Canadian Nuclear Laboratories | Laboratoires Nucléaires Canadiens

Environmental Assessment (and/or Environmental Effects Review)

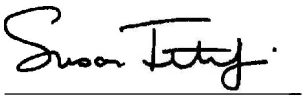
PROJECT DESCRIPTION - NPD CLOSURE PROJECT

NPD DECOMMISSIONING

64-509200-ENA-003

Revision 1

Prepared by
Rédigé par



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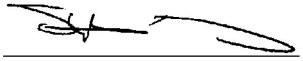

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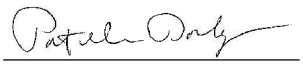

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2016/03/31
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1. INTRODUCTION

This document describes the activities related to the in-situ decommissioning of the Nuclear Power Demonstration Waste Facility (NPDWF) in Rolphton, Ontario. The purpose of the document is to provide Canadian Nuclear Safety Commission (CNSC) staff with the information necessary to make a determination of Environmental Assessment requirements for the project under the Canadian Environmental Assessment Act, 2012 [1]. The contents of the project description address information requirements identified in Canadian Environmental Assessment Act Regulations *'Prescribed Information for the Description of a Designated Project'* [2].

1.1 Acronyms and Abbreviations

AECL	Atomic Energy of Canada Limited
CANDU	CANada Deuterium Uranium
CEAA	Canadian Environmental Assessment Act
CNL	Canadian Nuclear Laboratories
CNSC	Canadian Nuclear Safety Commission
CRL	Chalk River Laboratories
GoCo	Government Owned- Contractor Operated
IAEA	International Atomic Energy Agency
MOE	Ministry of Environment
NPDNGS	Nuclear Power Demonstration Nuclear Generating Station
NPD	Nuclear Power Demonstration
NPDWF	Nuclear Power Demonstration Waste Facility
NRCan	Natural Resources Canada
PCB	Polychlorinated Biphenyl
SARA	Species at Risk Act
SWS	Storage with Surveillance

2. GENERAL INFORMATION

2.1 Project's Name, Nature and Location

2.1.1 Project's Name and Nature

The purpose of the Nuclear Power Demonstration Closure Project is to safely carry out the decommissioning of the Nuclear Power Demonstration Waste Facility (NDPWF). In-situ decommissioning is the preferred approach proposed by the project to carry out these activities.

This Class I nuclear facility is presently in the Storage with Surveillance (SWS) phase of decommissioning and has a Decommissioning Waste Facility License issued in 2014.

The Nuclear Power Demonstration Nuclear Generating Station (NPDNGS) consisting of a 20 Mwe CANDU (short for CANada Deuterium Uranium) was placed in service in 1962 and was operated by Ontario Hydro until 1987. The reactor was heavy water moderated, cooled by pressurized heavy water and fuelled with natural uranium. The main components of NPDWF were the reactor, heat transport system, turbine and electrical power generator equipment. Following permanent shutdown of the station, the operating and compliance responsibilities were transferred from Ontario Hydro to Atomic Energy of Canada Limited (AECL) and the facility is now renamed Nuclear Power Demonstration Waste Facility (NPDWF).

The proposed in-situ decommissioning activities include removing the above ground structure and placing contaminated materials into the below grade structure. The below grade structure, reactor vessel and systems and components will be sealed by grouting. The structure will then be capped with concrete and covered with an engineered barrier. In-situ decommissioning will isolate the contaminated systems and components inside the below grade structure.

Project's Location - Overview

The NPD site is on the south bank of the Ottawa River (Figure 2-1), about 3 km downstream from the Des Joachims Dam and approximately 25 kilometres upstream from the Chalk River Laboratories (CRL) site. The facility comprises parts of lots 43 and 44 in Rolphton Township, in the Town of Laurentian Hills in Renfrew County Ontario.

Figure 2-1 The Nuclear Power Demonstration Waste Facility.

The facility is in a remote area, with relatively low population density. The Town of Laurentian Hills has a population of approximately 2,800 distributed over an area of 640 km^2 and contains the former village of Chalk River and the former hamlets of Point Alexander, and Rolphton. It is located on a 2.4 hectare parcel of land (roughly 140 m wide by 180 m deep) surrounded by a 380 hectare exclusion zone (Figure 2-2).

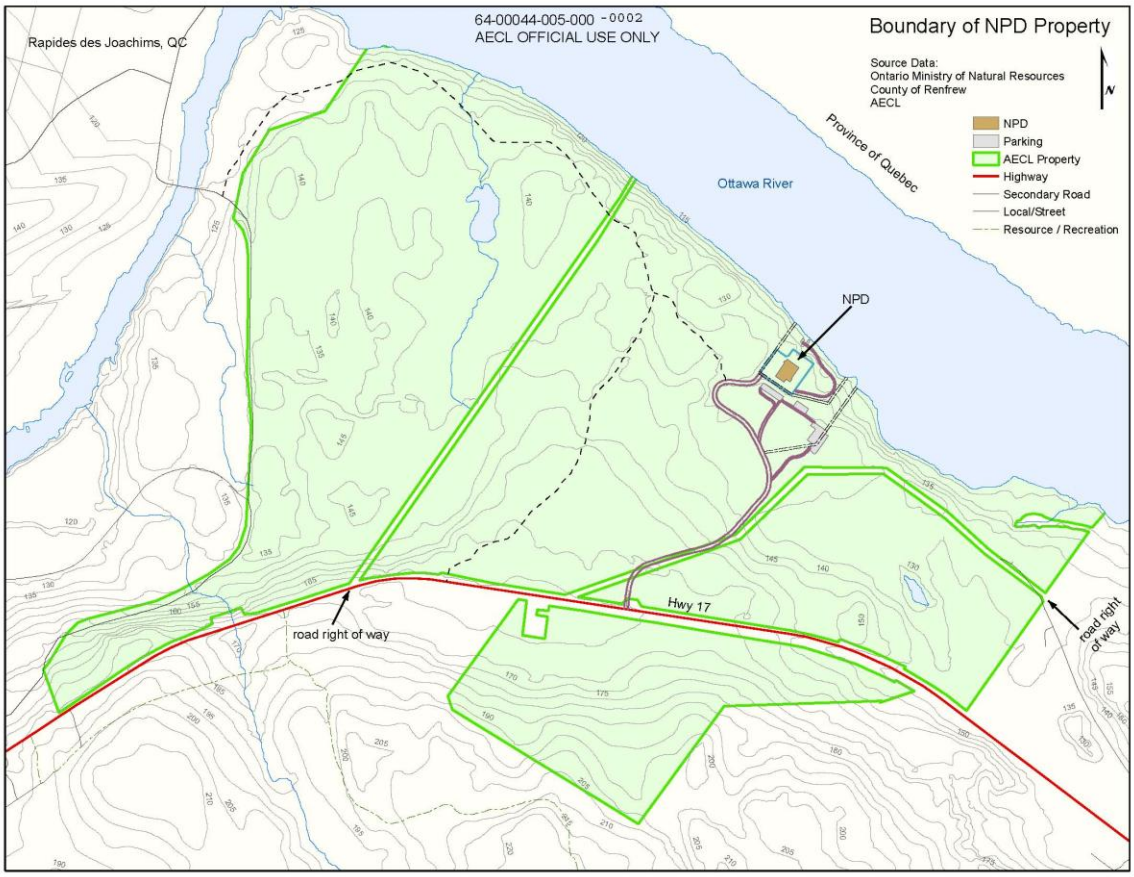

Figure 2-2 Boundary of NPD Property.

The NPDWF occupies a small percentage (<1%) of the total NPD site area. The green area shown in Figure 2-2 indicates that the NPD property has remained undisturbed during the operating life of the reactor, with the exception of the operation of two landfills.

2.2 Project Proponent

Atomic Energy of Canada Ltd. (AECL) is a federal Crown corporation, with a core mandate to deliver on Canada's radioactive waste and decommissioning responsibilities, provide nuclear expertise to support federal responsibilities, and offer services to users of the nuclear laboratories on commercial terms. It fulfils this mandate through a long-term contractual arrangement with Canadian Nuclear Laboratories (CNL) for the management and operation of AECL's sites, facilities and assets, and the performance of AECL's waste and decommissioning responsibilities, under a Government-owned, Contractor-operated ("GoCo") model.

Canadian Nuclear Laboratories is a private sector company that is contractually responsible for the management and operation of AECL's nuclear sites, facilities and assets, including the NPD site, and the performance of AECL's waste and decommissioning responsibilities. CNL is proposing to carry out a designated project on land that is held in the name of AECL and is therefore, property of the Crown. Therefore, CNL is the proponent for the NPD project.

2.2.1 Contact Information

Canadian Nuclear Laboratories is the project proponent. The contact information of the primary representatives for the project are:

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2.3 Description of Consultation Activities

CNL provides regular communication updates to public stakeholder groups to inform and educate stakeholder on the company vision and current and future activities. To date CNL has informed the following stakeholder groups of the proposed project within the context of a larger vision of the company. These communications activities have occurred during the 2015

September to December timeframe and have provided a brief overview of the proposed NPD in-situ decommissioning approach. The stakeholders have included:

- CNL employees (Executive, Management, Unions, Staff).
- Host Communities (Elected Officials, Municipalities, Interest Groups).
- Algonquins of Pikwàkanagàn.
- Local residents (Rolphton, Rapides-des-Joachims, the United Townships of Head, Clara, and Maria, Deep River and Chalk River area).
- Industry stakeholders, peers, and vendors.
- The Canadian Nuclear Safety Commission (CNSC).

The results from these preliminary consultations indicate no immediate concerns with the proposed decommissioning approach.

2.3.1 Future Engagement Activities

CNL recognizes that it must conduct its business in a manner that is both socially and environmentally responsible. CNL's demonstration of this commitment is founded within its public information program. The programs objective is to inform our stakeholders about the activities ongoing at CNL sites, the potential impacts of these activities on the health and safety of workers, members of the public, and on the environment. The overriding objective of the program is to build public awareness, understanding, and a supportive appreciation of the Laboratories' value and relevance to Canadians. These activities will be undertaken in consultation with the CNSC.

These objectives (among others) form the basis of communication with stakeholders and help to direct the establishment of long-term mutually beneficial working relationships. Engagement will include:

- Formal notification of the project.
- Regular and consistent communication on the project (e.g. website, newsletters).
- Targeted community initiatives.
- Site visits.
- Public project information sessions.
- Speaking engagements.

2.4 Environmental Assessment and Regulatory Requirements of Other Jurisdictions

This project is being undertaken on Federal lands. No other regulatory requirements of jurisdictions other than Federal have been identified.

2.4.1 Current or Past Environmental Studies

Since shutdown of the nuclear reactor in 1987, several studies have been undertaken to assess environmental conditions at the site and identify areas of potential concern. The results of those assessments have not identified any adverse effects on the environment. These have included but are not limited to:

- Hydrogeological assessments of two landfills in the late 1980's.
- A general site characterization study conducted in 1990.
- Site investigations and monitoring of groundwater following identification of a leak from an underground diesel tank located to the north of the facility.
- Nuclear Power Demonstration Site: A Description of the Environmental Baseline for Decommissioning; February 2013.
- NPD Phase I Environmental Site Assessment Review as well as supplemental site characterization studies in preparation for decommissioning; 2014.
- Safety Analysis Report for the Nuclear Power Demonstration Waste Management Facility; February 2015.
- Annual compliance monitoring of the NPD site such as ambient radiation fields as well as tritium in vegetation and surface soil, which is reported annually.

Based on the studies thus far, there are no adverse environmental effects expected as a result of decommissioning activities.

3. PROJECT INFORMATION

3.1 Project Context and Objectives

3.1.1 Project Context

Following permanent shutdown of the NPDNGS, all process systems not required during safe storage were drained and shut down, including the heavy water moderator and heat transport system. The spent fuel was transferred to fuel storage facilities at another CNL site. Any mobile material such as demineralizer equipment was removed for re-use and the entire turbine system, control room and support facilities were cleared out and demolished where possible. Some hazardous materials have been removed such as asbestos insulation and floor tiles. Any redundant buildings and non-nuclear systems were removed (i.e., power house components). The NPDWF currently consists of a limited number of structures including the main building storing the reactor and its associated systems, a diesel-generator, the ventilation stack and the guardhouse.

At the time of NPDNGS permanent shutdown, the preferred decommissioning strategy for the station was one of deferred decommissioning. A deferment period allowed the significant reduction of radiation fields emanating from the reactor and associated process systems as a result of radioactive isotopes decay.

In 1988, after the facility was shut down, total residual radioactivity in the NPD reactor system was estimated to be 2×10^{15} Bq. Since shut down, 29 years of radioactive decay have reduced radioactivity considerably. The total radiological inventory in 2012 was calculated to be 7.5×10^{13} Bq and by 2017 the total radiological inventory will have declined to 4.1×10^{13} Bq.

The NPDWF is in an ideal strategic position for completion of the remainder of the site decommissioning. As disposal options for nuclear waste within Canada are currently not available, in-situ decommissioning can safely reduce Canada's nuclear legacy liabilities at this property. In-situ decommissioning results in a concrete monolith which provides a robust and durable containment to allow for continued radioactive decay. This approach is consistent with the International Atomic Energy Agency (IAEA) '*Decommissioning Strategies for Facilities Using Radioactive Material*' [3]. The IAEA considers the entombment strategy an acceptable approach for member states that do not waste disposal options such as Canada. Also the NPD proposed approach is consistent with the IAEA strategy as the dominate contribution to the source term involves short lived radioactive isotopes and the longer lived isotopes are principally activation products.

Decommissioning options that have been considered for this project are:

1. In-situ decommissioning where the source term will be isolated inside the below grade structure and systems to allow for continued radioactive decay.
2. Full dismantling and removal of all systems, structures and components for interim storage at an alternate CNL site until final disposal options are available.
3. Partial removal of the source term (i.e., reactor systems and components) for interim storage at an alternate CNL site until final disposal options are available. The remaining facility systems, structures and components will remain in-situ.
4. Continue with a deferred decommissioning approach which includes maintaining the NPDWF in the Storage with Surveillance phase to allow for further radioactive decay.

In-situ decommissioning has been selected as the preferred approach as it provides the following advantages:

- Reduced risk for radiological and industrial hazards exposure to workers meets the As Low As Reasonably Achievable (ALARA) principle for worker protection.
- Reduced transport/waste handling risks to the public and environment.
- Effective reduction of the nuclear liability (e.g., eliminates interim waste storage at CRL).
- Eliminates the risk associated with multiple handling of waste packages to and from interim storage and final disposal.
- Lowest cost option for the Canadian tax payer.
- Allows for the early release of non impacted NPD property for alternate uses.

The disadvantages include:

- Additional long term monitoring of the impacted area (see section 3.5.6).

Following in-situ decommissioning, institutional controls and surveillance activities will be required to monitor environmental performance of the entombed material at the NPD site.

3.1.2 Project Objectives

The objective of the NPD Closure Project is to safely decommission NPDWF ensuring the prompt reduction of Canadian legacy long-term liabilities.

In-situ decommissioning of the NPDWF will meet the following end state objectives:

- The reactor, associated systems and below grade structures grouted to the extent practicable.
- Above grade structures removed and used as backfill.
- The grouted area covered with a concrete cap and engineered barrier.
- Remaining land returned to AECL for unrestricted use.

- Shall be designed so that the dose to the public and to workers will be *As Low As Reasonably Achievable* (ALARA) with <0.25 mSv per year to the public as a dose constraint.
- Long-term care and maintenance activities will continue for an agreed performance period.

3.2 Provisions in the Schedule to the Regulations Designating Physical Activities

Under the Canadian Environmental Assessment Act (CEAA) 2012, Environmental Assessments are required for Designated Projects identified in the *Regulations Designating Physical Activities* [4].

The preferred option of in-situ decommissioning will result in an end state that includes the disposal of nuclear waste at the site. Thus the proposed project qualifies as a Designated Project as per Section 37(b) of these regulations:

> *37. The construction and operation of a new (b) facility for the long term management or disposal of irradiated fuel or nuclear waste.*

The *Regulations Designating Physical Activities* identifies the Canadian Nuclear Safety Commission (CNSC) as the Responsible Authority for projects of this type. The CNSC as the responsible authority is responsible for the conduct of the Environmental Assessment.

3.3 Physical Works related to the Project

3.3.1 Current Status of NPDWF

The current layout of buildings and foundations at NPDWF is presented in Figure 3-1. The remaining permanent structures at the NPD site are:

- Main Building - The purpose of the Main Building substructure was to house the reactor, its associated equipment, and to provide shielding and containment. It has a one-storey above ground structure with five levels below grade, and has a building area of approximately 2,600 m^2.
- Ventilation stack - The purpose of the ventilation stack is to discharge airborne effluent from the Main Building. The stack is a reinforced concrete structure 45.7 m high.
- Guardhouse - The purpose of the Guardhouse is to serve as an access control point into the NPDWF. It is a standalone building at the entrance to the fenced area. It is a one-storey above ground structure with a building area of 80 m^2.
- Pressure Relief Duct - The purpose of the pressure relief duct was to provide an emergency relief for steam from the boiler package. It is a reinforced poured concrete construction that is 18 m in length and 6 m in width and 10 m below grade level.
- Diesel Generator Enclosure - The enclosure houses a diesel-generator set which provides emergency power to mitigate power interruptions at the facility.

There are also temporary facilities onsite such as sea containers and portable washrooms.

Foundations from the previously removed pump house, emergency vehicle garage, training center, construction camps, warehouses, dousing tank, transformer and an administration wing remain onsite. There are also two landfills on site which are currently closed. One landfill was used as a lay down area during construction of the site while the other landfill was used for conventional purposes during the operation of the facility. This landfill has a certificate of approval (A413107) from the Ministry of Environment (MOE) acknowledging closure of the landfill. During operation the domestic sanitary services consisted of two septic tanks which remain onsite but are not in use. There is also buried utilities and drainage systems onsite, some of which are still in use. The NPDNGS also had two underground storage tanks, for diesel fuel and furnace oil, as well as a tank which contained the radiological liquid waste, all of which were previously removed and soils around them remediated.

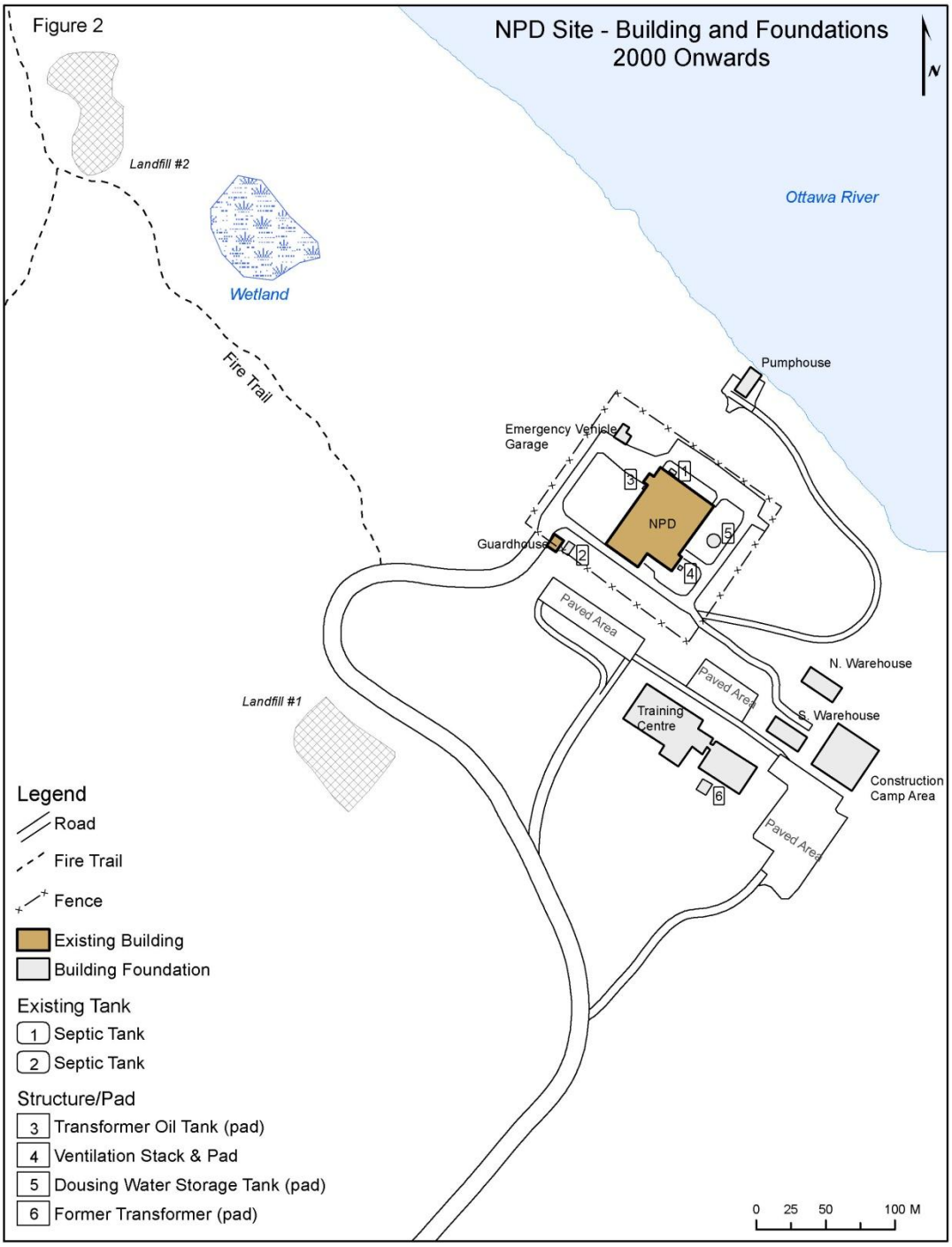

Figure 3-1 Buildings and foundations at NPDWF.

3.3.1.1 Reactor and Associated Systems

The main systems of the NPDNGS were the reactor, heat transport system, turbine, and electrical power generator equipment. Figure 3-2 provides a cross section view of the Main Building and these structures. The reactor was heavy water moderated, cooled by pressurized heavy water and fuelled with natural uranium. The reactor core, or calandria, contained 132 horizontal fuel-containing pressure tubes and was surrounded by the heavy water moderator. The heat transport system pumps circulated the hot pressurized heavy water through the reactor coolant tubes to a heat exchanger/boiler unit where the heat was transferred to the boiler steam and water system. The reactor, boiler and auxiliary systems were installed below ground and were surrounded by concrete as shielding to protect the surrounding accessible areas from radiation during operation. Steam generated in the boilers was transferred to the turbine/generator for electrical power generation.

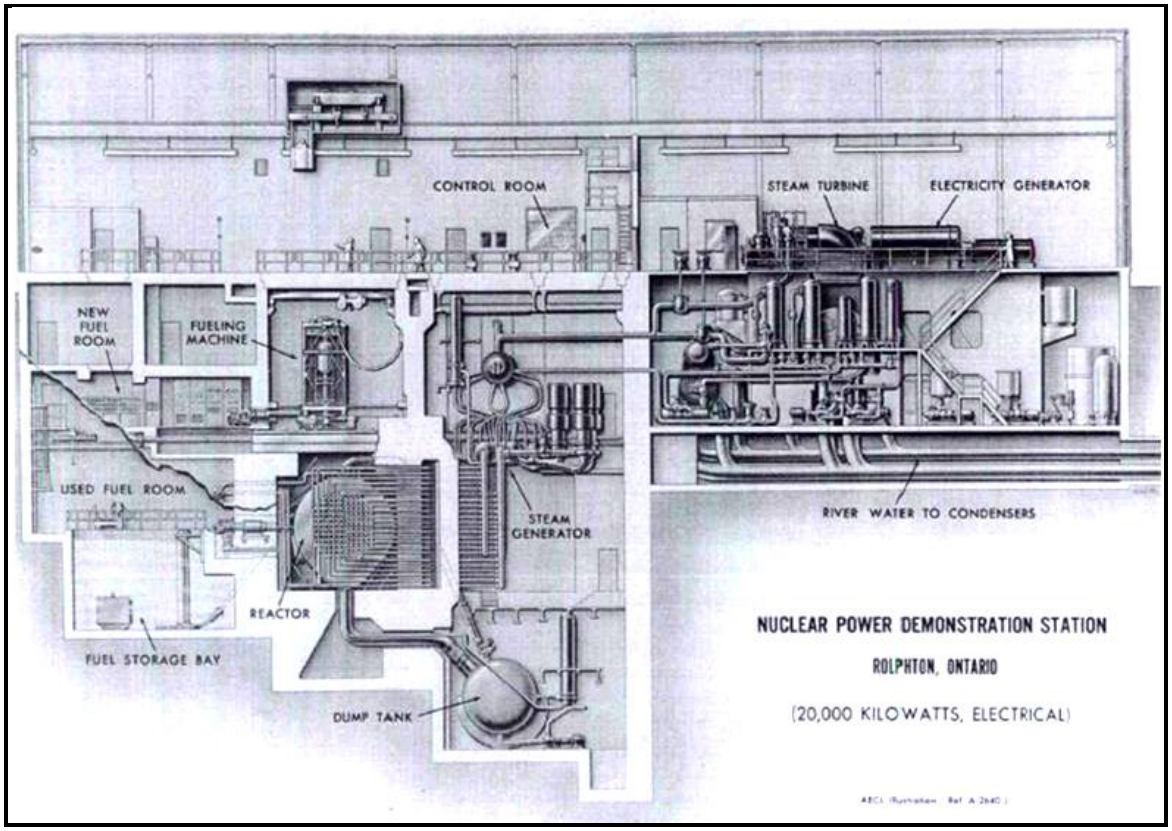

Figure 3-2 Cross sectional view of the Main Building during operation.

As noted in Section 3.1.1, during shutdown operations the heat transport and moderator systems heavy water was drained and shipped off site. The reactor was de-fuelled and the fuel bundles were transferred to another CNL site. Demineralizer system equipment was removed from the various nuclear process systems and dispositioned. Major and minor decontamination activities were completed as required.

3.3.1.2 Constituents of Concern

3.3.1.2.1 Radiological Inventory

The majority of the radiological inventory within NPDWF is associated with reactor core components (calandria and pressure tubes), the biological shield, the heat transport system, and the moderator system. A calculation of the accumulated radioactive inventory of the reactor components indicates that the radiological inventory associated with the reactor core and biological shield will decay to 4×10^{13} Bq, and the inventory associated with the primary heat transport and moderator systems will decay to 2×10^{11} Bq by 2017. The dominant radionuclides are ^{55}Fe, ^{60}Co, ^{65}Zn, ^{14}C, ^{54}Mn, ^{63}Ni, and ^{3}H.

3.3.1.2.2 Designated Substances

Hazardous designated substances in the facility include industrial chemicals, asbestos materials (such as pipe insulation, floor tiles and transite building cladding), lead-based paint, lead bricks and sheets, Polychlorinated Biphenyl (PCBs) in fluorescent light fixture ballasts, and small quantities of mercury in thermostats and switches.

3.4 Production and Infrastructure

3.4.1 Production Capacity

The NPDNGS was the first Canadian nuclear power reactor and was a 20 MWe heavy water moderated pressure tube reactor. During its operational period, the NPDNGS generated 3×10^{9} kWh of electricity, at 65.0% net electrical capacity factor. The reactor was permanently shutdown in May 1987 after exceeding its operational goals.

3.4.2 Associated Infrastructure

Following permanent shutdown of the NPDNGS, any systems not required during safe storage were drained and shut down, including domestic water and heating. The NPDWF is maintained with a safe enclosure strategy with active fire detection and security surveillance, a reduced electrical supply and ventilation systems which is operated periodically to allow for intermittent inspections. The remaining permanent structures on site were discussed in Section 3.3.1.

Since there is limited infrastructure currently onsite, some temporary infrastructure will be required in order to facilitate decommissioning. Mobile offices and washrooms as well as an increase to the electrical services will be brought to the NPD site to facilitate preparations for decommissioning. During decommissioning it is likely a temporary concrete batch mixing plant will be assembled on the NPD site. Water holding tanks and fuel storage may also be required on site to support the decommissioning activities.

3.5 Project Activities

The general approach to in-situ decommissioning involves preparing systems and structures for grouting to create a monolith below grade. The below grade sealed structures will contain any radiological sources within it for a period of institutional control. The decommissioning activities which constitute the designated project scope are:

- Assembly and operation of the grout batch mixing plant.
- Grouting of below grade structures.
- Removal of above grade structures to be used as backfill.
- Installation of concrete cap and engineered barrier over the grouted area.
- Final site restoration.
- Preparation for long-term care and maintenance activities.

Additional detail on each of these project activities is provided below.

3.5.1 Batch Mixing Plant

Due to the distances to the nearest concrete suppliers, a batch mixing plant will be assembled on the NPD site. This will require shipping by truck and stockpiling aggregate, sand and cement near the batch plant. A water tank, piping, power and settling ponds for equipment wash out will be constructed. A settling pond is an engineered catchment that collects water and allows sediments to collect. Water from the settling pond will be sampled prior to pumping for release or recycled to the batch plant. When complete the settled material will be placed and grouted into the facility. Any remaining aggregate or sand will be used as back fill in the facility before final capping.

3.5.2 Grouting of Below Grade Structure

All below grade areas are to be filled with grout. Using a master fill schedule, lifts of concrete pours will be planned to systematically fill the entire structure. The concrete pours will be designed to balance forces across walls and between rooms such that no failures of the current structures can occur. Pathways created during preparation of rooms will minimize void space and allow for dissipation of heat during curing of the concrete. Quality control measures on grouting operations will be implemented to ensure that the finished product will meet specified parameters. The NPDWF drainage system will be grouted with the structure and the outfall discharge pipes will be capped.

3.5.3 Removal of Above Grade Structures

The Main Building, the above ground portion of the Pressure Relief Pit walls, the Ventilation Stack, and Guard House will be demolished and placed in the available facility voids such as the Pressure Relief Pit and the Turbine Hall pit. Recyclable material will be separated where

practicable and the remaining structures will be crushed and placed as fill prior to final grouting.

3.5.4 Install Concrete Cap and Engineered Barrier

After all below grade grouting has been completed a final reinforced concrete cap will be poured over the foot print of the in-situ decommissioned reactor facility. An engineered barrier is anticipated to be installed over the concrete cap to reduce infiltration. The area will be graded and drainage ditching installed to manage precipitation run-off.

3.5.5 Final Site Restoration

After the final concrete has been poured, the temporary facilities including the concrete batch plant, construction trailers, temporary fencing and barriers will be removed.

Clean building slabs, foundations and non-essential roadways will be rubblized in-situ and the area restored with native vegetation. All buried utilities and systems will be capped or disconnected but remain in place, unless there is a risk of subsidence, to limit the disruption to the environment. The above grade electrical distribution systems will also be deactivated including removal of the backup power diesel generator from site.

The project will ensure appropriate post closure activities are in place for the two closed landfills as well. The lands surrounding the grouted area will be released to AECL for determination of re-use as applicable under the soil and groundwater quality guidelines.

3.5.6 Long-term Care and Maintenance

The grouted area will be fenced as part of institutional controls. Routine surveillance of the site may include inspecting the engineered barrier for subsidence, erosion, and animal or other intrusion. Additional groundwater monitoring wells will be installed, as required, to monitor the performance of the in-situ decommissioned facility.

3.6 Waste Generation and Management

The project intends to limit the amount of waste requiring off-site shipment by entombing wastes within the below grade structure. This includes all waste with radiological inventory such as the reactor systems, structures and components which will be grouted in place. All construction debris from the above grade structures demolition will also be re-used as fill in below grade voids. The plan for managing waste also includes encapsulation of the designated substances materials such as PCB containing light ballast, minimal amounts of asbestos, mercury containing equipment and lead paint and shielding.

To the extent practicable, demolition material will be recycled. If any waste cannot be disposed onsite (i.e., concrete encapsulation is deemed an unacceptable method) it will be transported offsite for storage at another CNL site, if containing radiological inventory, or to a certified disposal or treatment location if conventional or containing a designated substance. Any

wastes being transported off the NPD site will be managed according to CNL's Transport of Dangerous Goods Program as well as the respective CNL waste processing or treatment location requirements. Waste management plans will be developed to provide estimates of the waste volumes, characteristics and further assess suitability for on-site disposition.

At the end of the in-situ decommissioning activities, nuclear waste will remain safely entombed at the NPD site thus the project must assess the potential long term safety and risks to the environment and public. Long term management of the entombed material will be in accordance with applicable regulations including CNSC regulatory guidance [5].

3.7 Project Phases and Schedule

The lifecycle of a nuclear reactor includes design, construction, commissioning, operation and decommissioning. In accordance with CSA N294 *Decommissioning of facilities containing nuclear substances* [6], decommissioning of a nuclear reactor is typically performed in four phases: planning, preparation, execution and closeout. The NPDWF is currently in a safe shutdown state and in preparation for final decommissioning. During the preparation phase CNL is completing detailed work planning and licensing, mobilization and major procurements, characterization and hazard abatement, as well as preparation of the facility for execution of the decommissioning work. Any preparation activities will be performed under Environmental Effects Reviews executed by the proponent (Section 67 of CEAA 2012 [1]).

Activities associated with execution of the decommissioning phase, as well as their durations, are outlined in Table 3-1. CNL defines the Designated Project scope as activities directly associated with the execution phase of the decommissioning project.

Table 3-1
Project Phases and Schedule

Decommissioning Phase	Associated Activities	Duration
Execution	Assembly and operation of grout batch mixing plant.	2018
	Grouting of below grade structures.	2018 - 2019
	Removal of above grade structures and used as backfill.	2019
	Install concrete cap and engineered barrier	2019 - 2020
Closeout	Final site restoration.	2019 - 2020
	Long-term care and maintenance activities.	2020 - TBD

4. PROJECT LOCATION INFORMATION

4.1 Geographic Coordinates

The NPDWF site has an area of approximately 385 hectares. The centre of the site is located at approximately latitude 46° 11' 12'' N and longitude 77° 39' 28'' W.

4.2 Site Map

The location of NPDWF is discussed in Section 0. Figure 4-1 is a map showing the location of the NPD site in Ontario.

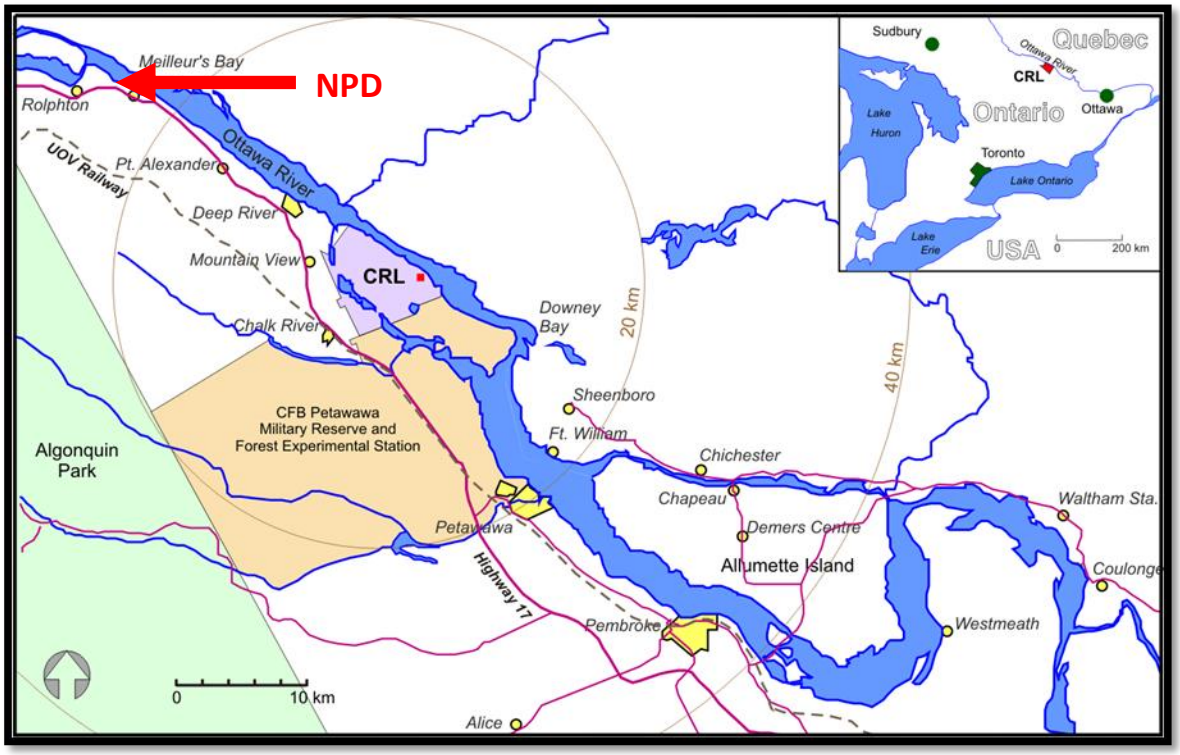

Figure 4-1 Location of the Nuclear Power Demonstration (NDP) site in Ontario.

4.3 Legal Description

The NPDWF is located on part of lots 41, 42, 43, 44 Range A and part of lots 41, 42, 43, 44, 45 Range B, Town Plot reserve road allowance between Ranges A and B, part of the bed of Ottawa River Road Allowance between Town Plot Reserve and Lot 45, Range B in the Municipality of the Townships of Rolph, Buchanan, Wylie and McKay, County of Renfrew.

4.4 Project Proximity to Residences

The nearest population centres are Rapides des Joachims (population roughly 170, 3 km northwest) and Deep River (population roughly 4,200, 17 km southeast). To the west of NPD is the United Townships of Head, Clara, and Maria (population roughly 230, over an area of 730 km^2). Individual residents of Laurentian Hills live within 1 km of the facility boundary. The closest resident property is at Point Stewart on the Ottawa River 1 km downstream of NPD.

4.5 Project Proximity to Reserves, Traditional Territories and Land/Resources used by Aboriginal Peoples

The closest reserve is the First Nation community of the Algonquins of Pikwàkanagàn, located in Golden Lake, approximately 80 km south east of the NPD site. The Algonquins of Pikwàkanagàn First Nations have declared an interest in the lands in the Ottawa Valley, which they consider their traditional homelands.

The Algonquins of Pikwàkanagàn First Nation Chief and Council are negotiating with the Federal and Ontario government to secure a land claim agreement. The area that is the subject of the Algonquin claim in Ontario includes the National Capital Region, all of Renfrew County and most of Algonquin Park.

CNL is currently reviewing the Aboriginal groups to be engaged. This includes an assessment of the significance of potential adverse impacts and consideration such as asserted rights, historical or traditional practices and land claims. CNL's review activities will be aligned with the CNSC's REGDOC-3.2.2 *Aboriginal Engagement* [7], and include reporting on the following:

- Aboriginal groups identified for engagement.
- A summary of Aboriginal engagement activities conducted.
- A description of planned Aboriginal engagement activities.
- The proposed schedule for interim reporting to the CNSC.

4.6 Proximity to Federal Lands

The Chalk River Laboratories (CRL), another CNL property, and the Canadian Forces Military Base, Garrison Petawawa property, is located approximately 25 and 32 kilometres, respectively, from the NPD site.

5. FEDERAL INVOLVEMENT

5.1 Federal Financial Support

Funding for the project is also provided by Natural Resources Canada (NRCan) and managed by AECL. A Target Cost Agreement between AECL and CNL is in place for funding the NPD Closure Project.

5.2 Associated Federal Lands

The NPD Closure Project is being undertaken on Federal lands.

5.3 Permits, Licenses or Other Authorizations

Canadian Nuclear Safety Commission regulatory approval is required for the project to proceed with decommissioning the NPDWF through an amendment of the current license - (WFDL-W4-332.01/2034, Waste Facility Decommissioning Licence, Prototype Waste Facilities) [8].

A permit from Environment Canada will be required under the Species at Risk Act (SARA) [9] in order to remove the Ventilation Stack which currently serves as a Chimney Swift roosting habitat.

A petroleum storage tank permit may also be required from Environment Canada, depending on the size of diesel tanks installed on the site to support decommissioning activities (if required).

6. ENVIRONMENTAL EFFECTS

6.1 Physical and Biological Setting

6.1.1 Geology

The general geology of the region is the Precambrian shield with old folding and faulting of the metamorphic rocks (gneiss). The small amount of overburden and relatively steep incline of the base rocks makes ground and subsurface water run off very quickly to the river. Bedrock, which consists of granitic Precambrian biotite and hornblende gneisses, is the dominant control on topography in the region, and appreciable portions of the region around NPD have been mapped as bedrock outcrop (i.e. less than about 1.5 m of unconsolidated sediments). Figure 6-1 shows the surficial geology of the area. The developed portion of the NPD site is located where fluvial sand and gravel are the surficial material. The two landfill sites on the NPD property are located in the two former gravel pits.

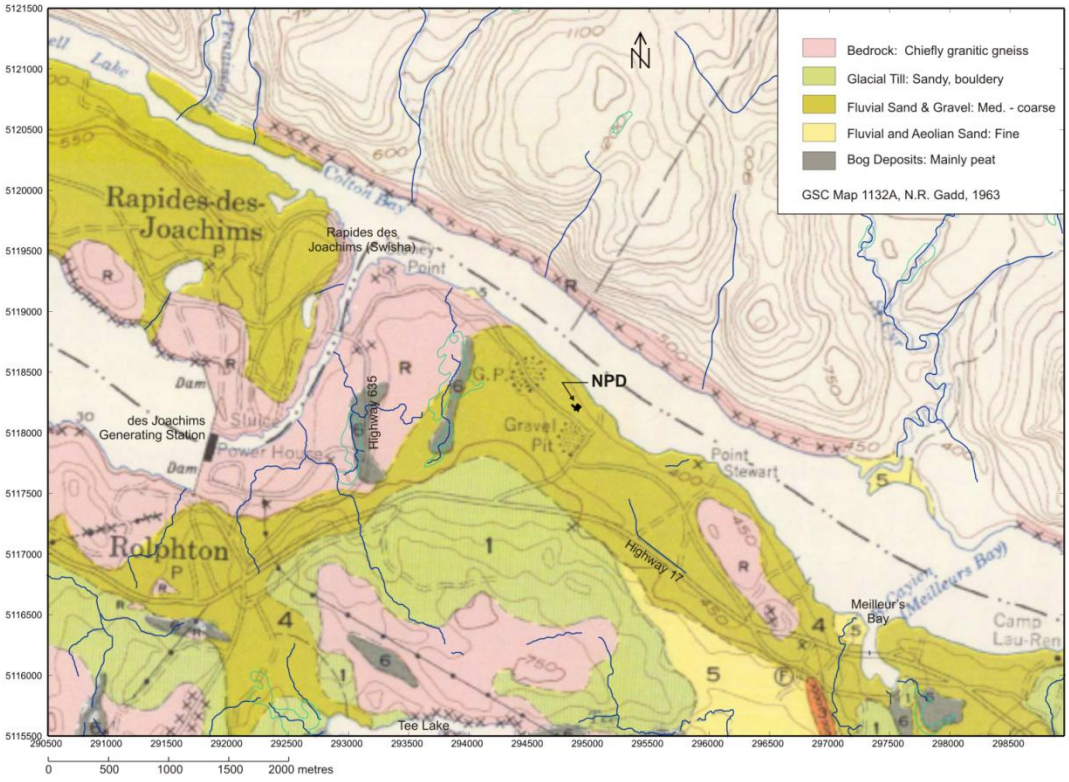

Figure 6-1 Surficial geology of the region around the NPD site.

During the construction of the NPDNGS, numerous man-made terraces and steep interconnecting benches were created for construction and security purposes. This activity has resulted in a highly modified landscape at the NPD site. The surface of the NPD site is covered

by a boulder pavement which, in most areas has been left as a result of water scouring the area and removing the finer fraction of the river-rain sediments.

6.1.2 Hydrology

The Ottawa River is the dominant drainage feature in the area. All surface drainage on the NPD site ultimately drains to the Ottawa River. As shown in Figure 6-2 most of the NPDWF containment area is located below grade, well into the bedrock. Surface ditches and underground collection pipes intercept the flow of precipitation from areas adjacent to the facility and direct it to the Ottawa River (see Tile Drain 1 and 2 in Figure 6-2). The facility's design also means that for portions of the facility below the water table any leakage is into the facility, and that there can be no releases to the local groundwater flow system. Groundwater seepage in to the facility directed to a sump at the lowest point and is less than 10 m^3 per year. This sump is periodically pumped to the Ottawa River after the water has been sampled and analysed.

Operational compliance monitoring for NPDWF over the past 10 years show discharges are far below regulatory limits indicating that the radioactivity is staying in place and decaying away. Tritium is the most mobile radionuclide at NPDWF and effluent monitoring indicates levels <0.001% of derived release limit.

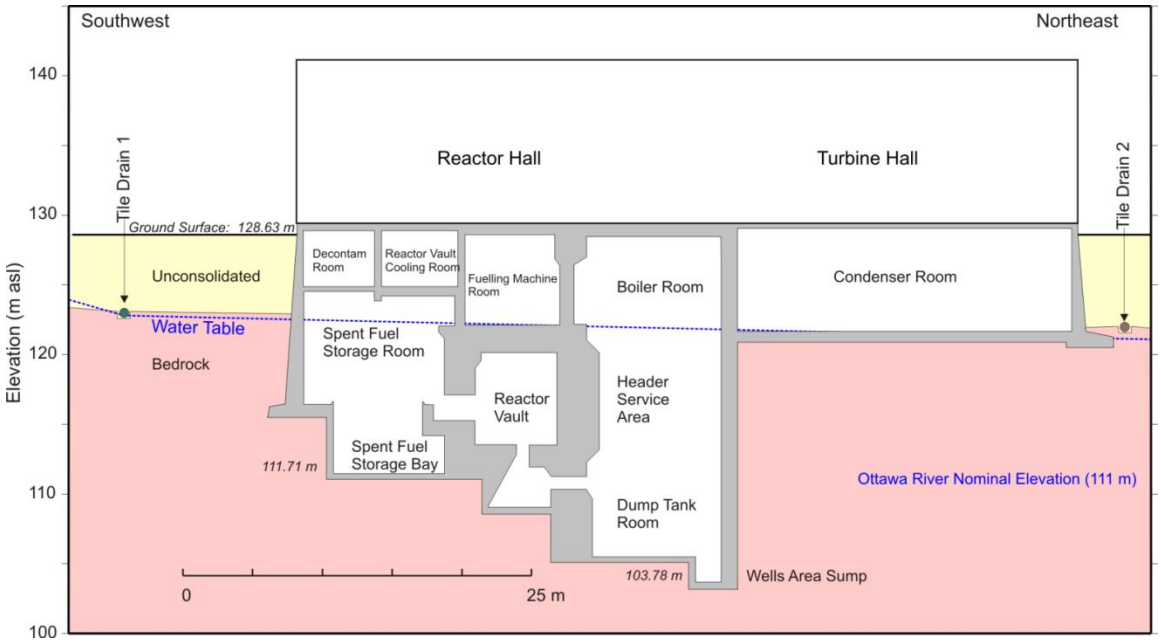

Figure 6-2 Southwest – Northeast cross section through the NPDWF.

6.1.3 Terrestrial Biota

The NPD site supports diverse mix upland areas with some wetland areas scattered throughout. The NPD property is mainly wooded with the exception of open wetland areas. Wooded uplands generally range from 40-80 years old. Wetland areas on the NPD site are mainly found on the western half of the property. Human activity is expected to stay within the project area and travel from the front gate to the built up area and back thus the impact on wildlife as a result of this project is expected to be limited.

6.1.4 Aquatic Biota

The NPDWMF site is located in the reach of the Ottawa River extending approximately 90 km between La Passe and the Des Joachims Dam. Specifically, the property is in close proximity to the Des Joachims Dam. This reach of the river consists of several lakes separated by short rapids and supports diverse warm-water and cool-water fish communities consisting of at least 55 documented species. The provincially-rare fish species in the Ottawa River includes the American Eel, Lake Sturgeon, Northern Brook lamprey and River Redhorse.

Typical catches from the river include Walleye, Northern Pike, Channel Catfish, Smallmouth Bass, and Lake Sturgeon.

6.2 Changes to the Environment by the Project

6.2.1 Fish and Fish Habitat

No significant impact on fish or fish habitat (as defined in subsection 2(1) of the Fisheries Act [10]) or on aquatic species (as defined in subsection 2(1) of the SARA [9]) are expected from in-situ decommissioning. The current plan is to cap the upstream ends and leave the effluent outflow pipes in-situ; however if that assumption were invalidated a Department of Fisheries permit would be required.

There is the potential for radionuclide releases to groundwater from the in-situ decommissioned reactor and radionuclide migration to the Ottawa River. The environmental assessment will assess the potential impacts on fish, fish habitat and aquatic species from such releases and ensure these are within acceptable limits.

6.2.2 Species at Risk

Nine species at risk have been confirmed on the overall NPD site. Targeted surveys were conducted only for those species. In addition, as described in Section 2.1.1, only a small portion of the site has been developed and scheduled for physical works. A small sub-set of species were chosen for specific surveys corresponding to the area where activities are scheduled to take place and potential species habitat present. This method eliminated the need to survey for the entire suite of species at risk potentially present at NPD.

The nine species at risk that have been reported at the NPD site include: Bald Eagle, Chimney Swift, Common Nighthawk, Eastern Wood Pewee, Eastern Milksnake, Eastern Small-footed Myotis, Little Brown Myotis, Northern Myotis and the Monarch Butterfly.

The main species of concern are the Chimney Swifts as they shelter in the stack at night and during inclement weather conditions. Roost counts were initiated in 2010 and are performed annually. Chimney Swifts sheltering in the stack during spring migration can reach just over 2,500 individuals. CNL is in the process of designing and constructing alternative habitat.

An active Bald Eagle's nest was identified 800 metres away from the zone identified for biodiversity survey. Since the project is to be carried out in the zone defined, no impact on the Bald Eagle's nest is expected.

No nationally or provincially endangered or threatened species of vascular plants have been identified or recorded on the NPD site.

6.2.3 Migratory Birds

There is not expected to be any tree clearing at the NPD site, however in the event there is, any impact on migratory birds (as defined in subsection 2(1) of the Migratory Birds Convention Act, 1994 [11]) will be minimized by prohibiting tree clearing during the Migratory Birds breeding season.

6.3 Changes to the Environment on Federal Land, in a Province Other than Ontario, or Outside Canada

The potential effects of the project will be limited to the NPD site. Although no impacts outside of the province of Ontario are expected, CNL acknowledges the site proximity to Quebec which is directly across the Ottawa River. The potential for downstream impacts will be thoroughly assessed during the project as well as Quebec stakeholder groups will be included in the consultation process.

6.4 Effects on Aboriginal Peoples

The Algonquins of Ontario have declared an interest in the lands in the Ottawa Valley, which they consider their traditional homelands. The NPD Closure Project will be engaging in a due diligence exercise to determine any existence of land claims.

As the NPD site is not currently used for traditional purposes (hunting, fishing, trapping etc) the project is not expected to affect the health of aboriginal peoples. Consultation of aboriginal peoples during the project was discussed in Section 2.3.

CNL carried out an archaeological assessment in preparation for the NPD Closure Project. A preliminary survey of the site determined that although there is potential for archaeological material to be present within the decommissioning footprint, the disturbance from past development and use has removed the cultural integrity of any resources.

The impact of decommissioning activities on any potential cultural resource is expected to be negligible; therefore the project was given heritage clearance from CNL's Cultural Resource Management Program.

7. SUMMARY OF THE PROJECT DESCRIPTION

Canadian Nuclear Laboratories (CNL) is undertaking in-situ decommissioning of the Nuclear Power Demonstration Waste Facility (NPDWF). The facility is located in Renfrew County of Ontario which is a low population density area. The NPDWF resides on federal land with a disturbed area that is less than 1% of the total land area. The facility consists of a permanently shut down, partially decommissioned demonstration CANDU reactor and associated structures and ancillaries. The facility is presently in the storage with surveillance phase of a deferred decommissioning program. Significant radioactive decay has occurred since the shutdown of the reactor.

As disposal options for nuclear waste within Canada do not currently exist, in-situ decommissioning can quickly and safely reduce the remainder of Canada's nuclear legacy liabilities at this property. In-situ decommissioning results in a concrete monolith which provides a robust and durable containment to allow for continued radioactive decay. The closure of the NPD site will entomb the remaining radiological inventory and designated substances, leave no structures aboveground, meet public dose restrictions, and support ongoing use of the site as a wildlife habitat.

The preferred option of in-situ decommissioning will result an end state that includes the safe disposal of nuclear waste at the site. Thus the proposed project qualifies as a Designated Project as per Section 37(b) of the regulations for Designating Physical Activities under CEAA 2012. The CNSC is the responsible authority for projects of this type. Public consultation activities are being planned to inform, educate and discuss project specific information to public stakeholders. Baseline environmental data is available from past environmental compliance monitoring.

The permanent structures still on the NPD site include the Main Building, Ventilation Stack, Guardhouse, Diesel Generator and Pressure Relief duct. Foundations from previously removed buildings are still onsite as well as buried septic tanks, utilities and two closed landfills. The main structures of the NPDNGS were the reactor, heat transport system, turbine, and electrical power generator equipment. The nuclear fuel has already been removed from the site as well as the heat transport and moderator systems heavy water has been drained. The majority of the radiological inventory within NPDWF is associated with reactor core components, the biological shield, the heat transport system, and the moderator system. Designated substances still exist in the facility as result of historic operational uses as well.

Since there is limited infrastructure currently onsite, some temporary infrastructure will be required in order to facilitate in-situ decommissioning including a grout batch mixing plant. The below grade reactor systems, components and structure will be sealed by capping the service drains and by grouting all systems, components to the extent practicable and the below grade structure. All above grade structures will be removed and grouted below grade. The structure will then be capped with concrete and covered with an engineered barrier. These activities will prevent water ingress and isolate the radiological inventory inside the decommissioned reactor

structure to allow for continued radioactive decay. The project is scheduled to commence in 2018 and have a duration of approximately two years.

As an environmental liability on federal land the project is funded by NRCan. The NPDWF is a licensed Class I Nuclear Facility under the Nuclear Safety and Control act thus has a license issued by the CNSC. The proposed decommissioning activities must also have regulatory approval to proceed. Additionally, a permit from Environment Canada will be required to remove the Ventilation Stack which is current a roosting habitat for Chimney Swifts. CNL's strategy is to construct an alternate roosting habitat in 2016.

At the end of the in-situ decommissioning activities, nuclear waste will remain safely entombed at the NPD site thus the project must assess the potential long term impact the end state may have on the health and safety of people and the environment. There is the potential for radionuclide releases to groundwater from the in-situ decommissioned reactor and radionuclide migration to the Ottawa River. The environmental assessment will assess the potential impacts from such releases and ensure these are within acceptable limits.

No significant impact on fish or fish habitat (as defined in subsection 2(1) of the Fisheries Act) [10] or on aquatic species (as defined in subsection 2(1) of the SARA) [9] are expected from in-situ decommissioning. Tree clearing is not planned during the project thus no significant impact on migratory birds is expected (as defined in subsection 2(1) of the Migratory Birds Convention Act, 1994) [11]. The environmental effects of the project are expected to be limited to the NPD site. No changes to the environment on other federal lands, in a province other than Ontario, or outside Canada are expected. The impact of decommissioning activities on any potential cultural resource is expected to be negligible. The NPD Closure Project will be engaging in a due diligence exercise to determine the existence of any land claims directly affecting the NPD site.

8. REFERENCES

[1] *Canadian Environmental Assessment Act, 2012.* S.C. 2012, C. 19, s. 52. Published by the Minister of Justice, http:/laws-lois.justice.gc.ca

[2] *Prescribed Information for the Description of a Designated Project Regulations*. SOR/2012-148. Published by the Minister of Justice, http:/laws-lois.justice.gc.ca.

[3] *Decommissioning Strategies for Facilities Using Radioactive Material*. March 2007, International Atomic Energy Agency, Safety Report Series # 50.

[4] *Regulations Designating Physical Activities.* SOR/2012-148. Published by the Minister of Justice, http:/laws-lois.justice.gc.ca

[5] *Assessing the Long Term Safety of Radioactive Waste Management*. Regulatory Guidance G-320. Canadian Nuclear Safety Commission.

[6] *Decommissioning of Facilities Containing Nuclear Substances*, CSA N294.

[7] *Aboriginal Engagement.* REGDOC-3.2.2. Canadian Nuclear Safety Commission.

[8] *Waste Facility Decommissioning Licence, Prototype Waste Facilities*, WFDL-W4-332.01/2034.

[9] *Species at Risk Act* S.C. 2002, c.29. Published by the Minister of Justice, http:/laws-lois.justice.gc.ca.

[10] *Fisheries Act,* R.S.C., 1985, c. F-14. Published by the Minister of Justice, http:/laws-lois.justice.gc.ca

[11] *Migratory Birds Convention*, *1994.* S.C. 1994, c.22. Published by the Minister of Justice, http:/laws-lois.justice.gc.ca.