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Technical Briefing

Exposé technique

**Canadian Nuclear
Laboratories (CNL)**

**Laboratoires Nucléaires
Canadiens (LNC)**

**Progress Update for
CNL's Prototype Waste
Facilities, Whiteshell
Laboratories and the
Port Hope Area Initiative**

**Rapport d'étape sur les
installations prototypes
de gestion des déchets,
les Laboratoires de
Whiteshell et l'Initiative
dans la région de Port
Hope des LNC**

Public Meeting

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Summary

This Commission Member Document (CMD) provides the Commission with a progress update on licensed activities as of April 1, 2018 at Canadian Nuclear Laboratories' prototype waste facilities (Douglas Point, Gentilly-1, Nuclear Power Demonstration), Whiteshell Laboratories, as well as remediation activities under the Port Hope Area Initiative.

Canadian Nuclear Laboratories is the licence holder for all of these sites.

There are no actions requested of the Commission. This CMD is for information only.

Résumé

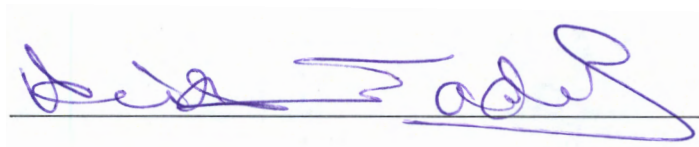
Le présent document à l'intention des commissaires (CMD) fournit à la Commission un rapport d'étape sur les activités autorisées au 1er avril 2018 aux installations prototypes de gestion des déchets (à Douglas Point, Gentilly-1 et au réacteur nucléaire de démonstration) et aux Laboratoires de Whiteshell, ainsi que sur les activités du projet de remise en état prévues dans le cadre de l'Initiative dans la région de Port Hope des Laboratoires Nucléaires Canadiens.

Laboratoires Nucléaires Canadiens sont le titulaire de permis pour chacun de ces sites.

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

Signed/Signé le

June 22, 2018



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EXECUTIVE SUMMARY

This CMD provides a progress update on Canadian Nuclear Laboratories' (CNL) licensed decommissioning activities at three shut down power reactors (Douglas Point, Gentilly-1 and Nuclear Power Demonstration, also known as prototype waste facilities) and Whiteshell Laboratories, as well as licensed remediation activities under the Port Hope Area Initiative (PHAI). This CMD is provided in response to the Commission's requests of October 24, 2012 and April 6, 2016 to receive periodic updates on the status of these projects.

The three shut down power reactors are Douglas Point (DP) in Tiverton, ON, Gentilly-1 in Bécancour, QC and Nuclear Power Demonstration in Rolphton, ON. These facilities ceased operations in the 1980s and were placed in safe shut down states. Since that time, the facilities have been in storage-with-surveillance phase. This is a planned phase of a deferred decommissioning strategy for nuclear reactors. As part of storage-with-surveillance, CNL continues to carry out care and maintenance activities, reduces hazards and liabilities, and undertakes decommissioning planning activities for final decommissioning and site closure.

Whiteshell Laboratories (WL) is a nuclear research and test facility located near Pinawa, Manitoba, which was originally operated by Atomic Energy of Canada Limited (AECL). It consists of the Whiteshell Reactor No. 1 (WR-1), a SLOWPOKE demonstration reactor, and other research and support facilities; WR-1 was shut down in 1985. In the late 1990s, AECL discontinued most research programs and operations at WL. A CNSC decommissioning licence was issued in 2003, renewed in 2008 and amended in 2016 to include a Licence Conditions Handbook. CNL continues to decommission the Whiteshell site under the current decommissioning licence, which expires in December 2018. In 2016, CNL submitted to the CNSC a project description to change the CNSC-approved decommissioning approach (full dismantling) to a new proposed approach for the WR-1 reactor (*in-situ* decommissioning). In order to have time to disposition comments received on the new proposed approach, in 2018, CNL applied for a licence renewal for a one-year term.

The PHAI represents the Government of Canada's commitment to the development and implementation of a safe, local, long-term management solution for historic low-level radioactive waste in the municipalities of Port Hope and Clarington, Ontario. The PHAI is being carried out as two separate projects, the Port Hope Project and Port Granby Project, under separate CNSC licences. At Port Granby, the long-term waste management facility (LTWMF) base liner construction was completed in 2016 and the excavation and emplacement of legacy wastes in the LTWMF is nearing completion. At Port Hope, the construction of the first of three cells of the LTWMF has been completed and emplacement of wastes has begun. CNL continues to conduct surveys of residential and commercial properties in Port Hope, aimed at identifying and remediating those that have historic low-level radioactive waste.

CNSC staff confirmed through inspections and desktop reviews that CNL continued carrying out work at these sites safely, and in compliance with the requirements of the *Nuclear Safety and Control Act* and their respective licences.

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

1 OVERVIEW

During a Commission Meeting held on April 6, 2016 CNSC staff committed to provide periodic progress updates for the three CNL shut down power reactors, and Whiteshell Laboratories (WL), a shut down nuclear research and test facility. The shut down power reactors are Douglas Point in Tiverton, ON, Gentilly-1 (G-1) in Bécancour, QC and Nuclear Power Demonstration (NPD) in Rolphton, ON. These three facilities are also known as prototype waste facilities. CNSC staff's previous update to the Commission on these sites was included in CMD 16-M12. During a Commission Meeting held on October 24, 2012 CNSC staff committed to provide progress updates on the Port Hope Area Initiative (PHAI), a clean-up of historic wastes in the region of Port Hope, ON. CNSC staff's last update to the Commission on the PHAI was delivered on November 9, 2016 as CMD 16-M44. CNSC staff have combined these two commitments to provide progress updates into this Commission Member Document (CMD).

The information presented in this CMD covers the period from January 1, 2016 to April 1, 2018 for the three shut down power reactors and WL, and from July 1, 2016 to April 1, 2018 for the PHAI. The start dates of these periods correspond to the end dates in the previous progress updates to the Commission.

2 REGULATORY OVERSIGHT

The Commission authorized CNL to conduct the activities related to decommissioning and remediation at the project sites that are covered by this report following the CNSC's public hearing process. Table 1 lists the licences, their expiration dates, and makes reference to Commission Records of Decision for CNL's licence projects covered by this report.

Table 1: Licences covered by this CMD

Licence Number	Facility/Site	Expiry	Record of Decision
WFDL-W4-332.01/2034	Douglas Point	December 31, 2034	e-Doc 4471304
	Gentilly-1		
	Nuclear Power Demonstration		
NRTEDL-W5-8.04/2018	Whiteshell Laboratories	December 31, 2018	e-Doc 3008086
WNSL-W1-2310.02/2022	Port Hope Long-Term Low-Level Radioactive Waste Management Project	December 31, 2022	e-Doc 4083842
WNSL-W1-2311.01/2021	Port Granby Long-Term Low-Level Radioactive Waste Management Project	December 31, 2021	e-Doc 3846017
WNSL-W1-182.0/2021	Pine Street Extension Temporary Storage Site	December 31, 2021	e-Doc 4535241
WNSL-W1-344-1.8/ind.	Port Hope Radioactive Waste Management Facility	Indefinite	e-Doc 5067125
WFDL = Waste Facility Decommissioning Licence NRTEDL = Nuclear Research and Test Establishment Decommissioning Licence WNSL = Waste Nuclear Substance Licence			

CNSC staff evaluate and confirm compliance with the licence and the licensing basis through verification, enforcement and reporting activities. CNSC staff develop compliance plans for each site, commensurate with the risk associated with the licensed activities at each site. Compliance verification activities conducted by CNSC staff include inspections, review of reports submitted by the licensee on a broad range of technical assessments, and the review and assessment of licensee programs and processes.

A summary of CNSC staff's compliance and licensing efforts associated with the shut down power reactors, WL and PHAI can be found in tables 2 and 3.

Table 2: CNSC regulatory effort on CNL's shut down power reactors and Whiteshell Laboratories, from January 1, 2016 to March 31, 2018

Facility	Number of onsite inspections	Person days for compliance	Person days for licensing activities
Douglas Point	4	573	707
Gentilly-1	3		
Nuclear Power Demonstration	2		
Whiteshell Laboratories	6	575	527

Table 3: CNSC regulatory effort on Port Hope Area Initiative licences, from July 1, 2016 to March 31, 2018

Facility	Number of onsite inspections	Person days for compliance	Person days for Licensing activities
Port Hope Project	10	582	148
Port Granby Project	11	413	38
Radioactive waste management facility	2	31	5
Pine Street Extension Temporary Storage site	2	43	3

Based on all the regulatory oversight activities that CNSC staff have conducted, CNSC staff are satisfied that CNL takes adequate measures to ensure that the public, workers and the environment are protected, and that these sites remain safe.

CNSC Independent Environmental Monitoring Program

The CNSC carries out its Independent Environmental Monitoring Program (IEMP) to verify and confirm that the public and the environment around licensed nuclear facilities remain safe. The IEMP is a regulatory tool that complements the CNSC's ongoing compliance verification program. The IEMP involves CNSC staff taking samples from publically accessible areas around nuclear sites, and measuring and analyzing the level of relevant contaminants in those samples.

Samples may be taken for air, water, soil, sediment, vegetation, and some food, such as locally-grown produce. Samples are analyzed at the CNSC's laboratory for both radiological and non-radiological contaminants related to the activities of the nuclear site. CNSC staff compare contaminant levels in samples to applicable guidelines and/or natural background levels. All IEMP sample results and associated standards are posted on the CNSC's IEMP [website](#).

In 2016 and 2017, CNSC staff conducted independent environmental monitoring around the sites covered by this CMD as shown in table 4. Detailed IEMP results for the areas surrounding these sites are available on the CNSC's IEMP [website](#) and indicate that the public and the environment, in the vicinity of these sites, are protected. Independent environmental monitoring is scheduled to occur in 2018 around the NPD site in Rolphton, ON.

Table 4: IEMP activities around sites covered by this report, January 1, 2016 to April 1, 2018

Site	Date(s)
Gentilly-2 Nuclear Facility (including the Gentilly-1 Waste Facility)	October 2016
Bruce Nuclear Generating Station (including the Douglas Point Waste Facility)	October 2016
Whiteshell Laboratories	July/August 2017
Welcome (Port Hope) and Port Granby Waste Management Facilities	May 2017 and August 2017

Waste Inventories

Radioactive wastes stored on the sites covered by this report consist of high-intermediate and low-level radioactive waste. Appendix A provides the inventory of wastes stored as reported in *Canada's Sixth National Report for the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (October 2017)*. The report can be found on the CNSC's [website](#).

3 PROJECT UPDATE

3.1 Decommissioning Projects

3.1.1 Background

CNL is currently decommissioning three shut down power reactors and a shut down nuclear research and test facility. Decommissioning encompasses a wide variety of activities to retire a licensed facility or site permanently from service and render it to a predetermined end-state. It may include any or all of the following activities: de-energizing and emptying systems, dismantling equipment and facilities, segregating and transferring wastes to waste storage areas, or maintaining facilities in a storage-with-surveillance state. The decommissioning strategy and end point are documented in the decommissioning plans that are associated with each site and form part of the approved licensing basis. CNL has developed decommissioning plans that include final end-state objectives and provided associated financial guarantees (FG) to assure the CNSC that it can access adequate funding upon demand, should the licensee not be able to fulfill its obligations. A FG must be sufficient to cover decommissioning work resulting from licensed activities or activities that will take place under the current licence.

As described in the decommissioning plans for DP, G-1, NPD and WL, CNL is employing a deferred decommissioning strategy. The three phases of deferred decommissioning are:

- Phase 1 – bring the facility to a safe sustainable shut down state suitable for storage with surveillance
- Phase 2 – the storage with surveillance period
- Phase 3 – final decommissioning where the facility achieves its final end state

While the decommissioning phases are the same for all facilities, the duration of each phase may vary depending on the specific CNSC-approved decommissioning plan for each of the facilities.

Shut Down Power Reactors

DP, G-1 and NPD, are in Phase 2 – storage-with-surveillance. The current licence for these facilities authorizes only Phase 2 activities.

As part of Phase 2 activities for decommissioning, the CNSC licence requires that CNL implement and maintain programs such as radiation protection, occupational health and safety, security and fire protection. CNL must ensure that facility structures that have yet to be finally decommissioned remain accessible for inspection and maintenance and they must also maintain monitoring and surveillance programs.

As described in the shut down power reactor preliminary decommissioning plans (PDPs), by the end of final decommissioning phase (i.e., decontamination, the dismantling, disposal, and site restoration), the shut down power reactor sites will be free of industrial hazards. The used fuel, radioactive wastes and all radioactive contamination in excess of the clearance levels established in CNSC Regulations and all other hazardous materials will have been removed from the sites. All of the systems will have been dismantled and all of the buildings demolished. Subsurface structures will have been drained, de-energized and decontaminated. The proposed end-states for the sites are brown field restored for industrial use.

According to the current PDPs, these facilities are to be maintained in storage-with -surveillance with Phase 3 activities planned to begin in 2053-2103 (G-1), 2030-2043 (NPD) and 2103 (DP). Prior to performing Phase 3 activities, CNL will have to submit Detailed Decommissioning Plans (DDPs) to the Commission for acceptance.

Whiteshell Laboratories

The WL site is currently in Phase 3 – final decommissioning, with the exception of the WR-1 reactor, which remains in Phase 2-storage with surveillance. The current CNSC-approved decommissioning approach for the WR-1 reactor is to fully remove and package all activated and contaminated components for disposal in licensed offsite facilities, to decontaminate the facility structure and then to demolish the building to achieve unrestricted release criteria.

As described in WL's CNSC-approved DDP, the end-state is the complete removal of radioactive materials from the site, with the exception of contaminated river sediments and the low-level radioactive waste (LLW) trenches that will be disposed of *in-situ*. CNL's current CNSC-approved decommissioning plan foresees that decommissioning will be completed by 2050. CNL plans a long-term institutional control period of 200 years after the cessation of physical decommissioning activities. It should be noted that the final safety case for the *in-situ* disposal of the LLW trenches was not fully developed for this plan and still needs to be provided to and assessed by CNSC staff prior to CNL proceeding.

3.1.1.1 CNL's Proposed Accelerated Decommissioning Approach

In a letter dated October 23, 2015 CNL notified CNSC staff of its intent to accelerate and change the decommissioning approach for NPD and WL. Under this proposed accelerated schedule, CNL expects to complete the final decommissioning of WL in 2024, and the decommissioning of NPD in 2020. CNSC staff note that the proposed decommissioning approach and end-state for these projects vary from what has been previously approved by the Commission. CNL is required to seek the Commission's approval to amend the current licences. CNL is further required to revise, update and reassess key planning tools for the new approaches, such as the DDPs. Additionally, new environmental assessments (EA) for NPD and WL are required under CEAA 2012; these new EAs have begun. Licensing for NPD and WL are further discussed in sections 3.1.4.2 and 3.1.5.2, respectively.

3.1.2 Douglas Point

The Douglas Point Waste Facility is located on the Bruce nuclear site near Kincardine, Ontario (figure 1). It is comprised of a reactor building, service building, turbine building/administration wing, an area for the storage of concrete canisters filled with used nuclear fuel and several outbuildings.

Figure 1: Douglas Point Waste Facility (Source: CNL)



The 200 megawatt electric (MWe) prototype CANDU power reactor was put into service in 1968 and permanently shut down in May 1984. Following the shut down of the reactor, the primary heat transport and moderator medium (heavy water) were safely drained and shipped to other licensed operating sites. The booster rods were safely removed and shipped to Chalk River Laboratories (CRL) for storage in February 1985. Non-radioactive hazardous materials, such as combustible and flammable materials, laboratory supplies and oils, were identified and safely disposed. The transfer of spent fuel from wet storage in the reactor pool to a dedicated licensed dry storage facility was completed in 1988.

Disassembly and decontamination of equipment, and consolidation of wastes, were completed as required. All radioactive or radioactively contaminated components that were not shipped to other facilities were consolidated onsite.

Since that time, the facility has been maintained in Phase 2 – storage-with-surveillance as part of deferred decommissioning. As part of Phase 2, the CNSC licence requires that CNL implement and maintain programs such as radiation protection, occupational health and safety, security and fire protection. CNL must ensure that facility structures remain accessible for inspection and maintenance. Hazard reduction activities can also form part of Phase 2, such as CNL's plans to reduce the footprint of the DP facility by demolishing some non-nuclear facilities over the next seven years, such as the Emergency Cooling Injection System Tank and Bunker, the Turbine Building and the Service Building, among others.

CNL anticipates beginning final decommissioning in 2059. The current CNSC-approved approach and end-state for DP is the eventual removal of used fuel and of radioactive components/wastes to licensed storage and/or disposal facilities, followed by the demolition of the buildings and structures. The proposed end-state for the site is a brown field restored for industrial use consistent with the rest of the Bruce Site.

3.1.2.1 Progress Update

CNL has been carrying out hazard reduction work at DP over the period covered by this report. CNL continues to provide CNSC staff with plans and progress updates for the activities they are carrying out under the programs approved by their CNSC licence and in accordance with the PDP. Since the last update to the Commission, CNL safely transferred approximately 35,000 gallons of lightly contaminated water that was stored in tanks at the DP site to CRL for treatment. In addition, CNL has characterized ion exchange resins stored at DP. The resins will be recovered and packaged in containers for storage at CRL following the resins retrieval at G-1 (described in section 1.1.1). Until the resins are moved, CNL continues to monitor and verify the integrity of the storage tanks which, to date, continue to perform well.

With approval from CNSC staff, CNL carried out the following non-nuclear decommissioning activities at DP in the period covered by this report:

- Demolition of the guard house, machine shop, plate shop and tool crib, according to DDPs approved by CNSC staff. All waste was proven non-radioactive and cleared from the site for recycling or disposal in municipal landfills.
- Characterization of the Emergency Cooling Injection System (ECIS) Tank in support of a DDP approved by CNSC staff. The ECIS tank is planned to be removed in 2018.

CNSC staff verified CNL's compliance with regulatory requirements through inspections and by review of relevant CNL documentation. CNSC staff have confirmed that all actions raised during this reporting period have been closed.

3.1.3 Gentilly-1

The G-1 Waste Facility is situated within Hydro-Québec's Gentilly-2 nuclear power plant boundary in Bécancour, Québec (figure 2). The facility consists of a permanently shut down, partially decommissioned prototype reactor and associated structures and ancillaries.

Figure 2: Gentilly-1 Waste Facility (Source: CNL)



The G-1 reactor was a 250 MWe boiling light water reactor put into service in May 1972. It was operated intermittently for a total of 183 effective full-power days until 1978, when it was determined that some modifications and considerable repairs would be required. In 1984, a decommissioning program was initiated to bring the G-1 station to a safe sustainable shut down state that permitted storage-with-surveillance.

The moderator (heavy water) was safely drained and shipped to other licensed operating sites. Non-radioactive hazardous materials, such as combustible and flammable materials, laboratory supplies and oils, were identified and safely disposed of. The transfer of spent fuel from wet storage to dry storage in the purpose-built canister storage area was completed in 1986. Disassembly and decontamination of equipment, and consolidation of wastes, were completed as required. All radioactive or radioactively contaminated components that were not shipped to other facilities were consolidated onsite in either the reactor building or turbine building.

Since 1986, the facility has been maintained in Phase 2 – storage-with-surveillance as part of deferred decommissioning. As part of Phase 2, the CNSC licence requires that CNL implement and maintain programs such as radiation protection, occupational health and safety, security and fire protection. CNL must ensure that facility structures remain accessible for inspection and maintenance. Hazard reduction activities can also form part of Phase 2.

CNL anticipates beginning final decommissioning in 2064. The current CNSC-approved approach and end-state for G-1 is the eventual removal of used fuel and of radioactive components/wastes to licensed storage and/or disposal facilities, followed by the demolition of the buildings and structures. The proposed end-state for the site is a brown field restored for industrial use.

3.1.3.1 Progress Update

CNSC staff continue to receive plans and progress updates from CNL for the activities they are carrying out under the programs approved by their CNSC licence and in accordance with the PDP.

In the early spring of 2018, a system was designed and deployed to retrieve the Heat Transport Purification System (HTPS) resins from the underground vaults in which they have been stored for the last 30 years; approximately 90 m³ of the total 126 m³ of resins have been safely retrieved and transferred to CRL for interim storage. A separate system has been designed and successfully tested to retrieve the Moderator Purification System (MPS) resins; this system will be deployed following completion of the HTPS retrievals. In March of 2018, CNSC staff conducted an inspection at the G-1 site and observed the resin retrieval process. CNSC staff noted a number of good practices by the licensee in the fields of radiation protection, conventional health and safety, and management systems.

CNL is progressively dispositioning low-level waste stored in the reactor building. 45,000 kg of wastes have been safely transferred to a licensed waste processing facility and a contract is in place to retrieve and transfer an additional 250,000 kg of waste. Processing residues will be sent to CRL for interim storage. In addition, asbestos abatement work has been carried out in both the Turbine Building and the Reactor Building. Further abatement will be carried out in the reactor building to enable the removal of the low-level waste.

CNSC staff verified CNL's compliance with regulatory requirements through inspections and by review of relevant CNL documentation. CNSC staff have confirmed that all actions raised during this reporting period have been closed.

3.1.4 Nuclear Power Demonstration

The NPD site (figure 3) is located in Rolphton, ON, adjacent to the Ottawa River and approximately 25 km upstream of the CRL site.

Figure 3: Nuclear Power Demonstration Facility (Source: CNL)



NPD was a 20 MWe prototype CANDU power reactor that was placed in service in October 1962, and operated until May 1987. It was then permanently shut down; all process systems not required were drained and removed from service, including the heavy water moderator and heat transport system. The spent fuel was safely transferred to the CRL site, and the facility was placed in a state of storage-with-surveillance.

The current CNSC staff-approved PDP for NPD indicates that final decommissioning will begin in the 2030-2043 timeframe. The deferred decommissioning approach and end-state includes the removal of radioactive components/wastes and demolition of the buildings and structures, with wastes sent to a licensed storage/disposal facility. This will allow return of the land to unrestricted use. CNL has requested an amendment to the current licence covering NPD (see section 3.1.4.2).

3.1.4.1 Progress Update

Under its current licence, CNL continues to maintain the NPD site in Phase 2 – storage-with-surveillance. As part of Phase 2, the CNSC licence requires that CNL implement and maintain programs such as radiation protection, occupational health and safety, security and fire protection. During this phase, routine inspections, housekeeping and continuous monitoring of the facility are performed regularly by CNL. CNL is also currently carrying out a number of CNSC-authorized preparatory activities (e.g., hazard reduction, characterization) for final decommissioning. For example, CNL completed the removal of accessible asbestos from the site's boiler room in June 2017. Safety improvements completed by CNL during this period include repairs to ladders, railings and platforms throughout the facility, along with relocating the personal protective equipment change room and radiation protection storage area to a more appropriate location. CNL also re-established access and maintained contamination control between the NPD Reactor Hall (a non-nuclear area) and NPD's Stairwell 21 (a nuclear area) with removal of a previously blocked up access way and installation of a fire door.

In preparation for decommissioning, CNL has completed several characterization activities of the facility structure and systems during the reporting period, this includes: the primary heat transport and moderator system, the reactor system and the building structure.

CNSC staff verified CNL's compliance with regulatory requirements through inspections and by review of relevant CNL documentation. CNSC staff have confirmed that all actions arising during this reporting period have been closed with the exception of one low-risk item related to CNL's internal inspection documentation for the NPD site. This item is anticipated to be closed in the summer of 2018.

3.1.4.2 Licensing

In March 2016, CNL submitted to the CNSC a Project Description to change the CNSC-approved decommissioning approach (full dismantling of NPD) to a new proposed approach, that is, *in-situ* decommissioning of the NPD reactor (also known as entombment). *In-situ* decommissioning is an approach in which the remaining radioactive material is permanently encapsulated in place, effectively creating a waste repository.

CNSC staff have determined that, in accordance with the *Canadian Environmental Assessment Act, 2012* (CEAA 2012) and the *Nuclear Safety and Control Act* (NSCA) and their associated Regulations, an environmental assessment (EA), conducted under CEAA 2012, and an amendment to the current licence, are required for the new proposed NPD Closure Project. Under CEAA 2012, CNSC staff are the Responsible Authority to ensure an EA for the project is conducted in accordance with requirements. In September 2017, CNL submitted a draft environmental impact statement (EIS) in support of the EA and an application to amend the current licence for review by CNSC staff. CNSC staff are leading the review and comment on the draft EIS by federal and provincial authorities (Environment and Climate Change Canada, Health Canada, Government of Quebec, and the Ontario Ministry of Environment and Climate Change), Indigenous groups and the public.

As part of the CEAA 2012 process, CNL has determined they need additional time to address the large number of comments raised by the public, First Nations, Métis communities and regulators in relation to the draft EIS. Consequently, on June 6, 2018, CNL informed the Commission that the final EIS, originally expected in June 2018, and the public hearing, which had been tentatively planned for December 2018, will be delayed. Both the EA and the licence amendment application will be subject to decisions made by the Commission at a future date through a public hearing process.

3.1.5 Whiteshell Laboratories

The Whiteshell Laboratories was established by AECL in the early 1960s to carry out nuclear research and development activities. In 1997, AECL decided to discontinue most research programs and operations at Whiteshell and applied to the CNSC for a decommissioning licence.

The WL site is 4,375 hectares in size and consists of a main campus area and a waste management area. The main campus includes the WR-1, a 60 megawatt thermal (MWth) research reactor, which operated from 1965 to 1985.

While the WR-1 reactor was initially the main focus of the facility, other programs were added, including the nuclear fuel waste management program, various research programs including environmental and radiation studies, and technology demonstration programs including accelerator projects and a SLOWPOKE demonstration reactor (SDR).

Figure 4: Whiteshell Laboratories Main Campus (Source: CNL)



The main campus of WL (figure 4) consists of offices, laboratories, hot cell facilities, the WR-1 research reactor and numerous support buildings. Located approximately 2.7 km north-east of the main campus, the waste management area (figure 5) contains Low-Level (LLW), Intermediate-Level (ILW) and High-Level (HLW) radioactive waste.

Figure 5: Whiteshell Laboratories Waste Management Area (Source: CNL)



3.1.5.1 Progress Update

Since the last update to the Commission in 2016, there has been continued progress made in decommissioning activities being performed at the Whiteshell site. CNL is planning, implementing and completing decommissioning activities, in accordance with CNSC approved decommissioning plans. CNL is also maintaining the WR-1 reactor in a state of storage-with-surveillance, while preparing for final decommissioning. As part of ongoing work, the CNSC licence for WL requires that CNL implement and maintain programs such as radiation protection, occupational health and safety, security and fire protection. CNL must ensure that facility structures that have yet to be decommissioned or are undergoing decommissioning remain accessible for inspection and maintenance.

The following are some of the WL decommissioning program activities that have been conducted by CNL, since the last update to the Commission in 2016.

Research Building B300

Building B300 was a central research complex that originally contained numerous laboratories, offices, mechanical rooms and areas for large-scale engineering projects. B300 was constructed in seven separate stages, and decommissioning is being conducted according to those stages. The first two stages dismantled were stages 4 and 7, as shown in figure 6. CNL completed demolition of stages 4 and 7 of Building B300 in 2016 as shown in figure 7.

Figure 6: Whiteshell Laboratories B300, stages 4 & 7 (Source: CNL)



Figure 7: Whiteshell Laboratories B300 after removal of stages 4 & 7
(Source: CNL)



Decontamination Centre

Building B411, the WL decontamination centre (figure 8) originally housed a laundry for contaminated clothing, decontamination services for tools and items and respirator cleaning and maintenance services. The building was shut down in 2016, with decommissioning/demolition complete in 2017.

Figure 8: Whiteshell Laboratories B411 Decontamination Centre (Source: CNL)



Active Liquid Waste Treatment Centre

The active liquid waste treatment centre (building B200, figure 9) was originally constructed to manage both ILW and LLW liquid waste streams from buildings B411, B100 and B300. Constructed of concrete, the active liquid waste treatment centre is an indoor tank farm consisting of 12 storage tanks, glove boxes, piping, and other related equipment.

The ILW circuit was shut down in 2001 while the LLW circuit was shut down in 2017. Any liquid waste currently being generated within B300 or B100 is now collected and treated with new, independent systems located in each building.

Decommissioning activities have begun in B200, including characterization and hazard reduction in preparation for building demolition. Hazard reduction activities have included asbestos remediation, application of fixatives on the interior of tanks, the removal of active drain lines, the drum filling station and fume hoods. Building demolition is planned for 2019.

Figure 9: Whiteshell Laboratories B200 Active Liquid Waste Treatment Centre
(Source: CNL)



SLOWPOKE Demonstration Reactor (SDR)

The SDR was developed in Building B100 to demonstrate the potential of using SLOWPOKE reactors for heating communities and commercial establishments. AECL operated the SDR for 614 hours between 1989 and 1990.

After shut down, fuel was removed and shipped to CRL. The pool water level was lowered, and in 1996, the remainder of the pool and piping was drained. Final dismantlement of the reactor, with the exception of the stainless steel pool liner, was completed in 2016. The pool liner will be decommissioned as part of the B100 building structure demolition, planned for 2022.

WR-1 Reactor

The WR-1 reactor is located in building B100 (figure 10). Recent decommissioning activities in this building have included the relocation of office areas, the removal of asbestos in accessible areas and characterization of reactor components.

Figure 10: Whiteshell Laboratories Building B100 (Source: CNL)



CNL's current CNSC-approved decommissioning plan foresees that decommissioning will be completed by 2050, while CNL's new proposed accelerated decommissioning approach would lead to WR-1 being decommissioned *in-situ* by 2025.

Waste Management Area

WL's Waste Management Area (WMA, figure 5) was developed when the facility was first opened. CNL conducts projects to re-characterize the performance and condition of structures, assess waste conditions, assess environmental conditions and assess the potential for environmental impacts. As part of the CNSC approved decommissioning plans, CNL is conducting projects to improve access to the area, reduce and repackage existing waste, and prepare facilities to be decommissioned.

CNSC staff have evaluated CNL's compliance during inspections of the waste management areas and are satisfied that CNL is carrying out decommissioning work in accordance with the licensing basis.

Some of the WL decommissioning activities that have been conducted by CNL at the Waste Management Area since the last update to the Commission are listed below:

- Preparing for the extraction of waste from the ILW bunkers and standpipes. This work began in 2017 and includes contracting out the design/build of systems for remediating these facilities (60% design complete).
- Construction work for expansion of the protected area in the WMA that surrounds the standpipes. This is required to allow space for the extraction of wastes noted above. The expanded protected area encompasses the standpipes and the ILW bunkers and will be activated in 2018.
- Developing a modular workspace complex at the entrance of the WMA to control and coordinate worker access to the WMA.

- Completing waste segregation and repackaging. Since 2016, most WR-1 and some other WMA wastes have been sorted and repackaged, in order to reduce fire loading in storage buildings and to reduce waste volumes. Repackaged wastes have been placed into steel containers and transferred to storage in the Shielded Modular Above Ground Storage building.
- Shipping to CRL of over sixty Cs-137 and Cf-252 sources and approximately 1500 m³ of soil waste from the former Experimental Cesium Pond.

Other Activities

- The decommissioning/demolition of several non-nuclear buildings, totaling more than 4700 m² of floor space dispositioned to licensed disposal facility.
- Ongoing inspections maintenance (aging management inspections, fire protection system testing and maintenance, and facility and support systems safety reviews).

3.1.5.2 Licensing

The first decommissioning licence for WL was issued by the Commission following a public hearing in January 2003 (CMD 02-H19). This licence was subsequently renewed for a 10-year period in November 2008 (CMD 08-H24).

In September 2017, CNL submitted its renewal application for the WL licence for a 10-year period to the CNSC. As part of the application, CNL proposed a new decommissioning approach for the WR-1 reactor, moving from the original deferred dismantling strategy to *in-situ* decommissioning. CNSC staff have reviewed the licensing basis documentation and provided comments to CNL.

Under the NSCA, CNL's proposal requires an amendment to its existing licence issued by the Commission. CNL's proposal also requires an EA be conducted under CEAA 2012 and EA decision affirming that the proposed activities will not cause significant adverse environmental effects. Under CEAA 2012, CNSC staff are the Responsible Authority to ensure an EA for the project is conducted in accordance with requirements. In September 2017, CNL submitted a draft environmental impact statement (EIS) in support of the EA for review by CNSC staff. CNSC staff are leading the review and comment on the draft EIS by federal and provincial authorities (Environment and Climate Change Canada, Health Canada, Natural Resources Canada and Manitoba Sustainable Development), Indigenous groups and the public.

As part of the CEAA 2012 process, CNL has determined they need additional time to address the large number of comments raised by the public, First Nations, Métis communities and regulators in relation to the draft EIS. Consequently, on March 13, 2018, CNL requested that the Commission renew their current licence for a one-year period with no changes, with a requested expiry date of December 31, 2019. CNL plans to use this time to address comments and provide documentation to support their safety case.

3.1.6 Public Information Program for CNL Decommissioning Projects

To ensure licensees provide open and transparent information to the public, in 2012, the CNSC published RD/GD 99.3, *Public Information and Disclosure*. CNL's public information program for the decommissioning projects has been developed in accordance with CNSC regulatory guide RD/GD 99.3 and allows members of the public to obtain information on all aspects of these projects, for instance CNL's website on decommissioning projects, as well as ensuring appropriate disclosure following the occurrence of unplanned events.

In May 2018, the CNSC published REGDOC-3.2.1 *Public Information and Disclosure*. A transition plan will be developed to incorporate requirements of this updated standard into licensing basis documents for CNL projects.

Indigenous Engagement

CNSC staff confirm that CNL performs outreach with Indigenous groups that have expressed interest in the decommissioning projects covered by this CMD. CNL's approach to Indigenous engagement follows the guidance found in CNSC REGDOC-3.2.2 *Aboriginal Engagement*. These efforts have included emails, letters, meetings, site visits and tours, and community visits, among others. CNL has stated that the Indigenous groups included in these efforts were Sagkeeng First Nation, Black River First Nation, Brokenhead Ojibway Nation, Hollow Water First Nation, Wabaseemoong Independent Nations, the Manitoba Métis Federation, Algonquins of Ontario, the Métis Nation of Ontario, the Algonquins of Pikwàkanagàn, the Algonquin Anishinabeg Nation Tribal Council, Eagle Village First Nation, Kitigan Zibi Anishinabeg First Nation, Williams Treaties First Nations, Alderville First Nation, Beausoleil First Nation, the Chippewas of Georgina Island First Nation, Chippewas of Rama First Nation, Curve Lake First Nation, Hiawatha First Nation, Mississaugas of Scugog Island First Nation, Union of Ontario Indians, and the Algonquin Nation Secretariat.

3.2 Port Hope Area Initiative

3.2.1 Background

The historic low-level radioactive waste (LLW) contamination found in Port Hope and Port Granby is a result of the area's long involvement with the nuclear industry. This legacy extends back to the 1930s with the commencement of radium refining activities by Eldorado Gold Mines Ltd. In the 1940s, Eldorado switched its focus to uranium processing, and became a Crown Corporation (Eldorado Mining and Refining Limited, later renamed Eldorado Nuclear Limited). During those early years, wastes from radium and uranium production were stockpiled at various locations in the Port Hope area, and also used for fill material in construction and landscaping.

In 1948, Eldorado began placing process wastes in the Welcome Waste Management Facility (WMF) in the Township of Hope. The Welcome WMF continued to receive wastes until 1955, when Eldorado began operating the Port Granby WMF, located in nearby Clarington, Ontario. The Port Granby WMF received process wastes and other waste materials until 1988. Although these facilities represented an improvement over earlier practices, they do not provide for acceptable long-term management of LLW.

In the late 1990s, the Township of Hope, the Town of Port Hope and the Municipality of Clarington each developed a proposal for the establishment of long-term management facilities for the LLW found in their municipalities. These proposals formed the basis for what is now the PHAI, which represents the Government of Canada's commitment to the development and implementation of a safe, local, long-term solution for the management of historic LLW in the municipalities of Port Hope and Clarington.

The Port Hope Area Initiative

The PHAI is defined by “An Agreement for the Cleanup and the Long-Term Safe Management of Low-Level Radioactive Waste Situate in the Town of Port Hope, the Township of Hope, and the Municipality of Clarington”, hereafter “the Legal Agreement”. The Legal Agreement was signed in 2001¹ by the Government of Canada and the Municipalities of Port Hope and Clarington. In 2012, the Government of Canada, through Natural Resources Canada, made a financial commitment of \$1.28 billion towards the clean-up of LLW and implementation of the PHAI.

The PHAI is comprised of two separate projects, each authorized under licences issued by the Commission to CNL as shown in table 1.

¹ The Legal Agreement was amended in 2003, 2006 and 2009.

Figure 11: The Port Hope area with insets showing the PGP and PHP sites
(Source: CNL)



The Port Hope Project and the Port Granby Project each involves the construction of an engineered above-ground containment mound, which will safely isolate legacy LLW. In both cases, the project involves the excavation of waste from a legacy waste management facility, and its emplacement in a nearby modern long-term waste management facility (LTWMF). In Port Hope, the project further includes excavation of LLW from various sites in the urban area of the municipality.

CNL also holds two additional Designated Officer licences that have connection to the PHAI. These licences are for the care and maintenance of interim LLW storage locations in Port Hope that will be transferred to the new Port Hope LTWMF. Further details on these licences are discussed in section 3.2.4.

3.2.2 Port Granby Project

The objective of the Port Granby Project is to remediate and remove approximately 450,000 m³ of historic LLW from the existing Port Granby WMF, and to consolidate and manage this waste at a new LTWMF. The Port Granby WMF is located in the Municipality of Clarington, Ontario, and it received wastes resulting from former radium and uranium refining operations at Eldorado Nuclear in Port Hope beginning in 1955 and continuing until 1988. The new LTWMF is an engineered above-ground mound which is located approximately 700 m north of the shoreline of Lake Ontario (see figure 12).

Figure 12: Location of the Port Granby WMF and new LTWMF. The LTWMF facility boundary is indicated by the dashed yellow line. (Source: CNL)



The Port Granby Project is currently in the second of three project phases. The first phase included ongoing operation, care and maintenance of the Port Granby WMF, and development of detailed technical information such as LTWMF design and other documentation to support licensing. CNSC staff reviewed and confirmed the information met all regulatory requirements. Following acceptance of this technical information, the Commission issued a licence amendment in November 2011 permitting the implementation phase, Phase 2, to commence.

Building on Phase 1 activities, the implementation phase includes the construction and operation of a new Waste Water Treatment Plant (WWTP); the construction and operation of a new LTWMF, including the excavation and emplacement of LLW; the capping of the LTWMF once complete; and the remediation and restoration of the existing Port Granby WMF site. CNSC staff continue to verify and evaluate compliance during the implementation phase.

The LTWMF base liner design consists of multiple layers of natural and synthetic materials which effectively prevents the release of contaminants to the environment. Within the base liner, a leachate collection system has been installed which directs contaminated water to the WWTP for treatment prior to discharge.

Following the completion of LLW placement on the LTWMF base liner, a cap consisting of a multi-layered cover system will be constructed to prevent water ingress and intrusion. Once complete, the Port Granby LTWMF will resemble a large grassy hill with radiation levels expected to be similar to natural background levels. CNL expects to begin capping the LTWMF in 2019.

Following completion of Phase 2, the Port Granby Project will enter into Phase 3, that is, long-term monitoring and maintenance of the LTWMF. CNL will install systems within and around the Port Granby LTWMF which will monitor the facility, and visual inspection and monitoring of WWTP influent will confirm the performance of the cover system. CNL will further monitor groundwater quality using a series of wells at the base of the mound and the perimeter of the site. CNSC regulatory oversight will continue for as long as the site is licensed.

3.2.2.1 Progress Update

Significant progress has been made at the Port Granby LTWMF, since the last update to the Commission in 2016. Construction of the base liner system in the waste cells, including the leachate collection system, was completed in 2016. CNSC staff carried out several inspections to confirm the integrity of the base liner system before the emplacement of waste began on November 1, 2016, and an additional inspection to verify that the base liner was being suitably winterized in December 2016. CNSC staff concluded that the base liner was properly installed and suitably winterized.

To facilitate the safe transfer of LLW from the existing WMF to the new LTWMF, a temporary underpass has been constructed to enable trucks carrying waste to travel beneath Lakeshore Road (see inset in figure 12). This underpass, completed in September of 2016, provides an internal haul road for use when travelling between the existing WMF and the LTWMF, thus eliminating the possibility of contaminating public roads.

As of April 1, 2018, CNL estimates that roughly 525,000 tonnes of the legacy LLW at the Port Granby WMF has been excavated and emplaced in the Port Granby LTWMF. In some areas of the WMF, CNL has progressed to verifying the effectiveness of the remediation by sampling soil in the remediated area and measuring the samples to ensure that excavations have been extensive enough to remove contamination in excess of the clean-up criteria specified in the licence. This stage will be followed by the final step in the remediation, backfilling, grading and seeding the remediated areas so as to achieve a natural end-state. CNSC staff's compliance activities related to remediation include inspections to verify the effectiveness of the remediation activities, collecting samples for analysis at the CNSC laboratory, and inspection of radiation protection, contamination control and worker health and safety measures. To facilitate these inspections, a CNSC inspector has been deployed to the Port Hope/Port Granby area.

Portions of the old Port Granby WMF site are quite steep leading down to Lake Ontario, and in 2017, CNL undertook significant work to ensure slope stability on the site, especially in the east and west gorge reservoirs (see figure 15). These undertakings to ensure worker safety were verified by CNSC staff during several inspections in 2017, with CNSC staff concluding that CNL has taken adequate measures to ensure slope stability on the Port Granby site.

As noted in table 4, in 2017, CNSC staff carried out independent environmental sampling in the area of the old Port Granby WMF under the CNSC's Independent Environmental Monitoring Program (IEMP).

Detailed IEMP results are available on the CNSC's IEMP [website](#), and results from the Port Granby area indicate that the public and the environment in the vicinity of that site are protected.

CNL expects remediation of the old Port Granby WMF to continue into 2019, and capping of the new LTWMF mound to begin in 2019.

3.2.2.2 New Waste Water Treatment Plant

Construction of the new WWTP was completed for the Port Granby Project in 2014. On April 1, 2016, CNL shifted treatment of collected groundwater at the existing WMF from the previous system to the new WWTP, resulting in an immediate and marked improvement in the effluent quality being discharged to Lake Ontario. Commissioning of the new WWTP was completed in October 2016. The new WWTP will continue to operate for the foreseeable future during Phase 3 of the Port Granby Project. The old water treatment building was demolished in 2017.

Figure 13: Port Granby Waste Water Treatment Plant (Source: CNL)



As required by the Port Granby Project LCH, in 2017, CNL established action levels for the new WWTP, and further established release limits for the new WWTP as well. CNSC staff have assessed the adequacy of the limits and sampling frequencies proposed by CNL and have agreed that they are appropriate and should become part of the licensing basis for the Port Granby licence. These new action levels and release limits will be incorporated into the LCH for the Port Granby Project in the coming months.

In order to evaluate WWTP performance, weekly composite effluent samples are collected by CNL from the effluent stream and sent to an accredited external laboratory for analysis. CNL submits quarterly reports to CNSC staff which include the maximum weekly result for each month. CNSC staff review and verify these data to ensure they meet regulatory requirements and standards.

Effluent quality results available as of April 1, 2018 indicate that the WWTP is performing well within the regulatory release limits. CNSC staff's independent analysis of effluent samples taken from the Port Granby WWTP during inspections have confirmed the validity of the results provided by CNL. CNL's most recent effluent results as of the date of this report are presented in Appendix A.2.

3.2.2.3 Events of Regulatory Significance at Port Granby

There were no lost-time injury events at the Port Granby Project during the period covered by this report. The following is a summary of events that occurred at the Port Granby Project during the same period.

Hazardous Substances at the Port Granby WMF

There were two events related to hazardous materials encountered by workers during the process of waste excavation and emplacement. The presence of certain hazardous materials in the Port Granby WMF was known from historic records prior to the commencement of excavations.

- In December of 2016, a drum containing an ammonia-based chemical was excavated from the Port Granby WMF and was ruptured during emplacement at the Port Granby LTWMF. Two workers suffered temporary eye and respiratory irritation. Workers were not wearing elevated levels of Personal Protective Equipment (PPE) because hazardous substances had not been expected in that area of the Port Granby WMF where the drum was found. CNL halted waste excavation until revised procedures and engineering controls were put in place and workers trained. These included the use of PPE offering a high level of respiratory and skin protection, and the installation of air supply tanks and ballistic protection on key excavation equipment (see figure 14).
- In May of 2017, while a specialist contractor was performing excavations in an area known to contain cylinders of potentially hazardous chemicals, slightly elevated levels of hydrogen fluoride in air were measured next to a cylinder being unearthed. As per the protocols in place, workers evacuated the area and returned in a higher class of PPE to continue work. The cylinder was safely unearthed using a hydro-vac truck, which is less likely to cause mechanical damage than conventional excavation equipment.

CNL's implementation of corrective measures related to these events has been verified by CNSC staff through document review and inspection activities, with CNSC staff concluding that worker safety has been clearly enhanced.

Figure 14: A bulldozer on the Port Granby WMF site, fitted with steel gratings over windows and air tanks on the roof



Hydrogen Sulphide Exposure at the Port Granby WWTP

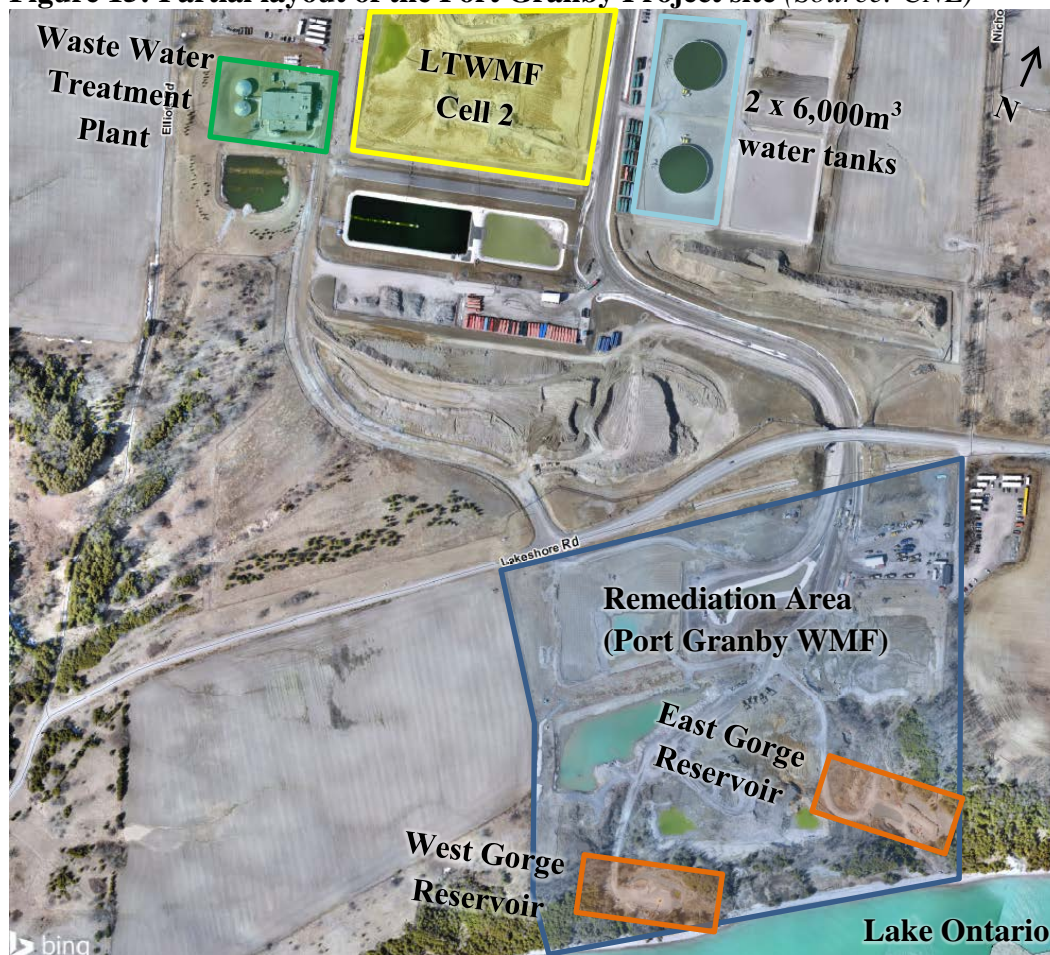
On January 13, 2017, hydrogen sulphide gas (H_2S) built up in the Port Granby WWTP, exposing several workers and triggering an alarm which caused the WWTP to be evacuated. Two workers exhibited symptoms such as mild headaches and nausea, but were cleared to return to work later the same day after medical evaluation. The H_2S gas was generated in stagnant solids in the WWTP's bioreactor, and released as workers disposed of that material. In response, CNL committed to put in place additional measures such as the mandatory use of personal H_2S monitors in specified areas of the WWTP, the provision of Self-Contained Breathing Apparatuses (SCBAs) for emergency use, and upgrades to building ventilation and the ambient H_2S monitoring system.

CNSC staff consider that CNL's H_2S corrective actions will result in increased worker safety. CNSC staff verified those corrective actions during a subsequent inspection and found upgrades to the ambient H_2S monitors were not yet complete. CNSC staff issued a compliance notice to CNL prohibiting the use of H_2S -generating portions of the WWTP until all corrective actions are complete. CNSC staff continue to monitor CNL's H_2S corrective actions.

Water Overflow Event at the East Gorge Reservoir

On June 23, 2017, heavy rains in the Port Granby area led to an unplanned discharge of untreated water from the East Gorge Reservoir (EGR) at the Port Granby WMF (see figure 15). The entire blue shaded area in figure 15 is under remediation; therefore, CNL must treat water from this area as being potentially contaminated. According to the Port Granby Project licensing basis, CNL is not authorized to release any untreated water from the site.

Figure 15: Partial layout of the Port Granby Project site (Source: CNL)



CNL determined that the overflow was due to valves having been incorrectly sequenced, which caused a restriction in the flow of water and resulted in an overflow. CNL estimated that up to 5 m³ of untreated water was discharged over 20 minutes, before valves were properly reconfigured and the problem corrected. CNL staff performed radiation surveys and took soil samples which indicated that contaminant levels in the path of the overflow are less than the average initial contaminant concentrations for the Port Granby WMF site, as identified in the EA. There was no impact to the environment as a result of this event.

CNSC staff carried out a reactive inspection of the Port Granby and Port Hope sites on June 26 and 27, 2017, which included representatives from the Ontario Ministry of Environment and Climate Change (MOECC) and Environment and Climate Change Canada (ECCC). As a result, an Order was issued to CNL against the Port Hope Project licence, as discussed further in section 3.2.3.4. In response to the Order, CNL has made significant updates to their emergency water management strategy, obtained supplies and developed detailed water management plans for the Port Granby site.

CNL has also installed multiple 6,000 m³ water tanks, two of which are shown on figure 15, to increase water storage capacity. CNSC staff have verified during inspections that emergency water management supplies as listed in CNL's Port Granby water management documents are present.

As a result of the same weather event, an unplanned discharge also occurred on the same day at the Port Hope LTWMF, and is discussed in section 3.2.3.4. An Event Initial Report on both events was presented to the Commission in August 2017 under CMD 17-M38.

Water Overflow Event at the West Gorge Reservoir

On January 23, 2018, there was an unplanned discharge of untreated water from the West Gorge Reservoir (WGR) at the Port Granby WMF (see figure 15). Upon observing the overflow, CNL ceased pumping water into the WGR and the overflow stopped shortly afterwards. CNL estimated the duration of the release to have been 30 to 45 minutes, and the volume of the release to be no more than 7 m³. CNL has concluded that the overflow was due to a restriction in the pipe running from the WGR to the adjacent sump where the WGR pumps draw water. After the overflow, CNL staff performed radiation surveys and took soil samples which indicated that contaminant levels in the path of the overflow are less than the average initial contaminant concentrations for the Port Granby WMF site, as identified in the EA. There was no impact to the environment as a result of this event.

CNL carried out various corrective actions in response to this incident, most significantly moving the sump from adjacent to the WGR, to directly in the WGR. CNSC staff performed an inspection in February 2018 at the Port Granby site and verified that the corrective measures were in place. CNSC staff continue to monitor and assess CNL's water management measures at the Port Granby site.

3.2.3 Port Hope Project

The objective of the Port Hope Project (figure 16) is to remediate and remove historic LLW from various locations in the Municipality of Port Hope (MPH), and to consolidate and manage this waste at a new LTWMF. The site of the Port Hope LTWMF encompasses the Welcome Waste Management Facility (WMF), which until 1955 was used to manage radioactive wastes arising from the refining of uranium and radium (cells 2a and 2b in figure 16).

The Port Hope Project involves the remediation of LLW from a variety of locations throughout the municipality, including:

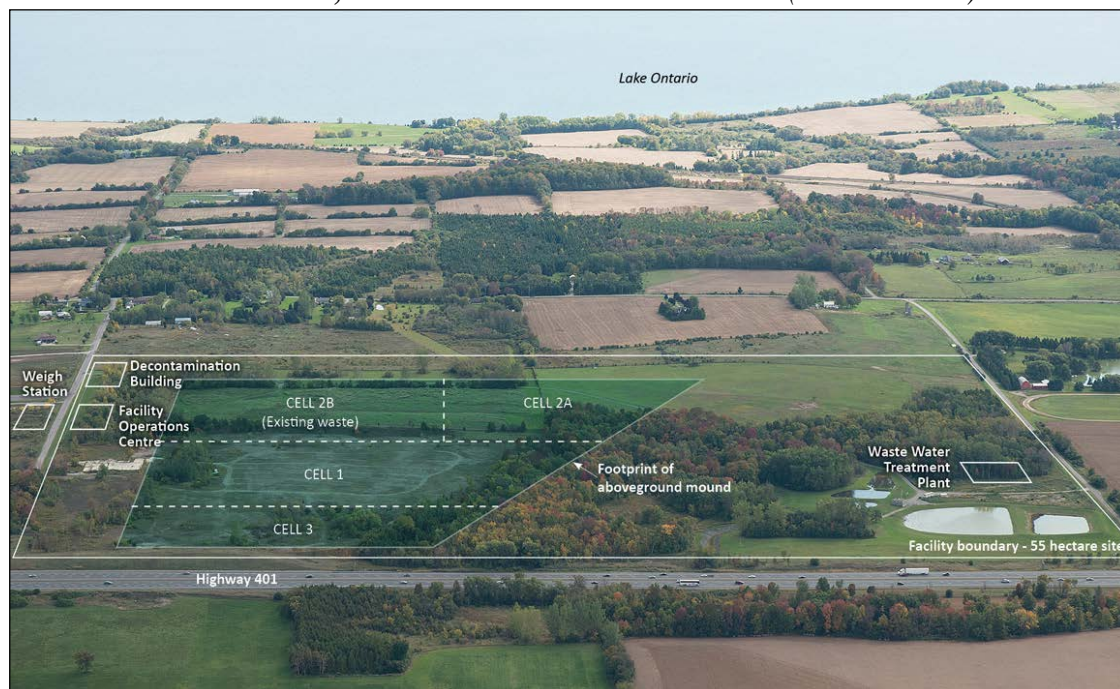
- 450,000 m³ of LLW from the existing Welcome WMF
- 572,000 m³ of waste from various remediation sites throughout Port Hope including the Port Hope Harbour, the closed-down Municipal Landfill on Highland Drive, and numerous residential properties

- 150,000 m³ of Cameco-owned waste generated prior to 1988 and waste from building demolition associated with Cameco's Vision in Motion project
- 51,250 m³ of waste from industrial waste contaminated sites (i.e., Port Hope Centre Pier, Lions Park, and the municipal sewage treatment plant)

The Port Hope Project is currently in the second of three project phases. The first phase included ongoing operation, care and maintenance of the Welcome WMF, and development of detailed technical information such as LTWMF design and other documentation to support licensing. CNSC staff reviewed and confirmed the information met all regulatory requirements. Following acceptance of this technical information, in November 2012, the Commission issued a licence amendment permitting the implementation phase, Phase 2, to commence. Building on Phase 1 activities, Phase 2 includes the construction and operation of a new WWTP; the construction and operation of the new Port Hope LTWMF, including the excavation and emplacement of LLW; the remediation and restoration of excavated areas; and the capping of the LTWMF once it is complete. CNSC staff continue to verify and evaluate compliance during Phase 2 activities.

The Port Hope Project LTWMF is designed for the safe long-term storage of LLW, and is conceived as an engineered above-ground mound with a design capacity of 1.9 million m³ of LLW. The design allows for a 30% contingency on waste volume estimates.

Figure 16: An overview of the Welcome WMF site prior to Port Hope LTWMF construction, overlaid with LTWMF features (Source: CNL)



The LTWMF design comprises a single mound with four waste storage cells. These cells will be developed progressively to permit efficient construction and operation of the facility. The base liner design consists of multiple layers of natural and synthetic materials which will effectively prevent the release of contaminants to the environment. Within the base liner, a leachate collection system has been installed which will direct contaminated water to the WWTP for treatment prior to discharge. Excavation and emplacement of wastes is expected to continue to 2023.

As noted in table 4, in 2017, CNSC staff carried out independent environmental sampling in the area of the old Welcome WMF under the CNSC's Independent Environmental Monitoring Program (IEMP). Detailed IEMP results are available on the CNSC's IEMP [website](#), and results from the Welcome WMF area indicate that the public and the environment in the vicinity of that site are protected.

Following the completion of LLW placement on the LTWMF base liner, a cap consisting of a multi-layered cover system will be constructed to prevent water ingress and intrusion. Once capping is complete, the Port Hope LTWMF will resemble a large grassy hill. Radiation levels on the mound are expected to be similar to natural background levels. The final phase of the project, Phase 3, will involve long-term monitoring and maintenance of the LTWMF under continued CNSC regulatory oversight.

3.2.3.1 Progress Update

Significant progress has been made at the Port Hope LTWMF, since the last update to the Commission in 2016. Following completion of site preparation in the spring of 2016, contractors began construction of Cell 1. The base liner of that first cell was completed in 2017, and significant progress has also been made on the construction of Cell 3. CNSC staff carried out several inspections to confirm the integrity of the Cell 1 base liner system during its installation, and a further inspection to verify that the site was being suitably winterized in December 2017. No significant deficiencies were noted.

On December 1, 2017, CNL began excavation of onsite wastes from the Welcome WMF, and emplacement of those wastes in Cell 1 of the Port Hope LTWMF. As of April 1, 2018, CNL estimates that roughly 15% of onsite waste has been excavated from the Welcome WMF and emplaced in Cell 1.

Figure 17: An aerial view of Port Hope LTWMF site (Source: CNL)



As the extent of excavation grows, so too does the need to collect and treat the water from the site to ensure that no untreated water is released outside the boundary. The two collection ponds adjacent to the WWTP (figure 17) serve this purpose. In order to ensure that sufficient capacity exists to cover all probable water inflow scenarios, CNL is in the midst of an expansion of the collection ponds. The ponds, with an original capacity of roughly 18,000 m³, have been expanded to 23,800 m³, and will be expanded to a total capacity of 47,000 m³ by October 2018.

CNL expects to begin receipt of offsite wastes in June 2018, beginning with contaminated soils and Cameco wastes from the Centre Pier at the Port Hope Harbour. Centre Pier remediation activities are discussed further under section 3.2.3.3.

3.2.3.2 New Waste Water Treatment Plant

CNL has constructed a new WWTP on the Port Hope LTWMF site, as shown in figure 18. In January 2017, CNL began discharging treated water from the new WWTP, resulting in an immediate and marked improvement in effluent quality. Commissioning of the new WWTP was completed in December 2017. The new WWTP will continue to operate for the foreseeable future during the long-term monitoring phase of the Port Hope Project.

Figure 18: The Port Hope Waste Water Treatment Plant (Source: CNL)



As required by the Port Hope Project LCH, in 2018, CNL established action levels for the new WWTP, which were accepted by CNSC staff in March 2018. CNL expects to have release limits in place for the Port Hope WWTP by mid-2018 and once accepted by CNSC staff, the action levels and release limits will be incorporated into the LCH for the Port Hope Project.

As part of routine operation of the WWTP, samples are collected from the effluent stream by CNL and sent to an accredited external laboratory for analysis. Effluent quality results obtained from CNL during commissioning and operation indicate that the WWTP is performing significantly better than the design objectives for the WWTP found in the Port Hope Project LCH. CNL's most recent effluent results as of the date of this report are presented in Appendix A.3.

CNSC staff have performed inspections related to the commissioning of the WWTP at the Port Hope LTWMF, and over the course of the inspections collected samples of influent and effluent for independent analysis at the CNSC laboratory. CNSC results were in agreement with CNL results.

The old Welcome WMF water treatment building remains in place and operable, as a part of CNL's contingency plan for water management at the Port Hope LTWMF.

3.2.3.3 Remediation Activities in Port Hope

CNL's Preparation for Remediation Activities in Port Hope

In preparation for remediation in the urban area of the Municipality of Port Hope, CNL is currently preparing key documents that will guide the work. Among those documents are the *Remediation Verification Standard Operating Procedures* (RVSOP) and the *Port Hope Special Circumstances Protocol*, both currently under development by CNL.

The RVSOP suite of procedures describe the approach that CNL will implement following remediation to demonstrate the cleanup has met the requirements of the licence.

The *Port Hope Special Circumstances Protocol* has been developed by CNL to address situations where property specific constraints make it impractical to meet the cleanup criteria prescribed in the licence for the Port Hope Project. Application of the special circumstance protocol will be managed by CNL and is expected for only a very small number of sites.

CNSC staff have reviewed and provided comments on drafts of these documents and CNL has been updating the documents accordingly. Representatives from the Municipality of Port Hope (MPH) have also been active participants in the review of these documents and have met collectively with CNL and CNSC staff on this topic, most recently in March 2018.

Remediation of Major Sites in Port Hope

CNL has defined the various major sites throughout Port Hope which are subject to remediation under the Port Hope Project. These are listed in table 5 below, including a brief update on their status. Interactive maps of these sites can be found on the [PHAI website](#).

Table 5: Major Remediation Sites in Port Hope

Title	Description	Remediation Timeline
Temporary Storage Sites	These include the Centre Pier Temporary Storage Site (TSS), Pine Street Extension TSS, and Sewage Treatment Plant TSS. More detail is provided in Section 3.2.4 below.	Expected to begin in 2018
Waterfront Area	This includes the West Beach and former Waterworks site, the Alexander Street Ravine, the Centre Pier, Port Hope Harbour, the Mill Street South site, and the CN/CP Viaducts area. The waterfront area is complex and remediation work will be ongoing for some years.	Expected to begin at the former Waterworks site and the Port Hope Harbour in 2018
Highland Drive Area	This includes the Highland Drive landfill, roadbed, and south ravine; the Pine Street Extension Consolidation Site; and the Pine Street North Extension roadbed.	Expected to begin in 2019
Industrial Sites	This includes areas of the Centre Pier, Lions Recreation Centre Park, Former Coal Gasification Plant, Chemetron Lagoon, and Sewage Treatment Plant Storage Cell.	Expected to begin in 2019
Central Area and Known Sites	This includes the former St. Mary's School, Strachan Street Ravine Consolidation Site, Caroline Street Park, Abandoned Pipeline, and Peter Street Mound.	Expected to begin in 2018 or 2019

Figure 19 - The Port Hope waterfront area

Waste Arising from Cameco Decommissioning Activities

The Legal Agreement specifies the accommodation of up to 150,000 m³ of defined “Cameco Decommissioning wastes” in the new Port Hope LTWMF. This includes stored legacy wastes that were generated as a consequence of uranium and radium refining at the site of the current conversion facility in Port Hope prior to 1988, and other historic LLW located at this facility, the Dorset Street warehousing facility, and the Centre Pier. Cameco has initiated the “Vision in Motion” project to transfer eligible wastes to the Port Hope LTWMF, in addition to other improvements to the Cameco site. In 2017, Cameco began preparing a variety of legacy Eldorado materials anticipation of their transfer to the Port Hope LTWMF.

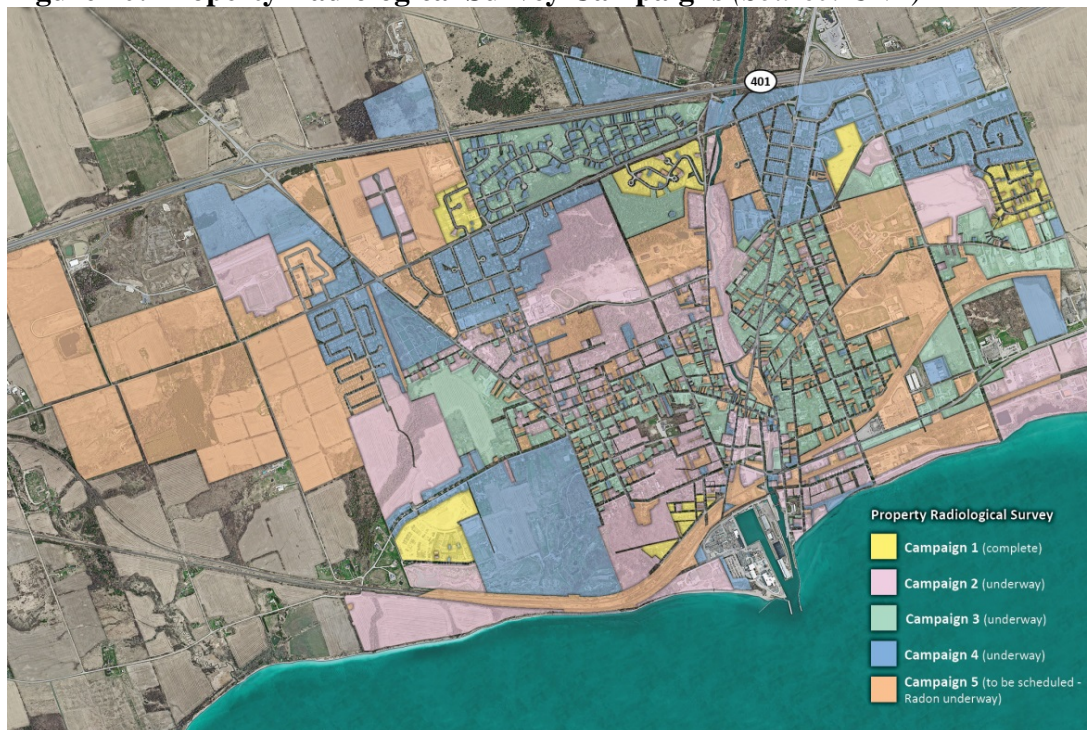
CNL and Cameco routinely meet to ensure agreement and understanding on logistics of these activities, and both CNL and Cameco keep CNSC staff informed of developments.

Small-Scale Sites

As previously indicated, the PHAI involves identification of LLW on residential and commercial properties in the Port Hope area. Surveys are being undertaken on all urban and some rural properties in the Port Hope area, for a total of roughly 4,800 properties. Through this program, properties will undergo four tests for detecting the presence of LLW: interior radon testing, interior gamma radiation surveys, exterior gamma radiation surveys, and subsurface soil sample analysis. This program was implemented in 2012 and is expected to be completed in 2023.

Port Hope properties have been organized into a series of five campaigns for the execution of property surveys, as shown in figure 20.

Figure 20: Property Radiological Survey Campaigns (Source: CNL)



Based on historic information, CNL initially estimated that at least 375 properties in Port Hope would have contamination at levels which require remediation, but as of April 1, 2018, has found LLW at 745 properties to date, and now estimates more than 800 properties will require remediation. The status of CNL's small-scale site sampling program, as of April 1, 2018 is summarized in Appendix B.

For each small-scale site requiring remediation, CNL is preparing a site-specific remediation plan which will serve to inform property owners of the extent of remediation activities on their property. CNL is currently working on roughly 45 such plans, and they form an important vehicle for consultation between CNL and property owners. Small-scale sites will temporarily become subject to the Port Hope Project licence during their respective remediation periods. During that time, CNSC staff may carry out inspections on these sites to verify CNL's compliance with their licensing basis.

3.2.3.4 Events of Regulatory Significance at Port Hope

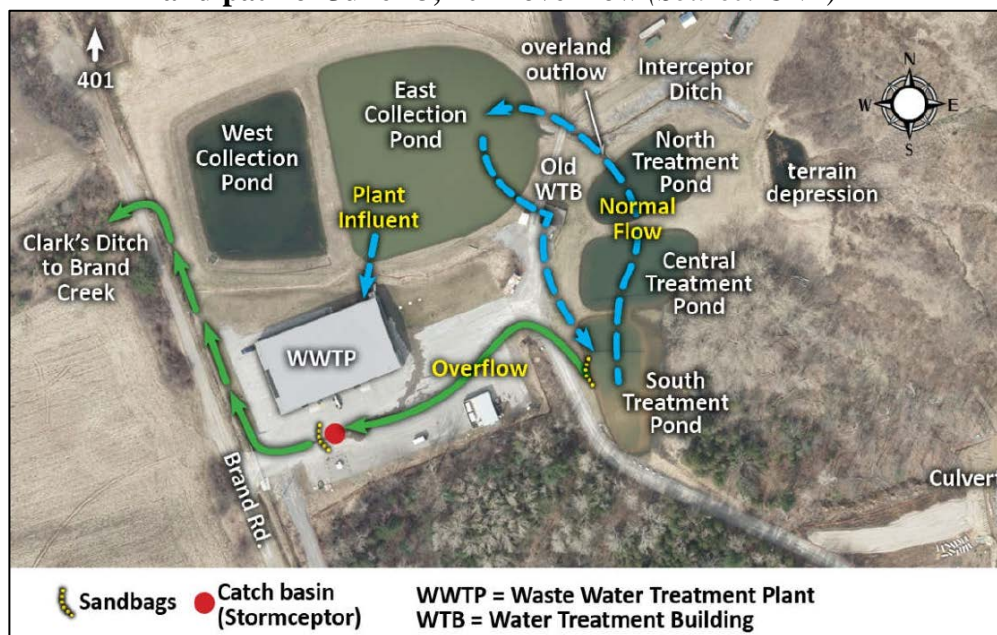
There were no lost-time injury events at the Port Hope Project during the period covered by this report. During the period covered by this report, one event occurred at the Port Hope Project which was of particular interest to CNSC staff. This event is summarized below.

Water Overflow Event at the South Treatment Pond

On June 23, 2017 sustained heavy rains (up to 70 mm) led to an unplanned discharge of untreated water from the Port Hope LTWMF site. An unplanned discharge also occurred on the same day at the Port Granby WMF site, as discussed above in section 3.2.2.3. An Event Initial Report was presented to the Commission in August 2017 under CMD 17-M38.

As shown in figure 21, the heavy rain event caused an overflow from the South Treatment Pond into the WWTP parking lot and then to Brand Creek and Lake Ontario (green lines). The normal flow of water is shown with blue lines. In response, CNL staff deployed sandbags at the point of overflow (yellow dots), and pumped water from the South Treatment Pond into the East Collection Pond. Sandbags were used to force most of the overflow into the Stormceptor drain (red dot), in order to minimize the sediment in the water being released. The overflow gradually lessened and was halted roughly 4-1/2 hours after its discovery.

Figure 21: Layout of water management features at the Port Hope LTWMF, and path of June 23, 2017 overflow (Source: CNL)



CNL conducted an extensive sampling campaign to determine whether there were any environmental impacts resulting from this event. Based on these results, CNL has concluded that there was no risk to the health and safety of workers or the public, and no lasting impact to the environment. CNSC staff reviewed CNL's sampling data and concurred with their conclusions.

CNSC staff carried out a reactive inspection of the Port Granby and Port Hope sites on June 26 and 27, 2017, which included representatives from the MOECC and ECCC. CNSC staff took various water samples from downstream of the LTWMF site and confirmed that there was no risk to public and the environment as a result of this overflow.

As a result of the inspection, CNSC staff identified the lack of a documented water contingency plan and the lack of emergency equipment and supplies were contributing factors to this overflow. Accordingly, CNSC staff issued an Order which required CNL to ensure its emergency preparedness measures are available to mitigate accidental releases of untreated water from the site and additionally to review and update its water management strategy to ensure that no further unauthorized releases would occur.

As of September 2017, CNSC staff have concluded that CNL has fulfilled the conditions of the Order through the submission of updated water management plans for the Port Hope Project. In subsequent inspections, CNSC staff verified that emergency water management supplies, as listed in CNL's water management documentation, are present. CNSC staff continue to monitor and assess CNL's water management measures at the Port Hope site.

3.2.3.5 Other Topics of Regulatory Significance

Licence Amendment related to *in-situ* Arsenic Management

On November 29, 2017 the Commission approved an amended licence for the PHP which includes revised requirements related to arsenic for specified portions of the Port Hope LTWMF site. Specifically, the amended licence exempts certain portions of the Port Hope LTWMF footprint from the clean-up criterion for arsenic of 40 parts per million, as specified in Appendix C of the Port Hope Project licence. This variance is acceptable because these areas are within the Port Hope LTWMF fence line, meaning that there will be no impact to the public or the environment resulting from this licensing change. The issuance of the amended licence allowed CNL to begin excavation of onsite wastes at the Port Hope LTWMF site, beginning with the high-arsenic wastes from the Welcome WMF, and emplacement of those wastes in the Port Hope LTWMF. As of January 31, 2018, all high-arsenic materials from the Welcome WMF have been excavated and emplaced in Cell 1 of the Port Hope LTWMF. Further information on this licence amendment is available in the Commission's Record of Decision, available on the [CNSC's website](#).

IAEA Safeguards at the Port Hope LTWMF

Pursuant to the *Treaty on the Non-Proliferation of Nuclear Weapons*, Canada has entered into a Comprehensive Safeguards Agreement and an Additional Protocol with the International Atomic Energy Agency (IAEA) (hereafter, the safeguards agreements). The objective of the safeguards agreements is for the IAEA to provide annual assurance to Canada and to the international community that all declared nuclear material is in peaceful, nonexplosive uses and that there is no indication of undeclared material.

The CNSC provides the mechanism, through the NSCA and Regulations, for the IAEA to implement the safeguards agreements. Under these agreements, CNL is required to maintain and declare detailed accounting records of all transactions involving nuclear material, allow access to IAEA inspectors for inspections, accept the installation of IAEA equipment for remote verification or surveillance where necessary, and to provide relevant design and operational information to the IAEA periodically.

The waste inventory destined for the LTWMF includes 17,000 drums of historical uranium-bearing waste currently under safeguards at Cameco's Port Hope Conversion Facility (PHCF). This material was generated by historical uranium processing activities at PHCF and contains approximately 1,400 tons of uranium. The uranium-bearing waste transferred to the LTWMF is subject to IAEA safeguards.

The IAEA, the CNSC, CNL, and Cameco have developed practical arrangements which codify the safeguards expectations at the LTWMF. As part of these arrangements, CNL will facilitate the installation of an IAEA unattended monitoring system to verify the safeguarded uranium bearing waste as it arrives at the LTWMF. The LTWMF will also be subject to measures provided for under the safeguards agreements for the IAEA to verify the absence of undeclared nuclear activities and materials.

CNSC staff have concluded that the practical arrangements and the CNL's safeguards program will meet the safeguards obligations of the licensee with respect to this project.

3.2.4 Other PHAI-Related CNL Licences in Port Hope

In addition to the PHAI licences for the Port Hope Project and Port Granby Project, CNL holds two Designated Officer-issued licences as shown in table 1.

The purpose of both of these licences is for the interim management of LLW until the Port Hope LTWMF is ready to begin receiving wastes. The Pine Street Extension Temporary Storage Site continues to accept new wastes, as identified by CNL's Construction Monitoring Program (CMP), while the Port Hope Radioactive Waste Management Facility is not accepting any new wastes. Through the CMP, excavations in properties in the Municipality of Port Hope are monitored and if the presence of historical LLW is confirmed, the material is collected and safely transported to the Temporary Storage Site.

The materials stored under these licences are among the first in Port Hope that will be remediated, with work expected to begin in 2018. CNL may choose to keep the pads at the Pine Street Extension Temporary Storage Site open and active during wider remediation work in Port Hope, in order to support the Construction Monitoring Program.

The data from CNL's annual reports and the results of CNSC staff's most recent inspection of these sites (conducted in November 2017) leads CNSC staff to conclude that CNL continues to conduct activities at these sites safely, and in accordance with the requirements of its licences.

3.2.5 Public Information Program for PHAI

As per the licences for the Port Hope and Port Granby projects, CNL is required to have a public information program. CNL's public information program for the PHAI has been developed in accordance with CNSC regulatory guide RD/GD 99.3 *Public Information and Disclosure*, and allows members of the public to obtain information on all aspects of the PHAI, as well as ensuring appropriate disclosure following the occurrence of unplanned events. CNSC staff confirm through compliance activities that CNL has shown willingness to share project-related information freely with interested parties and taken proactive steps to build positive relationships with stakeholders. In May 2018, the CNSC published REGDOC-3.2.1 *Public Information and Disclosure* and CNSC staff will ensure that this updated standard is included in the LCHs for the Port Hope and Port Granby projects in the coming months.

A primary information source for the public is the Project Information Exchange (PIE) located at the PHAI management office at 115 Toronto Road in Port Hope, Ontario, where members of the public can obtain documents or speak directly to CNL staff about the projects, including plans for the remediation of their properties. CNL's website for the PHAI also provides interested parties up-to-date information on current project activities. CNSC staff have observed that CNL also engages the public through opinion surveys, presentations, information sessions, newsletters, resident notifications, site tours, open houses, Indigenous engagement sessions, citizen liaison groups, etc.

CNL informs CNSC staff of the dates of its meetings in the community, and CNSC staff have participated in the past to answer questions about the CNSC's mandate and role in regulating the PHAI. CNSC staff have also participated in community events such as the "Port Hope & District Agricultural Society Fair" in the past, and CNSC staff meet bilaterally with the Municipality of Port Hope on an as-needed basis. Given that both the Port Hope and Port Granby projects are currently in extremely active phases, a CNSC inspector has been seconded to live in the area, to allow a more flexible approach to CNSC staff's compliance verification activities. This staff member will be able to carry out more frequent and smaller-scale compliance activities which are adapted to CNL's current project activities, and will allow CNSC staff to be more engaged in community activities.

Evolution of Citizen Liaison Groups

Since 2013, CNL has maintained a Citizen Liaison Group (CLG) for each project. CLG meetings provide a mechanism for CNL to provide information and updates directly to local residents and also receive important feedback from the community.

Up to 2018, the CLGs met four times per year. Beginning in 2018, CNL has changed the frequency of CLG meetings for the Port Granby Project to twice annually. This reduced frequency is reflective of the fact that the Port Granby Project is nearing completion. CNL is also transitioning the Port Hope CLG away from a fixed-membership model to several new approaches designed to encourage participation from members of the community from areas in which remediation work is currently underway.

CNSC staff confirm that these updated strategies and approaches meet the objectives of REGDOC-3.2.1 and demonstrate that CNL is proactive in ensuring the Port Hope and Port Granby communities are in possession of up-to-date information on the PHAI.

Indigenous Engagement

CNSC staff confirm that CNL holds an information session for Indigenous groups that have expressed interest in the projects on an annual basis. The most recent session was held in June 2017, and was attended by Curve Lake First Nation, Hiawatha First Nation, Mississaugas of Scugog Island First Nation, and Alderville First Nation. As part of their public disclosure program, CNSC staff confirm that CNL provided updates on both the Port Granby and Port Hope Projects, with a focus on remediation at the Port Hope Waterfront, followed by a walking tour of waterfront sites.

4 OVERALL CONCLUSIONS

Through site inspections and desktop verifications, CNSC staff conclude that CNL is maintaining and operating the various facilities covered by this report in accordance with the requirements of the NSCA, CNSC Regulations and the terms of the applicable licences.

Since the last reports to the Commission on these licensed activities, CNL is making progress on the decommissioning of Whiteshell Laboratories in accordance with their approved decommissioning plans, and has made significant progress in the Port Hope Project and Port Granby Projects.

CNSC staff continue to provide oversight and monitoring of CNL's adherence with regulatory requirements. Given the increasing activity at many of these sites, CNSC staff intend to provide another progress update to the Commission on these projects every two years.

CNSC staff conclude that:

- CNL is maintaining Douglas Point, Gentilly-1, Nuclear Power Demonstration and the Whiteshell Laboratories safely and in compliance with the requirements of the NSCA, CNSC Regulations and its licences.
- CNL is making progress on the decommissioning of Whiteshell Laboratories in accordance with their approved decommissioning plans.
- CNL is carrying out work under the Port Hope Area Initiative safely and in compliance with the requirements of the NSCA, CNSC Regulations and its licences.

LIST OF ACRONYMS

AECL	Atomic Energy of Canada Limited
CEAA	<i>Canadian Environmental Assessment Act</i>
CLG	Citizen Liaison Group
CNL	Canadian Nuclear Laboratories
CNSC	Canadian Nuclear Safety Commission
CRL	Chalk River Laboratories
CMD	Commission Member Document
CMP	Construction Monitoring Program
DDP	Detailed Decommissioning Plans
DP	Douglas Point
EA	Environmental assessment
ECCC	Environment and Climate Change Canada
ECIS	Emergency Cooling Injection System
EGR	East Gorge Reservoir
EIS	Environmental Impact Statement
FG	Financial guarantees
G-1	Gentilly-1
GoCo	Government-Owned Contractor-Operated
H ₂ S	Hydrogen sulphide gas
HLW	High-Level Radioactive Waste
HTPS	Heat Transport Purification System
IAEA	International Atomic Energy Agency
IEMP	Independent Environmental Monitoring Program
ILW	Intermediate-Level Radioactive Waste
LCH	Licence Conditions Handbook
LLW	Low-Level Radioactive Waste
LTWMF	Long-Term Waste Management Facility
MOECC	Ontario Ministry of Environment and Climate Change
MPH	Municipality of Port Hope
MPS	Moderator Purification System
MWe	Megawatt electric

MWth	Megawatt thermal
NPD	Nuclear Power Demonstration
NSCA	<i>Nuclear Safety and Control Act</i>
PHAI	Port Hope Area Initiative
PHCF	Port Hope Conversion Facility
PPE	Personal Protective Equipment
SCBAs	Self-Contained Breathing Apparatuses
SDR	SLOWPOKE Demonstration Reactor
TSS	Temporary Storage Site
WGR	West Gorge Reservoir
WL	Whiteshell Laboratories
WMA	Waste Management Area
WMF	Waste Management Facility
WR-1	Whiteshell Reactor No. 1
WWTP	Waste Water Treatment Plant

A.1 Waste Inventory Information²

Location	Classification of Waste	Description of Waste	Storage Method	Number of Bundles or Volume	Activity (TBq)
Douglas Point	High-level waste	Used nuclear fuel	Dry storage in concrete canisters	22,252 bundles	N/A
	Intermediate-level waste	Waste from reactor decommissioning	Reactor building	60 m ³	N/A
	Low-level waste	Contaminated soils	205-litre drums	66 m ³	N/A
	Low-level waste	Waste from reactor decommissioning	Reactor building	35 m ³	<1
Gentilly-1	High-level waste	Used nuclear fuel	Dry storage in concrete canisters	3,213 bundles	N/A
	Intermediate-level waste	Waste from reactor decommissioning	Reactor building	58 m ³	<1
	Low-level waste	Contaminated soils	205-litre drums	1 m ³	N/A
	Low-level waste	Waste from reactor decommissioning	Reactor building	607 m ³	N/A
Nuclear Power Demonstration	Low-level waste	Waste from reactor decommissioning	Reactor building	12 m ³	<1
Whiteshell Laboratories	High-level waste	Used nuclear fuel	Dry storage in concrete canisters	2,268 bundles	N/A
	Intermediate-level waste	Research reactor waste and waste from reactor decommissioning	In-ground concrete bunkers	863 m ³	2,794
	Intermediate-level waste	Waste from decommissioning activities	In-ground concrete bunkers	22 m ³	148
	Low-level waste	Research reactor waste and waste from reactor decommissioning	Above-ground concrete bunkers	19,700 m ³	325
	Low-level waste	Waste from decommissioning activities	Above-ground concrete bunkers	1,598 m ³	6
Port Hope	Low-level waste	Contaminated soils	<i>In-situ</i> and consolidated storage	720,000 m ³	N/A
Port Granby	Low-level waste	Waste and contaminated soils	Trench burial	438,200 m ³	N/A

² Waste inventory information from the *Canadian National Report For The Joint Convention On The Safety Of Spent Fuel Management And The Safety Of Radioactive Waste Management*, October 2017. Some radioactive waste at the NPD site is included in the CRL inventory as shown in Table D.5 of that report. The volume of LLW at Port Granby has increased over original estimates and will be larger than shown here.

A.2 Effluent Quality at the Port Granby Waste Water Treatment Plant

Parameter	Units	Maximum Weekly Results			Weekly Action Levels	Weekly Release Limits	Monthly Release Limits
		January 2018	February 2018	March 2018			
Radium-226	Bq/L	<0.0050	<0.0050	<0.0050	0.05	0.74	0.37
pH	-	7.54	7.67	7.35	Between 6.5 and 8.5	Between 6.5 and 9.5	Between 6.5 and 9.5
Nitrite	mg/L	0.102	0.159	0.403	1.5	3	1.5
Nitrate	mg/L	4.36	3.64	1.76	75	150	75
Total Suspended Solids	mg/L	<1	<1	<1	15	30	15
Ammonia	µg/L	0.36	0.33	0.21	1	11.5	5.75
Phosphorus	mg/L	0.023	0.029	0.024	5.75	0.7	0.35
Arsenic	µg/L	14	14	6.7	50	200	100
Cadmium	µg/L	<0.10	<0.10	<0.10	1	2	1
Cobalt	µg/L	<0.50	<0.50	<0.50	5	10	5
Copper	µg/L	2	<1.0	<1.0	5	10	5
Molybdenum	µg/L	7.1	6	3.1	50	-	-
Selenium	µg/L	<2.0	<2.0	<2.0	20	60	30
Thallium	µg/L	<0.050	<0.050	<0.050	0.5	16	8
Vanadium	µg/L	<0.50	<0.50	<0.50	5	80	40
Uranium	µg/L	4	11	7.9	100	200	100
Acute Toxicity	-	Pass	Pass	Pass	-	-	Cannot be toxic

Notes:

Results prefixed by “<” indicate a result less than the minimum detection limit

A.3 Effluent Quality at the Port Hope Waste Water Treatment Plant

Parameter	Units	Maximum Weekly Results			Weekly Action Levels
		January 2018	February 2018	March 2018	
Radium-226	Bq/L	<0.0050	<0.0050	<0.0050	0.05
pH	-	7.30	7.53	7.83	Between 6.5 and 8.5
Total Suspended Solids	mg/L	<1	2	<1	7.5
Aluminum	µg/L	9.2	7.5	<5.0	100
Arsenic	µg/L	1.6	2	2	41
Boron	µg/L	21	20	19	175
Copper	µg/L	<1.0	<1.0	<1.0	5
Lead	µg/L	<0.50	<0.50	<0.50	5
Uranium	µg/L	1.7	2.1	2.6	100
Zinc	µg/L	<5.0	<5.0	<5.0	15
Acute Toxicity	-	Pass	Pass	Pass	-

Notes:

Results prefixed by “<” indicate a result less than the minimum detection limit

A.4 Status of Port Hope Project Small-Scale Sites Surveys as of April 1, 2018

Campaign	Number of Properties in Campaign	Interior Measurements			Exterior Measurements			Number of Properties Found to Have LLW
		Radon	Gamma	Delineation	Gamma	Subsurface	Delineation	
Trial Survey	23	100%	100%	100%	100%	100%	100%	2
1	430	100%	100%	100%	100%	100%	100%	44
2	806	100%	100%	95%	100%	100%	95%	337
3	1108	100%	100%	19%	100%	100%	59%	362
4	1349	100%	69%	0%	87%	53%	0%	Estimated 50
5	1150	100%	Fieldwork to commence in summer 2018					Estimated 40
Estimate at completion	4866						Total forecast	835

Notes

- In this table, '%' refers to percentage of measurements complete
- 'Delineation' refers to the process of determining the extent of LLW in a given property where it has been found