulate a conclusion on whether the licensee fire protection program or IFB meets the requirements of N393.

# SCA – WASTE MANAGEMENT

## Licence Condition 11.1: Waste Management Program

**The licensee shall implement and maintain a waste management program.**

### Preamble:

The scope of this licence condition covers internal waste-related programs that form part of the WL operations. Topics include waste management, waste characterization, waste minimization and waste management practices.

### Compliance Verification Criteria:

**Licensing Basis Publications**

| Document Number | Document Title | Version | Effective Date |
|---|---|---|---|
| CSA N292.0 | General principles for the management of radioactive waste and irradiated fuel | 2014 | January 1, 2020 |
| CSA N292.2 | Interim dry storage of irradiated fuel | 2013 (R2015) | January 1, 2020 |
| CSA N292.3 | Management of low- and intermediate-level radioactive waste | 2014 | January 1, 2020 |
| CSA N292.6 | Long-term management of radioactive waste and irradiated fuel | 2018 | TBD |

**Licensee Documents that Require Notification of Change**

| Document Number | Document Title | e-Doc | Prior Notice |
|---|---|---|---|
| 900-508600-PDD-001 | Program Description Document: Waste Management | 5507946 | N |
| 900-508600-PRD-001 | Program Requirements Document: Waste Management | 5507946 | Y |
| CW-508600-PLA-002 | Plan: Canadian Nuclear Laboratories Integrated Waste Strategy | 5507946 | N |

The licensee shall not produce, in the course of the licensed activities, or accept from outside clients, waste for which there is no identified treatment, or storage, or disposal facility.

## Guidance:

**Guidance Documents**

| Document Number | Document Title | Version |
|---|---|---|
| REGDOC-2.11.1 | Waste Management, Volume III: Assessing the Long-Term Safety of Radioactive Waste Management | 2018 |
| CSA N292.5 | Guideline for the exemption or clearance from regulatory control of materials that contain, or potentially contain, nuclear substances | 2011 (R2017) |

# Licence Condition 11.2: Decommissioning Plan

**The licensee shall maintain a decommissioning plan.**

## Preamble:

*Class I Nuclear Facilities Regulations* requires that a licence application contain the proposed plan for decommissioning of the nuclear facility or of the site. The decommissioning plan for WL site is documented in the *Whiteshell Laboratories Detailed Decommissioning Plan – Volume 1 – Program Overview* and the associated cost estimate.

Whiteshell Laboratories is undergoing decommissioning in a staged manner. Consequently, it is noted that not all volumes of the detailed decommissioning plan have been developed, as they are developed when so required by CNL. For volumes not yet developed, decommissioning activities cannot proceed without CNSC concurrence.

## Compliance Verification Criteria:

### Licensing Basis Publications

| Document Number | Document Title | Version | Effective Date |
|---|---|---|---|
| CSA N294 | Decommissioning of facilities containing nuclear substances | 2009 (R2014) | January 1, 2020 |

### Licensee Documents that Require Notification of Change

| Document Number | Document Title | e-Doc | Prior Notice |
|---|---|---|---|
| 900-508300-PDD-001 | Program Description Document: Decommissioning and Demolition | 5507946 | N |
| 900-508300-PRD-001 | Program Requirements Document: Decommissioning and Demolition | 5507946 | Y |
| RC-1291-R1 | The Monitoring and Surveillance Plan for the WR-1 Deferment Period | 5776580 | Y |
| RC-2143-1 | Whiteshell Laboratories Detailed Decommissioning Plan – Volume 1 – Program Overview | 5776580 | Y[1] |
| WLDP-02000-DDP-001 AD | Whiteshell Laboratories Detailed Decommissioning Plan – Volume 1 – Program Overview – Addendum | 5776580 | Y[1] |
| WLDP-21400-DDP-001 | Whiteshell Laboratories Detailed Decommissioning Plan – Volume 2 - Shielded Facilities | 5776580 | Y[1] |
| WLDP-25400-DDP-001 | Whiteshell Laboratories Detailed Decommissioning Plan – Volume 5 – Active Liquid Waste Treatment Centre Building 200 | 5776580 | Y[1] |
| WLDP-26400-DDP-001 | Whiteshell Laboratories Detailed Decommissioning Plan – Volume 6 – Whiteshell Reactor #1: Building 100 | 5776580 | Y[1] |

| | | | |
|---|---|---|---|
| WLDP-22500-DDP-001 | Whiteshell Laboratories Detailed Decommissioning Plan – Volume 7 – Concrete Canister Storage Facilities (CCFS) | 5776580 | Y[1] |
| | Whiteshell Laboratories Detailed Decommissioning Plan – Volume 8 – Waste Management Area – Part 1 - Standpipes | | Y[1] |
| | Whiteshell Laboratories Detailed Decommissioning Plan – Volume 8 – Waste Management Area – Part 2 – ILW Bunkers, B417, Amine Tanks | | Y[1] |
| WLDP-24400-DDP-001 | Whiteshell Laboratories Detailed Decommissioning Plan – Volume 8 – Waste Management Area – Part 3 – Operational Structures, LLW Liabilities and WMA Grounds | | Y[1] |
| WLDP-23500-DDP-001 | Whiteshell Laboratories Detailed Decommissioning Plan – Volume 9 – Building 900 | 5776580 | Y[1] |
| WLDP-23500-DDP-001 AD | Whiteshell Laboratories Detailed Decommissioning Plan – Volume 9 – Building 900 - Addendum | 5776580 | Y[1] |
| | Whiteshell Laboratories Detailed Decommissioning Plan - Volume 11: Building 402 | 5776580 | Y[1] |
| RC-2143-12 Part 1 | Volume 12 - Whiteshell Laboratories Licensed Site Supporting and General Infrastructure, Part 1: South-Side Buildings | 5776580 | Y[1] |
| WLDP-32000-DDP-001 | Volume 12 - Whiteshell Laboratories Licensed Site Supporting and General Infrastructure, Part 2: North-Side Buildings | 5776580 | Y[1] |
| WLDP-33000-DDP-001 | Volume 12 - Whiteshell Laboratories Licensed Site Supporting and General Infrastructure, Part 3: Outer-Area Building and Facilities | 5776580 | Y[1] |
| WLDP-34000-DDP-001 | Volume 12 - Whiteshell Laboratories Licensed Site Supporting and General Infrastructure, Part 4: Site Services | 5776580 | Y[1] |
| WLDP-35000-DDP-001 | Volume 12 - Whiteshell Laboratories Licensed Site Supporting and General Infrastructure, Part 5: Site Affected Lands and Contaminated Structures | 5776580 | Y[1] |

[1] DDPs are to be reviewed and accepted by the CNSC in accordance with the requirements in CSA N294.

Note: The Whiteshell Laboratories Detailed Decommissioning Plan - Volume 3: Van de Graaff Accelerator, the Whiteshell Laboratories Detailed Decommissioning Plan - Volume 4: Neutron Generator

and the Whiteshell Laboratories Detailed Decommissioning Plan - Volume 10: Decontamination Centre Building 411 have been completely decommissioned and are therefore not listed in the above table.

***Facilities under Decommissioning***

The licensee shall conduct decommissioning activities in accordance with Volumes 1 to 12 of the Whiteshell Laboratories Detailed Decommissioning Plan. Decommissioning plans are reviewed by CNSC staff and decommissioning activities cannot proceed without CNSC concurrence.

## Guidance:

**Guidance Documents**

| Document Number | Document Title | Version |
|---|---|---|
| G-219 | Decommissioning Planning for Licensed Activities | 2000 |

# SCA – SECURITY

## Licence Condition 12.1: Security Program

**The licensee shall implement and maintain a security program.**

## Preamble:

The *General Nuclear Safety and Control Regulations* require that a licence application contain information related to site access control and measures to prevent loss or illegal use, possession or removal of the nuclear substance, prescribed equipment or prescribed information.

The *Class I Nuclear Facilities Regulations* require that a licence application contain the proposed measures to prevent acts of sabotage or attempted sabotage at the nuclear facility.

The *Nuclear Security Regulations* require that a licence application contain specific information related to nuclear security, stipulates the requirements for high-security sites, and contains specific requirements pertaining to the transportation of Category I, II or III nuclear material.

The *Nuclear Security Regulations* require that a licensee of a high security site:

- maintain at all times a qualified onsite nuclear response force;
- obtain the applicable certifications, before issuing an authorization to a nuclear security officer;
- prevent and detect unauthorized entry into a protected area or inner area; and
- prevent unauthorized entry of weapons and explosive substances into a protected area or inner area.

## Compliance Verification Criteria:

### Licensing Basis Publications

| Document Number | Document Title | Version | Effective Date |
|---|---|---|---|
| REGDOC-2.12.1 (prescribed information) | High-Security Sites, Volume I: Nuclear Response Force | 2013 | January 1, 2020 |
| REGDOC-2.12.1 (prescribed information) | High-Security Facilities, Volume II: Criteria for Nuclear Security Systems and Devices | 2018 | January 1, 2020 |
| REGDOC-2.12.2 | Site Access Security Clearance | 2013 | January 1, 2020 |
| REGDOC-2.12.3 | Security of Nuclear Substances: Sealed Sources | 2013 | January 1, 2020 |
| CSA N290.7 | Cyber-security for nuclear power plants and small reactor facilities | 2014 (R2015) | January 1, 2020 |

**Licensee Documents that Require Notification of Change**

| Document Number | Document Title | e-Doc | Prior Notice |
|---|---|---|---|
| 900-508710-PDD-001 | Program Description Document: Security | 5507946 | N |
| 900-508710-PRD-001 | Program Requirements Document: Security | 5507946 | Y |
| 900-511400-PDD-001 | Program Description Document: Cyber Security | 5507946 | N |
| 900-511400-PRD-001 | Program Requirements Document: Cyber Security | 5507946 | Y |
| EPS-14000-RPT-18 (prescribed information) | Site Security Report | 5776580 | Y |

The CSA standard N290.7 covers the cyber security of new and existing nuclear power plants (NPPs) and small reactor facilities.

The CNL document EPS-14000-RPT-18 *Site Security Report* document is required to be updated periodically and resubmitted to the CNSC staff. The site security report shall be updated and resubmitted when there are significant changes to the program.

## Guidance:

**Guidance Documents**

| Document Number | Document Title | Version |
|---|---|---|
| G-208 | Transportation Security Plans for Category I, II or III Nuclear Material | 2003 |
| G-274 | Security Programs for Category I or II Nuclear Material or Certain Nuclear Facilities | 2003 |

# SCA – SAFEGUARDS AND NON-PROLIFERATION

## Licence Condition 13.1: Safeguards Program

**The licensee shall implement and maintain a safeguards program.**

## Preamble:

Safeguards is a system of inspection and other verification activities undertaken by the International Atomic Energy Agency (IAEA) in order to evaluate a Member State's compliance with its obligations pursuant to its safeguards agreements with the IAEA.

The *General Nuclear Safety and Control Regulations* requires the licensee to take all necessary measures to facilitate Canada's compliance with any applicable safeguards agreement.

The *Class I Nuclear Facilities Regulations* requires that a licence application contain information on the licensee's proposed measures to facilitate Canada's compliance with any applicable safeguards agreement.

Canada has entered into a safeguards agreement with the IAEA pursuant to its obligations under the Treaty on the Non-Proliferation of Nuclear Weapons. The objective of the Canada/IAEA Safeguards Agreement is for the IAEA to provide assurance on an annual basis to Canada and to the international community that all declared nuclear materials are in peaceful, non-explosive uses and that there is no indication of undeclared nuclear materials or activities. This conclusion confirms that Canada is in compliance with its obligations under the following Canada/IAEA Safeguards Agreement:

- *Treaty on the Non-Proliferation of Nuclear Weapons*;
- *Agreement Between the Government of Canada and the International Atomic Energy Agency for the Application of Safeguards in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons*; and
- *Protocol Additional to the Agreement Between Canada and the International Atomic Energy Agency for the Application of Safeguards in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons*.

These are reproduced in information circulars INFCIRC/140, INFCIRC/164, and INFCIRC/164/Add. 1.

## Compliance Verification Criteria:

### Licensing Basis Publications

| Document Number | Document Title | Version | Effective Date |
|---|---|---|---|
| REGDOC-2.13.1 | Safeguards and Nuclear Material Accountancy | 2018 | January 1, 2020 |

### Licensee Documents that Require Notification of Change

| Document Number | Document Title | e-Doc | Prior Notice |
|---|---|---|---|
| 900-508510-PDD-001 | Program Description Document: Nuclear Materials and Safeguards Management | 5507946 | N |
| 900-508510-PRD-001 | Program Requirements Document: Nuclear Materials and Safeguards Management | 5507946 | Y |

The licensee shall obtain prior written approval of the CNSC, for any changes to operation, equipment or procedures requested by the licensee that would affect the implementation of safeguards measures.

## Guidance:

None Provided.

# SCA – PACKAGING AND TRANSPORT

## Licence Condition 14.1: Packaging and Transport Program

**The licensee shall implement and maintain a packaging and transport program.**

## Preamble:

The *Class I Nuclear Facilities Regulations* require that a licence application contain information on the proposed procedures for transporting nuclear substances and hazardous substances.

The transport of nuclear substances or hazardous substances must be done in accordance with the requirements of the *Packaging and Transport of Nuclear Substances Regulations, 2015*, (PTNSR) and *Transportation of Dangerous Goods Regulations* (TDGR) set out by Transport Canada.

IAEA document SSR-6 *Regulations for the Safe Transport of Radioactive Material (2018 Edition)* is incorporated by reference in PTNSR. These Regulations establish standards of safety which provide an acceptable level of control of the radiation, criticality and thermal hazards to persons, property and the environment that are associated with the transport of radioactive material.

## Compliance Verification Criteria:

### Licensing Basis Publications

| Document Number | Document Title | Version | Effective Date |
|---|---|---|---|
| IAEA SSR-6 | Regulations for the Safe Transport of Radioactive Material (2012 Edition) | 2018 | January 1, 2020 |

### Licensee Documents that Require Notification of Change

| Document Number | Document Title | e-Doc | Prior Notice |
|---|---|---|---|
| 900-508520-PDD-001 | Program Description Document: Transportation of Dangerous Goods | 5507946 | N |
| 900-508520-PRD-001 | Program Requirements Document: Transportation of Dangerous Goods | 5507946 | Y |

The licensee shall implement and maintain a packaging and transport program that will be in compliance with all the regulatory requirements set out in the Transport Canada TDGR and in the CNSC PTNSR.

Shipments of nuclear substances within the WL site where access to the property is controlled are exempted from the application of the PTNSR.

Based on the current versions of the PTNSR and TDGR, for the packaging and transport of nuclear substances

(a) to and from the WL site, both PTNSR and TDGR apply.

(b) between the WL facilities:

- according to paragraph 2(2)(*d*) of the PTNSR, the PTNSR do not apply to the transport of nuclear substances within the WL site, except for sections 6 and 7. Sections 6 and 7 refer to the CNSC *Nuclear Security Regulations*, specifically to the transport of Category I, II or III nuclear material.
- TDGR do not apply per subsection 1.25 of those regulations.

## Guidance:

**Guidance Documents**

| Document Number | Document Title | Version |
|---|---|---|
| RD-364 | Joint Canada-United States Guide for Approval of Type B(U) and Fissile Material Transportation Packages | 2009 |
| REGDOC-2.14.1 | Information Incorporated by Reference in Canada's Packaging and Transport of Nuclear Substances Regulations, 2015 | 2016 |

# APPENDIX A: DEFINITIONS AND ACRONYMS

## 1. DEFINITIONS

The following is a list of definitions of words or expressions used in the LCH that may need clarification; they are defined for the purpose of the LCH only. All other terms and expressions used in the LCH are consistent with the definitions provided in the NSCA, the regulations made pursuant to the NSCA, or in the CNSC regulatory document REGDOC-3.6 *Glossary of CNSC Terminology*.

**Approval** – Commission's permission to proceed, for situations or changes where the licensee would be:

- not compliant with a regulatory requirements set out in applicable laws and regulations;
- not compliant with a licence condition; and
- not in the safe direction but the objective of the licensing basis is met.

**Boundary Conditions** – procedural, administrative rules and operating limits for ensuring safe operation of the facility based on safety analyses and any applicable regulatory requirements.

**Compliance Verification Criteria** – regulatory criteria used by CNSC staff to verify compliance with the licence conditions.

**Design Basis** – the entire range of conditions for which the nuclear facility is designed, in accordance with established design criteria, and for which damage to the fuel and/or the release of radioactive material is kept within authorized limits.

**Effective Date** – the date that a given document becomes effective within the licensing period. The effective date is either set to the licence issue date or to a future date when the given document becomes effective.

**Guidance** – guidance in the LCH is non-mandatory information, including direction, on how to comply with the licence condition.

**Program(s)** – a documented group of planned activities, procedures, processes, standards and instructions coordinated to meet a specific purpose.

**Qualified Staff** – trained licensee staff, deemed competent and qualified to carry out tasks associated with their respective positions.

**Safe Direction** – changes in facility safety levels that would not result in:

(a) a reduction in safety margins;

(b) a breakdown of barrier;

(c) an increase (in certain parameters) above accepted limits;

(d) an increase in risk;

(e) impairment(s) of safety systems;

(f) an increase in the risk of radioactive releases or spills of hazardous substances;

(g) injuries to workers or members of the public;

(h) introduction of a new hazard;

(i) reduction of the defence-in-depth provisions;

(j) reducing the capability to control, cool and contain the reactor while retaining the adequacy thereof; or

(k) causing hazards or risks different in nature or greater in probability or magnitude than those stated in the safety analysis of the nuclear facility.

**Safety and Control Measures** – measures or provisions which demonstrate that the applicant:

(i) is qualified to carry on the licensed activities; and

(ii) has made adequate provision for the protection of the environment, the health and safety of persons, the maintenance of national security and any measures required to implement international obligations to which Canada has agreed.

**Written Notification** – a physical or electronic communication between CNSC staff and a person authorized to act on behalf of the licensee.

## 2. ACRONYMS LIST

| Acronym | Definition |
|---|---|
| AECL | Atomic Energy of Canada Limited |
| ALARA | As Low As Reasonably Achievable |
| CAF | Change Approval Form |
| CNEA | Canadian National Energy Alliance |
| CNL | Canadian Nuclear Laboratories |
| CNSC | Canadian Nuclear Safety Commission |
| CSA | Canadian Standards Association |
| DDP | Detailed Decommissioning Plan |
| DG-DNCFR | Director General, Directorate of Nuclear Cycle and Facilities Regulations |
| IAEA | International Atomic Energy Agency |
| LCH | Licence Conditions Handbook |
| NSCA | Nuclear Safety and Control Act |
| NT | Notification at time of making the change |
| PN | Prior Notification |
| PTNSR | Packaging and Transport of Nuclear Substances Regulations, 2015 |
| SSC | Structures, Systems, Components |
| SWS | Storage with Surveillance |
| TDGR | Transportation of Dangerous Goods Regulations |
| TLD | Thermoluminescent Dosimeter |
| WL | Whiteshell Laboratories |

# CURRENT LICENCE

The current licence is provided on the following pages of the document.

e-Doc 5482676 (WORD)

e-Doc 5492696 (PDF)

e-Doc 5482676 (Word)
e-Doc 5492696 (PDF)

# NUCLEAR RESEARCH AND TEST ESTABLISHMENT DECOMMISSIONING LICENCE

# WHITESHELL LABORATORIES

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**I) LICENCE NUMBER:** **NRTEDL-W5-8.05/2019**

**II) LICENSEE:** Pursuant to section 24 of the *Nuclear Safety and Control Act*, this licence is issued to

**Canadian Nuclear Laboratories Limited**
**286 Plant Road**
**Chalk River, Ontario**
**K0J 1J0**

**III) LICENCE PERIOD:** This licence is valid from January 1, 2019 and remains in effect until December 31, 2019 unless otherwise suspended, amended, revoked or replaced.

**IV) LICENSED ACTIVITIES:**

This licence authorizes the licensee to:

a) operate and decommission the Whiteshell Laboratories (hereinafter "WL") located in Pinawa, Province of Manitoba as further described in the Whiteshell Laboratories *Licence Conditions Handbook* (LCH) ,

b) produce, possess, process, refine, transfer, use, package, manage, import, export and store the nuclear substances that are required for, associated with or arise from the activities described in a),

c) possess, use, produce and transfer prescribed equipment that is required for, associated with, or arises from the activities described in a),

d) possess, use and transfer prescribed information that is required for, associated with, or arises from the activities described in a),

e) carry out the site preparation, construction or construction modification or undertaking that is required for, associated with or arise from the activities described in a).

## V) EXPLANATORY NOTES:

(i) Nothing in this licence shall be construed to authorize non-compliance with any other applicable legal obligation or restriction.

(ii) Unless otherwise provided for in this licence, words and expressions used in this licence have the same meaning as in the *Nuclear Safety and Control Act* and associated Regulations.

(iii) The Whiteshell Laboratories Licence Conditions Handbook (LCH) provides compliance verification criteria used to meet the conditions of this licence. The LCH also provides information regarding delegation of authority and applicable versions of documents.

## VI) CONDITIONS:

### 1 GENERAL

1.1 The licensee shall conduct the activities described in Part IV of this licence in accordance with the licensing basis, defined as:

(i) the regulatory requirements set out in the applicable laws and regulations

(ii) the conditions and safety and control measures described in the facility's or activity's licence and the documents directly referenced in that licence

(iii) the safety and control measures described in the licence application and the documents needed to support that licence application

unless otherwise approved in writing by the Canadian Nuclear Safety Commission (hereinafter "the Commission").

1.2 The licensee shall, in the event of any conflict or inconsistency between licence conditions, codes or standards or regulatory documents referenced in this licence, direct the conflict or inconsistency to the Commission, or a person authorized by the Commission, for resolution.

1.3 The licensee shall give written notification of changes to the facility or its operation, including deviation from design, operating conditions, policies, programs and methods referred to in the licensing basis.

1.4 The licensee shall ensure that every contractor working at the facility complies with this licence.

1.5 The licensee shall maintain a financial guarantee for decommissioning that is acceptable to the Commission.

1.6 The licensee shall comply with all commitments defined in the NRTEDL-W5-8.04/2018 LCH.

1.7 The licensee shall implement and maintain a public information and disclosure program.

1.8 The licensee shall implement and report on the progress of the Environmental Assessment Follow-Up Program.

## 2 DECOMMISSIONING

2.1 The licensee shall conduct decommissioning activities in accordance with Volumes 1 to 12 of the Whiteshell Laboratories Detailed Decommissioning Plan.

2.2 The licensee shall implement and maintain decommissioning policies, programs and procedures.

2.3 The licensee shall not make modifications to, or deviate from the design, operating conditions, purposes, methods, procedures or limits described in the safety analysis reports and/or operational limits and conditions documents that would result in an impact on health, safety or the environment that is different in nature or greater in magnitude or probability than that described in those documents without prior approval of the Commission or a person authorized by the Commission.

2.4 The licensee shall submit the project design requirements for construction of the approved second SMAG storage building prior to the commencement of construction activities described in paragraph e) of Part IV of this licence.

2.5 The licensee shall not carry out the activities referred to in paragraph a) of Part IV of this licence that relate to the completed construction activities in paragraph e) of Part IV of this licence for the approved second SMAG storage building until the submission of a commissioning report that is acceptable to the Commission.

## 3 SAFETY AND CONTROL AREA LICENCE CONDITIONS

### MANAGEMENT SYSTEM

3.1 The licensee shall implement and maintain a management system.

## 4 HUMAN PERFORMANCE MANAGEMENT

4.1 The licensee shall implement and maintain a human performance program.

4.2 The licensee shall implement and maintain a training program.

## 5 OPERATING PERFORMANCE

5.1 The licensee shall implement and maintain a program for reporting to the Commission or a person authorized by the Commission.

## 6 SAFETY ANALYSIS

6.1 The licensee shall implement and maintain a safety analysis program.

6.2 The licensee shall implement and maintain a nuclear criticality safety program.

## 7 PHYSICAL DESIGN

7.1 The licensee shall implement and maintain a design program.

7.2 The licensee shall implement and maintain a pressure boundary program.

## 8 FITNESS FOR SERVICE

8.1 The licensee shall implement and maintain a fitness for service program.

## 9 RADIATION PROTECTION

9.1 The licensee shall implement and maintain a radiation protection program, which includes a set of action levels. When the licensee becomes aware that an action level has been reached, the licensee shall notify the Commission within seven days.

## 10 CONVENTIONAL HEALTH AND SAFETY

10.1 The licensee shall implement and maintain a conventional health and safety program.

## 11 ENVIRONMENTAL PROTECTION

11.1 The licensee shall implement and maintain an environmental protection program, which includes a set of action levels. When the licensee becomes aware that an action level has been reached, the licensee shall notify the Commission within seven days.

## 12 EMERGENCY MANAGEMENT AND FIRE PROTECTION

12.1 The licensee shall implement and maintain an emergency preparedness program.

12.2 The licensee shall implement and maintain a fire protection program.

## 13 WASTE MANAGEMENT

13.1 The licensee shall implement and maintain a waste management program.

13.2 The licensee shall maintain a cost estimate for decommissioning.

## 14 SECURITY

14.1 The licensee shall implement and maintain a security program.

## 15 SAFEGUARDS AND NON-PROLIFERATION

15.1 The licensee shall implement and maintain a safeguards program.

## 16 PACKAGING AND TRANSPORT

16.1 The licensee shall implement and maintain a packaging and transport program.

SIGNED at OTTAWA, AUG 0 1 2018.

M. Binder

Michael Binder, President
on behalf of the Canadian Nuclear Safety Commission