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Canadian Nuclear Laboratories

Laboratoires Nucléaires Canadiens

Regulatory Oversight Report for Canadian Nuclear Laboratories Sites: 2021

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Summary

This Commission member document (CMD) concerns the regulatory oversight report for sites operated by Canadian Nuclear Laboratories (CNL) for the 2021 calendar year. CNL is the licensee for each of these sites.

No actions are required of the Commission. This CMD is for information only.

Résumé

Le présent document à l'intention des commissaires (CMD) porte sur le Rapport de surveillance réglementaire pour les sites exploités par les Laboratoires Nucléaires Canadiens (LNC) durant l'année civile 2021. Les LNC sont le titulaire de permis pour chacun de ces sites.

Aucune mesure n'est requise de la part de la Commission. Ce CMD est fourni à titre d'information seulement.

Signed/Signé le

21 July 2022

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PLAIN LANGUAGE SUMMARY

This Regulatory Oversight Report (ROR) describes the regulatory oversight and safety performance of sites licensed to and operated by Canadian Nuclear Laboratories (CNL) by the Canadian Nuclear Safety Commission (CNSC). It also provides details of CNSC staff's work to ensure the safety and protection of the people and the environment.

The functional areas of licensed facilities or activities consist of a standard set of 14 safety and control areas (SCAs). CNSC staff evaluate the performance of each licensee across all SCAs, and this report provides performance ratings for the following sites for the 2021 calendar year:

- Chalk River Laboratories (CRL) – an operating nuclear research laboratory
- Whiteshell Laboratories (WL) – a nuclear research laboratory undergoing decommissioning
- Douglas Point Waste Facility (DPWF) – a shutdown prototype power reactor
- Gentilly-1 Waste Facility (G1WF) – a shutdown prototype power reactor
- Nuclear Power Demonstration Waste Facility (NPDWF) – a shutdown prototype power reactor

The Port Hope Area Initiative (PHAI) is a federal government initiative based on a community proposal that includes the Port Hope Long-Term Waste Management Project (Port Hope Project) and Port Granby Long-Term Waste Management Project (Port Granby Project). On September 10, 2021, CNL submitted an application requesting a 10-year licence renewal for its Port Hope Project (PHP) Waste Nuclear Substance Licence (WNSL) and consolidate the PHP licence with 3 other WNSLs associated with the PHAI into a single WNSL for a 10-year licence term. CNL's application will be presented to the Commission on November 22, 2022. At this hearing, CNSC staff will be presenting their assessment of CNLs performance, therefore the PHAI is not part of this ROR.

Sites operated by CNL continued to operate safely in 2021, and monitoring data demonstrates that both the water and any food grown in proximity to these sites are safe to consume. There were no releases that could have harmed the health or safety of people or the environment.

Each year, CNSC inspectors conduct inspections at CNL sites. The number of inspections and their focus depends on the individual site and its performance. The CNSC uses a risk-informed approach when planning inspections. In 2021, CNSC staff performed a total of 17 inspections at the CNL sites, and these are covered in this report. The inspections resulted in the issuance of 43 notices of non-compliance (NNCs), which all related to issues identified as low safety significance. All NNCs have been closed or have an appropriate corrective action plan in place to prevent recurrence.

The CNSC assess the safety performance of licensees through the conduct of regulatory oversight activities including inspections, technical assessments of reports submitted by licensees, reviews of events and incidents, general communication, and exchanges of information with licensees. The CNSC evaluates licensees across 14 SCAs; however, this report focuses on the following 3 SCAs, as these provide a good overview of safety performance at CNL sites:

- **Radiation protection:** In 2021, the maximum individual radiation dose to a worker at any of the CNL sites occurred at Chalk River Laboratories and was 7.01 mSv (14% of the annual regulatory limit) which is 14% of the annual dose limit. The maximum estimated dose to the public from a CNL site was from CRL at 0.0015 mSv/year (0.15% of the 1 mSv/year prescribed dose limit).
- **Conventional health and safety:** All CNL sites must report any workplace-related lost-time injuries to the CNSC and federal/provincial agencies. In 2021, there were a total of 5 lost-time injuries reported, the same number as reported in the previous year and well below comparable industry values.
- **Environmental protection:** CNSC licensees are required to report to the CNSC and other regulatory authorities on any unauthorized releases of hazardous substances or nuclear materials to the environment. In 2021, all the releases from CNL facilities remained below their regulatory limits as approved and listed within the licensing basis, Licence Condition Handbook and Licence. All releases (water and airborne) from CNL operations met the applicable regulatory requirements. CNL has implemented an environmental protection program at its licensed facility in Canada in compliance with applicable regulatory requirements and are protective of the environment and the public.

Indigenous Nations and community engagement

The traditional and/or treaty territories of many Indigenous peoples resides on CNL sites. The CNSC is committed to building partnerships and trust with Indigenous Nations and communities interested in CNSC-regulated facilities. In 2021, CNSC staff continued to build relationships with Indigenous Nations and communities in proximity to CNL sites through ongoing engagement activities and collaboration.

Summary

For this reporting year, CNSC staff rated all SCAs as “satisfactory” (SA) with the exception of the Security SCA at CRL and WL (these were rated as “below expectations” (BE)).

CNSC staff concluded that the CNL sites continued to perform licensed activities safely in 2021. This conclusion was supported by safety performance measures and observations which included CNL having:

- operated within the bounds of their operating policies and principles
- followed approved procedures and took adequate corrective actions for all events reported to the CNSC.

And CNL confirmation that:

- The health and safety of Indigenous Nations and communities and the public near the CNL sites, and the surrounding environment continued to be protected.
- Workers at each CNL site have conducted the licensed activities safely and are properly protected.
- There were no releases from CNL sites that could have harmed the environment or health and safety of people.

The referenced documents in this Commission Member Document are available to the public upon request, subject to confidentiality considerations.

1 INTRODUCTION

For the purposes of the [Nuclear Safety and Control Act](#) [1], and its associated regulations, the Canadian Nuclear Safety Commission (CNSC) regulates Canada's nuclear industry to protect the health, safety of the people, security and the environment; to implement Canada's international commitments on the peaceful use of nuclear energy; and to disseminate objective scientific, technical and regulatory information to the public. Licensees are responsible for operating their facilities safely and are required to implement programs that make adequate provision for meeting legislative and regulatory requirements.

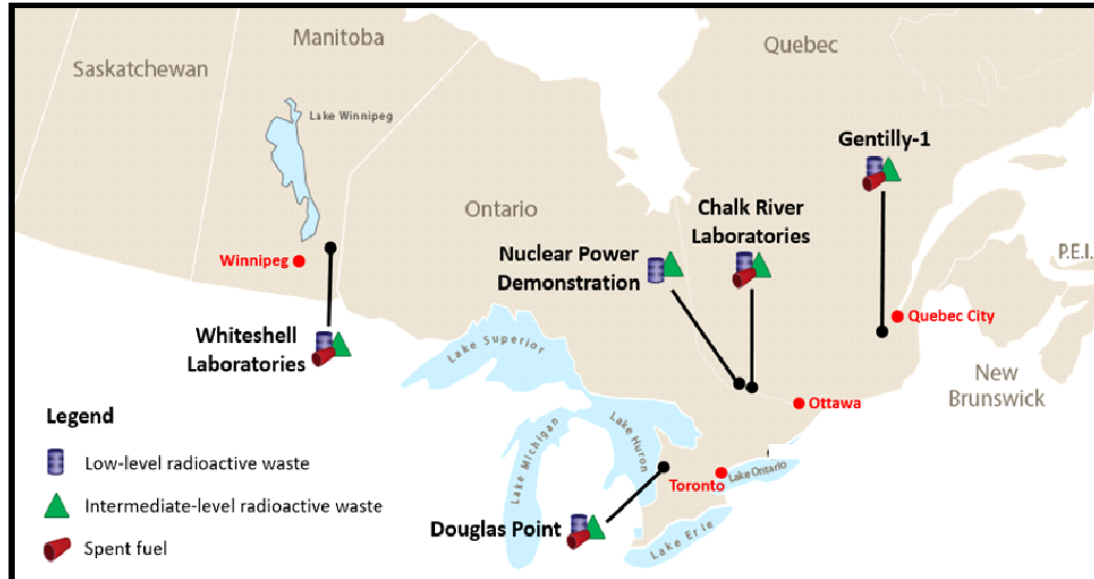
The Commission has directed CNSC staff to report to the Commission annually on the safety performance of sites operated by Canadian Nuclear Laboratories (CNL) in the form of a Regulatory Oversight Report (ROR). This ROR provides an overview of CNSC regulatory effort and staff's assessment of licensee performance at sites operated by CNL for the 2021 calendar year.

The CNL sites covered by this report are located in many different parts of the country ([Figure 1](#)). CNSC staff would like to acknowledge the Indigenous Nations and communities ([appendix A](#)) who's traditional and/or treaty territories are within proximity to the CNL sites covered by this report.

These CNL sites include:

- Chalk River Laboratories (CRL)
- Whiteshell Laboratories (WL)
- Douglas Point Waste Facility (DPWF)
- Gentilly-1 Waste Facility (G1WF)
- Nuclear Power Demonstration Waste Facility (NPDWF)

Figure 1: CNL sites covered by this report¹



¹ CNL's application requesting a 10-year licence renewal for its Port Hope Project (PHP) Waste Nuclear Substance Licence (WNSL) and consolidate the PHP licence with 3 other WNSLs is not covered in the 2021 ROR. Port Hope Area Initiative and CNL's application will be presented to the Commission separately on November 22, 2022.

This ROR discusses all safety and control areas (SCAs), but focuses on Radiation Protection, Conventional Health and Safety, and Environmental Protection. The report also provides an overview of licensee operations, licence changes, major developments at licensed facilities and sites, and reportable events. In addition, the report includes information on the CNSC's and CNL's engagement with Indigenous Nations and communities, and the public, and COVID-19 response.

2 CANADIAN NUCLEAR LABORATORIES

CNL is responsible for the operation and management of nuclear sites owned by Atomic Energy of Canada Limited (AECL) under a Government-Owned, Contractor-Operated model. While AECL owns the sites and nuclear substances, CNL is the CNSC licensee for activities at those sites.

A brief overview of each CNL site is provided below, with a link to the CNSC web page that contains more details such as facility information, announcements, regulatory reporting, and other key topics.

2.1 Chalk River Laboratories

Chalk River Laboratories (CRL) is located in the province of Ontario, 160 kilometers northwest of Ottawa ([Figure 2](#)), on the traditional unceded territory of the Algonquin Anishnaabeg people. CRL operates under a single licence that includes Class I and Class II nuclear facilities, waste management areas, radioisotope laboratories, support facilities and offices. CNL safely manages low-level waste, intermediate-level waste, and high-level radioactive waste at the site. The CRL site continues to undergo a period of change. Where permitted by the current licensing basis, CNL is continuing to shut down and decommission legacy facilities and constructing and commissioning replacement facilities throughout the site. Further information on CRL is available on the CNSC's website at: <http://nuclearsafety.gc.ca/eng/reactors/research-reactors/nuclear-facilities/chalk-river/index.cfm>.

Figure 2: View of the CRL built-up area (Source: CNL)



2.1.1 Major Activities at CRL

The National Research Universal (NRU) reactor ceased operating on March 31, 2018, and remained in a permanently shut down, defueled and dewatered state in 2021. CNL continued its work in the NRU reactor and its associated systems to place the facility in a permanently safe shut down state. All minimum staffing requirements were met in 2021. CNL performed a total of 63 work plans since 2018, and further activities will continue until the NRU reactor and facility can be placed in a state of storage-with-surveillance.

In November 2021, CNL publicly announced the signing of a multi-party integrated project delivery agreement for the design and construction of the Advanced Nuclear Materials Research Centre (ANMRC) construction site. The detailed design for ANMRC is ongoing and construction work is scheduled to commence in spring 2022 with the construction of the main building elements intended to begin in the spring-summer 2023 timeframe. The ANMRC will consolidate existing laboratories and hot cells located at CRL and is anticipated to be one of the largest active research laboratories in Canada.

CNL continued work on the proposal to construct and operate a Near Surface Disposal Facility (NSDF) at the CRL site. This project underwent a review by CNSC staff and was subject to an [Environmental Assessment](#) (EA) [2] pursuant to the [Canadian Environmental Assessment Act, 2012](#) (CEAA, 2012) [3]. CNSC accepted the [Final Environmental Impact Statement](#) [4], leading to a two-part public hearing to consider CNL's application to authorize the construction of the proposed NSDF. The hearings occurred on February 22, 2022 and May 30 to June 3, 2022. On July 5, 2022, the Commission announced its direction to leave the NSDF hearing record open to allow more time for engagement and consultation with Indigenous Nations and communities, and for the filing of additional information about these consultative efforts. The Commission will await this additional information before making decisions on the NSDF.

2.2 Whiteshell Laboratories

Whiteshell Laboratories (WL) is a former nuclear research and test facility located near Pinawa, Manitoba that was established in the early 1960s ([Figure 3](#)). It is located in the homeland of the Métis Nation, Treaty 3 territory, and the traditional territory of Anishinaabeg, Cree, Oji-Cree, Dakota, and Dene Peoples. The site hosts the 60-megawatt thermal (MWth) Whiteshell Reactor No. 1 (WR-1), a SLOWPOKE demonstration reactor, other research and support facilities, and a waste management area that contains low-level waste, intermediate-level waste, and high-level radioactive waste. The WR-1 and SLOWPOKE reactors were permanently shut down in 1985 and 1990 respectively. Decommissioning activities at WL commenced in 2003. Further information on WL is available on the CNSC's website at: <http://nuclearsafety.gc.ca/eng/reactors/research-reactors/other-reactor-facilities/whiteshell-laboratories.cfm>.

Figure 3: Whiteshell Laboratories main campus (Source: CNL)



2.2.1 Major Activities at WL

Demolition of the Active Liquid Waste Treatment Centre and the Health and Safety Facilities began in 2021 and was completed in early 2022. The Shielded Modular Above Ground Storage facility is being converted to the Cask Loading Facility. The Cask Loading Facility will be used to handle, stage, and load waste into appropriate shipping packages for transportation off-site. The removal, characterization, and packaging of low-level radioactive waste packages from storage facilities in the waste management area continues.

CNL also prepared a Recoverable Surface Storage and Staging Area (RSSSA) consisting of an outdoor, above ground storage pad to enable the storage and loading of solid low-level waste in sea land containers and storage of oversize low-level waste items awaiting further processing, characterization and/or packaging prior to off-site disposition. The RSSSA was placed into service in early 2022.

CNL continues to work on the proposal to change the decommissioning approach for WR-1 from full dismantlement to in-situ decommissioning. This proposed approach is currently under review by CNSC staff [5], and is subject to an [EA](#) pursuant to the [Canadian Environmental Assessment Act, 2012](#) (CEAA, 2012)[3], which will require authorization from the Commission. As these are not currently CNSC licensed activities and will be the subject of separate Commission decisions, they are not specifically discussed further in this report.

2.3 Prototype Power Reactors

The Douglas Point Waste Facility (DPWF), Gentilly-1 Waste Facility (G1WF), and Nuclear Power Demonstration Waste Facility (NPDWF) are 3 prototype power reactors that are currently in a safe shutdown state and undergoing decommissioning activities including hazard reduction and waste characterization, in line with plans reviewed and accepted by CNSC staff. For these prototype reactors, CNL continues to implement and maintain programs such as Radiation Protection, Conventional Health and Safety, Security, and Emergency Management and Fire Protection.

2.3.1 Douglas Point Waste Facility

Douglas Point Waste Facility (DPWF) located in Tiverton; Ontario on the Bruce nuclear site is a partially decommissioned prototype power reactor ([Figure 4](#)). The DPWF is located on the traditional territory of the Anishinabek Nation: the peoples of the three fires known as Ojibway, Odawa and Pottawatomie Nations, as well as the homeland of the Historic Saugeen Métis and the Métis Nation of Ontario. The 200-megawatt electric (MWe) prototype Canada deuterium uranium (CANDU) power reactor was put into service in 1968 and permanently shut down in 1984. CNL safely manages low and intermediate-level radioactive wastes, as well as used nuclear fuel stored in concrete dry storage canisters at the DPWF site. CNL is also undertaking decommissioning planning activities. Further information on DPWF is available on the CNSC's website at: <http://nuclearsafety.gc.ca/eng/reactors/research-reactors/other-reactor-facilities/douglas-point-waste-facility.cfm>.

In its Record of Decision [DEC 20-H4](#), *Application to amend the Waste Facility Decommissioning Licence for the Douglas Point Waste Facility to include phase 3 decommissioning activities* [6], the Commission granted a licence amendment effective March 12, 2021. Decommissioning work is ongoing on the non-nuclear buildings to facilitate the safe dismantling and demolition of the buildings.

Figure 4: Douglas Point Waste Facility (Source: CNL)



2.3.2 Gentilly-1 Waste Facility

Gentilly-1 (G1WF), located in Bécancour, Québec within Hydro-Québec's Gentilly-2 site, is a partially decommissioned prototype power reactor ([Figure 5](#)). The site is located on the traditional and unceded territory of the Abenaki people and the Wabanaki confederacy and the traditional land of the Huron-Wendat. The 250 MWe boiling water reactor was put into service in 1972 and shut down in 1984. At G1WF, CNL safely manages low and intermediate-level radioactive wastes, as well as used nuclear fuel in concrete dry storage canisters. Additionally, CNL is undertaking decommissioning planning activities. Further information on G1WF is available on the CNSC's website at: <http://nuclearsafety.gc.ca/eng/reactors/research-reactors/other-reactor-facilities/gentilly-1-facility.cfm>.

Figure 5: Gentilly-1 Waste Facility, outlined in yellow (Source: CNL)



2.3.3 Nuclear Power Demonstration Waste Facility

Nuclear Power Demonstration Waste Facility (NPDWF) is a partially decommissioned prototype power reactor located in Rolphton, Ontario ([Figure 6](#)) on the traditional unceded territory of the Algonquin Anishnaabeg people. The 20 MWe prototype CANDU power reactor was placed into service in 1962 and operated until 1987. At NPDWF, CNL safely manages low and intermediate-level radioactive wastes. Additionally, CNL is undertaking decommissioning planning activities. Further information on NPDWF is available on the CNSC's website at: <http://nuclearsafety.gc.ca/eng/reactors/research-reactors/other-reactor-facilities/nuclear-power-demonstration.cfm>.

CNL continues to work on the proposal to modify the decommissioning approach for NPDWF from full dismantling to in-situ decommissioning. This application under review by CNSC staff, is subject to an [EA](#) [7] pursuant to the [Canadian Environmental Act, 2012](#) (CEAA, 2012)[3], and will require authorization from the Commission. As these are not currently CNSC-licensed activities and will be the subject of separate Commission decisions, they are not specifically discussed further in this report.

Figure 6: Nuclear Power Demonstration Waste Facility (Source: CNL)



3 CNSC'S REGULATORY OVERSIGHT OF CNL

The CNSC performs regulatory oversight of licensed facilities to verify compliance with the requirements of the [Nuclear Safety and Control Act](#) [1] and associated regulations, each site's conditions of licence and licence conditions handbook (LCH), and any other applicable standards and regulatory documents forming part of the licensing basis.

CNSC staff use the safety and control area (SCA) framework to assess, evaluate, review, verify and report on licensee performance. The SCA framework includes 14 SCAs, which are subdivided into specific areas that define its key components. Further information on the CNSC's SCA framework can be found on the CNSC's website at:

<http://www.nuclearsafety.gc.ca/eng/resources/publications/reports/powerindustry/safety-and-control-areas.cfm>.

<http://www.nuclearsafety.gc.ca/eng/resources/news-room/feature-articles/safety-and-control-areas.cfm>.

3.1 Regulatory Activities

CNSC staff spent over 18,160 hours in 2021 working on licensing and compliance activities with respect to CNL sites. Note that regulatory effort spent on Port Hope Area Initiative (PHAI) totaling 5,150 hours, Near Surface Disposal Facility (NSDF) licensing totaling 5,135 hours, Nuclear Power Demonstration Waste Facility (NPDWF) licensing totaling 1,780 hours and WL WR-1 licensing totaling 1,719 hours are out of scope and not included in the 2021 total. While compliance verification activities were leveraged to the extent possible, the total on-site compliance effort was significantly higher than the previous year's total hours. An increase in inspection activities in 2021 was directly attributed to COVID-19 restrictions and protocols. Details related to COVID-19 are further discussed in [section 6.4](#) of this report.

Licensing

In 2021, CNSC staff spent roughly 6,102 hours on licensing activities, which includes drafting new licences, preparing Commission Member Documents (CMDs), and drafting or revising LCHs. [Appendix C](#) provides a summary of licensing activities for 2021.

As CNSC regulatory documents are published, CNSC staff update the LCHs as applicable for each site, taking into consideration the licensee's implementation plans. CNSC staff verify regulatory document (REGDOC) implementation as part of ongoing compliance verification activities. [Appendix D](#) provides a list of CNSC regulatory documents implemented at CNL sites and used by CNSC staff for compliance verification.

Compliance

The CNSC ensures licensee compliance through verification, enforcement and reporting activities. CNSC staff implement compliance plans for each site by conducting regulatory activities including inspections, desktop reviews, and technical assessments of licensee programs, processes, and reports.

In 2021, CNSC staff spent over 12,058 hours on compliance activities.

[Appendix E](#) contains a list of CNSC inspections carried out at each CNL site in 2021. All NNCs resulting from non-compliance with legislation, regulations and licensing basis requirements noted during these inspections were considered low-risk and did not have an impact on the health, safety, and environment. CNSC staff determined that all NNCs were adequately addressed either through closure or an appropriate corrective action plan. [Appendix F](#) contains a list of reportable events at each CNL site in 2021. For these events, CNSC staff were satisfied with CNL's corrective actions to prevent recurrence.

[Appendix G](#) provides a summary of regulatory effort in 2021, including hours spent by CNSC staff participating in inspections with the International Atomic Energy Agency (IAEA).

3.2 Performance Ratings

The safety assessments presented in this report are based on the results of activities planned through the CNSC compliance verification program. In 2021, these activities included remote and on-site inspections as well as technical assessments of submissions. CNSC staff use the results of these activities to assign performance ratings to licensees. For 2021, the ratings that were used for CNL sites were either “satisfactory” (SA) or “below expectations” (BE). Use of binary ratings is consistent with a neutral and fair approach that the CNSC strives to implement in its regulatory oversight. In 2020, the Commission agreed, in the Commission Meeting Minutes, [Minutes of the Canadian Nuclear Safety Commission \(CNSC\) Meeting held on December 8, 9 and 10, 2020](#) [8], with the use of a binary approach for RORs, using only SA or BE ratings.

For 2021, CNSC staff have rated CNL's performance in each SCA as SA, with the exception of the Security SCA at CRL and WL. [Appendix H](#) provides SCA ratings for each site from 2017 to 2021.

4 THE CNSC'S ASSESSMENT OF SAFETY AT CNL SITES

The CNSC regulates all aspects of safety at nuclear sites in Canada, including risks to workers, the public, and the environment. Assessments are carried out across 14 SCAs. CNSC staff assess performance in all SCAs by verifying licensee compliance through planned or reactive desktop reviews and inspections.

Although all 14 SCAs are covered generally in the following sections, this report focuses on Radiation Protection, Conventional Health and Safety, and Environmental Protection since these 3 SCAs are considered the most relevant in determining CNL's overall safety performance. In particular, the SCAs of Radiation Protection, and Conventional Health and Safety are a good measure of the safety of workers at CNL sites, while the SCA of Environmental Protection is a good measure of the safety of the public and the environment.

CNSC staff have determined that all NNCs from inspections were adequately addressed either through closure or an appropriate corrective action plan, and that the NNCs did not impact safety at CNL sites. CNSC staff concluded that CNL has met regulatory requirements and for 2021 have rated all SCAs at all CNL licensed sites as "satisfactory", with the exception of the Security SCA, at CRL and WL. Details on the Security SCA are provided in [section 4.12](#) of this report.

For both the Radiation Protection and Environmental Protection SCAs, the concept of action levels (ALs) is used. ALs are a specific dose of radiation or other parameter that serve as an early warning to safeguard against exceedances of radiation dose limits and environmental release limits. AL exceedances are reportable to the CNSC. Further information on ALs is available on the CNSC's website at: <http://www.nuclearsafety.gc.ca/eng/resources/news-room/feature-articles/radiation-dose-limits-release-limits-and-action-levels.cfm>.

4.1 Management System

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

CNSC staff assess CNL's performance in the management system SCA through desktop reviews of program documents reportable events ([appendix F](#)), and inspections ([appendix E](#)). In 2021, this included an assessment of the Management System Manual and updates to CNL's associated program description and program requirement documents.

4.2 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.

CNSC staff assess CNL's performance in the human performance management SCA through desktop reviews of documents, reportable events ([appendix F](#)) and through the course of inspections ([appendix E](#)). These compliance activities concluded that facilities and activities were operated and maintained by CNL according to the licensing basis.

CNSC staff concluded that CNL continues to implement and maintain an effective human performance management program in accordance with regulatory requirements.

4.3 Operating Performance

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

CNSC staff assess CNL's performance for the operating performance SCA through desktop reviews of documents, reportable events ([appendix F](#)), and through the course of inspections. CNL also submits annual reports on compliance monitoring and operational performance of facilities. No significant regulatory issues were identified during CNSC staff's review of these reports.

CNL continued to meet its reporting requirements including those associated with annual reports and reportable events, which demonstrated that facilities were operated and maintained according to the licensing basis.

CNSC staff assessments concluded that CNL has conducted its activities at CRL in compliance with regulatory requirements for CRL.

4.4 Safety Analysis

The safety analysis SCA covers maintenance of the safety analysis that supports the overall safety case for the facilities. 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.

CNSC staff assess CNL's performance in the safety analysis SCA through desktop reviews of documents, reportable events ([appendix F](#)) and through the course of inspections ([appendix E](#)). In 2021, CNL proposed operational changes and submitted revised Criticality Safety Documents and Safety Analysis Reports. CNSC staff review of CNL's submissions confirmed that facilities and activities were operated according to the licensing basis.

4.5 Physical Design

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

CNSC staff assess CNL's performance in the physical design SCA through desktop reviews of documents and reportable events ([appendix F](#)), and through the course of inspections.

CNSC staff have verified through desktop reviews that CNL's programs related to the physical design SCA continue to meet regulatory requirements and expectations.

4.6 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 includes programs that ensure all equipment is available to perform its intended design function when called upon to do so.

CNSC staff assess CNL's performance in the fitness for service SCA through desktop reviews of documents, reportable events ([appendix F](#)) and through the course of inspections ([appendix E](#)). CNL demonstrated that facilities were operated and maintained according to the licensing requirements. CNSC staff concluded that CNL continues to operate and maintain the facilities in accordance with regulatory requirements.

4.7 Radiation Protection

The radiation protection SCA covers the implementation of a Radiation Protection (RP) program in accordance with the *Radiation Protection Regulations* [9]. CNL has successfully implemented and maintained an RP program which ensures that contamination levels and radiation doses received by individuals are monitored, controlled, and maintained as low as reasonably achievable (ALARA).

CNSC staff assessed CNL's performance in the radiation protection SCA through desktop reviews of documents, reportable events ([appendix F](#)), and through the course of inspections ([appendix E](#)). These compliance activities confirmed that the facilities and its processes were operated and maintained by CNL in accordance with their licensing requirements.

In addition to the following, data on dose to workers for each CNL site from 2017 to 2021 can be found in ([Appendix I](#)).

CNSC staff concluded that CNL continues to implement and maintain an RP program in accordance with regulatory requirements.

4.7.1 Application of ALARA

CNL's application of ALARA within the RP program includes management commitment and oversight, personnel qualification and training, design analyses of facilities and systems, provision of protective equipment and ALARA assessments/reviews of radiological activities.

In 2021, CNSC staff confirmed that all CNL sites continued to implement radiation protection measures to keep radiation exposures and doses received by persons ALARA. CNL continued to effectively implement the corporate ALARA process at its sites. This process integrates ALARA into design, planning, management, and control of radiological activities.

At CNL sites, dose control points (DCP) are used as a dose management tool for Nuclear Energy Workers' (NEWs) radiological exposures. If a NEWs dose exceeds their assigned DCP by more than 1 mSv, an ALARA assessment is documented to assess whether the dose received was justified and optimized, as applicable. In 2021, no NEWs exceeded their assigned DCP by more than 1 mSv.

4.7.2 Worker Dose Control

Workers, including employees and contractors, conducting work activities which present a reasonable probability that the worker may receive an occupational dose greater than 1 mSv/year, are identified as NEWs. Workers, whose job functions do not present a reasonable probability of receiving an occupational dose greater than 1 mSv/year are not considered as NEWs.

In 2021, no worker received a radiation dose in excess of the CNSC's regulatory dose limits. The maximum individual effective dose received by a NEW across CNL sites was at the CRL site, with a dose of 7.01 mSv, which is approximately 14% of the CNSC's regulatory limit for effective dose of 50 mSv in a 1-year dosimetry period. The maximum cumulative individual effective dose received by a NEW for the 5-year dosimetry period, beginning on January 1, 2021, was also at the CRL site, and was 7.01 mSv. To date the 5-year dosimetry period dose is approximately 7% of the regulatory limit for effective dose of 100 mSv in a 5-year dosimetry period.

4.7.3 Radiation Protection Program Performance

In 2021, CNL revised the corporate Radiation Protection (RP) program to ensure alignment with the [Radiation Protection Regulations](#) [9], which were amended in November 2020. The revised RP Program meets CNSC regulatory expectations.

Action levels for radiological exposures are established as part of CNL's RP Program to alert CNL before a regulatory limit is reached. If an action level is reached or exceeded, CNL must notify the CNSC, complete an investigation and implement corrective actions (if required). The following radiation protection action level exceedance at the CRL site was reported to the CNSC.

For the calendar year 2021, the committed effective doses (CEDs) for tritium for 2 National Research Universal (NRU) workers were 1.09 mSv and 1.01 mSv, which exceeds the action level for internal CEDs established at 1 mSv/year.

Under CNL's RP program, a process is established where exceedances to action levels (ALs) can be authorized by CNL's RP program manager if it can be demonstrated that the dose expected to be received by, or committed to, workers is ALARA. The exceedance of the AL was planned and authorized by CNL as per CNL's RP program requirements. When bioassay results indicated that the workers were likely to reach the action level, an ALARA assessment was conducted by CNL which included a review of the work to ensure optimized worker protection. Steps were also taken by CNL to minimize tritium doses to workers to the maximum extent possible.

CNSC staff assessed that there were no impacts to workers as a result of the action level exceedances. It was concluded that the internal dose received was due to low chronic inhalation of tritiated water vapor while working in the NRU Rod Bays to support specialized work activities. Based on the results of the compliance verification activities, CNSC staff concluded that there was no loss of control of CNL's RP program and that CNL is in compliance with the regulatory requirements set by the [Radiation Protection Regulations](#) [9].

4.7.4 Radiological Hazard Control

Radiation and contamination monitoring programs continued to be implemented at CNL sites in 2021, to control and minimize radiological hazards and the spread of radioactive contamination. Dose rate measurements, surface contamination monitoring and, where appropriate, in-plant air monitoring are routinely performed to confirm that radiation exposures are kept ALARA. The radiological hazard surveys conducted in 2021 by CNL did not identify any adverse trends and were consistent with expected radiological conditions.

4.8 Conventional Health and Safety

The conventional health and safety SCA covers a program to manage workplace safety hazards and protect workers. CNL has developed and implemented a program to manage the workplace safety hazards and protect workers on the job whilst ensuring compliance with [Canada Labour Code](#) [10] and [Canada Occupational Health and Safety Regulations](#) [11].

CNSC staff assessed CNL's performance in the conventional health and safety SCA through desktop reviews of documents and reportable events ([appendix F](#)) and through the course of inspections ([appendix E](#)). These compliance activities demonstrate that the facilities and activities were operated and maintained by CNL according to their licensing basis.

CNSC staff concluded that CNL continues to implement and maintain an effective conventional health and safety program in accordance with regulatory requirements.

4.8.1 Performance

The key performance indicators for conventional health and safety are the number of recordable lost-time injuries (RLTI) that occur per year, and the RLTI severity and frequency. An RLTI is defined as a workplace injury that results in the worker being unable to return to work for a period of time. RLTI severity and frequency provide context to the number of RLTIs. Severity quantifies the number of lost workdays experienced per 100 employees, while frequency quantifies the number of lost-time injuries relative to the number of hours worked. Data on RLTI, and RLTI frequency and severity from 2017 to 2021 are included in [appendix J](#) for all sites covered by this ROR. In 2021, there were 3 RLTIs at CNL sites, all at CRL consisting of slips, cuts, and other minor medical emergencies. This is a decrease of approximately 57% from the previous year for all CNL sites. These events led to 4 lost working days. For CRL the RLTI frequency was 0.11 and the RLTI severity was 0.15. There were no RLTIs at WL, DPWF, G1WF or NPDWF.

For comparison, CNL's reported RLTI frequency is lower than the 2020 lost-time injury rates for comparable industries in Ontario like construction (0.96) and manufacturing (0.9), as per Ontario Workplace Safety and Insurance Board data in the [2020 Workplace Safety and Insurance Board Statistical Report](#) [12]. CNSC staff consider this to be a conservative comparison because Ontario lost-time injury data includes only injuries for which compensation claims were allowed, rather than all reportable injuries, as is included in CNL data.

4.8.2 Practices

CNL's occupational safety and health program applies to all work performed by both CNL employees and contractors. When evaluating safety practices at a site, CNSC staff do not distinguish between the licensee's own staff and those of contractors or visitors, considering all to be 'workers' and equally subject to CNSC requirements and licensee policies. This is notable for CNL, as many CNL sites employ contractors to perform a wide variety of tasks. CNL's Improvement Action System is used by CNL to record all events, including injuries, at CNL sites. CNSC staff have access to CNL's Improvement Action data to determine trends and monitor actions.

4.8.3 Awareness

On September 1, 2020, in response to changing work conditions due to the COVID-19 pandemic, CNL conducted a mandatory safety pause across all sites to refocus and prioritize safety in the workplace. In early 2021, CNL entered their Phase 3 work conditions which consisted of continuing to work remotely where feasible and continuing to limit the number of people in enclosed spaces. Further information on CNL's 2021 COVID-19 approaches can be found in [section 6.4](#) of this report.

4.9 Environmental Protection

Protection of the environment and the public are both assessed in the environmental protection SCA. This SCA covers programs that identify, control, and monitor all releases of radioactive and hazardous substances, and the effects on people and the environment from facilities or as a result of licensed activities.

CNSC staff assess CNL's performance in the environmental protection SCA through desktop reviews of documents and reportable events ([appendix F](#)) and through inspections ([appendix E](#)).

The CNSC publishes annual radionuclides loadings to the environment from nuclear facilities on the CNSC Open Government Portal. The data is available on the CNSC Open Government Portal:

<https://open.canada.ca/data/en/dataset/6ed50cd9-0d8c-471b-a5f6-26088298870e>

In previous RORs, the annual radionuclides information was replicated in an appendix, and is provided via the above reference for the 2021 report.

CNSC staff concluded that the environmental protection programs currently in place at all CNL sites covered by this report are protective of the public and the environment.

4.9.1 Effluent and Emissions Control

In compliance with CSA standard N288.5-11, [Effluent monitoring programs at Class I nuclear facilities and uranium mines and mills](#) [13], CNL has implemented and maintains an effluent verification monitoring program at all sites covered by this report. Airborne and waterborne releases of radioactive and hazardous substances at all CNL sites remained below their respective regulatory limits in 2021.

Based on CNSC staff assessment of CNL's 2021 annual effluent monitoring results, regulatory oversight, and past performance history, CNSC staff concluded that the effluent verification monitoring program in place for CNL sites and are in compliance with the applicable regulatory requirements and protective of the environment and the public.

4.9.2 Environmental Management System

The CNSC requires that licensees develop and maintain an Environmental Management System to provide a documented framework for integrated activities related to environmental protection. An Emergency Management System includes activities such as establishing annual environmental objectives, goals, and targets. CNL has established a corporate level environmental management system that is part of the overall CNL management system which applies to all CNL sites. CNL's corporate environmental management system conforms to International Organization for Standardization (ISO) standard 14001:2015, [Environmental Management Systems](#) [14], and the environmental management systems for CRL and WL are registered to ISO 14001:2015.

4.9.3 Assessment and Monitoring

In compliance with CSA standard N288.4, *[Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills](#)* [15], CNL has implemented an environmental monitoring program at CRL and WL. An environmental monitoring program is not required at the DPWF, G1WF and NPDWF sites as none of the criteria of CSA standard N288.4 are met.

Based on CNSC staff assessment of CNL's 2021 annual environmental monitoring results, regulatory oversight, and past performance history, CNSC staff concluded that all the releases to the environment in 2021 remained a small fraction of their respective derived release limits (DRLs). CNSC staff further concluded that the environmental monitoring programs in place are in compliance with applicable regulatory requirements and are protective of the environment and the public.

4.9.4 Independent Environmental Monitoring Program

In addition to requiring that licensees carry out environmental monitoring of their own operations, CNSC staff implement an Independent Environmental Monitoring Program (IEMP) to verify that the public and the environment around licensed nuclear facilities remain safe.

The IEMP complements 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 (nuclear) and hazardous substances in those samples. Sampling frequency is prioritized on a risk-based approach where nuclear facilities in Canada are visited anywhere from 2 to 4 times every 10 years under the auspices of IEMP.

In 2021, due to challenges associated with the ongoing COVID-19 pandemic which limited interprovincial travel and resulted in deferred sampling campaigns, CNSC staff did not conduct the scheduled independent environmental monitoring around WL. In 2022 based on the planned IEMP sampling frequency, CNSC staff will be visiting CRL, WL, DPWF.

Further information on the CNSC's IEMP, including sampling results and associated standards, can be found on the CNSC's website at:

<http://www.nuclearsafety.gc.ca/eng/resources/maps-of-nuclear-facilities/iemp/index-iemp.cfm>.

4.9.5 Environmental Risk Assessment

The environmental risk assessment (ERA) conducted by licensees is a systematic process used to identify, quantify, and characterize the risk posed by contaminants and physical stressors to the environment and human health. An ERA includes Ecological Risk Assessment (EcoRA) and Human Health Risk Assessment (HHRA). As per the licence condition handbooks (LCH), only CRL, WL and DPWF sites are required to have ERAs. CNSC staff reviewed the submitted ERAs for these sites and have determined that they were compliant with the guidance provided in CSA standard N288.6-12, *[Environmental risk assessments at class I nuclear facilities and uranium mines and mills](#)* [16].

The updated ERA for the CRL site submitted in 2019 continues to apply during the 2021 operating year. An updated ERA for the WL site was submitted by CNL in 2021, taking into consideration current site conditions. This update considers the lagoon and landfill areas of the WL site, and a WL site-wide ERA is expected to be submitted in 2022. An updated ERA and associated environmental effects review for the DPWF site was submitted in 2019 taking into account releases from the Bruce nuclear site, including those from authorized discharges in the DPWF site's current storage-with-surveillance state.

CNSC staff concluded that CNL continued to maintain and implement an effective ERA at applicable sites in accordance with regulatory requirements. There were no unacceptable risks to people and the environment in 2021. Additionally, CNSC staff concluded that CNL has comprehensive groundwater monitoring programs at applicable CNL sites consistent with licensing requirements.

4.9.6 Protection of the Public

CNL is required to demonstrate that the health and safety of the public are protected from exposures to hazardous and nuclear substances released from its licensed operations. The effluent and environmental monitoring programs are used to verify that releases of hazardous and nuclear substances do not result in environmental concentrations or quantities that may adversely affect the public nor the environment.

Through the reporting requirements outlined in CNL's licences and LCHs, the CNSC receives reports of discharges to the environment.

Based on CNSC staff assessment of the results in CNL's 2021 environmental monitoring program reports for hazardous substances, CNSC staff concluded that the releases of hazardous substances from CNL sites met the regulatory requirements.

4.9.7 Estimated Dose to the Public

As part of annual reporting to the CNSC and in accordance with criteria outlined in CSA standard N288.1, [*Guidelines for calculating derived release limits for radioactive materials in airborne and liquid effluents for normal operation of nuclear facilities*](#) [17], CNL provides data on dose to a hypothetical member of the public that is representative of someone who spends considerable time in proximity to the licensed site.

In all cases, CNL's data indicates that doses to the public resulting from CNL's operations are well below the 1 mSv/year limit prescribed in the [*Radiation Protection Regulations*](#) [9]. At no point during 2021 did the emissions from the CRL site exceed the constraint for dose to the public of 0.30 mSv/year indicated in the CRL LCH. The maximum estimated dose to the public from a CNL site was estimated to be from CRL, at 0.0015 mSv/year (0.15% of the 1 mSv/year dose limit).

4.10 Emergency Management and Fire Protection

The Emergency Management and Fire Protection SCA covers emergency plans and emergency preparedness programs that exist in case of emergencies and for non-routine conditions. This area also includes any results of participation in exercises.

CNSC staff assess CNL's performance in the emergency management and fire protection SCA through desktop reviews of documents, reportable events ([appendix F](#)) and also through the course of inspections ([appendix E](#)).

CRL conducts drills and exercises to test their emergency procedures and evaluate their response capabilities. This includes an annual emergency preparedness exercise. Due to COVID-19 pandemic, this exercise was postponed in 2020 and was held in August 2021. During the exercise, CNSC staff evaluated CNL's response and identified areas of improvement regarding good exercise practice and adherence to procedures. CNSC staff are satisfied with CNL's corrective plan to address these areas and the inspection has been closed.

Also, in August 2021 as required by CSA standard N393, *Fire protection for facilities that process, handle or store nuclear substances* [18], a Third-Party Audit was conducted of the CRL Fire Protection Program Response Capability to review the fire protection program. The Third-Party audit concluded that CNL has an effective emergency management and fire protection program and that testing and maintenance at the CRL facility is performed in line with the applicable codes and standards.

CNSC staff concluded that CNL continues to implement and maintain an effective emergency management and fire protection program at CRL in accordance with regulatory requirements.

4.11 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 area also covers the planning for decommissioning.

CNSC staff assess CNL's performance in the waste management SCA through desktop reviews of documents, reportable events ([appendix F](#)), and through the course of inspections ([appendix E](#)). CNL's activities involve the management of radioactive wastes, from generation to storage. Radioactive and other hazardous wastes have been previously generated from reactor operations and radioisotope production, and waste continues to be generated from on-going site operations, research and development, decommissioning, and environmental remediation activities at CNL. CNSC staff maintain oversight of CNL's current and future management of radioactive wastes through compliance activities, including inspections and desktop reviews.

Radioactive wastes stored on the sites consist of high-, intermediate- and low-level radioactive wastes. The inventory of wastes stored at CNL sites as of 2020 is included in the seventh [*Canadian National Report for the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management \(October 2020\)*](#) [19].

During 2021, CNL maintained a waste management program to safely manage radioactive and hazardous wastes as a result of CNL's licensed activities, including the decommissioning of its facilities. The waste management program ensured the safe management, processing, and storage of low- and intermediate-level radioactive wastes, and hazardous wastes (in the form of solid, liquid, or gaseous states). It also ensured that the decommissioning of buildings and structures was documented and conducted in a manner that met the requirements as defined in the relevant site-specific LCHs. CNSC staff determined that CNL's waste management programs for minimizing radioactive waste continued to meet the applicable regulatory requirements.

Waste from institutions, including hospitals and universities from across Canada, is received at CRL on a commercial basis for safe long-term storage. This service ensures that wastes are managed in a safe, secure, and environmentally-sound manner. CRL received a total of 61.3 m³ of radioactive waste from external organizations in 2021. This includes 25.3 m³ of commercial waste and 36 m³ of waste returned from off-site waste processors (i.e., secondary waste from the off-site treatment of CNL waste, such as ash from incineration of waste). In comparison 2020, CNL received a total of 255.8 m³ of radioactive waste from external sources.

Throughout 2021, CNL continued to execute decommissioning and remediation activities to reduce the legacy liabilities at all CNL sites. These activities included:

- The Land Use program and Environmental Remediation program were fully integrated with the Decommissioning program, which has been updated and is now implemented through the Cleanup Functional Support Area.
- At WL, several buildings and structures were decommissioned, where operational wastes were dispositioned, building services isolated and industrial hazardous materials removed prior to demolition where feasible.
- CRL safely demolished its 100th building, a key milestone towards the revitalization and renewal of the campus which included N413, B440, B440A, B440B, B157 (pipeline only), and B444.

At CRL, decommissioning of legacy deep geological boreholes commenced, with 20 of the 37 deep geological boreholes decommissioned. It is CNSC staff's conclusion that, during 2021, CNL maintained effective programs to safely manage radioactive and hazardous wastes from CNL's licensed activities and decommissioning of its facilities.

4.12 Security

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

CNSC staff assess CNL's performance in the security SCA through desktop reviews of documents, reportable events ([appendix F](#)) and through the course of inspections ([appendix E](#)).

On September 2021, CNSC staff conducted a security focused inspection at WL to verify the implementation of WL's security measures. CNSC staff identified areas of improvement in the implementation of the security program at WL. These areas did not pose any immediate risk to the security of nuclear substances at WL. WL implemented a corrective action plan to address these areas with a completion date of May 27, 2022.

In June 2022, CNSC staff conducted a follow-up compliance inspection at WL to verify CNL's progress in implementing their corrective action plan. Details of CNL's progress and associated corrective actions will be presented in a protected CMD 22-M33.A. As a result of the inspection findings and the associated corrective plan that is still ongoing, CNSC staff have assigned a "below expectations" performance rating for the security SCA at WL Laboratories.

For CRL, following a technical assessment of the security program in 2020, CNL submitted additional documentation that contained insufficient information to permit CNSC staff to conclude whether CNL was meeting their regulatory requirements. Throughout 2021, further documentation was requested from CNL to substantiate statements of compliance made by the licensee. In August 2021, CNSC staff concluded that a non-compliance existed in CNL's security program. CNSC staff issued a notice of non-compliance (NNC) and required that immediate compensatory measures be taken. In October 2021, CNL failed to implement the requested compensatory measures needed to mitigate the identified risk, therefore Inspector Order # 6656254 was issued to CNL (amended in November 2021 by the Designated Officer).

In November 2021, CNL met the compensatory measures required by the Order. CNL continues to provide periodic updates including submissions and status reports on their progress. CNL remains obligated to continue to meet the terms and conditions of the Order. As the specific conditions of this Order is considered security sensitive information, additional details will be provided in protected CMD 22-M33.A.

CNSC staff assessed that in 2021 CRL did not meet the applicable regulatory requirements and are therefore rated as "below expectations" for the security SCA.

4.13 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](#) [20].

CNSC staff assessed CNL's performance in the safeguards and non-proliferation SCA through desktop reviews of documents, reportable events ([appendix F](#)) and also through the course of inspections ([appendix E](#)). These compliance activities demonstrated that facilities were operated and maintained according to the licensing basis.

Under the terms of the Canadian-IAEA safeguards agreements, the IAEA has the right to perform independent verification activities at various types of sites in Canada, including all of the CNL sites covered by this report. IAEA activities are not CNSC compliance inspections, however CNSC staff accompanied the IAEA staff on 2 of their activities at the sites covered by this report in 2021.

In 2021, the IAEA carried out activities at CRL, WL, DPWF, G1WF, and NPDPWF to verify nuclear material inventories and confirm the absence of undeclared nuclear materials and activities. As a result of the inspections conducted by the IAEA, no significant issues were identified. [Appendix E](#) contains a list of IAEA lead inspections carried out at each CNL site in 2021.

In spite of the COVID-19 pandemic, the CNSC, IAEA, and CNL continued to work together to ensure that Canada's requirements under the [Treaty on the Non-Proliferation of Nuclear Weapons](#) [20] were fulfilled.

4.14 Packaging and Transport

The packaging and transport SCA includes the programs that cover the safe packaging and transport of nuclear substances to and from licensed facilities.

CNSC staff assessed CNL's performance in the packaging and transport SCA through desktop reviews of documents, reportable events ([appendix F](#)) and also through the course of inspections ([appendix E](#)). CNL has developed and implemented a packaging and transport program that ensure compliance with the [Packaging and Transport of Nuclear Substances Regulations, 2015](#) [21] and [Transportation of Dangerous Goods Regulations](#) [22]. This program covers elements of package design, package maintenance, and the registration for use of certified packages as required by the regulations.

These compliance activities demonstrated that facilities and activities were operated and maintained according to the licensing basis.

5 INDIGENOUS CONSULTATION AND ENGAGEMENT

5.1 CNSC

CNSC is committed to building long-term relationships and conducting ongoing engagement with Indigenous Nations and communities who have interest in CNSC-regulated facilities within their traditional and/or treaty territories. The CNSC's Indigenous engagement practices include sharing information, discussing topics of interest, seeking feedback and input on CNSC processes, and providing opportunities to participate in environmental monitoring. The CNSC also makes funding support available through the CNSC's Participant Funding Program for Indigenous peoples to meaningfully participate in Commission proceedings and ongoing regulatory activities.

CNL sites fall within the traditional and treaty territories of many Indigenous Nations and communities, as listed in ([appendix A](#)). The vast majority of engagement and consultation activities with Indigenous Nations and communities in 2021 occurred via remote means due to public health measures related to COVID-19, although a few meetings were held in person when travel and local health restrictions allowed. CNSC staff welcomed the opportunity to discuss and address topics of interest and concern to the Indigenous Nations and communities through these various engagement activities.

In 2021, CNSC staff engagement efforts in relation to CNL sites were largely focused on consultation activities for the ongoing EAs and licensing processes for the Near-Surface Disposal Facility, the Nuclear Power Demonstration decommissioning, and the Whiteshell Reactor-1 proposed licence amendment, which are outside the scope of this ROR. Indigenous Nations and communities were also provided updates on ongoing licensed activities at the Douglas Point Waste Facility, Whiteshell Laboratories, and Chalk River Laboratories sites.

CNSC staff ensure that all Indigenous Nations and communities with a potential interest in CNL's sites, facilities, and activities, are aware of the CNL ROR process and how they can get involved. In 2021, CNSC staff held the first-ever CNL ROR virtual engagement session with Indigenous Nations and communities. There were 20 participants representing at least 11 Indigenous Nations, communities, and organizations. Based on the success of that event, CNSC staff will host another such session for the 2021 ROR. Seven (7) interested Indigenous Nations and communities participated in the 2021 Commission meeting as intervenors, all supported by the Participant Funding Program. CNSC staff continue to keep Indigenous Nations and communities informed on regulatory oversight and encourage their participation in the RORs and other Commission proceedings.

As environmental monitoring is often a topic of interest, CNSC staff have increasingly involved Indigenous Nations and communities in the CNSC's Independent Environmental Monitoring Program. Although there were no sampling campaigns in relation to CNL sites in 2021 due to pandemic travel restrictions, CNSC staff-initiated discussions with interested Indigenous Nations and communities to solicit their input and participation in the 2022 sampling campaigns around the Bruce Nuclear Generating Station (which encompasses the Douglas Point Waste facility) and the Whiteshell Laboratories site.

CNSC staff have formalized long-term engagement relationships with interested Indigenous Nations and communities through [Terms of Reference](#) [23] collaboratively developed with each Nation or community. The terms include regular meetings (e.g., monthly, quarterly, biannual), an accountability and governance structure, specific collaborative activities, as well as topics, facilities, sites, and projects of interest. CNSC staff remain open to developing such Terms of Reference with other interested Nations and communities.

The following updates on engagement activities relevant to the 2021 CNL ROR conducted under each of these Terms of Reference were collaboratively drafted with each respective Indigenous Nation or community.

CNSC Engagement with the Historic Saugeen Métis

Following the licence renewal hearing for the Bruce Nuclear Generating Station in 2018, [Terms of Reference](#) [23] were agreed upon and signed April 12, 2019, between CNSC staff and the Historic Saugeen Métis (HSM), which formally document the engagement with their community. CNSC staff continued to meet with HSM representatives in 2021 to discuss areas of interest such as the Douglas Point decommissioning licence application and Bruce Power's Fisheries Act authorization, the Mitigation Measures Study, radioactive waste, the major component replacement project, and the pressure tube findings. CNSC staff appreciated the opportunity to learn more about HSM's history and connection to the Bruce region through a series of webinars. While the HSM did not have any outstanding concerns related to the nuclear activities on the Bruce site, they continued to actively participate and make informed contributions to address any potential impacts on HSM rights and interests.

CNSC staff plan to continue to engage and update HSM on regulatory activities with regards to the Bruce site, including CNL's Douglas Point decommissioning project, on a semi-annual basis as agreed upon in the Terms of Reference including active participation in the IEMP sampling campaign in 2022.

CNSC Engagement with the Saugeen Ojibway Nation

[Terms of Reference](#) [23] were signed in 2019 between the Saugeen Ojibway Nation (SON) and CNSC staff, which document the CNSC's commitment to formalize engagement and collaboration with their communities, as directed by the Commission in the Bruce Power licence renewal record of decision. Under the Terms of Reference, the SON and the CNSC collaborate on a number of areas including:

- joint review and analysis of licensee submissions, particularly around environmental protection
- participation in the CNSC's IEMP
- inclusion on the design and review of Bruce Power's study of available mitigation measures for environmental impacts
- SON community outreach
- sharing the results of CNSC's environmental oversight, such as inspection reports
- identifying federal, provincial, and municipal decision-making agencies, as needed
- coordinating meetings with federal and provincial Crown agencies, as needed
- sharing information on the Western Waste Management Facility, Douglas Point and Nuclear Waste Management Organization (NWMOs) Adaptive Phased Management project.

A work plan was developed, which sets out detailed tasks and timelines for each of these items.

In 2021, CNSC staff and the SON continued to meet and work collaboratively to complete a number of the agreed upon initiatives in the work plan. These activities included CNSC's funding support for a traditional land use and occupancy study to obtain a baseline inventory of mapped cultural sites in relation to the SON's Territory, including the Territory around the Bruce Power site. However, due to the pandemic and inability to meet with community members in person, this work has been postponed.

Throughout 2021, CNSC staff and members from the SON environment office engaged to develop a rack card which provided a summary of the CNSC IEMP and presented past results in a format meaningful to SON community members. These rack cards were distributed to SON community members in advance of the virtual webinar held on IEMP in May 2021. CNSC staff plan to continue to include SON in the 2022 IEMP sampling campaign.

CNSC staff also participated in a number of other webinars for the SON community members targeted on topics of interest, including NWMO's Adaptive Phased Management project, Douglas Point decommissioning and how radioactive waste is managed.

CNSC staff and SON will continue to work collaboratively in order to address areas under SON's concerns, rights and interests in relation to the Bruce site, including CNL's Douglas Point decommissioning project.

CNSC Engagement with the Métis Nation of Ontario

Following the licence renewal hearing for the Bruce Nuclear Generating Station in 2018, [Terms of Reference](#) [23] were agreed upon and signed on December 18, 2019, between CNSC staff and the Métis Nation of Ontario (MNO), which formally document the engagement with their Nation. As the MNO is a province-wide organization, a specific engagement plan under the Terms of Reference [23] was also signed in December 2019 with MNO Region 7, which is the consultation committee region that includes the Bruce site to address their areas of interest.

As per the engagement plan, in 2021, CNSC staff continued to meet with MNO Region 7 representatives to discuss topics such as the CNSC's IEMP, the Douglas Point decommissioning licence application, the regulation of transportation of nuclear substances, the Bruce Power Mitigation Measures Study, the Bruce Power Major Component Replacement project and the pressure tube finding.

As discussed at Bruce Power's licence renewal hearing in 2018, MNO Region 7 would like to be more involved in environmental monitoring activities and addressing the concerns their citizens have regarding perceived environmental impacts related to the Bruce site. CNSC staff will continue to collaborate and engage with the MNO Region 7 on areas of interest with regards to the Bruce site, including CNL's Douglas Point decommissioning project.

CNSC Engagement with Curve Lake First Nation

As committed to with Curve Lake First Nation (CLFN) as part of the [Terms of Reference](#) [23] for long-term engagement with the CNSC, the update below was prepared in collaboration with CLFN representatives.

In 2020, CNSC staff started discussions with CLFN to establish a formal long-term relationship with the community, and a Terms of Reference for a long-term engagement was signed between the CLFN and CNSC in February 2021. This Terms of Reference [23] ensures that CLFN is provided with adequate and meaningful funding, support, and capacity to participate in consultation and engagement activities required throughout the year. As part of the Terms of Reference, a yearly work plan is developed between the CNSC and CLFN, which provides information on the scope of work, detailed activities, and timelines associated with work items for collaboration and engagement.

In 2021 the work plan included:

- Terms of Reference [23] maintenance and updates
- Participation in the CNSC's IEMP
- Updates and discussions on specific Projects and Ongoing Operations of Existing Nuclear Facilities of Interest (including the Darlington and Pickering Nuclear Generating Stations (NGS) and Waste Management Facilities)

- Co-Jurisdictional Matters of Significance (i.e., *Fisheries Act* Authorization, Emergency preparedness and thermal emissions from NGS)
- Information, communication, and other topics (i.e., Regulatory Document updates, feedback on CNSC reporting and processes, Participant Funding Program opportunities)
- Developing a plan for a Curve Lake Indigenous Knowledge (IK) Study

Even though the last item of the plan has not been completed in 2021, it is CLFN and CNSC's commitment to develop a plan for a Curve Lake IK Study in 2022.

In 2021, CLFN and CNSC staff continued to meet monthly and work collaboratively to make progress on a number of the agreed upon initiatives in the work plan. Through routine monthly meetings and interactions, CLFN and CNSC have developed a good working level relationship; one that has been more conducive to open and direct communications.

Topics of discussion included updates and information sharing with regards to ongoing CNL projects and sites including Near Surface Disposal Facility, Nuclear Power Demonstration, Chalk River Laboratories, and the Port Hope Area Initiative.

In 2021, CLFN provided feedback through their intervention on the 2020 RORs and continue to do so through ongoing discussions. CNSC staff have made a number of improvements to reports and documentation based on the feedback, such as including land acknowledgements for each facility and creating a separate Indigenous consultation and engagement section.

CNSC staff and CLFN continue to be committed to strengthening the relationship through on-going respectful dialogue to share knowledge, information on culture, history and perspectives that help CNSC staff and CLFN learn from each other. CNSC staff will also continue to have discussions regarding areas of interest and issues, or concerns related to existing CNSC-regulated nuclear activities of interest to CLFN.

In 2022, CLFN and CNSC staff are planning to initiate discussions and collaboration regarding a Territory-wide study IK and Land Use Study as it relates to CNSC-regulated facilities and activities. Discussions will include the specific funding and capacity needs in order for CLFN to be able to meaningfully participate and complete these important studies and research. CLFN and CNSC staff will also continue to foster and create a safe ethical space for IK to be collected and shared.

CNSC Engagement with the Mississaugas of Scugog Island First Nation

As committed to with the Mississaugas of Scugog Island First Nation (MSIFN) as part of the [Terms of Reference](#) [23] for long-term engagement with the CNSC, the following update was prepared in collaboration with MSIFN representatives.

In September 2021, CNSC staff and MSIFN representatives started discussions to establish a long-term engagement Terms of Reference. The Terms of Reference was signed in March 2022, providing a formalized structure for ongoing dialogue

regarding CNSC-regulated facilities and activities of interest in the MSIFN's traditional and treaty territories. As part of the Terms of Reference [23], a yearly work plan was developed between the CNSC and MSIFN which provides information on the scope of work, detailed activities, and timelines associated with work items for collaboration and engagement. The 2022 work plan includes activities that CNSC staff and MSIFN will be working to implement throughout 2022 and beyond, including:

- Participation in the CNSC's IEMP
- Collaborative annual reporting to the Commission and to MSIFN Chief and Council
- Updates and discussions on specific projects and ongoing operations of licenced nuclear facilities of interest
- Enhancing information sharing and communication between the CNSC and MSIFN members
- Emergency management and preparedness

Facilities of interest in the workplan related to this ROR include Chalk River Laboratories and the Nuclear Power Demonstration Waste Facility.

CNSC staff and MSIFN are committed to continuing to strengthen the relationship through ongoing respectful dialogue to share knowledge, information on culture, history and perspectives that help CNSC staff and MSIFN learn from each other. CNSC staff will also continue to have discussions regarding areas of interest and issues, or concerns related to CNSC-regulated nuclear activities of interest to MSIFN.

CNSC Engagement with other Indigenous Nations and communities

CNSC staff have also been working with many other interested Indigenous Nations and communities for the CNL sites including CRL and WR-1. For the CRL site, CNSC staff have been working to advance ongoing engagement with the Algonquins of Ontario, Mitchikanibikok Inik (Algonquins of Barriere Lake), Algonquins of Pikwakanagan First Nation (AOPFN), Kebaowek First Nation (KFN), Kitigan Zibi Anishinabeg and Wolf Lake First Nation. For the Whiteshell Laboratories site, CNSC staff have been working to strengthen ongoing relationships with Black River and Hollow Water First Nations, the Manitoba Métis Federation (MMF), Sagkeeng Anicinabe First Nation, and Wabaseemoong Independent Nations. In 2021, CNSC began negotiating long-term relationship arrangements with AOPFN, KFN, and the MMF. CNSC staff remain committed to continuing building relationships with all interested Indigenous Nations and communities for all CNL sites.

5.2 CNL

CNSC staff note that CNL has a dedicated Indigenous Engagement program that covers CNL's operations and activities. CNL met and shared information with interested Indigenous Nations and communities throughout 2021. CNL staff also participated in cultural awareness activities, provided capacity funding to support engagement activities, and invited Indigenous community members to CNL events.

CNL engagement with respect to Chalk River Laboratories, the Douglas Point Waste Facility, and the Whiteshell Laboratories site in 2021 generally focused on project-specific environmental assessments and licensing processes. However, discussions and activities have also addressed concerns and interest in the broader sites and ongoing licensing activities.

For the Chalk River Laboratories site, CNL continued to work on long-term relationship agreements in 2021, signing a Memorandum of Understanding with the Algonquins of Ontario, another with the Métis Nation of Ontario (MNO) Regions 5 and 6, and a Contribution Agreement with Curve Lake First Nation (CLFN). CNL worked with the Algonquins of Pikwakanagan First Nation on establishing a Guardian Program and a communications protocol. The MNO and the AOPFN are also involved in CNL's public Environmental Stewardship Council. CNL also engaged with Kitigan Zibi Anishnabeg First Nation and Kebaowek First Nation and established monthly meetings with the Williams Treaties First Nations (including CLFN). CNL has noted that Indigenous Nations and communities expressed interest in biodiversity and cultural heritage studies, as well as future site use. In response, CNL invited interested Indigenous community members to participate in archaeological assessment field studies.

For the Douglas Point Waste Facility (DPWF), CNL focused on transitioning to long-term engagement in 2021 after the 2020 licence amendment process. CNL participated in the annual Saugeen Ojibway Nation (SON) Tradeshow, presented at a SON webinar, provided regular project updates, and worked towards signing a [Terms of Reference](#) [23] for long-term engagement. CNL provided project updates on the DPWF, including communications products for the Historic Saugeen Métis (HSM) Annual General Meeting, and discussed a long-term contribution agreement with the HSM. CNL also met with the MNO Georgian Bay Traditional Territory Consultation Committee to provide project updates and discuss a relationship agreement. Noted topics of interest included archaeological work, environmental protection and monitoring, site restoration and end-state land use, the transportation of nuclear materials, and potential impacts on fish.

In 2021, CNL shifted its approach to engaging with First Nations and the Red River Métis in the vicinity of the Whiteshell Laboratories (WL) site to be more relationship-based than project-focused. CNL worked to establish an Indigenous Advisory Committee as well as relationship agreements with key Indigenous Nations. With the Sagkeeng Anicinabe First Nation, CNL established a community liaison officer position, met with Chief and Council, provided site tours, recorded a video for National Indigenous Peoples Day, participated in trauma-informed engagement training, and included Sagkeeng representatives in CNL environmental monitoring activities. The MMF participated in or observed many CNL environmental monitoring and other site activities, received updates on ongoing WL decommissioning activities, hosted a discussion with CNL and AECL leadership, discussed potential collaborative initiatives, and began negotiating a relationship agreement with CNL. Black River First Nation and Hollow Water First Nation signed a relationship agreement with CNL and appointed a liaison officer, who participated in CNL onboarding, site tours, and environmental monitoring, and received updates on ongoing WL decommissioning activities.

No specific engagement activities with Indigenous Nations and communities were carried out for Gentilly-1 in 2021. However, CNL has indicated its intention to share information with and seek feedback from interested Indigenous communities with respect to Gentilly-1 and has noted that planning activities for Indigenous engagement were initiated in 2021.

CNSC staff is satisfied with the level and quality of Indigenous engagement conducted by CNL with regards to its operations and proposed projects at its different sites. CNSC staff encourages CNL to continue to remain flexible and responsive to the requests and needs of the Indigenous Nations and communities that have an interest in its sites, facilities, and proposed projects.

6 EVENTS AND OTHER MATTERS OF REGULATORY INTEREST

This section of the ROR provides information on other matters of regulatory interest, including reportable events and nuclear liability insurance at CNL sites, as well as the separate efforts of CNSC staff and CNL regarding public engagement, Indigenous consultation and engagement, and the response to the COVID-19 pandemic.

CNSC staff carried out independent public and Indigenous engagement activities as part of the organization's commitment to building trust and long-term relationships. CNSC continued to ensure regulatory oversight in regard to safety and protection of people and the environment while also managing employee health during the COVID-19 pandemic.

6.1 Reportable Events

Detailed requirements for reporting unplanned situations or events at CNL licensed sites to the CNSC are referenced in the applicable licence condition handbooks. CNSC REGDOC- 3.1.2, [Reporting Requirements, Volume I: Non-Power Reactor Class I Nuclear Facilities and Uranium Mines and Mills](#) [24] was implemented for applicable CNL sites in January 2019. Over the period covered by this report, CNL has complied with the requirements for submission of these reports.

[Appendix F](#) provides a list and a brief description of the reportable events which occurred in 2021. These events are low safety significant and CNSC staff are satisfied with CNL's corrective actions to prevent recurrence. There were no "Event Initial Reports" submitted by CNSC staff to the Commission in 2021.

6.2 Public Engagement

6.2.1 CNSC

Public engagement consists of activities carried out directly by CNSC staff, and those activities carried out by CNL. The [Nuclear Safety and Control Act](#) [1] mandates the CNSC to disseminate objective scientific, technical and regulatory information to the public concerning its activities and the activities it regulates. CNSC staff fulfill this mandate in a variety of ways, including hosting in-person and virtual information sessions and through annual regulatory reports. CNSC staff also participate in local community events as well as CNL-led public meetings. CNSC staff also seek out other opportunities to engage with the public and Indigenous Nations and communities, often participating in meetings or events in communities with interest in nuclear sites. These allow CNSC staff to answer questions about the CNSC's mandate and role in regulating the nuclear industry, including CNL's sites.

CNSC staff carried out several targeted outreach activities in 2021. Some of these activities were targeted to specific regulatory review processes underway, including the WR-1 in-situ decommissioning project, the NSDF, and the NPDWF in-situ decommissioning project. Other activities were more generic in nature including the outreach related to the CNL ROR. Outreach related to the ROR also focused on Indigenous Nations and communities that have traditional and/or treaty territories in proximity to CNL sites. Due to the ongoing COVID-19 pandemic, CNSC outreach in 2021 was reduced from previous years and was limited to virtual events.

Outreach included hosting and participating in webinars, and attending environmental stewardship meetings such as:

- CNSC ROR Indigenous engagement session
- CNSC NSDF and NPDWF joint webinars
- CNL Environmental Stewardship Council meetings

CNSC awarded approximately \$107,190 in participant funding to assist Indigenous peoples, members of the public and stakeholders in reviewing this ROR and submitting comments to the Commission, as detailed in [appendix L](#).

6.2.2 CNL

The CNSC requires licensees to maintain and implement public information and disclosure programs, in accordance with CNSC's [REGDOC-3.2.1, *Public Information and Disclosure*](#) [25]. These programs are supported by disclosure protocols that outline the type of facility's information to be shared with the public as well as details on how that information is to be disseminated. This ensures that timely information about the health, safety and security of persons and the environment, and other issues associated with the lifecycle of nuclear facilities, is effectively communicated to the public.

CNSC staff monitor CNL's implementation of its public information and disclosure program to verify that it communicates regularly with its audiences in a way that is meaningful to them. CNSC staff also review yearly program updates to verify CNL is taking communities feedback into consideration and taking steps to implement program adjustments to meet the evolving needs of the various communities.

Due to the COVID-19 pandemic, all licensees faced challenges and had to adapt their public information programs accordingly. This included moving away from traditional in-person meetings and events and offering webinars and increased digital communications whenever possible.

Communications activities by CNL included:

- Redesigning the CNL website to reflect their long-term rebranding plans
- Regularly updating the CNL website with information on each facility / site / project, as well as posting its public disclosure protocol and 9 public disclosures in 2021
- Extensive posting on social media with information on each facility / site / project, as well as engaging with audiences on social media. This included 72 Twitter posts, 103 LinkedIn posts, 260 Facebook posts, 69 Instagram posts and 16,075 YouTube views
- Advertising on social media, highway billboards, community posters, radio ads, personal service announcements that reached 35,000 listeners weekly
- Sending out information externally to local communities and interested stakeholders via newsletters (mailout and online), as well as internally to CNL employees via staff meetings, intranet, and internal newsletter (online). CNL produces general newsletters as well as facility / site / project specific newsletters for specific communities (CRL, WR-1)
- Publishing peer reviewed articles in its peer reviewed academic journal
- Hosting and participating in virtual events such as webinars, online conferences, career fairs and school presentations, with special focus on topics of particular interest such as WR-1, DPWF, NSDF and NPDWF
- Conducting sitewide tours at various facilities / sites for local communities, school groups, interested stakeholders and media as requested
- Supporting local communities, specifically through direct sponsorship, volunteering and an employee crowdfunding initiative
- Providing mechanisms for audience feedback and responding to public inquiries including:
 - 828 website visitors who used the ‘Contact Us’ function
 - a toll-free information line
 - breakfast sessions, technical meetings and focus groups and other local events
- Consistent engagement with local and national media, proactively and in response to requests. This included 5 remote appearances on CBC’s (Radio) Element of Surprise segment – including taking part in the 2-hour series finale. In 2021, CNL produced 27 news releases and appeared in media coverage for various facilities / sites / projects over 30 times.

In 2021, CNL demonstrated a strong commitment to disseminating appropriate and timely health and safety information to the public and community members through the use of their website, social media, virtual events, engagement activities and newsletters. CNSC staff found that all of CNL sites and facilities were in compliance with the applicable public information program requirements.

6.3 Nuclear Liability Insurance

Pursuant to section 7 of the [Nuclear Liability and Compensation Act](#) [26], which came into force on January 1, 2017, and previously under the [Nuclear Liability Act](#) [27], CNL is required to maintain nuclear liability insurance for designated nuclear installations. The 5 nuclear installations operated by CNL that require nuclear liability insurance, as designated in the Schedule (section 2) of the [Nuclear Liability and Compensation Regulations](#) [28], are: CRL, WL, DPWF, G1WF, NPDWF.

The insured facilities at CRL are a single-unit reactor of over 7 megawatts, nuclear fuel waste processing facilities, retired nuclear reactor structures, facilities for nuclear fuel production and nuclear substance processing, and radioactive waste processing and storage facilities. CNL's prescribed limit of liability for this installation is \$180 million, in accordance with paragraph 5(a) of the [Nuclear Liability and Compensation Regulations](#) [28].

The insured facilities at WL, DPWF, and G1WF have each a prescribed limit of liability of \$13 million.

CNL's prescribed limit of liability for the installation at NPDWF is \$1 million.

Natural Resources Canada, which is the federal department responsible for the administration of the [Nuclear Liability and Compensation Act](#) [26], confirms that CNL is in compliance with its obligation under the [Nuclear Liability and Compensation Act](#) [26] for nuclear liability insurance for all 5 designated nuclear installations.

6.4 COVID-19 Response

6.4.1 CNSC

In 2021, CNSC staff reviewed all planned compliance activities on a risk-informed basis to determine an appropriate path forward. The CNSC developed a pandemic-related "Pre-Job Brief" as additional instructions to be delivered by CNSC management to inspectors prior to performing oversight activities remotely. COVID specific personal protective equipment were provided to inspectors prior to any in-person activity. The "Pre-Job Brief" clearly outlined the rights of individual employees to not attend an in-person inspection if they did not feel it was safe.

To complement the reduced number of onsite inspections due to COVID-19 restrictions, CNSC staff identified planned compliance activities well suited to be delivered by other means (remote verification methods, desktop reviews of documents and licensee submissions, etc.) and adjusted the planned compliance activities accordingly. Additionally, in certain cases, a hybrid virtual/in-person approach was adopted to minimize in-person time on site.

CNSC staff continue to conduct oversight activities during the COVID-19 pandemic to ensure the protection of the environment, and the health and safety of people. Specific oversight activities completed in 2021 during the pandemic are outlined in [appendix E](#) of this report.

6.4.2 CNL

In accordance with federal and provincial public health measures, CNL continued to operate under reduced operations aligned with its five phase Pandemic Recovery Plan. Safety and maintenance activities of CNL sites, facilities, equipment, and processes were conducted to ensure compliance with regulatory requirements.

In early 2021, CNL started Phase 3 of its recovery plan that allowed increased personnel onsite. By August 2021, CNL sites transitioned to phase 4, with several safety precautions at sites to ensure the safety of staff and visitors. These included:

- Remote work arrangements, where possible.
- Face Covering Protocols, which continued to be updated based on government recommendations, and which identified where and when coverings were required and how exemptions would be handled.
- Daily COVID-19 screening for all CNL staff and contractors was aligned with changing public health protocols.
- Physical headcounts were taken at each of CNL-managed sites based on health authority advice.
- CNL work planning practices included an assessment of COVID-19 precautions, proper physical distancing, and the use of additional personal protective equipment.

CNL continues to evaluate new information and risks related to COVID-19 at their site. CNSC staff are notified in a timely manner of any specific on-site COVID-19 cases and changes made by CNL.

6.5 Overall Conclusions

CNSC staff concluded that the CRL, WL, DPWF, G1WF and NPDWF sites operated safely in 2021. This conclusion is based on CNSC staff's assessments of licensee activities which included site inspections, reviews of reports submitted by licensees, and event and incident reviews, supported by follow-up and general communication with the licensee.

For 2021, the performance in all SCAs was rated as "satisfactory" with the exception of the security SCA at CRL and WL, which were rated as "below expectations".

CNSC staff's compliance activities confirmed that:

- Radiation Protection programs at all CNL sites adequately controlled radiation exposures, keeping doses ALARA
- Conventional Health and Safety programs at all CNL sites continue to protect workers; and
- Environmental Protection programs at all CNL sites were effective in protecting people and the environment.

CNSC staff will continue to provide regulatory oversight at all CNL sites, to ensure that CNL makes adequate provision to protect the health, safety and security of workers, Canadians, and the environment, and continues to implement Canada's international obligations on the peaceful use of nuclear energy.

REFERENCES

- [1] [*Nuclear Safety and Control Act*](#), S.C. 1997, c. 9
- [2] [*Regulatory review status for the Near Surface Disposal Facility \(NSDF\) - Canadian Nuclear Safety Commission*](#)
- [3] [*Canadian Environmental Assessment Act, 2012*](#), S.C. 2012, c. 19, s. 52
- [4] [*Outcome of Federal-Provincial Review Team Review of Final Environmental Impact Statement for the Near Surface Disposal Facility Project CNSC to CNL*](#), July 2, 2021
- [5] [*Regulatory review status for the decommissioning of the Whiteshell Reactor #1 - Canadian Nuclear Safety Commission*](#)
- [6] DEC 20-H4, Record of Decision, [*Application to amend the Waste Facility Decommissioning Licence for the Douglas Point Waste Facility to include phase 3 decommissioning activities*](#)
- [7] [*Regulatory review status of Nuclear Power Demonstration Closure Project - Canadian Nuclear Safety Commission*](#)
- [8] Commission Meeting Minutes, [*Minutes of the Canadian Nuclear Safety Commission \(CNSC\) Meeting held on December 8, 9 and 10, 2020*](#)
- [9] [*Radiation Protection Regulations*](#), SOR/2000-203
- [10] [*Canada Labour Code*](#), R.S.C., 1985, c L-2
- [11] [*Occupational Health and Safety Regulations*](#), SOR/86-304
- [12] [*Ontario Workplace Safety and Insurance Board, 2020 WSIB Statistical Report, Industry Sector Claims and LTI Rate*](#)
- [13] CSA Group, CSA N288.5-11, [*Effluent monitoring programs at Class I nuclear facilities and uranium mines and mills*](#)
- [14] ISO Standard 14001:2015, [*Environmental Management Systems*](#)
- [15] CSA Group, CSA N288.4, [*Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills*](#)
- [16] CSA Group, CSA N288.6-12, [*Environmental risk assessments at class I nuclear facilities and uranium mines and mills*](#)
- [17] CSA Group, CSA N288.1-14, [*Guidelines for calculating derived release limits for radioactive materials in airborne and liquid effluents for normal operation of nuclear facilities*](#)
- [18] CSA Group, CSA N393, [*Fire Protection for facilities that process, handle, or store nuclear substances*](#)

- [19] [Canadian National Report for the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management \(October 2020\)](#)
- [20] United Nations, [Treaty on the Non-Proliferation of Nuclear Weapons](#)
- [21] [Packaging and Transport of Nuclear Substances Regulations, 2015](#), SOR/2015-145
- [22] [Transportation of Dangerous Goods Regulations](#), SOR/2001-286
- [23] [Terms of Reference](#)
- [24] CNSC REGDOC-3.1.2, [Reporting Requirements, Volume I: Non-Power Reactor Class I Nuclear Facilities and Uranium Mines and Mills](#)
- [25] CNSC REGDOC-3.2.1, [Public Information and Disclosure](#)
- [26] [Nuclear Liability and Compensation Act](#), S.C. 2015, c. 4, s. 120
- [27] [Nuclear Liability Act](#), R.S.C. 1985, c. N-28
- [28] [Nuclear Liability and Compensation Regulations](#), SOR/2016-88
- [29] CNSC REGDOC-3.6, [Glossary of CNSC Terminology](#)
- [30] CMD 22-M32, Annual Program Report, *Regulatory Oversight Report on the Use of Nuclear Substances in Canada: 2021*
- [31] [General Nuclear Safety and Control Regulations](#), SOR/2000-202
- [32] CSA Group, CSA N288.1-14, [Guidelines for calculating derived release limits for radioactive materials in airborne and liquid effluents for normal operation of nuclear facilities](#)

GLOSSARY AND ACRONYMS

For definitions of terms and acronyms used in this document, except for those listed below, see REGDOC-3.6, [Glossary of CNSC Terminology](#) [29].

AECL	Atomic Energy of Canada Limited
ALARA	As Low As Reasonably Achievable
AL	Action Level
ANMRC	Advanced Nuclear Materials Research Centre
AOPFN	Algonquins of Pikwakanagan First Nation
BE	Below Expectation
Bq	Becquerel
CANDU	Canada Deuterium Uranium
CED	Committed Effective Dose
CNL	Canadian Nuclear Laboratories
CNSC	Canadian Nuclear Safety Commission
CMD	Commission Member Document
CRL	Chalk River Laboratories
DCP	Dose Control Points
DRL	Derived Release Limits
DPWF	Douglas Point Waste Facility
EcoRA	Ecological Risk Assessment
ERA	Environmental Risk Assessment
FS	Fully Satisfactory
G1WF	Gentilly-1 Waste Facility
HRS	Hours
HHRA	Human Health Risk Assessment
HSM	Historic Saugeen Métis
IAEA	International Atomic Energy Agency
IEMP	Independent Environmental Monitoring Program
IK	Indigenous Knowledge
ISO	International Organization for Standardization
KFN	Kebaowek First Nation
KG	Kilogram

LCH	Licence Conditions Handbook
M	Meter
MBq	Megabecquerel
MMF	Manitoba Métis Federation
MNO	Métis Nation of Ontario
MSIFN	Mississaugas of Scugog Island First Nation
mSv	Millisievert
MWe	Megawatt Electric
MWth	Megawatt Thermal
NEWs	Nuclear Energy Workers
NNC	Notice of Non-compliance
NPDWF	Nuclear Power Demonstration Waste Facility
NRTEOL	Nuclear Research and Test Establishment Operating Licence
NRTEDL	Nuclear Research and Test Establishment Decommissioning Licence
NSDF	Near Surface Disposal Facility
NRU	National Research Universal
NWMO	Nuclear Waste Management Organization
PHAI	Port Hope Area Initiative
PHP	Port Hope Project
REGDOC	Regulatory Document
RLTI	Recordable Lost-Time Injuries
ROR	Regulatory Oversight Report
RSSSA	Recoverable Surface Storage and Staging Area
SA	Satisfactory
SCA	Safety and Control Areas
SON	Saugeen Ojibway Nation
WFDL	Waste Facility Decommissioning Licence
WL	Whiteshell Laboratories
WNSL	Waste Nuclear Substance Licence
WR-1	Whiteshell Reactor No. 1

A. INDIGENOUS NATIONS AND COMMUNITIES THAT HAVE TRADITIONAL AND/OR TREATY TERRITORIES WITHIN PROXIMITY TO CNL SITES

Chalk River Laboratories and Nuclear Power Demonstration

- Algonquin Anishinabeg Nation Tribal Council
- Algonquin Nation Secretariat
- Algonquins of Barriere Lake
- Algonquins of Ontario
- Algonquins of Pikwàkanagàn First Nation
- Conseil de la Nation Anishnabe de Lac Simon
- Conseil de la Première Nation Abitibiwinni
- Kebaowek First Nation
- Kitcisakik First Nation
- Kitigan Zibi Anishinabeg First Nation
- Long Point First Nation
- Métis Nation of Ontario
- Mitchikanibikok Inik (Algonquins of Barriere Lake)
- Timiskaming First Nation
- Wahgoshig First Nation
- Williams Treaties First Nations:
 - Alderville First Nation
 - Beausoleil First Nation
 - Chippewas of Georgina Island First Nation
 - Chippewas of Rama First Nation
 - Curve Lake First Nation
 - Hiawatha First Nation
 - Mississaugas of Scugog Island First Nation
- Wolf Lake First Nation

Douglas Point Waste Facility

- Historic Saugeen Métis
- Métis Nation of Ontario
- Saugeen Ojibway Nation, comprised of:
 - Chippewas of Nawash Unceded First Nation
 - Saugeen First Nation

Gentilly-1 Waste Facility

- Abénakis of Wôlinak and Odanak, represented by the Grand Conseil de la Nation Waban-Aki
- Nation huronne-wendat

Whiteshell Laboratories

- Black River First Nation
- Brokenhead Ojibway Nation
- Grand Council of Treaty 3
- Hollow Water First Nation
- Iskatewizaagegan #39 Independent First Nation
- Manitoba Métis Federation
- Northwest Angle #33 First Nation
- Sagkeeng Anicinabe First Nation
- Shoal Lake #40 First Nation
- Wabaseemoong Independent Nations

B. ROR DASHBOARD

Regulatory Oversight Report (ROR) Dashboard of Canadian Nuclear Laboratories Sites: 2021

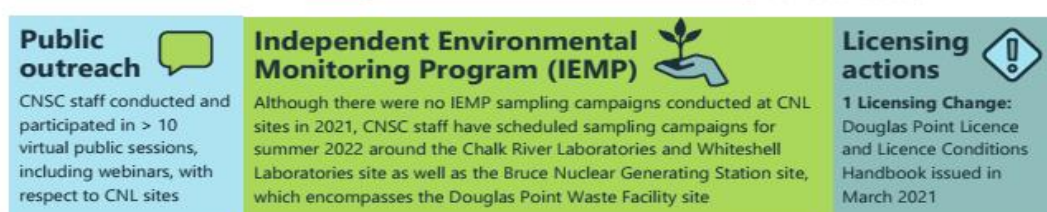
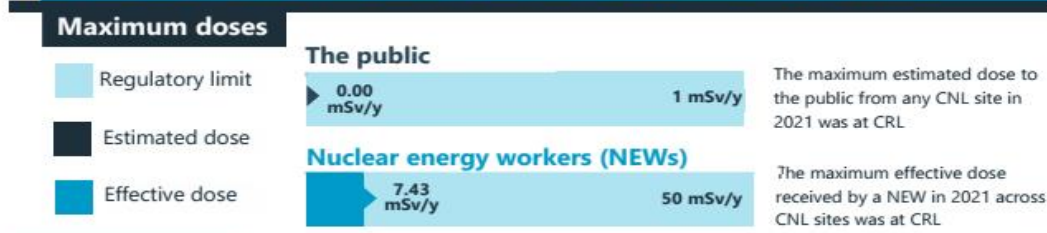
This dashboard reports on the safety performance of Canadian Nuclear Laboratories (CNL) sites and the efforts of the Canadian Nuclear Safety Commission (CNSC) to ensure the safety and protection of the people and the environment around the sites in 2021. For the full ROR, please refer to CMD 22-M33.



CNSC staff conclude that all CNL sites operated safely in 2021



All NNCs were considered low-risk and did not have an impact on safety at CNL sites



C. LICENCES AND LICENSING ACTIVITIES

Site/ Facility/ Project	Licence Number	Previous Commission Hearing	Licensing Changes in 2021
Chalk River Laboratories	NRTEOL-01.00/2028	CMD 18-H2, January 24-25, 2018	None
Whiteshell Laboratories	NRTEDL-W5-8.00/2024	CMD 19-H4, October 2-3, 2019	None
Douglas Point Waste Facility	WFDL-W4-332.03/2030	CMD 20-H4, November 25-26, 2020	New Licence issued March 12, 2021
Gentilly-1 Waste Facility	WFDL-W4-331.00/2034	CMD 18-H107, December 12, 2018	
Nuclear Power Demonstration Waste Facility	WFDL-W4-342.00/2034		
Waste Nuclear Substance Licence (WNSL) for Unspecified Locations	WNSL-W2-2202.0/2026	WDD-DOD-16-004, November 28, 2016	
Canadian Nuclear Laboratories Import Licence	IL-01.00/2031	NLRRD-DOD-16-001, April 26, 2016	Updated Import Licence
Canadian Nuclear Laboratories Export Licence	EL-01.00/2031		Updated Export Licence
La Prade Nuclear Substances and Radiation Devices Licence*	15193-4-26.00	N/A	
Low-Level Waste Programs Nuclear Substances and Radiation Devices Licence*	15193-5-23.00		
Dosimetry Service Licence	15193-1-26.2		
* <i>These Nuclear Substances and Radiation Devices Licences are discussed in CMD 22-M32, Regulatory Oversight Report on the Use of Nuclear Substances in Canada: 2021[30] and are not included as part of the content of this ROR.</i>			

D. REGULATORY DOCUMENT IMPLEMENTATION

Table D-1: Regulatory Documents - CRL

Document Number	Document Title	Version	Status
REGDOC-2.2.4, Volume II	Fitness for Duty: Managing Alcohol and Drug Use, Version 3	2021	Effective January 2022
REGDOC-2.11.1, Volume I	Waste Management: Management of Radioactive Waste	2021	Effective September 2022
REGDOC-2.11.2	Decommissioning	2021	Effective September 2022
REGDOC-3.3.1	Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities	2021	TBD
CSA N292.0:19	General principles for the management of radioactive waste and irradiated fuel	2019	Effective September 2022
CSA N294:19	Decommissioning of facilities containing nuclear substances	2019	Effective September 2022

Table D-2: Regulatory Documents - WL

Document Number	Document Title	Version	Status
REGDOC-2.4.3	Nuclear Criticality Safety, Version 1.1	2020	Gap analysis received June 2021
REGDOC-2.9.1	Environmental Principles, Assessments and Protection Measures, Version 1.1	2017	Effective September 30, 2022
REGDOC-2.12.3	Security of Nuclear Substances: Sealed Sources and Category I, II and III Nuclear Material, Version 2.1	2020	Gap analysis received June 2021
REGDOC-2.11.2	Decommissioning	2021	Effective September 2022
REGDOC-2.2.4, Volume II	Fitness for Duty: Managing Alcohol and Drug Use, Version 3	2021	TBD
REGDOC-3.3.1	Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities	2021	TBD
CSA N292.0:19	General principles for the management of radioactive waste and irradiated fuel	2019	Effective September 2022

Table D-3: Regulatory Documents - DPWF, G1WF and NPDWF

Document Number	Document Title	Version	Status
REGDOC-2.4.3	Nuclear Criticality Safety, Version 1.1	2020	Gap analysis received June 2021
REGDOC-2.9.1	Environmental Principles, Assessments and Protection Measures, Version 1.1	2017	Effective December 2021
REGDOC-2.12.3	Security of Nuclear Substances: Sealed Sources and Category I, II and III Nuclear Material, Version 2.1	2020	Gap analysis received June 2021
REGDOC-2.11.1, Volume I	Waste Management: Management of Radioactive Waste	2021	Effective September 2022
REGDOC-2.11.2	Decommissioning	2021	Effective September 2022
REGDOC-3.3.1	Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities	2021	TBD
CSA N292.0:19	General principles for the management of radioactive waste and irradiated fuel	2019	Effective September 2022

E. LIST OF INSPECTIONS AT CNL SITES

Table E-1: List of CNSC-led inspections at CRL

Inspection	Dates	SCAs Covered	Number of Notices of Non-Compliance (NNCs) and Recommendations (Recs.)
CNL-CRL-2021-01 Compliance Inspection of Waste Management Practices in CNL's Shielded Facilities	March 24, 2021	<ul style="list-style-type: none"> • Waste Management • Radiation Protection 	6 NNCs 4 Recs.
CNL-CRL-2021-02 General Inspection of Facilities Decommissioning in Buildings 204, 220 and 200A	December 9, 2021	<ul style="list-style-type: none"> • Operating Performance • Radiation Protection • Conventional Health and Safety • Emergency Management & Fire Protection • Waste Management • Security 	2 NNCs 4 Recs.
CNL-CRL-2021-03 General Inspection of the Waste Management Areas D, G and H	September 22, 2021	<ul style="list-style-type: none"> • Human Performance Management • Fitness for Service • Radiation Protection • Conventional Health and Safety • Waste Management 	7 NNCs 3 Recs.
CNL-CRL-2021-04 Compliance Inspection of NRU Permanent Safe Shutdown Program	March 11, 2021	<ul style="list-style-type: none"> • Operating Performance • Environmental Protection • Human Performance Management • Emergency Management & Fire Protection • Waste Management 	0 NNCs 2 Recs.
CNL-CRL-2021-05 Compliance Inspection of the Fuel Assembly Science and Technologies (FAST) Laboratory at Chalk River Laboratories	March 25, 2021	<ul style="list-style-type: none"> • Radiation Protection • Emergency Management & Fire Protection • Conventional Health and Safety • Security • Waste Management 	4 NNCs 4 Recs.

Inspection	Dates	SCAs Covered	Number of Notices of Non-Compliance (NNCs) and Recommendations (Recs.)
CNL-CRL-2021-06 General Inspection of Nuclear Materials Storage Building 575	August 26, 2021	<ul style="list-style-type: none"> • Fitness for Service • Safety Analysis • Radiation Protection • Conventional Health and Safety 	3 NNCs 1 Rec.
CNL-CRL-2021-07 CNL Environmental Management System	September 16, 2021	<ul style="list-style-type: none"> • Environmental Protection • Management System 	3 NNCs 2 Recs.
CNL-CRL-2020-09 Type II Compliance Inspection of CRL Emergency Stay-in Exercise Gamma IX	August 24, 2021	<ul style="list-style-type: none"> • Emergency Management & Fire Protection 	2 NNCs 4 Recs.
CNLCRL-2020-07 Compliance Inspection of CRL Facilities Decommissioning in Building 300	June 24, 2021	<ul style="list-style-type: none"> • Operating Performance • Radiation Protection • Conventional Health and Safety • Emergency Management and Fire Protection • Waste Management 	3 NNCs 5 Recs.
Security	June 17, 2021	<ul style="list-style-type: none"> • Security 	N/A
Security	October 19, 2021	<ul style="list-style-type: none"> • Security 	N/A

Table E-2: List of CNSC safeguard inspections at WL

Inspection	Dates	SCAs Covered	Number of Notice of Non-Compliance (NNCs) and Recommendations (Recs.)
CNL-WL-2021-01 Human Performance Management	March 4, 2021	<ul style="list-style-type: none"> • Human Performance Management • Management System • Operating Performance 	2 NNCs 2 Recs.
CNL-WL-2021-02 Management System Focused Compliance Inspection	April 22, 2021	<ul style="list-style-type: none"> • Management System 	6 NNCs 1 Rec.
CNL-WL-2021-03 Baseline General Inspection of Whiteshell Laboratories	October 13, 2021	<ul style="list-style-type: none"> • Fitness for Service • Operating Performance • Radiation Protection • Conventional Health and Safety • Emergency Management & Fire Protection • Waste Management 	3 NNCs 4 Recs.
CNL-WL-SEC-21-T2-001		<ul style="list-style-type: none"> • Security 	N/A

Table E-3: List of CNSC-led inspections at DPWF, G1WF* and NPDWF

Inspection	Dates	SCAs Covered	Number of Notice of Non-Compliance (NNCs) and Recommendations (Recs.)
CRL-NPD-2021-01 Baseline Inspection of Nuclear Power Demonstration Waste Facility	July 7, 2021	<ul style="list-style-type: none"> • Fitness for Service • Environmental Protection • Waste Management • Security • Radiation Protection • Conventional Health and Safety • Emergency Management & Fire Protection • Operating Performance 	2 NNCs 5 Recs.
CNL-DP-Security		<ul style="list-style-type: none"> • Security 	N/A
<i>*No inspections were performed at G1WF in 2021.</i>			

Table E-4: List of IAEA-led inspections at CNL Sites

SITE/ Facility/ Project	IAEA inspections (CNSC Escort)
CRL	54 (2)
WL	4 (0)
DPWF	3 (0)
G1WF	2 (0)
NPDWF	0 (0)
TOTAL	63 (2)

F. REPORTABLE EVENTS

This appendix contains information on the number of reportable events at the CNL sites covered by this ROR, in the 2021 calendar year. CNL is required to report events as per the [General Nuclear Safety and Control Regulations](#) [31], and, if applicable to site, the criteria outlined in CNSC's REGDOC-3.1.2, [Reporting Requirements, Volume I: Non-Power Reactor Class I Nuclear Facilities and Uranium Mines and Mills](#) [24]. A total of 45 events were reported to and assessed by CNSC staff in 2021. CNSC staff, determined that there was no risk to the environment, nor the public associated with these events.

Table F-1: Number of reportable events at each CNL site in 2021

Site/Facility/Project	Number of events
Chalk River Laboratories	37
Whiteshell Laboratories	6
Douglas Point Waste Facility	1
Gentilly-1 Waste Facility	1
Nuclear Power Demonstration Waste Facility	0
TOTAL	45

Table F-2: Reportable events at CRL in 2021

Event Number	Title	SCA	Facility (if applicable)
1.	Smoke Observed in B229 During Routine Operations	Emergency Management and Fire Protection	Molybdenum-99 Production Facility
2.	Sewer Line leak	Environmental Protection	Facilities Decommissioning
3.	Backfilling Dump Truck Tipped Onto Side	Conventional Health and Safety	Facilities Decommissioning
4.	Radiation Source Not Registered	Radiation Protection	N/A
5.	Fire Suppression System Impairment - Firewater Line Break	Emergency Management and Fire Protection	N/A
6.	CRL Fire Department temporarily below Minimum Shift Complement	Emergency Management and Fire Protection	N/A
7.	IAEA seal missing metal cap	Safeguards and Non-proliferation	N/A
8.	Contaminated Flasks containing Depleted Uranium used as shielding are not being leak tested	Radiation Protection	N/A
9.	Damaged IAEA Seal	Safeguards and Non-proliferation	N/A
10.	Ludlum 375 Gamma Area Monitor Found Out of Calibration	Radiation Protection	HPNG Facility
11.	Late submission of Inventory Change Documents (ICD) to the CNSC	Safeguards and Non-proliferation	N/A
12.	Fire Screening Form Not Completed for Fire System Impairment	Emergency Management and Fire Protection	N/A
13.	Transportation of Dangerous Goods Shipment from an External Consignor Received with Labelling Issues	Packaging and Transport	N/A
14.	Depleted Uranium unaccounted for	Safety Analysis	N/A
15.	Liquid Found Leaking from Waste Package	Environmental Protection	Waste Management Area H

Event Number	Title	SCA	Facility (if applicable)
16.	Temporary Breach of CRL Fire Minimum Complement	Emergency Management and Fire Protection	N/A
17.	Continuous Air Monitor (CAM) found past its Calibration date.	Radiation Protection	Molybdenum-99 Production Facility
18.	Annual Fire Alarm Testing Overdue PMM's	Emergency Management and Fire Protection	N/A
19.	Activation of Crisis Management Team due to IT Outage	Emergency Management and Fire Protection	N/A
20.	Air Effluent Exceedance of Gross Beta Action Level	Environmental Protection	Fuels & Materials Cells
21.	Storage area not registered or signed appropriately	Radiation Protection	N/A
22.	Conduct of Operations Deficiencies at Mixed Waste Drum Storage Units	Waste Management	Waste Management Area D
23.	Emergency Lighting Failure	Emergency Management and Fire Protection	N/A
24.	Contractor Chemical Burns by Concrete	Conventional Health and Safety	N/A
25.	CRL Fire Protection Program Non-Compliances	Emergency Management and Fire Protection	N/A
26.	EOC Activation Due To Service Water Leak In B466	Physical Design	N/A
27.	Motor Vehicle Accident	Human Performance Management	N/A
28.	Failure of International Atomic Energy Agency (IAEA) Sealing Device	Safeguards and Non-proliferation	Waste Management Areas
29.	Chalk River Laboratories EOC Activation for Class IV Power Outage Due to a Provincial Wide Winter Storm with High Winds	Emergency Management and Fire Protection	N/A
30.	Underground Fire Water Impairment – North Loop	Emergency Management and Fire Protection	N/A

Event Number	Title	SCA	Facility (if applicable)
31.	Non-Occupational Injury Requiring Emergency Off-Site Medical Response	Emergency Management and Fire Protection	N/A
32.	Small Fire in CNL Non-licensed Lab	Emergency Management and Fire Protection	N/A
33.	CRL main site and WMAs affected	Security	N/A
34.	CRL main site PA Entry	Security	N/A
35.	CRL main site PA	Security	N/A
36.	CRL main site security event	Security	N/A
37.	Committed Effective Dose (CED) Action Level for Tritium	Radiation Protection	NRU Rod Bays

Table F-3: Reportable events at WL in 2021

Event Number	Title	SCA	Facility (if applicable)
1	Injury- Slip, Trip, Fall	Human Performance	N/A
2	Missed maintenance of safety related systems as per shielded facilities facility authorization	Safety Analysis	Shielded Facilities
3	Incomplete Inventory Results in Misclassification of Shipment	Packaging and Transport	N/A
4	Hydraulic Leak at the Building 200 Demolition site involving a contractor's Hyster 550 Forklift (Rental Unit)	Operating Performance	Active Waste Treatment Centre
5	Radiation Source Found in Area Radiation Monitor Removed from B305 Electron Accelerator	Radiation Protection	N/A
6	Fire Protection System Impairment	Emergency Management and Fire Protection	N/A

Table F-4: Reportable events at DPWM in 2021

Event Number	Title	SCA	Facility (if applicable)
1	Audit of Fire Protection Program	Emergency Management and Fire Protection	N/A

Table F-5: Reportable events at G1WF in 2021

Event Number	Title	SCA	Facility (if applicable)
1	Audit of Fire Protection Program	Emergency Management and Fire Protection	N/A

Table F-6: Reportable events at NPDWF in 2021

There were no reportable events for NPDWF in 2021.

G. REGULATORY EFFORT

Site/ Facility/ Project	Inspections	Person Hours of Compliance Work*	Person Hours of Licensing Work*	Total Effort*
CRL**	11	8,082	4,385	12,466
WL	4	2,946	704	3,650
DPWF	1	431	222	653
G1WF	0	417	20	437
NPDWF	1	183	771	954
TOTAL	17	12,059	6,102	18,160
<p>* Rounded to the nearest hour. Data for 2021 does not include CNSC staff effort on ongoing environmental assessments and licensing processes for NSDF, NPDWF and WR-1 in-situ decommissioning projects.</p> <p>** Includes data for CRL, and CNL Import Licence and CNL Export Licence.</p>				

H. SAFETY AND CONTROL AREA RATINGS

Note that the following acronyms are used in this appendix:

SA = satisfactory

BE = below expectations

Table H-1: Safety and control area summary, CRL, 2017-2021

Safety and control areas	2017	2018	2019	2020	2021
Management system	SA	SA	SA	SA	SA
Human performance management	SA	SA	SA	SA	SA
Operating performance	SA	SA	SA	SA	SA
Safety analysis	SA	SA	SA	SA	SA
Physical design	SA	SA	SA	SA	SA
Fitness for service	SA	SA	SA	SA	SA
Radiation protection	SA	SA	SA	SA	SA
Conventional health and safety	SA	SA	SA	SA	SA
Environmental protection	SA	SA	SA	SA	SA
Emergency management and fire protection	SA	SA	SA	SA	SA
Waste management	SA	SA	SA	SA	SA
Security	SA	SA	SA	SA	BE
Safeguards and non-proliferation	SA	SA	SA	SA	SA
Packaging and transport	SA	SA	SA	SA	SA

Table H-2: Safety and control area summary, WL, 2017-2021

Safety and control areas	2017	2018	2019	2020	2021
Management system	SA	SA	SA	SA	SA
Human performance management	SA	SA	SA	SA	SA
Operating performance	SA	SA	SA	SA	SA
Safety analysis	SA	SA	SA	SA	SA
Physical design	SA	SA	SA	SA	SA
Fitness for service	SA	SA	SA	SA	SA
Radiation protection	SA	SA	SA	SA	SA
Conventional health and safety	SA	SA	SA	SA	SA
Environmental protection	SA	SA	SA	SA	SA
Emergency management and fire protection	SA	SA	SA	SA	SA
Waste management	SA	SA	SA	SA	SA
Security	SA	BE	BE	SA	BE
Safeguards and non-proliferation	SA	SA	SA	SA	SA
Packaging and transport	SA	SA	SA	SA	SA

Table H-3: Safety and control area summary, DPWF, 2017-2021

Safety and control areas	2017	2018	2019	2020	2021
Management system	SA	SA	SA	SA	SA
Human performance management	SA	SA	SA	SA	SA
Operating performance	SA	SA	SA	SA	SA
Safety analysis	SA	SA	SA	SA	SA
Physical design	SA	SA	SA	SA	SA
Fitness for service	SA	SA	SA	SA	SA
Radiation protection	SA	SA	SA	SA	SA
Conventional health and safety	SA	SA	SA	SA	SA
Environmental protection	SA	SA	SA	SA	SA
Emergency management and fire protection	SA	SA	SA	SA	SA
Waste management	SA	SA	SA	SA	SA
Security	SA	SA	SA	SA	SA
Safeguards and non-proliferation	SA	SA	SA	SA	SA
Packaging and transport	SA	SA	SA	SA	SA

Table H-4: Safety and control area summary, G1WF, 2017-2021

Safety and control areas	2017	2018	2019	2020	2021
Management system	SA	SA	SA	SA	SA
Human performance management	SA	SA	SA	SA	SA
Operating performance	SA	SA	SA	SA	SA
Safety analysis	SA	SA	SA	SA	SA
Physical design	SA	SA	SA	SA	SA
Fitness for service	SA	SA	SA	SA	SA
Radiation protection	SA	SA	SA	SA	SA
Conventional health and safety	SA	SA	SA	SA	SA
Environmental protection	SA	SA	SA	SA	SA
Emergency management and fire protection	SA	SA	SA	SA	SA
Waste management	SA	SA	SA	SA	SA
Security	SA	SA	SA	SA	SA
Safeguards and non-proliferation	SA	SA	SA	SA	SA
Packaging and transport	SA	SA	SA	SA	SA

Table H-5: Safety and control area summary, NPDWF, 2017-2021

Safety and control areas	2017	2018	2019	2020	2021
Management system	SA	SA	SA	SA	SA
Human performance management	SA	SA	SA	SA	SA
Operating performance	SA	SA	SA	SA	SA
Safety analysis	SA	SA	SA	SA	SA
Physical design	SA	SA	SA	SA	SA
Fitness for service	SA	SA	SA	SA	SA
Radiation protection	SA	SA	SA	SA	SA
Conventional health and safety	SA	SA	SA	SA	SA
Environmental protection	SA	SA	SA	SA	SA
Emergency management and fire protection	SA	SA	SA	SA	SA
Waste management	SA	SA	SA	SA	SA
Security	SA	SA	SA	SA	SA
Safeguards and non-proliferation	SA	SA	SA	SA	SA
Packaging and transport	SA	SA	SA	SA	SA

I. DOSES TO NUCLEAR ENERGY WORKERS AND NON-NUCLEAR ENERGY WORKERS AT CNL SITES

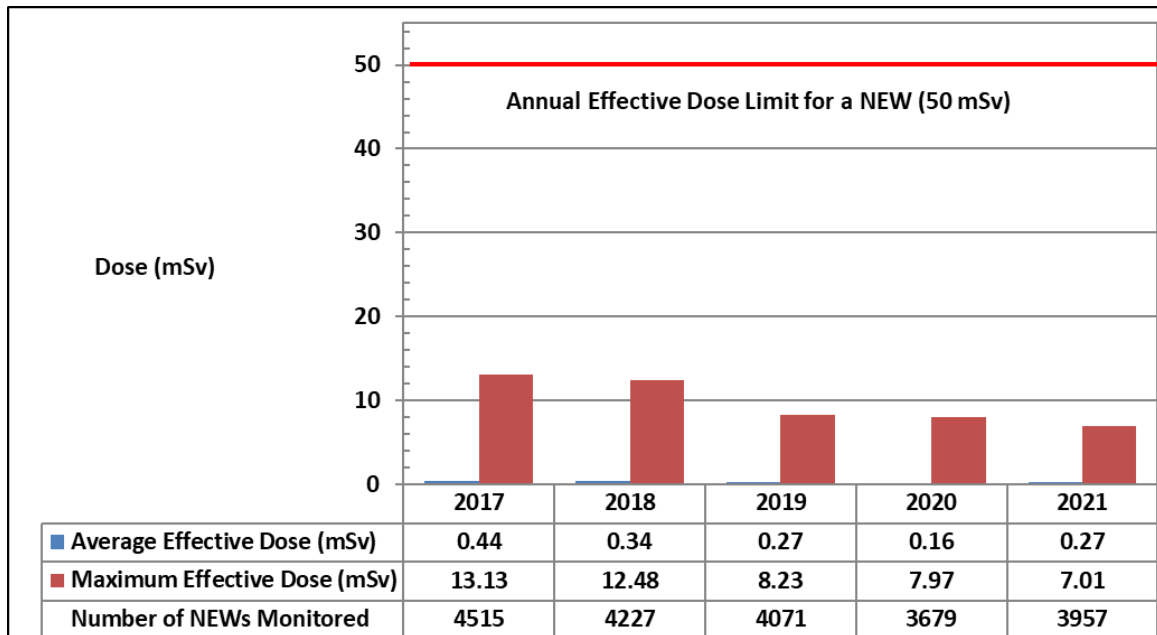
This appendix presents information on doses to Nuclear Energy Workers (NEWs) and non-NEWs at CNL sites.

Chalk River Laboratories

Figure I-1 provides the average effective doses and the maximum effective doses to NEWs at CRL from 2017 to 2021. CRL workers, including employees and contractors, conducting work activities which present a reasonable probability of receiving an occupational dose greater than 1 mSv/year are identified as NEWs. In 2021, the maximum effective dose received by a NEW was 7.01 mSv, well below the CNSC's regulatory effective dose limit for NEWs of 50 mSv in a 1-year dosimetry period. For the 5-year dosimetry period, which began on January 1, 2021, the maximum cumulative individual effective dose to a NEW was also 7.01 mSv, which is well below the CNSC's regulatory effective dose limit of 100 mSv in a 5-year dosimetry period.

The dose fluctuations from year to year are attributed to the scope and duration of the radiological work conducted, along with the dose rates associated with the work. No adverse trends were identified in 2021.

Figure I-1: Average and maximum effective doses to NEWs at CRL from 2017 - 2021



Tables I-1a and I-1b, shows the annual average and maximum equivalent doses to the skin and extremities (hands) for NEWs at CRL from 2017 to 2021.

In 2021, the maximum skin dose received by a NEW at CRL was 7.43 mSv, and the maximum extremity dose received by a NEW at CRL was 28.30 mSv. Doses to the skin and extremities at CRL were well below the CNSC's regulatory equivalent dose limit for NEWs of 500 mSv in a 1-year dosimetry period.

Table I-1a: Equivalent (skin) doses to NEWs at CRL from 2017 - 2021

Dose Data	2017	2018	2019	2020	2021	Regulatory Limit
Average skin dose (mSv)	0.53	0.40	0.29	0.19	0.31	N/A
Maximum skin dose (mSv)	19.95	15.84	9.65	9.37	7.43	500 mSv/year

Table I-1b: Equivalent (extremity) doses to NEWs at CRL from 2017 - 2021

Dose Data	2017	2018	2019	2020	2021	Regulatory Limit
Average extremity dose (mSv)	6.10	4.85	2.21	1.70	2.02	N/A
Maximum extremity dose (mSv)	85.06	44.83	21.38	11.86	28.30	500 mSv/year

Non-NEWs at CRL

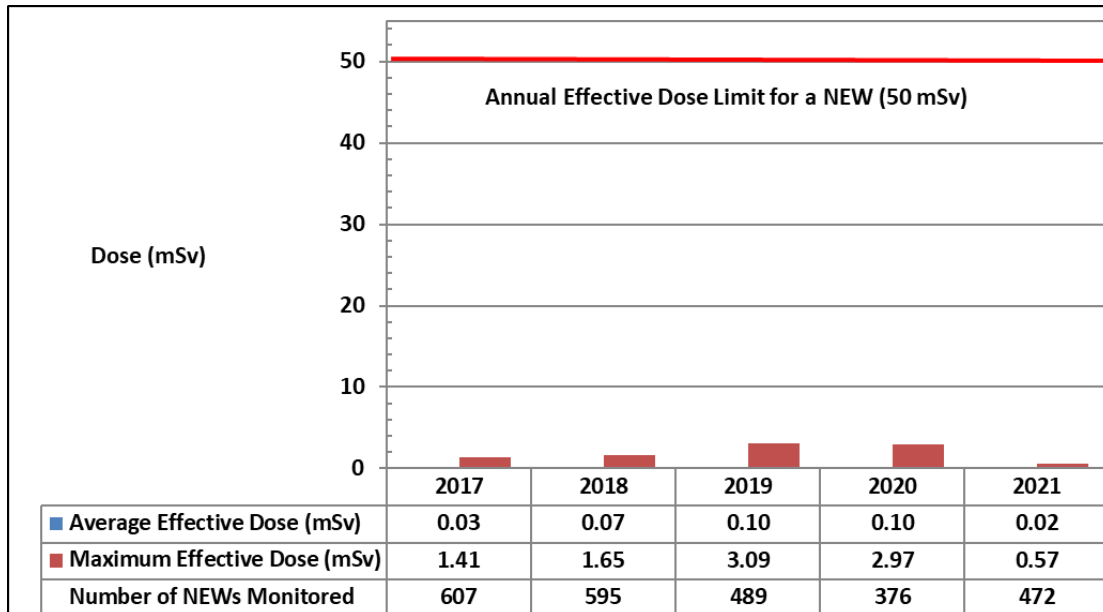
In 2021, the maximum effective and equivalent (skin) doses received by a person not considered as a NEW was 0.33 mSv and 0.36 mSv, respectively, which is well below the CNSC's regulatory effective and equivalent dose limits for persons who are not NEWs of 1 mSv and 50 mSv, respectively, in 1 calendar year.

Whiteshell Laboratories

Figure I-2 provides the average effective doses and the maximum effective doses to NEWs at WL from 2017 to 2021. WL workers, including employees and contractors, conducting work activities which present a reasonable probability of receiving an occupational dose greater than 1 mSv/year are identified as NEWs. In 2021, the maximum effective dose received by a NEW was 0.57 mSv, well below the CNSC's regulatory effective dose limit for NEWs of 50 mSv in a 1-year dosimetry period. For the 5-year dosimetry period, which began on January 1, 2021, the maximum cumulative individual effective dose to a NEW at WL was 0.57 mSv, which is well below the CNSC's regulatory effective dose limit of 100 mSv in a 5-year dosimetry period.

The dose fluctuations from year to year are attributed to the scope and duration of the radiological work conducted, along with the dose rates associated with the work. Worker doses decreased in 2021 with the completion of decommissioning activities in Building 200 in 2020. The main contribution to effective doses in 2021 was radioactive tank removal during Building 200 demolition activities, and operational replacement of hot cell roughing filters. There was increased waste handling in 2021 with the start of the removal, characterization, and packaging of low-level radioactive waste packages from storage facilities waste management areas. However, these activities had only a small contribution to site worker doses.

Figure I-2: Average and maximum effective doses to NEWs at WL from 2017 – 2021



Tables I-2a and I-2b, shows the annual average and maximum equivalent doses to the skin and extremities (hands) for NEWs at WL from 2017 to 2021.

In 2021, the maximum skin dose received by a NEW at WL was 0.94 mSv, and the maximum extremity dose received by a NEW at WL was 1.86 mSv. Doses to the skin and extremities at WL were well below the CNSC's regulatory equivalent dose limits for NEWs of 500 mSv in a 1-year dosimetry period.

Table I-2a: Equivalent (skin) doses to NEWs at WL from 2017 – 2021

Dose Data	2017	2018	2019	2020	2021	Regulatory Limit
Average skin dose (mSv)	0.05	0.12	0.20	0.16	0.02	N/A
Maximum skin dose (mSv)	2.90	3.72	7.47	6.80	0.94	500 mSv/year

Table I-2b: Equivalent (extremity) doses to NEWs at WL from 2017 - 2021

Dose Data	2017	2018	2019	2020	2021	Regulatory Limit
Average extremity dose (mSv)	1.51	5.02	4.80	1.43	0.45	N/A
Maximum extremity dose (mSv)	11.35	36.71	37.77	6.46	1.86	500 mSv/year

Non-NEWs at WL

In 2021, the maximum effective and equivalent doses received by a contractor not considered as a NEW was 0.11 mSv, which was well below the CNSC's regulatory effective and equivalent dose limits for persons who are not NEWs of 1 mSv and 50 mSv respectively, in 1 calendar year.

Douglas Point Waste Facility

Figure I-3 provides the average effective doses and the maximum effective doses to NEWs at the DPWF from 2017 to 2021. DPWF workers, including employees and contractors, conducting work activities which present a reasonable probability of receiving an occupational dose greater than 1 mSv/year are identified as NEWs. In 2021, the maximum effective dose received by a NEW at the DPWF was 0.36 mSv, which is well below the CNSC's regulatory effective dose limit for NEWs of 50 mSv in a 1-year dosimetry period. For the 5-year dosimetry period, which began on January 1, 2021, the maximum cumulative effective dose received by a NEW at the DPWF was 0.36 mSv, which is well below the CNSC's regulatory effective dose limit of 100 mSv in a 5-year dosimetry period.

Figure I-3: Average and maximum effective doses to NEWs at DPWF from 2017 – 2021

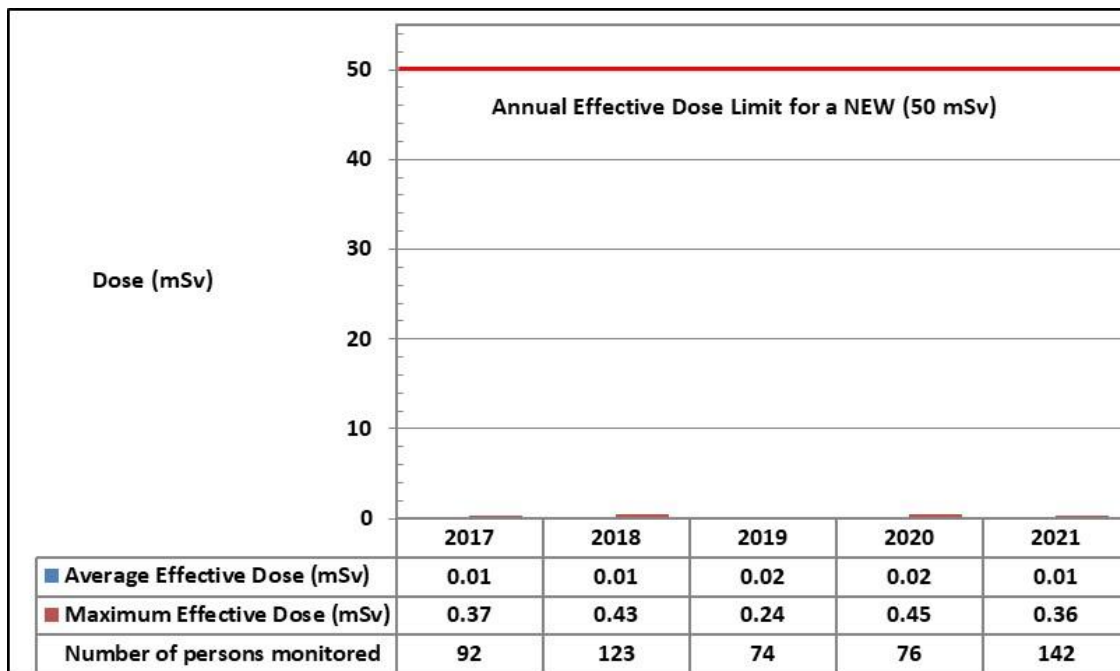


Table I-3 shows the annual average and maximum equivalent doses to the skin for NEWs at DPWF from 2017 to 2021.

In 2021, no measurable doses were recorded for visitors and contractors that were not considered as NEWs at the DPWF.

Table I-3: Equivalent (skin) doses to NEWs at DPWF from 2017 - 2021

Dose Data	2017	2018	2019	2020	2021	Regulatory Limit
Average skin dose (mSv)	0.01	0.01	0.02	0.03	0.01	N/A
Maximum skin dose (mSv)	0.37	0.43	0.24	0.51	0.45	500 mSv/year

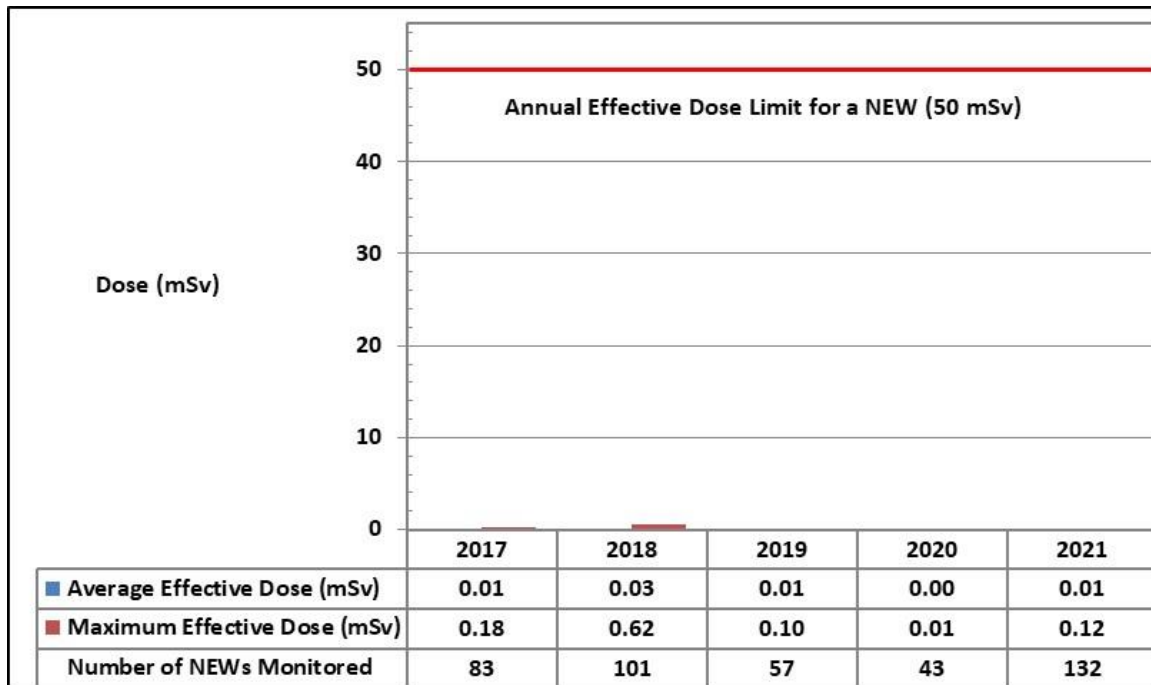
Non-NEWs at DPWF

In 2021, no measurable doses were recorded for visitors and contractors that were not considered as NEWs at the DPWF.

Gentilly-1 Waste Facility

Figure I-4 provides the average effective doses and the maximum effective doses to NEWs at G1WF from 2017 to 2021. G1WF workers, including employees and contractors, conducting work activities which present a reasonable probability of receiving an occupational dose greater than 1 mSv/year are identified as NEWs. In 2021, the maximum effective dose received by a NEW at the G1WF was 0.12 mSv, which is well below the CNSC's regulatory effective dose limit for NEWs of 50 mSv in a 1-year dosimetry period. For the 5-year dosimetry period, which began on January 1, 2021, the maximum cumulative effective dose received by a NEW at the G1WF was 0.12 mSv, which is well below the CNSC's regulatory effective dose limit of 100 mSv in a 5-year dosimetry period.

Figure I-4: Average and maximum effective doses to NEWs at G1WF from 2017 - 2021



Over 2017 to 2021, there has been an execution of planned hazard reduction work activities at the G1WF site. In 2018, most of the maximum individual effective dose was attributed to the Spent Resin Removal Project. From 2019 to 2021, the hazard reduction work continued, including asbestos abatement and dry active waste removal. This work had a low potential for worker exposures and resulted in low effective doses observed as compared to 2018.

Table I-4 shows the annual average and maximum equivalent doses to the skin for NEWs at G1WF from 2017 to 2021.

In 2021, the maximum skin dose received by a NEW at the G1WF was 0.12 mSv, which is well below the CNSC's regulatory equivalent dose limit for NEWs of 500 mSv in a 1-year dosimetry period.

Table I-4: Equivalent (skin) doses to NEWs at G1WF from 2017 - 2021

Dose Data	2017	2018	2019	2020	2021	Regulatory Limit
Average skin dose (mSv)	0.01	0.03	0.01	0.00	0.01	N/A
Maximum skin dose (mSv)	0.18	0.62	0.16	0.01	0.12	500 mSv/year

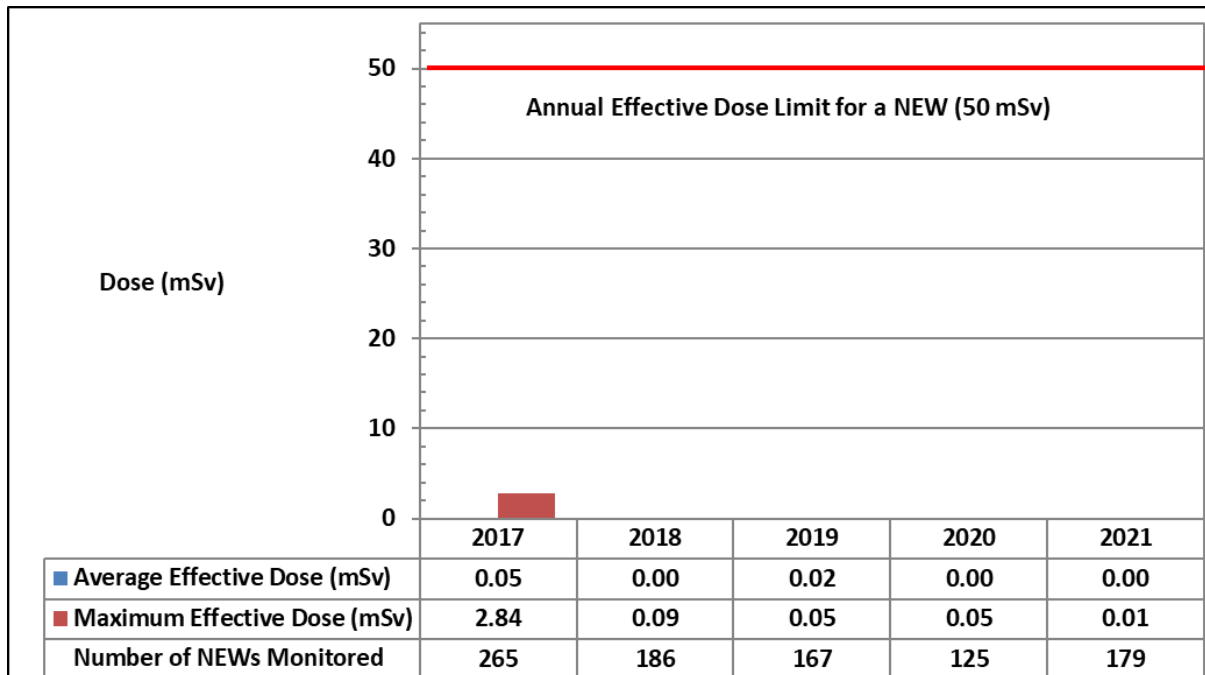
Non-NEWs at Gentilly-1

In 2021, no measurable doses were recorded for visitors and contractors that were not considered as NEWs at the G1WF.

Nuclear Power Demonstration Waste Facility

Figure I-5 provides the average effective doses and the maximum effective doses to NEWs at the NPDWF from 2017 to 2021. NPDWF workers, including employees and contractors, conducting work activities which present a reasonable probability of receiving an occupational dose greater than 1 mSv/year are identified as NEWs. In 2021, the maximum effective dose received by a NEW at the NPDWF was 0.01 mSv, which is well below the CNSC's regulatory effective dose limit for NEWs of 50 mSv in a 1-year dosimetry period. For the 5-year dosimetry period, which began on January 1, 2021, the maximum cumulative effective dose received by a NEW at the NPDWF was 0.01 mSv, which is well below the CNSC's regulatory effective dose limit of 100 mSv in a 5-year dosimetry period.

Figure I-5: Average and maximum effective doses to NEWs at NPDWF from 2017 – 2021



Effective doses over these years are consistently low and reflect storage with surveillance (SWS) activities such as routine inspection and maintenance, as well as some hazard reduction activities. Effective doses in 2017 did see an increase due to planned work activities involving engineering assessments, thorough facility characterization and large-scale hazard reduction activities (asbestos abatement). In 2021, a continuous decrease in effective doses to NEWs is observed; this is due to a consistent decrease in engineering assessment activities since 2017.

Table I-5 shows the annual average and maximum equivalent doses to the skin for NEWs at NPDWF from 2017 to 2021.

In 2021, the maximum skin dose received by a NEW at the NPDWF was 0.01 mSv, which is well below the CNSC's regulatory equivalent dose limit for NEWs of 500 mSv in a 1-year dosimetry period.

Table I-5: Equivalent (skin) doses to NEWs at NPDWF from 2017 - 2021

Dose Data	2017	2018	2019	2020	2021	Regulatory Limit
Average skin dose (mSv)	0.04	0.00	0.02	0.00	0.00	N/A
Maximum skin dose (mSv)	3.02	0.09	0.05	0.05	0.01	500 mSv/year

Non-NEWs at NPDWF

In 2021, no measurable doses were recorded for visitors and contractors that were not considered as NEWs at the NPDWF.

J. LOST-TIME INJURY INFORMATION

This appendix contains information on the number, frequency, and severity of reportable lost time injuries (RLTIs) at the CNL sites covered by this ROR, with information presented separately for CNL employees and contractors.

CNL Employees

Frequency and severity are calculated per 100 full-time workers (equivalent to 200,000 worker-hours per year) using the following formulas:

Frequency rate =

(# of Lost-Time Injuries) x (200 000 hrs of exposure) / (person hours worked)

Severity rate =

(# of Working Days Lost) x (200 000 hrs of exposure) / (person hours worked)

Table J-1: Summary of CRL's Employee RLTIs, frequency and severity (Source: CNL)

Year	2017	2018	2019	2020	2021
Person Hours Worked	5,597,015	5,396,450	5,729,010	5,346,690	5,358,630
Lost-Time Injuries	4	5	1	4	3
Working Days Lost	10	69	75	78	4
Frequency	0.14	0.19	0.03	0.15	0.11
Severity	0.36	2.56	2.62	2.92	0.15

In 2021, 4 working days were lost at CRL, the lowest in the last 5 years for CRL employees.

Table J-2: Summary of WL's Employee RLTIs, frequency and severity (Source: CNL)

Year	2017	2018	2019	2020	2021
Person Hours Worked	706,000	688,000	642,000	584,030	684,000
Lost-Time Injuries	3	1	0	1	0
Working Days Lost	27	5	0	2	0
Frequency	0.85	0.28	0	0.34	0
Severity	7.67	1.45	0	0.68	0

Table J-3: Summary of DPWF, G1WF, and NPDWF Employee RLTIs, frequency and severity (Source: CNL)

Year	2017	2018	2019	2020	2021
<i>CNL staff at the DPWF, G1WF, and NPDWF sites have not recorded a lost-time injury since 2016.</i>					

Contractors at CNL sites

The number of contractor recordable lost-time incidents reported to CNL in 2021 is shown in Table J-4.

CNL records the number of lost-time injuries reported to CNL by their contractors. However, contractor employee hours worked is considered sensitive information and the contractors do not divulge the specific number of hours worked to CNL as their client. Therefore, CNL does not provide frequency and severity rates for contractors since these calculations require hours worked.

Table J-4: Contractor lost-time injuries in 2021 (Source: CNL)

Site	CRL	WL	DPWF	G1WF	NPDWF
Lost-Time Injuries (Change from 2019)	2	0	0	0	0

K. ESTIMATED DOSE TO THE PUBLIC

This appendix contains information on the estimated dose to the public around CNL sites. Regulatory release limits known as Derived Release Limits (DRLs) are site-specific calculated release levels that could, if exceeded, expose a member of the public of the most highly exposed group to a committed dose equal to the regulatory annual dose limit of 1 mSv/year. DRLs are calculated using CSA standard N288.1-14, [Guidelines for calculating derived release limits for radioactive materials in airborne and liquid effluents for normal operation of nuclear facilities](#) [32].

As per the [Radiation Protection Regulations](#) [9] subsection 1(3), and considering the fact that the radiological releases from all the sites covered by this ROR have remained small fractions of the DRLs applicable to those sites, the contribution to the dose to the public from these releases remains a very small fraction of the prescribed limit for the general public.

Chalk River Laboratories

The maximum dose in each year since 2017 has been well below the dose limit of 1 mSv/year. Furthermore, at no point during this period have the emissions from the CRL site exceeded the constraint for dose to the public of 0.30 mSv/year.

Table K-1: CRL maximum effective dose to a member of the public from 2017 - 2021

Dose Data	2017	2018	2019	2020	2021	Regulatory Limit
Maximum Effective Dose (mSv)	0.0870	0.0360	0.0039	0.0074	0.0015	1 mSv/year

Whiteshell Laboratories

The dose to critical groups from releases from CNL-WL in 2021 was well below the regulatory dose limit of 1 mSv/year.

Table K-2: WL maximum effective dose to a member of the public from 2017 - 2021

Dose Data	2017	2018	2019	2020	2021	Regulatory Limit
Maximum effective dose (mSv)	0.00005	0.00004	0.00009	0.000003	0.0000109	1 mSv/year

DPWF

The gap analysis against CSA standard [N288.1-14](#) conducted in 2016 by CNL determined that given the very low levels of contaminants in airborne and waterborne effluents, there is no need for an environmental monitoring program at DPWF. CNSC staff reviewed and accepted this gap analysis. All releases of radioactive material in DPWF effluents are a small fraction of their respective regulatory limits which indicate the potential of minimal impact on the public or the environment. In addition, as DPWF is located within the Bruce Nuclear Site, thus the Bruce Power environmental monitoring program potentially captures any environmental impacts emanating from the small contribution of DPWF. The dose to the public from the Bruce Nuclear Site, (potentially including contributions from the DPWF), remain well below 0.16 $\mu\text{Sv}/\text{year}$ (0.00016 mSv/year)

G1WF

The effluent monitoring plan assessment conducted in 2016 by CNL determined that there is minimal or no source of airborne radioactivity from routine operations at G1WF. In addition, all liquid releases were discharged through the Gentilly-2 effluent system, operated by Hydro-Québec, and represent a small fraction of the total releases from the larger Gentilly site. Hydro-Québec's Gentilly-2 environmental monitoring program captures any environmental impacts from the small contribution from G1WF. The dose to the public from the Gentilly-2 nuclear site, including contributions from G-1, remain below 0.01 mSv/year.

NPDWF

NPD is no longer discharging liquid effluents from the facility sumps to the Ottawa River, and there were no such releases during the 2021 reporting period. All other releases of radioactive material in NPD effluents are a small fraction of their respective DRLs and thus, continue to indicate minimal impact on the public or the environment. CNL's environmental monitoring at CRL will regionally overlap with the Nuclear Power Demonstration (NPD), so information from CRL's off-site environmental monitoring program could also be considered. CNSC staff have determined that the public dose from NPD remains at a very small fraction of the public dose limit.

L. PARTICIPANT FUNDING AWARDED FOR THE 2021 CNL REGULATORY OVERSIGHT REPORT

CNSC staff provided interested communities with notice of the opportunity for funding through the CNSC's Participant Funding Program to review and comment on this report and the opportunity to submit a written intervention and/or appear before the Commission as part of the Commission meeting.

CNSC awarded approximately \$107,190 in participant funding to assist the following Indigenous peoples, members of the public and stakeholders in reviewing this ROR and submitting comments to the Commission.

Recipient	
	Algonquins of Pikwakanagan First Nation
	Canadian Environmental Law Association
	Chippewas of Kettle and Stony Point First Nation
	Grand Council of Treaty 3
	Manitoba Metis Federation
	Curve Lake First Nation
	Sagkeeng First Nation
	Nuclear Transparency Project
Total:	\$107,190

Further information on the CNSC's Participant Funding Program can be found on the CNSC's website at: <http://www.nuclearsafety.gc.ca/eng/the-commission/participant-funding-program/index.cfm>

M. SELECTED WEBSITES

Canadian Nuclear Laboratories - www.cnl.ca

Canadian Nuclear Safety Commission - www.nuclearsafety.gc.ca

CNL Annual Compliance Monitoring Reports via the CNL website -
<https://www.cnl.ca/environmental-stewardship/performance-reporting/>

CNL Regulatory Oversight Reports via the CNSC website -
<http://www.nuclearsafety.gc.ca/eng/resources/publications/reports/regulatory-oversight-reports/CNL-sites.cfm>

Information on CRL via the CNSC website-
<http://nuclearsafety.gc.ca/eng/reactors/research-reactors/nuclear-facilities/chalk-river/index.cfm>

CSA Group - www.csagroup.org/

CSA Group via the CNSC website - <https://nuclearsafety.gc.ca/eng/acts-and-regulations/regulatory-documents/csa-standards.cfm>

Information on WL via the CNSC website-
<http://nuclearsafety.gc.ca/eng/reactors/research-reactors/other-reactor-facilities/whiteshell-laboratories.cfm>

Information on DPWF via the CNSC website-
<http://nuclearsafety.gc.ca/eng/reactors/research-reactors/other-reactor-facilities/douglas-point-waste-facility.cfm>

Information on G1WF via the CNSC website-
<http://nuclearsafety.gc.ca/eng/reactors/research-reactors/other-reactor-facilities/gentilly-1-facility.cfm>

Information on NPDWF via the CNSC website-
<http://nuclearsafety.gc.ca/eng/reactors/research-reactors/other-reactor-facilities/nuclear-power-demonstration.cfm>

CNSC's SCA framework via the CNSC website-

1. <http://www.nuclearsafety.gc.ca/eng/resources/publications/reports/powerindustry/safety-and-control-areas.cfm>

2. <http://www.nuclearsafety.gc.ca/eng/resources/news-room/feature-articles/safety-and-control-areas.cfm>

Action Levels (AL) via the CNSC website-
<http://www.nuclearsafety.gc.ca/eng/resources/news-room/feature-articles/radiation-dose-limits-release-limits-and-action-levels.cfm>

2021 Annual radionuclides via CNSC Open Government Portal-
<https://open.canada.ca/data/en/dataset/6ed50cd9-0d8c-471b-a5f6-26088298870e>

Independent Environmental Monitoring Program (IEMP) via CNSC website-
<http://www.nuclearsafety.gc.ca/eng/resources/maps-of-nuclear-facilities/iemp/index-iemp.cfm>