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Title:

**Preliminary Decommissioning Plan - Pickering Waste Management Facility**

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**Preliminary Decommissioning Plan -  
Pickering Waste Management Facility****92896-PLAN-00960-00001-R004**  
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### Revision Summary

Revision Number	Date	Comments
R004	December 2021	<ul style="list-style-type: none"><li>Entire document: Revised to reflect OPG's current planning assumptions, current PWMF Phase II expansion plans (new DSC processing building plan cancelled), PWMF Safety Report Revision 6, changed L&amp;ILW DGR to LLW &amp; ILW long-term disposal facilities and alignment with latest revision of CSA N294:19</li><li>List of abbreviation updated</li><li>Abstract: minor wording change, added reference to SOR 2000-204 and updated licence condition number</li><li>Section 2.1: updated Figure 2-1</li><li>Section 2.2.4: updated to include Phase II currently encompasses DSC Storage Building 4 as well, in service date for DSC storage Building 5 and 6, revised wording in paragraph 3 to include site services are provided by PNGS, revised wording associated with security gate location, Figure 2-11 and Figure 2-12</li><li>Section 2.2.4.1: entire section removed to reflect current Phase II expansion plan</li><li>Section 2.2.4.1 (previously section 2.2.4.2): updated to include in service date for DSC Storage Building 4, capacity of DSC Storage Building 4 and included text associated with an additional fire rated man door entrance and fire rated overhead door for DSC Storage Building 4. Updated Figure 2-14 (previously Figure 2-16)</li><li>Added section 2.2.5 Interfacing Systems and Services</li><li>Section 2.3.2: updated to include geophysical information for DSC Storage Building 4 from reference 92896-REP-20000-00013 and 92896-REP15200-00001</li><li>Section 2.3.2.3: included statement "groundwater movement along with the monitoring around PNGS have been summarized in [R-9]"</li><li>Section 2.3.2.4: updated for consistency with current seismic information and PNGS safety analysis report.</li><li>Section 2.3.4: updated for alignment with current revision of PWMF Safety Report</li><li>Section 2.3.5: updated Table 2-1</li><li>Section 2.3.6: changed title of the section to Indigenous Communities and aligned text with current revision of PWMF Safety Report</li><li>Section 2.3.7: updated to include current information on public communication and engagement program</li><li>Section 2.3.7.1: new section added to include indigenous community relations program</li><li>Section 2.4: updated to include current status of DSCs, Phase II expansion plans and in-service dates for DSC Building 4, 5 and 6</li><li>Section 3.1: updated to include CEAA is replaced by Impact Assessment Act and included REGDOC 3.2.1 and REGDOC 3.2.2</li><li>Section 3.2: updated to reflect current planning assumptions and included text associated with aging managed program activities to address mitigation strategies</li></ul>

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Revision Number	Date	Comments
		<ul style="list-style-type: none"> <li>• Section 3.3: revised to include current Phase II expansion plans and Phase II current status as of March 2021</li> <li>• Section 3.6: updated to remove “the new DSC Processing Building”</li> <li>• Section 3.6.1: updated to reflect only one processing building</li> <li>• Section 3.6.4: updated to reflect current Phase II plans</li> <li>• Section 3.7: updated to include decommissioning experience from Bruce Heavy Water Plant and Spent Solvent Treatment Facility</li> <li>• Section 4.0: updated to include revised dates from TLG costing report</li> <li>• Section 4.1: added statement that OPG is responsible for planning, including development of all required documents throughout the life cycle of decommissioning, executing and funding all phases of decommissioning.</li> <li>• Section 4.1.2.4: updated to remove text related to Phase II DSC Processing Building</li> <li>• Section 4.1.3.3: added DOC will perform decontamination and dismantling as well as bring power supply. Changed clean fill to back fill in underline section Dry Storage Container Processing Building</li> <li>• Section 4.1.3.5: updated to reflect planning assumptions, added statement, all radioactive waste generated during decommissioning will be characterized as per CSA N292 3-14 for compliance with CSA N294:19 requirement, updated financial guarantee period, updated Table 4-2</li> <li>• Section 4.1.3.6: updated Survey Appendix reference to match with current Appendix related to surveys in CSA N294:19</li> <li>• Section 5.1: updated to reflect current cost estimates</li> <li>• Section 5.2: updated to reflect current financial guarantee period</li> <li>• Section 6: changed CNSC’s policy document P 219 reference to REGDOC-2.2.1. Updated text to reflect current planning assumptions and removed Table 6-1</li> <li>• Section 7.0: revised text in last paragraph to include CEAA 2012 has been superseded by the Impact Assessment Act</li> <li>• Section 7.1: updated for alignment with PNGS PDP</li> <li>• Section 7.2.1: updated to keep this section generic and removed specific clauses from previous revision of CSA N294:19</li> <li>• Section 7.2.4: updated to reflect current decommissioning dates</li> <li>• Section 12: updated to include indigenous engagement program and REDDOC-3.2.1 and REGDOC-3.2.2</li> <li>• Section 13: updated and added reference as required</li> <li>• Appendix A: removed new DSC Processing Building and added Building 5 and 6</li> <li>• Appendix B: removed text related to Phase II new DSC Processing Building</li> <li>• Appendix C: updated to reflect current cost estimate</li> <li>• Appendix D: updated to align with CSA N294:19</li> </ul>

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### Acronyms

<b>Abbreviation</b>	<b>Definition</b>
ALARA	As Low As Reasonably Achievable
APM	Adaptive Phased Management
BHWP	Bruce Heavy Water Plant
CCNS	Centre for Canadian Nuclear Sustainability
CEAA	Canadian Environmental Assessment Act
CNSC	Canadian Nuclear Safety Commission
CSA	Canadian Standards Association
DDP	Detailed Decommissioning Plan
DGR	Deep Geologic Repository
DOC	Decommissioning Operations Contractor
DQO	Data Quality Objectives
DSC	Dry Storage Container
DSM	Dry Storage Module
ECO	End-of-commercial operation
HEPA	High Efficiency Particulate Air
IAA	Impact Assessment Act
IAC	Indigenous Advisory Council
IAEA	International Atomic Energy Agency
IGLD	International Great Lakes Datum
ILW	Intermediate-Level Waste
L&ILW	Low- and Intermediate-Level Waste
LLW	Low-Level Waste
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
OHSA	Occupational Health and Safety Act
ONFA	Ontario Nuclear Funds Agreement
OPG	Ontario Power Generation
PDP	Preliminary Decommissioning Plan
PNGS	Pickering Nuclear Generating Station
PWMF	Pickering Waste Management Facility
RCSF	Retube Components Storage Facility
SEIA	Socio-Economic Impact Assessment
SQEP	Suitably Qualified and Experienced Persons
SSTF	Spent Solvent Treatment Facility
TLG	TLG Services, LLC
SWS	Storage with Surveillance
UFDS	Used Fuel Dry Storage
UPS	Uninterruptible Power Supply

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### **Abstract**

This Preliminary Decommissioning Plan (PDP) describes Ontario Power Generation's (OPG's) current plan for decommissioning the Pickering Waste Management Facility (PWMF). It has been prepared in accordance with the requirements of the Class I Nuclear Facilities Regulations (SOR/2000-204 – Clause 3(k) [R-1]) as well as the requirements of the PWMF licence condition handbook (LCH-W4-350.00/2028) [R-2]. It has also been written to meet the requirements of Canadian Nuclear Safety Commission (CNSC) Guide G-219 Decommissioning Planning for Licensed Activities (June 2000) [R-3] and Canadian Standards Association (CSA) N294:19 – Decommissioning of Facilities Containing Nuclear Substances [R-4]. Appendix D of this PDP refers to the specific requirements of CSA N294:19 and the respective sections of the PDP that cover these requirements. With regards to compliance with CNSC Guide G-219 [R-3], this is inferred through the demonstration of compliance with CSA N294:19 [R-4].

This PDP covers decommissioning activities performed after the used fuel and radioactive waste have been removed from the site and the decision has been made to shut down the PWMF for decommissioning until the site is available for other OPG uses.

The objective is to retire the facility in a manner that ensures the safety of workers, the general public, and the protection of the environment. This PDP includes a schedule and cost estimate based on planning dates.

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## 1.0 INTRODUCTION

OPG maintains an ongoing program to prepare for the eventual decommissioning of the PWMF, which is located at the Pickering Nuclear Generating Station (PNGS) site in Pickering, Ontario. The PWMF is comprised of buildings and other structures in two separate locations (referred to as Phase I and Phase II). The PWMF and the Pickering Nuclear site are described in Section 2.0.

The purpose of the PWMF is to:

- Provide safe interim storage of the used fuel from PNGS reactors in Dry Storage Containers (DSCs) until all the used fuel is transported to an alternative long-term used fuel storage or disposal facility; and
- Provide safe storage of the retube reactor components for PNGS A (Units 1-4) in Dry Storage Modules (DSMs) until they are transported to a disposal facility.

Although the PWMF is located on the same site as the PNGS, the life cycle plans of these two facilities are separate from each other. The last unit at PNGS is assumed to be shut down in nominally 2025. The PWMF will remain in operation after the cessation of power production at the PNGS and until the used fuel and retube waste have been removed from the site.

This document outlines the preliminary planning work that has been completed in accordance with the requirements in CNSC Regulatory Guide G-2191 [R-3] and CSA Standard N294:19 [R-4]. It is not intended to serve as a detailed plan for the eventual decommissioning of PWMF, but as a foundation/baseline document to demonstrate that the planned decommissioning is feasible with existing technology and provide a basis for estimating the cost of the decommissioning. This PDP includes or references:

- A description of the facility to be decommissioned;
- A description of the decommissioning strategy that will be employed;
- An outline of the work that will be required to complete the decommissioning;
- A discussion of the various waste types and quantities produced;
- A discussion of the decommissioning cost estimate and financial guarantee;
- An outline of the potential environmental and socio-economic impacts of the decommissioning;
- A proposed schedule for the decommissioning work; and

<sup>1</sup> REGDOC-2.11.2, Decommissioning, was published in January 2021 and supersedes G-219. OPG has communicated the timing for a gap analysis and implementation plan to REGDOC-2.11.2 in [R-5].

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- An outline of the radiological and conventional safety issues involved in the decommissioning.

This document describes the preliminary plan as it exists at the time of writing including any expansions made during the Financial Guarantee applicability timeframe (i.e., 2023 – 2027). This PDP will be revised periodically to take into account changes in planning assumptions until the Detailed Decommissioning Plan (DDP) is prepared.

Decommissioning of the PWMF may begin once the used fuel, retube waste and any hazardous materials have been removed and the facility has been removed from service. Before decommissioning begins, a DDP will be prepared.

The appropriate methods and technologies available for use at the time of decommissioning will be reviewed and, where applicable, these will be adopted and described in the DDP. Only when the licence to perform decommissioning activities has been issued can steps be taken to mobilize the finalized methods and techniques.

Appendix D refers to the specific requirements of CSA N294:19 and the respective sections of the PDP that cover these requirements. With regards to compliance with CNSC Guide G-219 [R-3], this is inferred through the demonstration of compliance with CSA N294:19 [R-4].

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## 2.0 DESCRIPTION OF THE PICKERING WASTE MANAGEMENT FACILITY AND SURROUNDING AREA

### 2.1 Pickering Nuclear Site

The Pickering Nuclear site is located within the City of Pickering in the Regional Municipality of Durham. It is situated on the north shore of Lake Ontario, 32 km east-north-east of downtown Toronto and 21 km southwest of the City of Oshawa at a latitude of 43°49' N and longitude of 79°04' W. A map showing the location of the Pickering Nuclear site within the local area is provided in Figure 2-1.

The Pickering Nuclear site is well serviced by road. Two major roadways, Highway 401 and Highway 2, as well as the main Canadian National railway line run in an east-west direction, at a closest distance of 2.8 km to the site. Access from the site to the highways is provided by Brock Road, a four-lane north-south artery. A spur line from the main railway to the site was built in the initial stages of site development. A dock was constructed on the west side of PNGS to facilitate unloading of the major reactor components. The two major watercourses closest to the site are Duffins Creek, 2.2 km to the east, and the Rouge River, 4 km to the west. A rail corridor is reserved to the Pickering Auxiliary Irradiated Fuel Bay at the west end of PNGS.

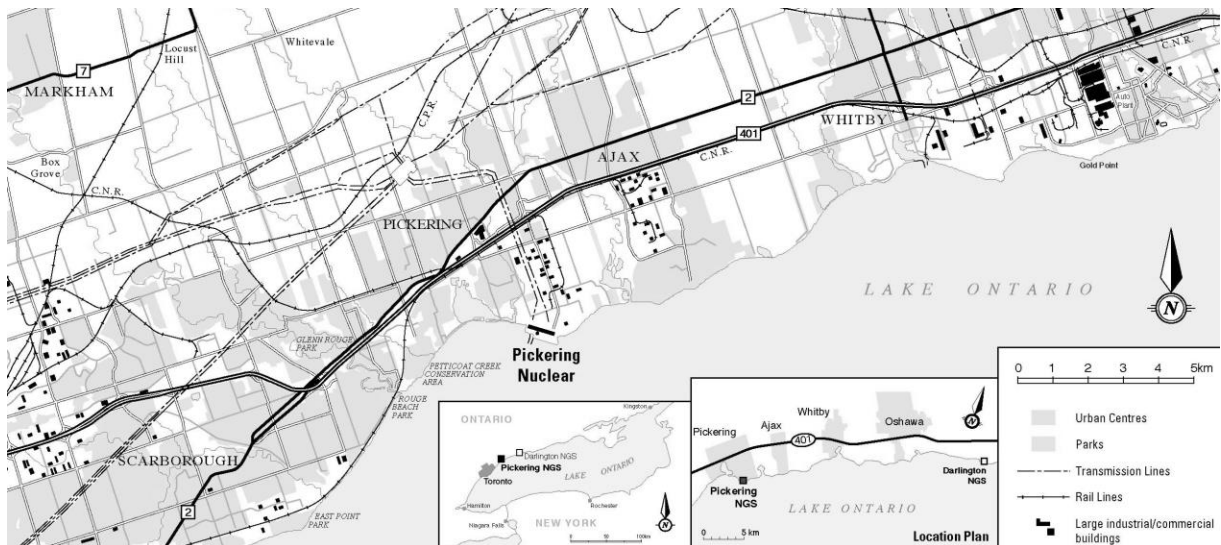


Figure 2-1: Location of the Pickering Nuclear Site

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## 2.2 Pickering Waste Management Facility

The PWMF is located within the Pickering Nuclear site property, just east of the PNGS. It is a Class 1B nuclear facility, owned and operated by OPG, and licensed independently of the PNGS.

The overall objective of the PWMF is to provide interim storage for used fuel and retube wastes from the PNGS in a safe, secure but ultimately retrievable form. Within the PWMF, used fuel is stored in DSCs and retube wastes in DSMs. These are described in Section 2.2.1 and Section 2.2.2 respectively.

The PWMF is composed of buildings and other structures in two separate locations:

- PWMF Phase I, which is located within the PNGS protected area, southeast of Unit 8 and adjacent to the east side of the PNGS security fence, see Figure 2-2. PWMF Phase I is described in Section 2.2.3.
- PWMF Phase II, which is located approximately 500 m northeast of the PWMF Phase I site in the East Complex and has its own protected area. PWMF Phase II is described in Section 2.2.4.

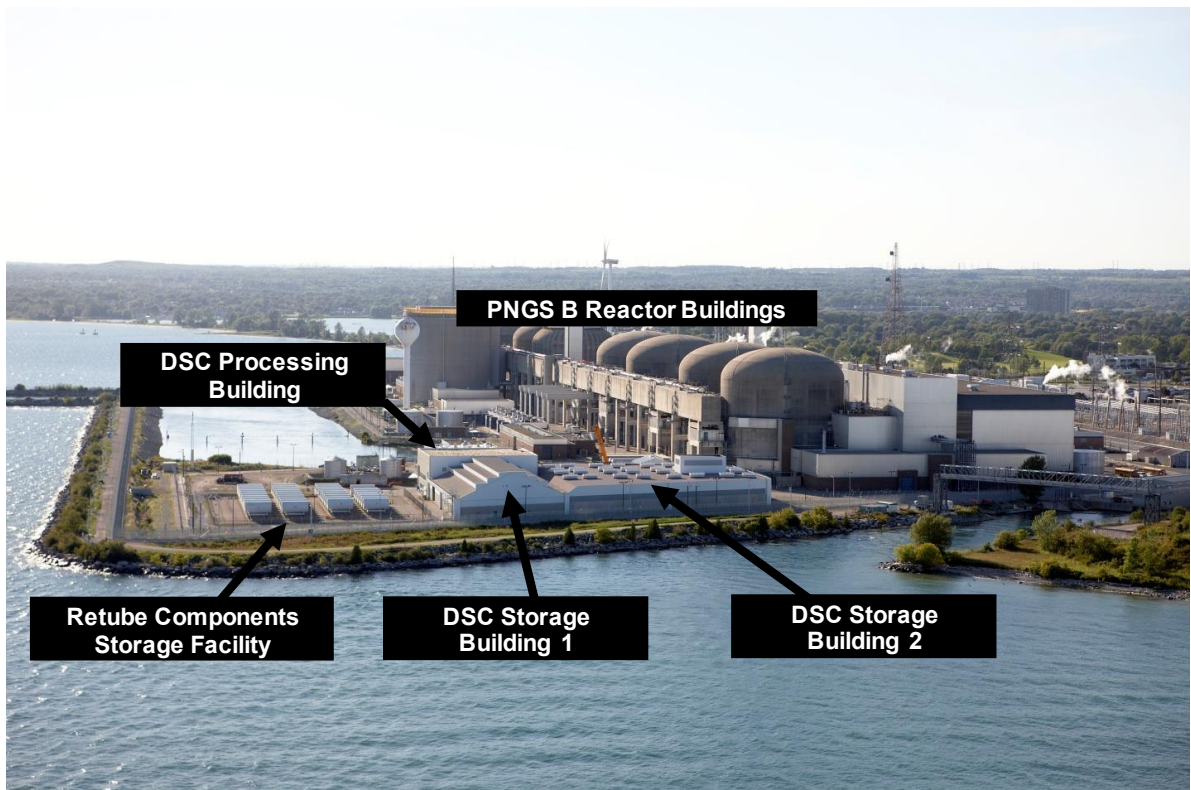


Figure 2-2: Aerial View of Pickering Waste Management Facility Phase I

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### 2.2.1 Dry Storage Containers

The DSC is a rectangular-section container made of a double carbon-steel shell filled with reinforced high-density concrete, see Figure 2-3. The DSC has been designed for above-ground storage and transportability. The design life of the DSCs is at least 50 years. Each DSC has a storage capacity of 384 used fuel bundles. The used fuel in the seal-welded DSCs is stored in an inert helium atmosphere. DSCs inside one of the DSC Storage Buildings are shown in Figure 2-4.

DSCs will be removed from the PWMF prior to decommissioning and are therefore not described further in this PDP.

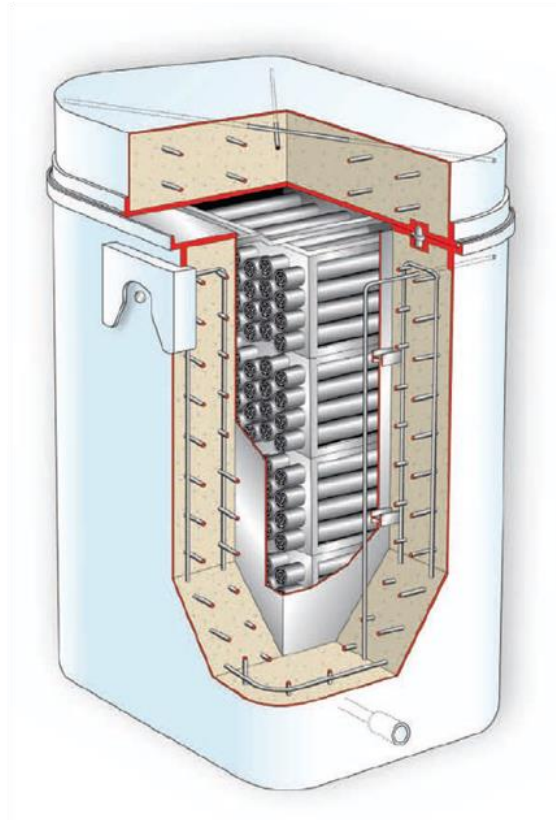


Figure 2-3: Dry Storage Container for Used Fuel

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**Figure 2-4: DSC Storage Building (Phase I) – Interior**

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### 2.2.2 Dry Storage Modules

The DSMs (see Figure 2-5) are reinforced heavy concrete cylinders 3.3 m (10 ft 8 in) in diameter and have an overall length of 7.6 m (24 ft 10 in). The concrete shell is protected by an outer steel shell. The DSMs were designed for horizontal loading. Each module is provided with a fill port and a loading mechanism running the full length of the module. Each DSM can hold about 90 pressure tubes or various combinations of pressure tubes, end fittings and miscellaneous reactor core components. DSMs are stored outside and are, as such, exposed to the PNGS site environmental conditions.

In order to prevent deterioration and minimize maintenance, the outer steel shell is coated with two coats of grey epoxy enamel paint. After the loading operation was completed, the fill port was sealed with a bolted gasketed shield door.

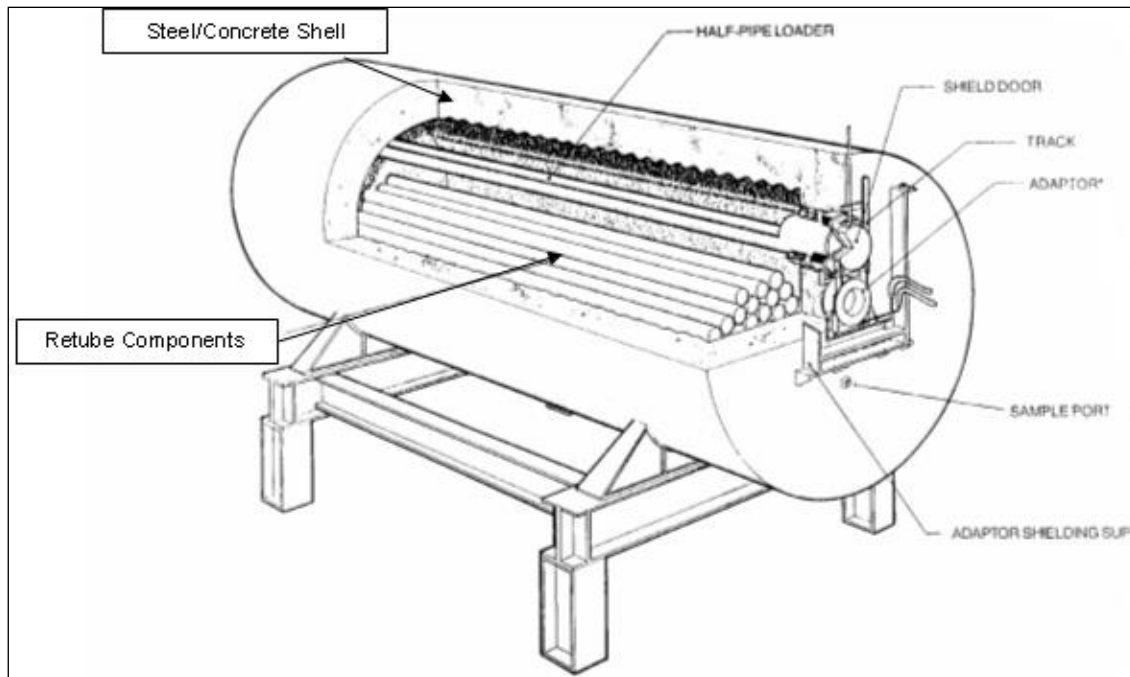


Figure 2-5: Dry Storage Module for Retube Waste

Each DSM is checked for any loose surface contamination twice per year. Potential sources of loose contamination include carbon-14, loose crud (primarily Co-60) and activated swarf. No tritium emission is expected due to the vacuum drying of components. The pressure tubes, shield plugs and end fittings were packaged in cans, and some end fittings in bags, before being stored in the DSMs. These cans/bags will keep the loose contamination from mixing in the free atmosphere of the DSM. If loose contamination is detected on a DSM, a loose contamination survey is also conducted on the surface of the concrete pad beneath the contaminated DSM. If loose contamination is detected on either a DSM or a concrete pad beneath the contaminated DSM or both, they will be decontaminated on a high-priority basis, the contamination will be recorded and the event will be reported. However, in routine checks, no surface contamination for the DSMs has been detected to date. In addition, no liquid discharges and no significant

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atmospheric discharges have been detected. Although this strongly suggests that no loose contamination will be present at the time of decommissioning, the PWMF Safety Report [R-6] suggests that a very small fraction of loose material could become available for release from a DSM. This would require some decontamination effort as appropriate. It is recognized that radionuclide inventories inside the DSMs have been steadily decreasing due to radioactive decay.

### 2.2.3 Pickering Waste Management Facility Phase I

The PWMF Phase I consists of a Used Fuel Dry Storage (UFDS) for interim storage of Pickering used fuel in DSCs, as well as the Retube Components Storage Facility<sup>2</sup> (RCSF), which is used for interim storage of PNGS A irradiated reactor components in DSMs.

The UFDS covers an area about 0.8 ha and comprises a DSC Processing Building and Storage Buildings 1 and 2, as described below. The floor plans of the UFDS are shown in Figure 2-6 and Figure 2-7. The site surfaces outside the western, southern and northern perimeter of the UFDS are paved. The surface outside the eastern perimeter contains gravel.

The RCSF is about 0.43 ha and contains concrete slabs for supporting the DSMs. The surfaces between and surrounding the concrete slabs are paved. A drainage system is provided to collect the runoff water from the storage area, with catch basins permitting periodic sampling of the water.

Site services provided to PWMF Phase I by the PNGS include: domestic and fire water supply, Class II electrical power supply, Class IV electrical power supply, Class I electrical power supply, low pressure instrument air, security, emergency response including public address system, sewage collection and removal, active liquid waste drainage and storm water management.

The major systems and components of PWMF Phase I are listed in Appendix A.

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<sup>2</sup> Retube Components Storage Facility is also referred to as Retube Components Storage Area.

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### 2.2.3.1 Dry Storage Container Processing Building

The DSC Processing Building (at Phase I) has been used for the processing of DSCs (i.e., preparation, welding, inspection, testing, etc.) since 1996.

The DSC Processing Building, also referred to as a workshop, is an industrial type building made of concrete block walls. It is equipped to receive, inspect and prepare new DSCs and to seal weld, leak test and inspect DSCs loaded with used fuel from the PNGS before the DSCs are transferred to one of the DSC Storage Buildings.

Loaded DSCs are transported to the DSC Processing Building by a custom-built transport vehicle. The layout, exterior and interior of the DSC Processing Building are shown in Figure 2-7, Figure 2-8 and Figure 2-9.

The DSC Processing Building is a single-storey structure with two mezzanine floors. The ground floor of the building has a floor area of 830 m<sup>2</sup> and accommodates mechanical and electrical rooms, tool rooms, storage room, washrooms, coffee room, and office space for the International Atomic Energy Agency (IAEA) staff involved in safeguards. The floor surfaces are treated with surface hardening agents and sealants, as required, to improve floor durability under heavy wheel loading and to prevent ingress of radioactive contamination while minimizing slipping hazard at variable humidity levels.

The DSC Processing Building is equipped with a standard range of services including: active ventilation system, active liquid drainage, instrument air supplies, fire detection and protection system, an 85-tonne overhead crane that is fitted with a 10-tonne auxiliary crane, and DSC handling equipment (such as DSC transporters, lifting systems and transfer clamps). A number of items of plant and equipment, such as welding machines and phased array ultrasonic testing equipment, are present within the building but will be removed as part of the post-operation clean out prior to decommissioning. No hazardous materials were used in the construction of the workshop.

Two mezzanine floors are located at the north and south ends of the building. The mezzanine floor at the north end houses the welding control centre and ventilation system components. The mezzanine floor to the south houses offices and washrooms. The mezzanine floors permit a view of the DSC processing area on the ground floor.

Used fuel, with the prescribed minimum cooling period, is removed from the PNGS A Auxiliary Irradiated Fuel Bay and PNGS B Irradiated Fuel Bay and loaded into DSCs (see Section 2.2.1). The outer surface of the DSC is decontaminated and then moved to the DSC Processing Building where it is welded and prepared for storage. No liquid is present inside the DSCs during dry storage. After processing, the DSCs are placed in storage in one of the DSC Storage Buildings and will remain there until the used fuel is transferred to a long-term used fuel management facility.

Spot decontamination operations, carried out in the DSC Processing Building, are not expected to generate any liquids. DSC processing involves lid closure by welding, weld inspection, vacuum drying, helium backfill, and helium leak detection prior to transport to the DSC Storage Buildings. Liquids are not normally used as part of these operations.

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The DSC Processing Building, due to the nature of its operations, stores a variety of consumable materials, including hazardous materials such as compressed gases, paints, etc. Appendix B lists the materials used and their storage locations at the PWMF. The storage locations of the consumable materials are shown in Figure 2-7. The consumable materials are stored in small quantities and are easily removed. There is no laboratory or bulk chemical store in the DSC Processing Building.

Note: The plan for new DSC Processing Building has been cancelled but there is a plan to upgrade the existing processing building to achieve a higher production rate of DSCs. Any changes to the existing DSC Processing Building will be included in future updates of this PDP.

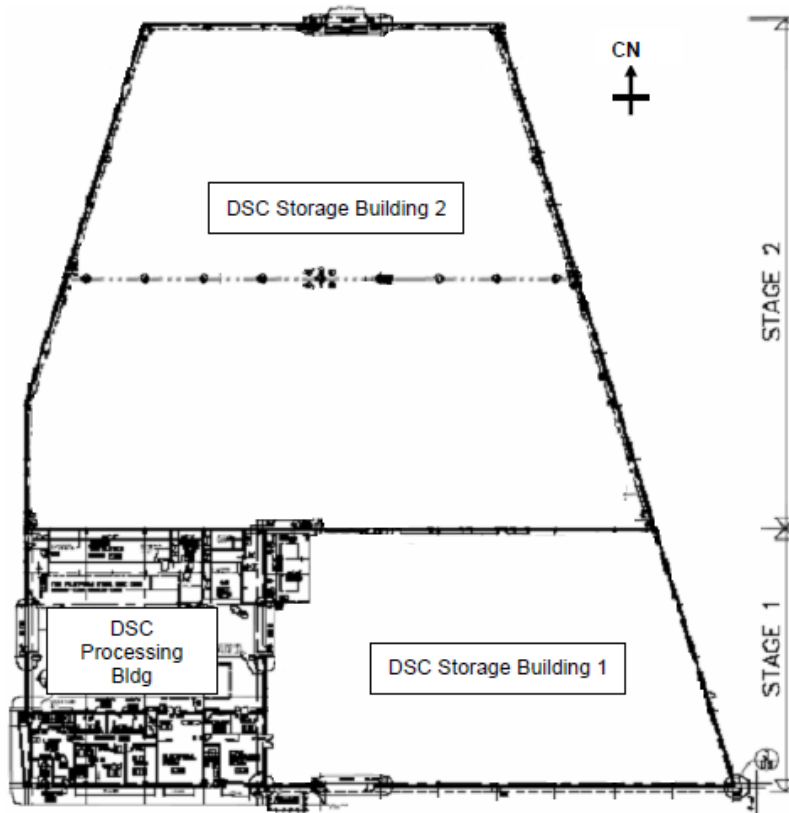


Figure 2-6: Layout of the Used Fuel Dry Storage (Phase I)

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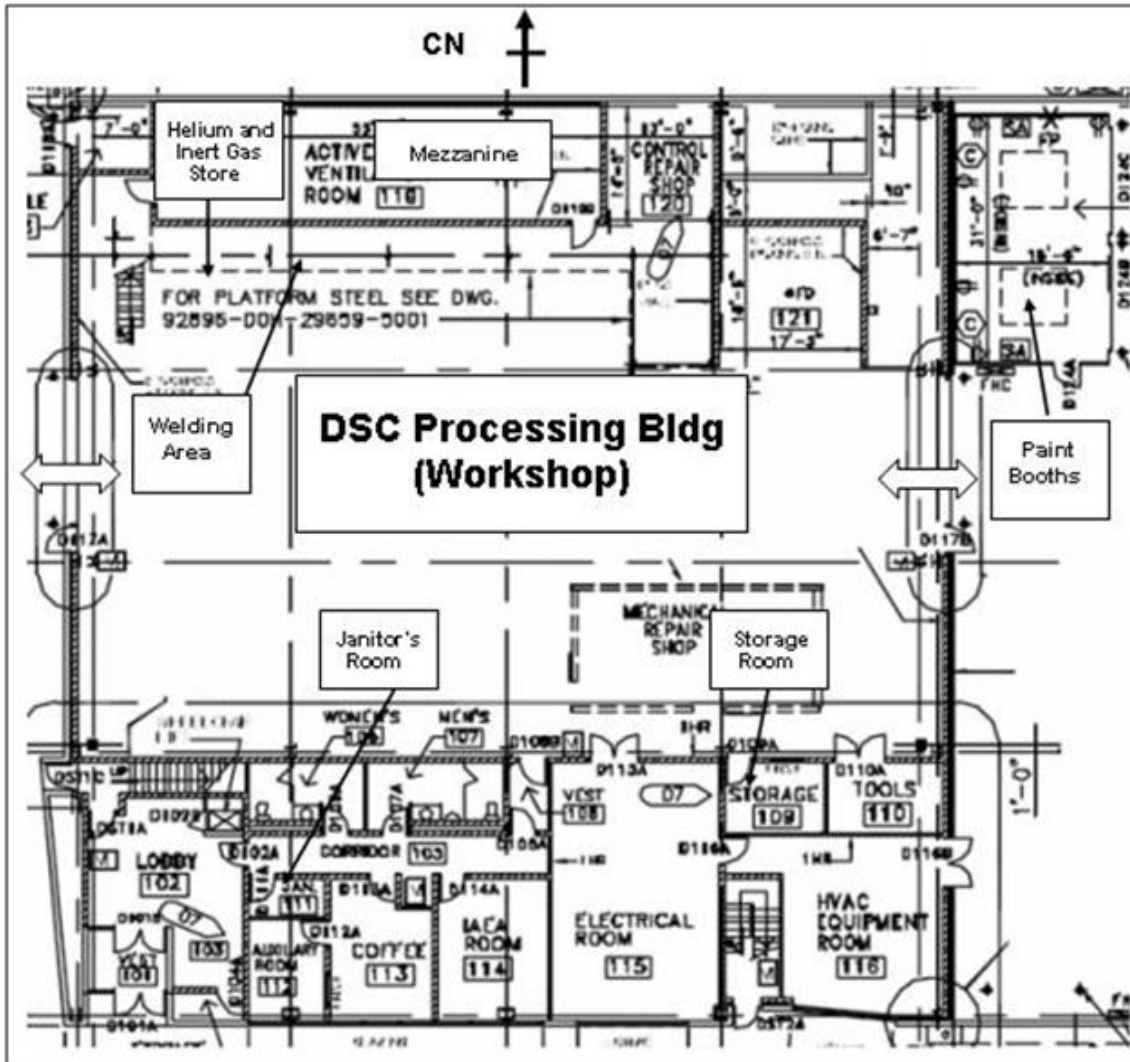


Figure 2-7: Layout of the Phase I DSC Processing Building (Workshop)

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Figure 2-8: DSC Processing Building (Phase I) – Exterior



Figure 2-9: DSC Processing Building (Phase I) – Interior

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### 2.2.3.2 Dry Storage Container Storage Buildings 1 and 2

The DSC Storage Buildings in PWMF Phase I were built in stages. DSC Storage Building 1 (Stage 1) came into service in 1995, and is located directly east of the DSC Processing Building (Workshop). The DSC Storage Building 1 is an industrial building that has a capacity of up to 185 DSCs and also houses the paint enclosures. The DSC Storage Building 2 (Stage 2) came into service in 2001, and is located directly north and east of the DSC Processing Building. It is constructed similar to DSC Storage Building 1 and has a capacity of up to 469 DSCs. DSC Storage Building 2 is equipped with a 77.1 Mg (85-ton) gantry crane to service the DSC receiving area. The DSC Storage Building 2 is accessible from the PNGS site by a door on its north side and through DSC Storage Building 1. DSC Storage Building 1 is accessible from the Workshop and also via doors on the south of the DSC Storage Building 1. The DSC Storage Buildings have concrete peripheral walls of 0.2 m (8 in) thickness, which limit the radiation dose rate at the exterior surface to less than 2.5  $\mu\text{Sv/hr}$  (0.25 mrem/hr). The layout of DSC Storage Buildings 1 and 2 are shown in Figure 2-6.

No hazardous materials were used in the construction of the DSC Storage Buildings and, other than the used nuclear fuel, no hazardous materials are stored in these structures.

Loaded DSCs are transported to DSC Storage Buildings 1 and 2 by means of a special-purpose transport vehicle. Figure 2-4 shows DSCs in storage inside one of the buildings.

### 2.2.3.3 Retube Components Storage Facility

The RCSF was put into service in 1984. Reactor core components from past retubing of PNGS A reactors (which occurred in the period 1984 – 1992) are stored in DSMs at the RCSF in PWMF Phase I. The RCSF is designed to accommodate 38 DSMs, with each DSM having the ability to hold ~90 pressure tubes or combinations of pressure tubes, end fittings and miscellaneous components. At present, the RCSF has 16 DSMs from Units 1 and 2 retubing and 18 DSMs from Units 3 and 4 retubing for a total of 34 loaded DSMs. Additionally, there are two empty DSMs and two vacant storage positions. The RCSF area is at the southern end of the PWMF Phase I site, covering about 0.43 ha, and is protected by a chain link fence. A plan view of the RCSF is shown in Figure 2-10.

The storage area is open to the elements and is therefore paved to provide a hard surface barrier between the DSMs and the natural environment and reduce subsequent maintenance. A drainage system is provided to collect the runoff water from the storage area, with catch basins permitting periodic sampling of the water. Each DSM is supported on two concrete pads embedded in the paved surface of the RCSF, capable of taking the 175 Mg loaded weight.

Other than periodic monitoring and maintenance activities, no operations have been undertaken within the RCSF since 1993. It is intended that the wastes held within the RCSF will be held in this isolated condition until the reactor units have been decommissioned. This will provide additional time for the wastes to decay to safer levels until a long-term management option is employed. This has been considered a safe strategy, as no liquid discharges or significant atmospheric emissions have been identified when considering this approach.

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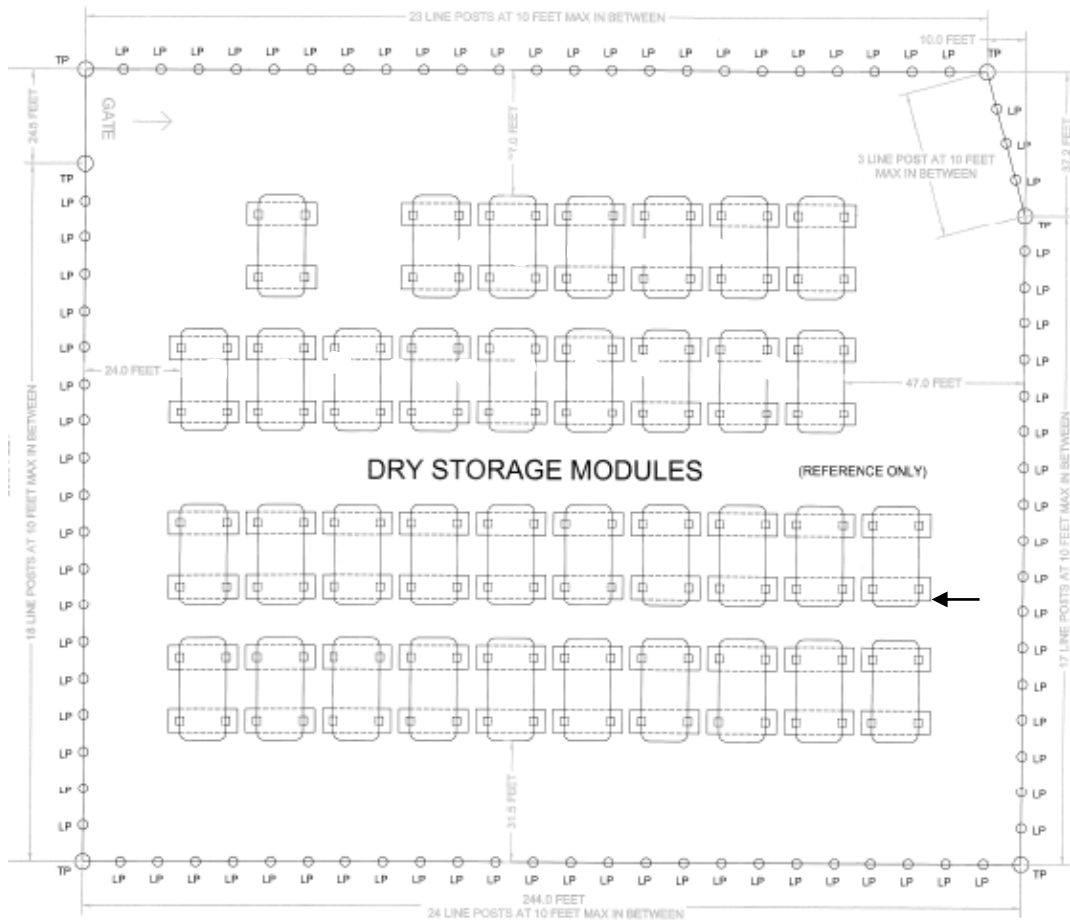


Figure 2-10: Layout of the Retube Components Storage (Phase I)

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### 2.2.4 Pickering Waste Management Facility Phase II

The PWMF Phase II is situated in the East Complex, about 330 m west of the PNGS east property boundary. PWMF Phase II currently encompasses a security kiosk and DSC Storage Building 3 and DSC Storage Building 4. The location of DSC Storage Building 3 and DSC Storage Building 4 is shown in Figure 2-11.

An additional two storage buildings (Buildings 5 and 6) are planned to be in service by 2027 and 2033. A site plan that illustrates the general layout of both existing and planned Phase II buildings is provided in Figure 2-12.

The site services provided by PNGS to PWMF Phase II include: Class II and Class IV electrical power supply, security and emergency response. The PWMF Phase II has its own storm water management system.

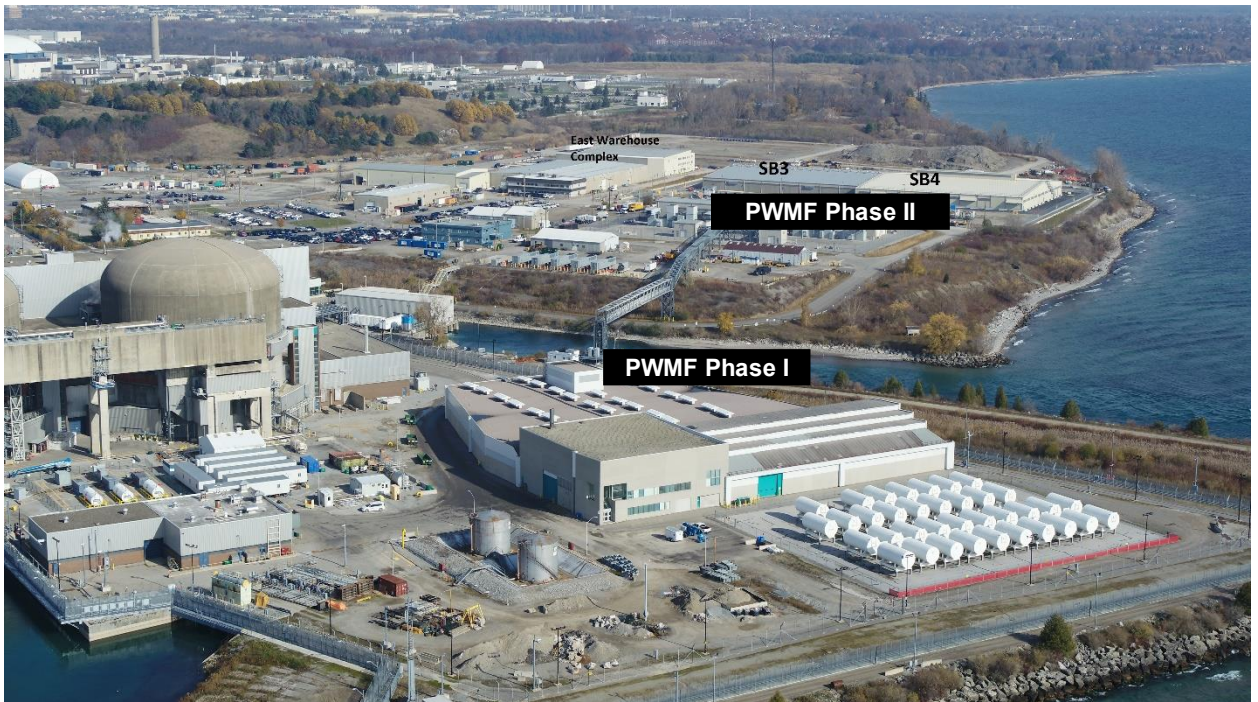


Figure 2-11: Aerial View of Pickering Waste Management Facility Phase II

The main entry point to PWMF Phase II is a security gate located directly west of the fence. A secondary gate is located at the southwest corner of the fence line for emergency vehicle access.

The major systems and components of PWMF Phase II are listed in Appendix A.

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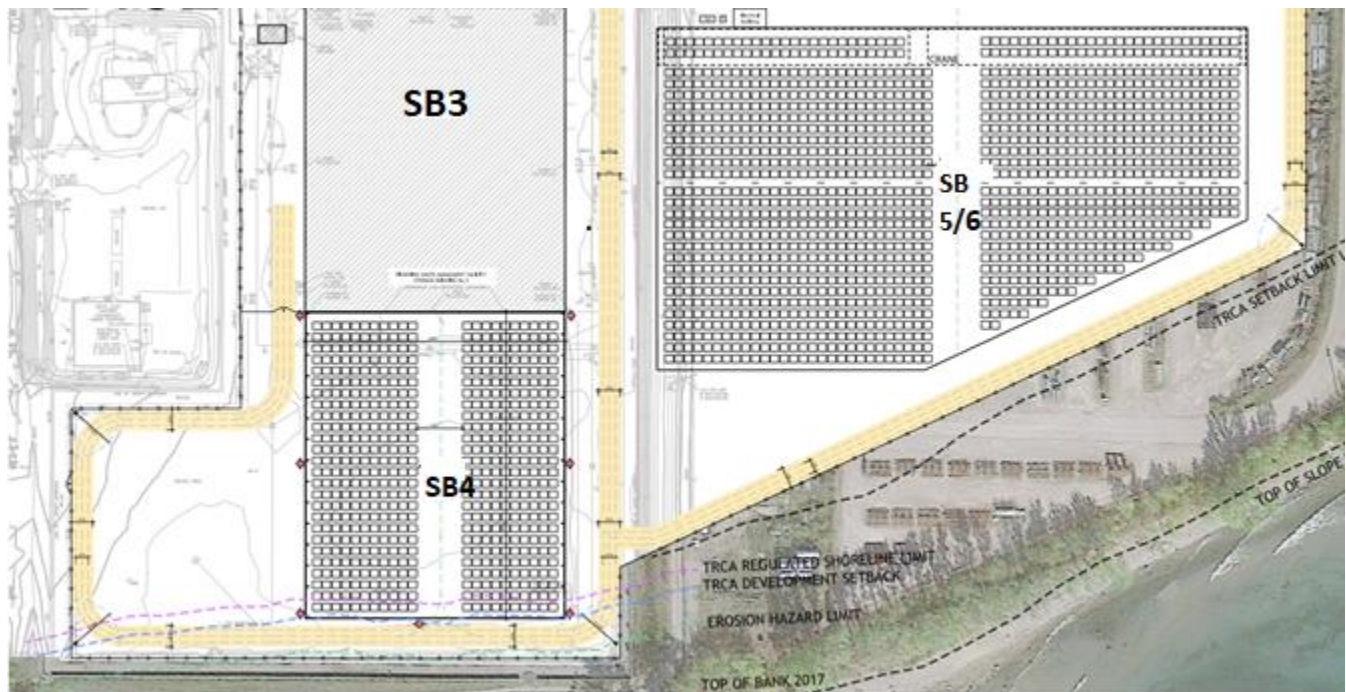


Figure 2-12: Phase II Site Plan – General Layout of Existing and Planned Buildings

#### 2.2.4.1 Dry Storage Container Storage Buildings 3 and 4

DSC Storage Building 3 (at PWMF Phase II) was placed in service on June 9, 2009. DSC Storage Building 3 is similar in construction to DSC Storage Buildings 1 and 2. This includes exterior walls consisting of precast concrete panels, reinforced concrete floor slabs to accommodate heavy vehicles and equipment, and a roof with provisions for drainage of rainwater and melted snow. Loaded DSCs are transported to DSC Storage Building 3 by means of a special-purpose transport vehicle. DSC Storage Building 3 currently contains 480 DSCs and is considered to be at capacity. The location of DSC Storage Building 3 is shown in Figure 2-11 and the layout is shown in Figure 2-13.

DSC Storage Building 4 is located adjacent to DSC Storage Building 3 and has a capacity of 624 DSCs. DSC Storage Building 4 exterior walls are made of metal. It was placed in service in March 2021. The layout of DSC Storage Building 4 is shown in Figure 2-14.

DSC Storage Buildings 3 and 4 occupy a total site area of about 4 ha.

DSC Storage Buildings 3 and 4 share similar building services and systems. Both storage buildings use passive ventilation. The kiosk and electrical rooms of the storage buildings use split unit air conditioning units. There are no water services in Phase II of the PWMF. DSC Storage Buildings 3 and 4 share the following building systems:

- Fire detection;
- Security (monitored from the PNGS);

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- Electrical (supplied by City of Pickering);
- Public Address (supplied by PNGS);
- Telephone (supplied by PNGS) and
- P10 gays system for radiological monitoring.

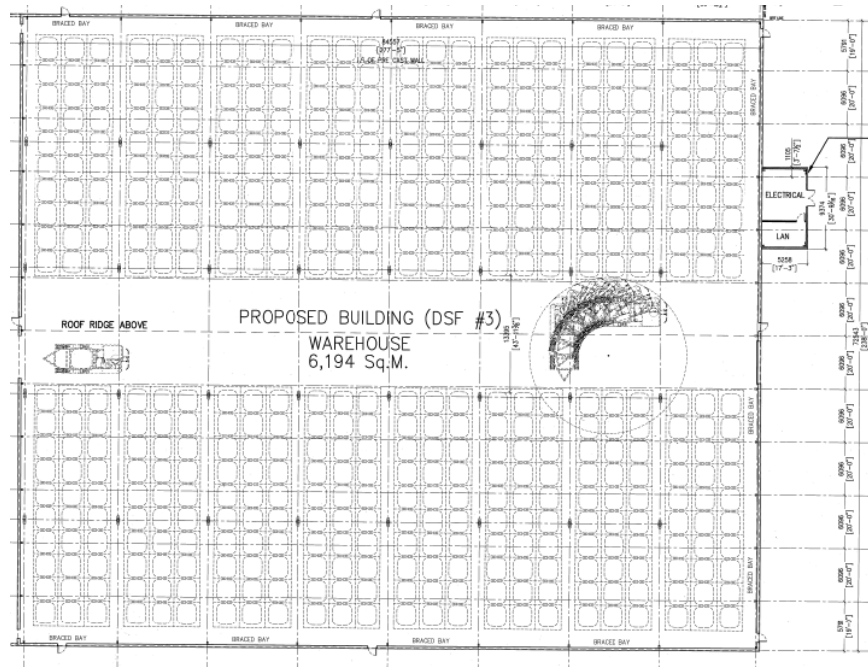


Figure 2-13: Layout of DSC Storage Building 3 (Phase II)

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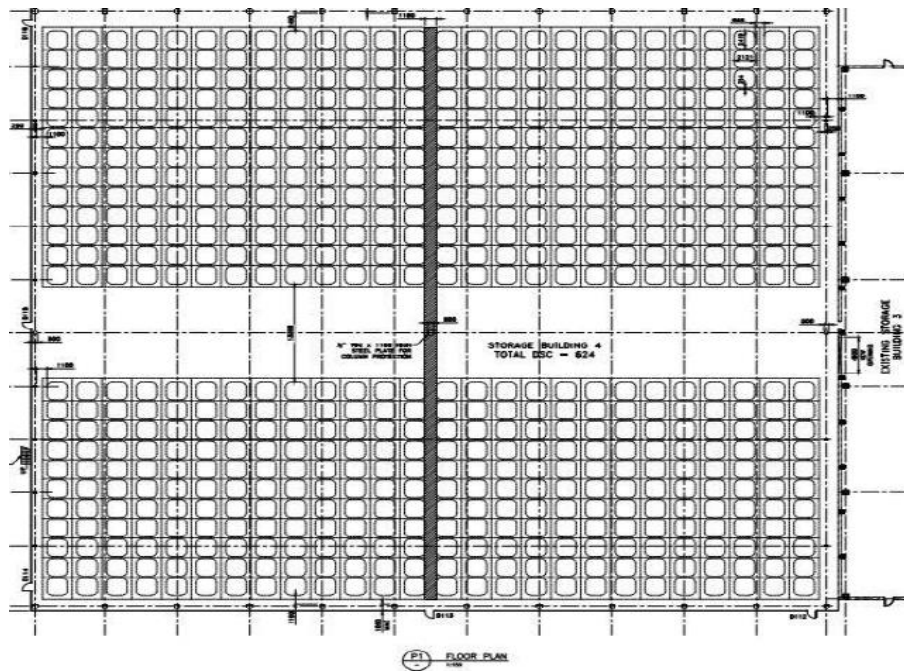


Figure 2-14: Layout of DSC Storage Building 4 (Phase II)

### 2.2.5 Interfacing Systems and Services

There are multiple interfacing systems and services between the PWMF and PNGS to ensure safe operations of the facilities.

The interfacing systems include:

- Electrical Power:
  - Class IV Main Power Supply for Phase I, required for the general building loads, radiation monitoring and IAEA Safeguards equipment, is provided by PNGS Unit 8 (Powerhouse);
  - Class IV Main Power Supply for Phase II, required for general building loads, is provided by the city of Pickering.
  - Class II Power for Phase I, used for the emergency lighting, fire detection control panel, alarm and annunciation equipment, is provided by PNGS Unit 8 (Powerhouse);
  - Class II Power for Phase II, used for the emergency lighting, fire detection control panel, alarm/annunciation equipment, and security monitoring equipment, is provided by a diesel standby generator, automatic transfer switch and Uninterruptible Power Supply (UPS).
  - Class I Power, required for switch gear protection and control circuits, is provided by PNGS Unit 8 (switchgear).

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- Fire protection water is supplied from the PNGS “B” side station fire water;
- Low Pressure Instrument air is supplied from Unit 8 (Reactor building) Instrument Air System;
- Domestic (service) water is supplied from the underground domestic water piping north of PNGS-B/Unit 8;
- Active Drainage originating from floor drains and directed to two underground stainless steel lined sumps within the facility is pumped to two holding tanks. After routine monitoring, the tank contents are periodically transferred through a connection to the Unit 8, Reactor building. and ultimately to the active waste treatment system at the station in Unit 5; and
- Sewage, which is collected in a sump is subsequently pumped from the PWMF to the Pickering ‘B’ yard Manhole #5 in the northeast corner of the powerhouse. This in turn flows into the main yard sewage pumping station (where it is monitored and discharged to municipal sewage systems).

There are other systems at the PWMF, such as ventilation, heating and air conditioning (Service Air) which do not require external supply. As none of the systems used by DSC Storage Building #3 are sourced from the station, there will be no impact on its operation as the PNGS undergoes stabilization and Storage with Surveillance (SWS). DSC Storage Building #4 connects internally to systems of DSC Storage Building #3 and also does not require additional supplies nor will be impacted during the stations’ stabilization and SWS period.

The interfacing services between PNGS and PWMF include the following:

- Environmental Monitoring;
- Radiation Protection;
- Security; and
- Emergency Response.

Although the life cycle plans of PNGS and the PWMF are separate from each other, the decommissioning of PNGS may have an impact on PWMF as PWMF will remain in operation after shutdown of PNGS reactors. For example, a facility to transfer DSM waste must be operational at PNGS (to be developed as part of PNGS dismantling) prior to the decommissioning at the PWMF. This impact along with the overall decommissioning timeline for the PNGS and PWMF is described in detail in the PNGS PDP [R-7].

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## 2.3 Description of the Surrounding Environment

### 2.3.1 Natural Environment

Much of the area surrounding the Pickering site consists of urban, industrial and commercial development. The site itself has been extensively modified by development. The eastern end of the site is dominated by an artificial hill covering the abandoned East Landfill. A second abandoned waste landfill is located on the western end of the site. These landfills were closed in 1997 and 1999 and have become a habitat for wildlife.

The area within and surrounding the site is host to a variety of natural vegetation. A number of small wetlands (wet meadows and shallow marshes) can be found throughout the site, with a larger wetland occupying the northwest corner of the site boundary. Various wildlife species benefit from a small swale at the southeast corner of the station property, near the PVMF (about 5 m beyond the fence).

The area of the PVMF Phase I site has either been paved or covered with gravel or granular type soil. The area has no natural vegetation remaining.

Existing vegetated areas close to the PVMF Phase II site consist primarily of drainage ditches, which are routinely maintained by OPG. A few small areas of culturally modified vegetation are located around the margins of the East Complex, including mineral cultural meadows, a mineral thicket swamp and cultural woodland communities.

The Pickering property is visited by birds during the spring and fall migration; a number of species have been identified as breeding on-site, particularly in association with the Hydro Marsh and adjacent Frenchman's Bay Marsh. Breeding species associated with the marsh habitats include Mallard, Canada goose, common tern, black tern and tree swallow. Regarding species at risk, barn swallows breed annually on the PNGS property. One pair of Peregrine falcons has nested annually on PNGS property since 2014 but have stopped nesting since 2019. One Eastern Wood-Pewee was recorded at the East Landfill in 2017. No significant breeding bird populations were identified in association with the PVMF.

During observations made in mid-April 1998, no wildlife was observed on the PVMF Phase I site. This was likely due to the site being fenced-in, as well as containing no vegetation or foodstuff. However, some water birds were observed along the edge of the berm bordering the PNGS B outfall channel. Members of operations staff have observed that small wildlife mammals also visit the outskirts of the PVMF Phase I site frequently.

Due to the relatively developed nature of the surrounding environment and the limited number of local natural areas, the mammal community in the PVMF area is very limited. Similarly, few reptile and amphibian species were identified. No rare or endangered species were located within the site. Any significant wildlife species that have been reported as breeding at the PNGS property are primarily associated with the wetland habitat of Hydro Marsh and Frenchman's Bay well to the west.

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## 2.3.2 Geophysical Environment

During the course of subsurface investigations and excavations of the PNGS, OPG has added substantially to the geological information of the site area. Further geological information for the PWMF site was obtained in a study conducted exclusively for this site [R-8]. The borehole locations and a sample geotechnical data sheet are given in the subsoil investigation and evaluation report for the site. The present ground surface at the PWMF Phase I site is at an elevation of approximately 3 m above the lake level.

A geotechnical investigation study was conducted for the PWMF Phase II Storage Building 4 [R-9]. The study was conducted by means of six boreholes and analysis of soil samples obtained from the boreholes to support the construction of Storage Building 4. The PWMF Phase II site is at elevation of approximately 5 – 7 m above lake level [R-10].

### 2.3.2.1 Soils

The PWMF Phase I site is covered with a variable fill deposit, composed of coarse to fine sand and gravel, ranging in thickness up to 4.6 m. The state of compaction of this fill is erratic. Caissons were used to support the structure at the PWMF Phase I site. In general, the fill overlies a natural deposit of clayey silt till having stiff to hard consistency. The clayey silt till deposit extends to a depth of 13 m to 15.5 m to rest on a basal till deposit of very dense silt or clayey silt containing pieces of weathered shale. Zones of hard to very stiff silty clay and dense sand are found sandwiched between the upper clayey silt till and the basal shale-till complex.

The PWMF Phase II site is underlain by 1 m to 2 m of grading fill and 15 m to 20 m of stiff to hard upper and lower till complex soil deposits overlying a shale bedrock. The grading fill for road bases and parking lots was derived from either reworked glacial till from on-site or imported granular soils. This shallow horizon is underlain by a hard, low permeability silty clay to clayey silt till horizon approximately 5 m thick which extends out beneath Lake Ontario. This upper till layer is a barrier that restricts downward seepage of groundwater. The upper till is underlain by a more permeable silty to sandy horizon over a lower till layer above the bedrock surface.

The Lake Ontario shoreline south of the PWMF Phase II site, is a relatively undisturbed natural shoreline and bluff, rising an average of 3 to 4 m to a level plateau above. The bluff has significantly eroded over the last few years due to higher water levels. Due to recent erosion, the bluff is mostly exposed soil with limited natural vegetation. The beach and foreshore are relatively flat, composed of sand, gravel and boulders associated with the parent tills. The bluff is routinely monitored by OPG for erosion to ensure safety and security of the PNGS facilities. DSC Storage Building 4 was built at a location beyond the 100-year erosion limit point [R-11].

### 2.3.2.2 Bedrock

The Pickering Nuclear site is underlain by Ordovician age sedimentary rocks composed of nearly flat-lying shales and limestones that dip gently (1%) southward, characteristic of the north shore of Lake Ontario. The bedrock surface is encountered at depths of approximately 10 m to 20 m below the surface with localized areas of low bedrock topography. The surface of the bedrock sequence slopes southward from elevations of 68 m above sea level at the north of the site to elevations of approximately 47 m above sea level approximately 1.5 km offshore in Lake

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Ontario. The projected local dip of the bedrock is southeastward at a generally uniform grade of 1%. The bedrock surface directly beneath the Pickering Nuclear site, in the vicinity of the units, is relatively level, varying between elevations of approximately 58 m to 62 m, with a gentle southward dip of approximately 0.1% to 0.2%.

During the several borings and excavations carried out over the years at and around the Pickering site, no evidence has been found of any structural weakness in the bedrock foundation at the site. Neither mining activity nor withdrawal of fluids under the site has occurred that may affect the PWWF.

### 2.3.2.3 Groundwater

Subsurface investigations indicate a lower water-bearing zone of sand, silt and gravel within the lower till complex and local water-bearing lenses in the upper till complex. A relatively minor water-bearing zone occurs in the top part of the bedrock. Generally, on a regional basis, the groundwater level is about 1 m below the ground surface, which slopes gently towards Lake Ontario. The groundwater gradient is relatively flat and towards the lake [R-6]. Groundwater movement along with monitoring around PNGS have been summarized in [R-12].

Groundwater and sump samples collected in 2006 demonstrated that groundwater quality exhibits seasonal changes in response to the level of the water table and variation in recharge. Overall, sampling results indicate that current conditions are comparable to historical data where available [R-6].

### 2.3.2.4 Seismicity

The western Lake Ontario region lies within the tectonically stable interior of the North American continent, which is characterized by low rates of seismicity. The seismic zoning maps in the National Building Code of Canada, for example, place the site in Zone 0 to 1, with Zone 6 corresponding to the most seismically active regions of the country. The region surrounding the Pickering site experiences low to moderate levels of seismicity. Most events have magnitude (M, called 'Richter' magnitude) less than 5, with rare occurrences of larger events. In general, earthquakes in stable interior regions, such as the Lake Ontario region, occur at depths of 5 to 20 km, on faults formed hundreds of millions of years ago during previous active tectonic episodes. These faults are widespread throughout the crust, and typically have little to no surface expression [R-6].

Two seismic events with a magnitude of greater than 4 have been recorded within 100 km of the station from 1900 – 1991; one centered southeast of St. Catharines in 1954 had a magnitude of 4.1 and the other centered near Hamilton in 1958 had a magnitude of 4.3. From 1992-2017, 655 events were detected, out of which 9 events had a magnitude greater than 4.0 M and 120 events had a magnitude greater than 2.6. Within an approximated 100-km radius of the PNGS, 72 events were recorded and of these, the highest event magnitude was 3.8 [R-13].

From August 2017 to February 2021 inclusive, there has been an additional 12 seismic events reported in Ontario of a magnitude greater to or equal to 3.0 (the magnitude of these earthquakes range between 3.0 and 4.1, and two of these earthquakes were within a 100-km radius of PNGS) [R-14].

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As a guide to levels of seismic activity in the region, the western Lake Ontario region experiences an earthquake of  $M = 5$  or larger about once every 100 years. This estimate of the level of seismicity is well-established. A magnitude 5 is considered a moderate earthquake, which may cause significant damage to poorly built (unreinforced) structures in the epicentral area, but does not generally damage modern well-engineered structures or heavy industrial structures. More damaging earthquakes of  $M = 6$  or greater are considered possible but the rate of occurrence is ten times lower. This means that the likelihood of a large potentially damaging event (of  $M = 6$  or greater) occurring in the local area is less than 1 in 1,000 per year [R-6].

### 2.3.3 Aquatic Environment

#### 2.3.3.1 Drainage

Drainage in the Pickering Nuclear site is a mix of ephemeral swales, ditches, culverts and storm sewers – no major watercourses traverse the site. The discharge points are approximately 6 m to 10 m above the Lake Ontario water level. No water body other than a small (0.5 ha), isolated wetland, known as the Southeast Wetland, is located within the Pickering site. This small, isolated wetland, which was once farmland and created during the construction of PNGS as a result of landfilling activities, lies in the southeast corner of the PNGS property at the foot of Montgomery Park Road. This wetland receives drainage from the area around the former construction landfill within the Pickering site [R-6].

Surface drainage from the Pickering site is enabled by 19 separate stormwater drainage basins, or catchments. The PWMF Phase I site is part of a smaller drainage basin with an area of 3.7 ha. The PWMF Phase I site shares this area with the PNGS B standby generators. Greater than 95 percent of this area is considered to be impervious. Runoff, including the PWMF Phase I roof drainage, is directed through the PNGS drainage network into the PNGS B discharge channel. Drainage from the RCSF area is directed via catch basins to the PNGS drainage system for discharge to the outfall [R-6].

Even though liquid effluents generated inside the PWMF Phase I site are infrequent and small in volume, they are sampled and pumped into the PNGS Active Liquid Waste Management System [R-6].

Surface drainage from the PWMF Phase II site in the East Complex area drains to Lake Ontario, with drainage areas of between 0.4 ha and 19.8 ha. Catchments numbered 12 through 16 are affected by the PWMF Phase II site and associated stormwater management [R-6].

#### 2.3.3.2 Fish

More than 90 fish species are known to inhabit Lake Ontario, of which 60 species have been found in impingement, gillnetting and electrofishing studies at the PNGS site and are considered to represent the fish community in the vicinity. The American Eel was identified as a species at risk in the Environmental Risk Assessment [R-15]. As there are no surface water features suitable as fish habitat within the site, the only aquatic habitat and biota are located within Lake Ontario. However, almost all of these species make use of the nearshore waters of the lake for one or more of spawning, rearing, feeding, migration and over-wintering. These nearshore

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waters include the Rouge River, Frenchman's Bay and Duffins Creek; the PNGS B discharge channel is used by smallmouth bass as a spawning area [R-6].

Sport fish taken near the Pickering Nuclear Site include brown trout, walleye, chinook and coho salmon, rainbow trout, smallmouth bass, white bass and carp. Commercial fishing is not a significant industry in the area and its importance is declining. Within a 100 km radius of the Pickering Nuclear Site, there are two Ministry of Natural Resources hatcheries [R-16], [R-17].

### 2.3.3.3 Lake Water Levels

Based on measurements of the monthly water level of Lake Ontario (i.e., the average levels of the whole lake) taken from 1918 to 2011, the annual maximum monthly average water levels range from a low of 73.74 m relative to the International Great Lakes Datum (IGLD) (in 1934) to a high of 75.76 m relative to the IGLD (in 1952). Lake Ontario water levels have been regulated since the completion of the St. Lawrence Power Project in 1958. The mean Lake Ontario water level from 2004 to 2019 was 74.63 m above mean sea level in December to 75.79 m above mean sea level in June [R-18].

The lowest bank height along the shoreline of the Pickering site is at the southwest corner of the East Complex, which is at 76.7 m IGLD. The PWMF Phase I site is slightly higher at an estimated 77 m IGLD (with Phase II even higher) [R-6].

With near-shore water depths of 2 to 2.5 m, the maximum wave runups will be approximately 2 m on a riprap shore. As the crest of the protection works at PNGS exceeds 77.5 m IGLD for much of their length, the probability of flooding due to wave runup and overtopping is considered low. Periodic wetting of extreme events due to wave spray and splash will occur. However, it is considered unlikely that waves breaking directly over top of the foreshore works will occur. It is also reasonable to assume that the surface drainage system will have adequate capacity to deal with any spray that may occur [R-6].

### 2.3.4 Current Use of the Adjacent Land

As mentioned in Section 2.2. PWMF is located within the Pickering Nuclear Site property, just east of the PNGS. Pickering Nuclear Site is located in the Regional Municipality of Durham, which is one of the largest municipalities in Canada and is also among the fastest growing. The Pickering Nuclear site is close to residential, industrial, agricultural, technological, recreational, municipal service and transportation lands.

Agriculture has historically been an important component of the local and regional economies, environment and social fabric, and represents the most significant land use throughout most of the northern portions of the City of Pickering and Durham Region. Notwithstanding this agricultural heritage, both the City and the Region have developed an industrial platform with major industries in energy, automotive manufacturing, plastics/packaging, pharmaceuticals, aerospace/defense, chemicals/rubber and environmental technologies [R-6].

Existing residential as well as other land uses in the vicinity of the site are illustrated in Figure 2-15. This figure is taken from the Regional Municipality of Durham official plan and is used to demonstrate existing land use designations [R-19]. The area bounded by Highway 401 on the north, Duffin Creek on the east, the Pickering Nuclear site on the south and Sandy Beach Road

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on the west has been designated for industrial development. The southern boundary of the Pickering Nuclear site property extends as a water lot into Lake Ontario. The lake is used locally for sport fishing, as well as recreational swimming and boating. The lands and ravines associated with Frenchman's Bay, immediately west of the Pickering site boundary fence, also provide the greatest concentration of recreational amenities in the City of Pickering. In addition, recreational and natural areas are located immediately to the east and north-west of the site, while the residential areas of Bay Ridges and Fairport are located further to the north-west (north of the Alex Robertson Community Park and Frenchman's Bay) [R-16], [R-17].

Lake Ontario provides water supply to the adjacent municipalities, the nearest water supply plant being in Ajax, 4 km to the east. The Duffin Creek Water Pollution Control Plant is located on lands immediately east of the Pickering property. The remaining portions of the Brock Industrial neighbourhood contain a variety of employment uses and vacant land [R-6].

There is a 914 m radius exclusion zone around the PNGS reactors. Beyond this limit, land uses include recreational, institutional, industrial, commercial and park facilities. In general, land use adjacent to the Pickering Nuclear site is consistent with industrial and residential development throughout the city.

The Pickering Nuclear site has been developed since its inception in the early 1960s. The Pickering property is designated as a utility in the Region of Durham Official Plan. The property is zoned Industrial Zone M2. The entire property is fenced and access to the site is restricted and controlled by OPG. Within the PNGS boundaries, existing land uses consist of buildings, structures, switchyards (belonging to Hydro One Inc.) and transportation access required to operate and support the stations' functions. A small site located between the closed Brock Road right-of-way and the Pickering NGS B thermal discharge bay is zoned Public Service Zone M3 [R-6].

The Waterfront Trail, an active recreational path paralleling Lake Ontario across the City of Pickering, with connections to municipalities to the east and west, runs adjacent to the Pickering NGS site boundary fence along Montgomery Park Road, on lands leased to the municipality by OPG [R-6].

The Bay Ridges, West Shore and Rosebank neighbourhoods west of Pickering NGS contain predominately residential and compatible ancillary uses (e.g., schools), with some employment and commercial uses generally along Bayly Street and Liverpool Road [R-6].

The PWMF is distributed across the Phase I and Phase II sites. The RCSF area is at the southern end of the PWMF Phase I site, covering about 0.43 ha. At the northern end of the PWMF Phase I site are the DSC processing building, offices, and DSC Storage Buildings 1 and 2. A berm to the east of the PWMF Phase I site prevents direct discharge of runoff to the PNGS B outfall channel. The PWMF Phase II site includes Storage Building 3 and 4 for DSCs. Space on the Phase II site is reserved for future DSC storage needs.

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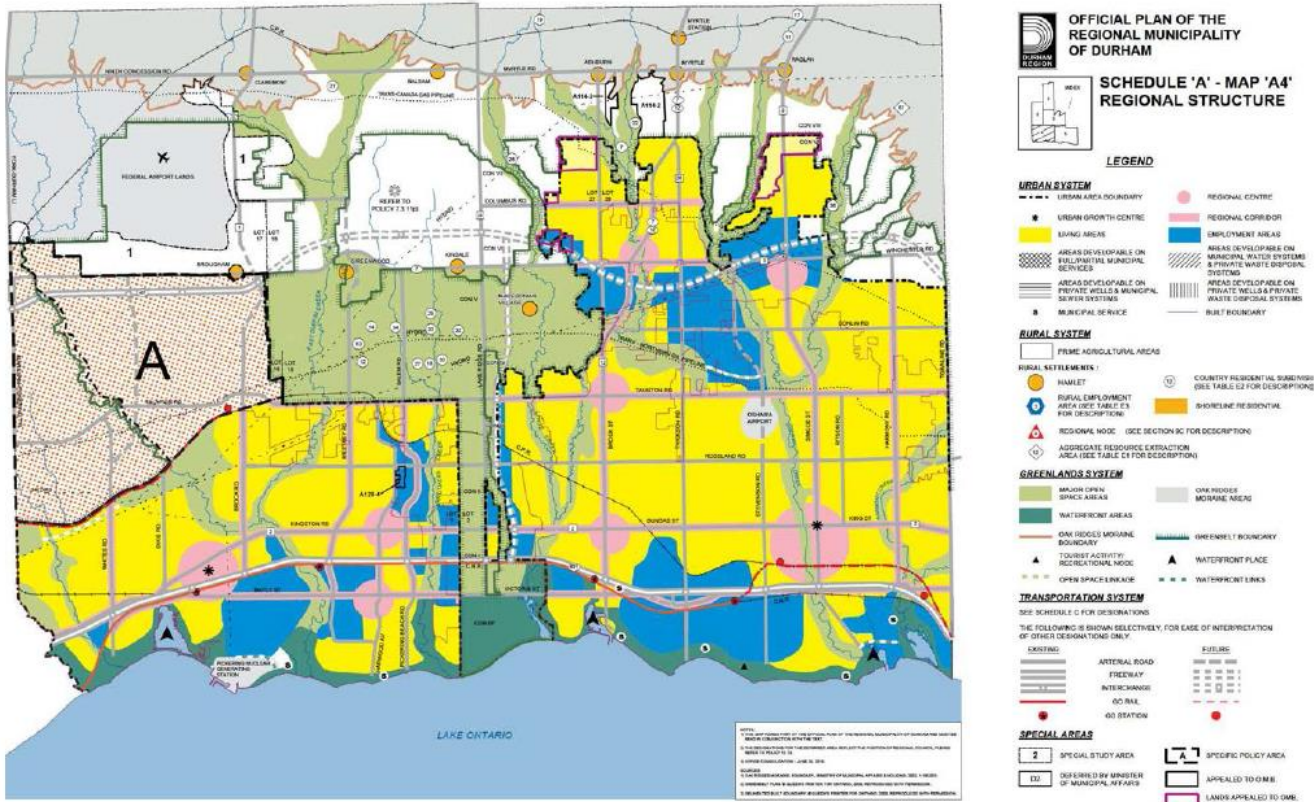


Figure 2-15: Land use in the Vicinity of Pickering Nuclear Site

### 2.3.5 Local Communities

The Regional Municipality of Durham is one of the largest municipalities in Canada and is also among the fastest growing. Durham Region includes the City of Pickering, the City of Oshawa, the Towns of Ajax and Whitby, the Townships of Brock, Scugog and Uxbridge, and the Municipality of Clarington [R-6].

Population growth in Durham Region has been closely linked to development and economic growth in Toronto and surrounding regions (i.e., Peel and York Regions). Buoyed by the strong economy in the Greater Toronto Area, strong population and economic growth is projected for Durham Region and its area municipalities [R-6].

Detailed population data for 2016 for these and other nearby municipalities are shown in Table 2-1 [R-20].

Table 2-1: Population of Nearby Municipalities

Municipality	Population
	2016
City of Pickering	91,771
Town of Ajax	119,677
Town of Whitby	128,377
City of Oshawa	159,458
Town of Clarington	92,103
Township of Scugog	21,617
Township of Uxbridge	21,176
GTA	5,928,040
Town of Markham	328,966
Town of Richmond Hill	195,022
Town of Newmarket	84,224
Town of Vaughan	306,233
Town of Aurora	55,445
Township of King	24,512
Town of Whitechurch - Stouffville	32,634

The economy in the region of the Pickering Nuclear site is founded on a diverse manufacturing base. As such, there is a large and mobile labour force, which supports a wide range of industrial, commercial, technological and institutional businesses. The economic base, in turn, is supported by good infrastructure, skilled labour and a solid range of available community amenities and housing. PNGS is a major employer within the region.

While there is a significant impact of PNGS on the community, the PWMF is a small but integral part of Pickering Nuclear. The PWMF has only a minimal impact on the social and community environment, mainly due to its limited size and number of employees. However, the PWMF supports the continued operation of PNGS, and thus contributes indirectly to the social economic benefits of the Pickering site to the neighbouring communities.

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### 2.3.6 Indigenous Communities

There are seven indigenous communities located within 155 km of the PNGS property. First Nations in particular have a relationship with the lands along the north shore of Lake Ontario (from Toronto east to the Bay of Quinte) and north to Lake Simcoe and Rice Lake as a result of their occupation and traditional use of these lands prior to European settlement.

These indigenous communities are listed here, along with their approximate location:

- **Alderville First Nation:** 20 km southeast of Peterborough on south side of Rice Lake.
- **Curve Lake First Nation:** 15 km north of Peterborough on Buckhorn Lake.
- **Hiawatha First Nation:** 15 km southeast of Peterborough on north side of Rice Lake.
- **Mississaugas of Scugog Island First Nation:** 35 km north of Oshawa on Scugog Island in Lake Scugog.
- **Chippewas of Georgina Island First Nation:** 10 km north of Sutton West on the southern end of Lake Simcoe.
- **Mohawks of the Bay of Quinte:** 35 km east of Belleville.
- **Métis Nation of Ontario, Region 8:** Three community councils, which take in an area between Durham and Guelph.

While there are no historic Métis settlements in or near the PNGS property, there are Métis persons residing within the area. For example, the Oshawa and Durham Region Métis council represents Métis people in the Durham region. Overall, Durham has a fast-growing, diverse indigenous population from across the country [R-6].

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### 2.3.7 Community Relationships

OPG believes in open and transparent communication with the public in a timely manner, in accordance with CNSC REGDOC-3.2.1 [R-21]. As such, OPG regularly and proactively provides information to the public on its operations and projects.

OPG's Corporate Relations manages communications and relationships between the nuclear facilities and the host communities by fostering healthy, open relationships and sustainable partnerships with community stakeholders, including government, media, business leaders, educational institutions, interest groups and community organizations. OPG ensures transparent disclosure of its operations and potential impacts, both positive and negative that may occur as a result of OPG's operations.

OPG regularly provides milestones and regular waste management updates to key stakeholders. Presentations are regularly made at the Pickering Community Advisory Committee and Durham Nuclear Health Committee. In addition, presentations and informal meetings are held with local elected officials and community leaders a number of times each year to provide updates on performance and other activities taking place both at the stations and waste facilities.

In addition to maintaining the Pickering and Darlington Public Information Centres, OPG has a robust online presence and is active in local communities. To provide local residents with information on operations, projects and future endeavors, including Pickering decommissioning, OPG produces a number of communications materials, including Neighbours Newsletter. The OPG corporate website, [www.opg.com](http://www.opg.com), provides online access to information, including informational brochures, quarterly performance reports, annual Environmental Monitoring Program reports, educational videos and more. OPG also shares information and responds to inquiries through Twitter, Facebook, LinkedIn and other social media platforms.

For operational status changes, OPG follows a protocol to notify key community stakeholders in a timely manner by maintaining a duty on-call position 24 hours a day, seven days a week.

OPG receives and manages inquiries raised by stakeholders and the public and has a managed process in place to respond and track actions and resolution of issues. This record is used as a gauge to monitor public attitudes and potential issues

The Indigenous Relations Policy, OPG-POL-0027 [R-22], describes OPG's commitment to work with indigenous communities and peoples, proximate to OPG's present and future operations, and to develop positive and mutually beneficial relationships that will create social and economic benefits through partnership and collaboration. This policy governs OPG's engagement with indigenous peoples with respect to End-of-commercial operation (ECO) and beyond planning for PNGS.

The Nuclear Public Information and Disclosure Standard, N-STD-AS-0013 [R-23], identifies indigenous communities and peoples as one of the target audiences, among others, for regular and targeted communication through the Public Information protocol. The purpose of this standard is to work with indigenous communities and peoples to convey ECO and related plans and activities, elicit feedback and foster opportunities through partnership and collaboration. Indigenous communities proximate to PNGS and PWF include Williams Treaties First Nations

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(specifically Scugog Island, Curve Lake, Hiawatha, and Alderville), Mohawks of the Bay of Quinte and Métis Nation of Ontario Region 8.

OPG is respectful of the fact that PNGS and PWF are sited within the traditional and treaty territory of the Williams Treaties First Nations. OPG engages with these identified indigenous communities on a regular basis to discuss plans such as ECO as well as station operations, environmental reporting, employment/procurement opportunities and other subjects.

OPG's Centre for Canadian Nuclear Sustainability (CCNS) is focused on community and stakeholder communications and relationships specifically related to decommissioning. The CCNS communication program is integrated into OPG's existing public information program and focuses on research and development, innovation and collaboration in decommissioning. The communication program holds meaningful interaction with CCNS partners, committees, indigenous communities and the broader community through a variety of channels including social media, Neighbours Newsletter, community presentations and events, and collaboration with the Pickering Community Advisory Council. The CCNS also has its own website, [www.theccns.com](http://www.theccns.com), which provides online information to the general public about CCNS projects and opportunities to engage with the CCNS team.

The CCNS has also launched an Indigenous Advisory Council (IAC) that provides advice and insight to CCNS on how indigenous communities, organizations and businesses can bring indigenous values and content into the Centre's mandate. The IAC is comprised of indigenous individuals and representatives of specific indigenous organizations within Durham Region and the surrounding area.

Public opinion polling in Durham Region for Pickering station and PWF waste operations following the Fukushima event showed an increase in the level of support for OPG and nuclear power. This speaks to the strength of the relationships and trust OPG has built up with the community and community leaders. Quantitative and qualitative research in Durham two months after the events in Japan point to higher-than-ever perceptions of OPG's station and used fuel operations and nuclear power in Ontario. OPG's community relations and public information program has been recognized as a strength by national and international utility peers. OPG benchmarks current practices amongst other industries to ensure continuous performance improvement.

In preparation for Pickering end of commercial operations, extensive public and stakeholder engagement activities have also occurred as part of OPG's *Repurposing Pickering* initiative. This includes a series of pop-up information booth sessions at various locations around Pickering and Ajax, a community open house, youth engagement activities and formation of a Technical Advisory Committee.

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### 2.3.7.1 Indigenous Relations

OPG has a board-level Indigenous Relations Policy [R-22] and active community relations program that focuses on:

- Community relations and outreach;
- Capacity building support with communities;
- Employment/business contracting opportunities; and
- OPG staff education

Building positive, community-minded relationships with indigenous communities is important to OPG with respect to current operations and the planning of new projects. OPG recognizes close consultation with community members and leaders is an essential part of the process. OPG continues to engage in active dialogue with indigenous people on a number of issues and operational decisions related to the nuclear operations. Discussions and information sharing are undertaken to build long-term mutually beneficial working relationships with indigenous communities near our nuclear host communities and along our radioactive transportation routes on a regular basis.

Nuclear Waste operations is an important issue for indigenous people. OPG has on-going discussions and information sharing with Williams Treaty First Nations (Alderville First Nation, Chippewas of Georgina Island First Nation, Curve Lake First Nation, Hiawatha First Nation, and Mississaugas of Scugog Island First Nation) and more detailed discussions with Alderville First Nations, Métis Nation of Ontario and Oshawa and Durham Region Métis Councils. During the recent Pickering licence hearing OPG engaged the Métis Nation of Ontario – Toronto/Durham Councils with an information sharing session, community exchange and tours to discuss station and waste operations. This engagement will continue.

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## 2.4 History and Current Status

Construction of PNGS A started in 1966 and PNGS B in 1974. All four PNGS A units were retubed during the Large-Scale Fuel Channel Replacement Program conducted between 1984 and 1992. During the course of the retubing, it was discovered that some reactor systems had become contaminated with carbon-14 produced from nitrogen-14 in the annulus gas. Some of these contaminated and retube components were removed from the reactor and transferred to DSMs. The DSMs were dry loaded with retube components at the reactor auxiliary bay adjacent to Unit 8 of PNGS B, and transported to the RCSF and stored outside since 1985. These DSMs are stored in the RCSF in the southeast corner of the protected area of the PNGS site and form part of the PWMF Phase I.

In 1996, the Stage 1 UFDS (Phase I) became operational to process and store DSCs. Stage 1 consisted of the DSC Processing Building and the attached DSC Storage Building 1 with a capacity to store up to 185 DSCs.

In 2001, Stage 2, DSC Storage Building 2 (Phase I) with a capacity to store up to 469 DSCs was added to the UFDS.

In 2009, DSC Storage Building 3 (Phase II) was taken into operation. DSC Storage Building 3 is currently at capacity with 480 DSCs in storage.

DSCs containing used fuel from the PNGS are currently processed in the UFDS and placed in the storage buildings on a routine basis.

In March 2021, DSC Storage Building 4 was put in service. The DSC Storage Building 4 will have a capacity of 624 DSCs. The plan for a new DSC Processing Building at the Phase II site has been cancelled but there is a plan to upgrade the existing processing building in Phase I to achieve a higher production rate of DSCs.

As of June 2021, a total of 1092 DSCs have successfully been placed into dry storage at the PWMF. In addition, there were 34 DSMs containing Intermediate-Level Waste (ILW) (retube waste) and two empty DSMs being stored at the PWMF.

OPG plans to build two additional storage buildings<sup>3</sup> (DSC Storage Building 5/ 6) with a combined capacity of 1378 DSCs in the 2027 to 2033 timeframe.

<sup>3</sup> Since this financial guarantee period covers 2023 to 2027, only DSC Storage Building 5 (planned in service date 2027) is accounted in the scope. DSC Storage Building 6 (planned in service date 2033) will be included in the next round of financial guarantee update.

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### 3.0 PRELIMINARY DECOMMISSIONING PLAN

#### 3.1 Applicable Legislation, Standards and Regulatory Guidance

Work related to the decommissioning of the PWMF will be performed in accordance with the requirements of applicable legislation and regulations. The following list details some of the current legislation applicable to OPG's decommissioning activities. It is important to note that whilst the list is accurate at the time of writing, it is assumed that a number of items will be updated, amended or replaced at a later time. As a result, it is necessary that the list is carefully reviewed during future revisions of the decommissioning plan. Key legislation and other regulatory controls include:

- Nuclear Safety and Control Act;
- Environmental Protection Act, R.S.O. 1990, c.E.19 (Ontario);
  - R.R.O. 1990, Regulation 347: General – Waste Management
- Ontario Water Resources Act, R.S.O 1990, C. O.40;
- Occupational Health and Safety Act (OHSA), R.S.O. 1990, C. O.1;
- National Pollutants Release Regulations; and
- Impact Assessment Act (IAA)<sup>4</sup>, if applicable.

CSA standards and regulatory documents and guidance that are applicable for decommissioning of the PWMF include:

- CSA N286: Management System Requirements for Nuclear Facilities;
- CSA N292.5: Guideline for the Exemption or Clearance from Regulatory Control of Materials that Contain, or Potentially Contain, Nuclear Substances;
- CSA N294: Decommissioning of Facilities Containing Nuclear Substances;
- CSA N393: Fire Protection for Facilities that Process, Handle, or Store Nuclear Substances;
- Regulatory Guide G-206<sup>5</sup>: Financial Guarantees for the Decommissioning of Licensed Activities;

<sup>4</sup> Canadian Environmental Assessment Act (CEAA) 2012 has now been superseded by the IAA.

<sup>5</sup> REGDOC-3.3.1, Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities was published in January 2021 and supersedes G-206. OPG has communicated the timing for a gap analysis and implementation plan to REGDOC-3.3.1 [R-5].

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- Regulatory Guide G-219<sup>6</sup>: Decommissioning Planning for Licensed Activities;
- Regulatory Document REGDOC 3.2.1: Public Information and Disclosure; and
- Regulatory Document REGDOC-3.2.2: Indigenous Engagement.

OPG will also consider the recommendations and guidance from the IAEA relevant to decommissioning. At this stage, specific IAEA standards and other guidance documents are referenced in this PDP, as applicable, whereas a complete list will be provided closer to the time of preparing for decommissioning.

### 3.2 Planning Assumptions

Planning for the eventual decommissioning of the PWMF is an ongoing process, and planning assumptions can be expected to evolve over time, but as input to this PDP the following assumptions have been made:

1. The PDP scope is limited to the PWMF protected/licensed area. Any contamination found outside of the licensed/protected area is expected to be low and provisions will be made at that time for its remediation.
2. PWMF Phase II has been expanded to include DSC Storage Building 4, which was put in service in March 2021. The plan for a new DSC Processing Building at the Phase II site has been cancelled but there is a plan to upgrade the existing processing building in Phase I to achieve a higher production rate of DSCs.
3. OPG plans to build two additional storage buildings (DSC Storage Buildings 5 and 6) with a combined capacity of 1378 DSCs in the 2027 to 2033 timeframe.
4. All used fuel will be transferred from the PWMF to a long-term used fuel disposal facility (i.e., Adaptive Phase Management (APM)<sup>7</sup>) prior to decommissioning. Operations to remove used fuel from the site for transferral to a long-term used fuel management facility are assumed to start in 2043, facilitating the start of PWMF decommissioning in 2061. OPG intends to have the used fuel removed from the PWMF and transferred to a long-term used fuel management facility by this date. All other dates in this document follow from this date and are shown for financial planning purposes only.
5. Decommissioning waste from the PWMF will be disposed of in a long-term disposal facility for Low Level Waste (LLW). The disposal facility is currently assumed to be available prior to the start of dismantling and demolition activities.

<sup>6</sup> REGDOC-2.11.2, Decommissioning, was published in January 2021 and supersedes G-219. OPG has communicated the timing for a gap analysis and implementation plan to REGDOC-2.11.2 in [R-5].

<sup>7</sup> On June 14, 2007, the Government of Canada selected APM as the best plan for Canada for safeguarding the public and the environment over the very long time in which used nuclear fuel must be managed [R-24].

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6. Low-level decommissioning waste will be packaged in containers similar to B-25 containers due to the higher payload capacity. Intermediate-level decommissioning waste will be placed in modular shielded containers with all metal shielding.
7. Contaminated concrete will be packaged and shipped to a licensed long-term waste management facility. Remaining concrete that meets the free-release criteria will be crushed, graded and used on-site as back fill.
8. Hazardous wastes that do not form part of the PWMF's structures, systems or components will be removed prior to dismantling and demolition and are therefore not included as part of the decommissioning activities.
9. Non-radioactive hazardous waste will be disposed of at approved disposal facilities. Mixed waste (i.e., radioactive waste that also is hazardous), if any, will also be disposed of in an appropriate licensed facility.
10. The stored retube components will be retrieved from the DSMs and repackaged prior to decommissioning the PWMF. The repackaged retube components will be transferred to the ILW long-term disposal facility, facilitating the start of decommissioning of the associated RCSF in 2061. The timing of this activity is aligned with the decommissioning of PNGS, so that the retube components can be transferred along with other decommissioning waste from PNGS to the LLW and ILW long-term disposal facilities. The empty DSMs will remain at site and will be decommissioned as part of PWMF decommissioning.
11. Removal of DSCs from the PWMF and removal of retube components from the DSMs is outside the scope of the decommissioning of the PWMF. These activities are planned and funded by separate means. The empty DSCs are considered operational waste and are not included in the cost estimate in this PDP.
12. A Decommissioning Operations Contractor (DOC) – a company or consortium – will perform all work during the dismantling, demolition and site restoration period and will bring in the required power supply to carry out the work. OPG will provide the necessary oversight during this time period.
13. "Clearance Levels" will be developed based on CSA Standard N292.5 along with the Nuclear Substances and Radiation Devices Regulations and OPGN Governance [R-25] to determine clearance levels acceptable to CNSC prior to dismantling and demolition. These will permit segregation of the decommissioning wastes into those requiring long-term management and those that can be recycled, left on site or disposed of as conventional waste.
14. Above-ground structures within the protected area will be demolished. The structures will be surveyed for contamination and decontaminated, if required. Contaminated concrete surfaces will be decontaminated via scabbling, vacu-blasting or other surface decontamination techniques. Where contamination is found in the bulk material, chipping or cutting techniques will be used. Resultant contaminated materials will be shipped to a long-term disposal facility for LLW. Future use of the site has not been

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defined. As such, demolition, not reuse of buildings or facilities, is considered in the decommissioning cost in this PDP.

15. Sub-surface structures will be surveyed for contamination, decontaminated if required and dismantled to a nominal depth of 1 m below grade, backfilled with concrete rubble and/or soil and graded over.
16. Underground piping and utility lines will be de-energized, capped and abandoned in-place if demonstrated as free from contamination.
17. At-grade foundation slabs exceeding 1 m in thickness will be abandoned in place and covered over with a 1 m thick layer of backfill.
18. No salvage credit is assigned to equipment and components removed during decommissioning and such equipment is considered waste for costing purposes. However, recycling of clean materials will be pursued.
19. OPG will retain ownership of the PWMF site areas throughout the course of the decommissioning.
20. The site will be made available for other OPG uses after completion of decommissioning as a brownfield<sup>8</sup> (industrial).
21. Any new land uses implemented on the Pickering Nuclear site prior to completion of decommissioning (as part of the Repurposing Pickering initiative or otherwise) will have no impact on decommissioning.
22. No radiologically contaminated soil that requires remediation exists within the licensed/protected area of the PWMF.

Many of the above assumptions are based on the required used fuel and waste repositories becoming available prior to the shutdown of the PWMF. In the event that consensus and subsequent commissioning of these repositories do not occur within these timescales, there are numerous potential consequences that should be considered. For example:

- The structural integrity of existing structures may not be guaranteed for an extended (unknown) period. If wastes are not disposed of within the timeframes specified within the design intent, degradation of storage containers and other structures may occur. Contingency strategies will need to be considered, such as increased inspection, surveillance, and maintenance to safely extend the design life of containers/structures or alternative disposal options.
- Alternatively, external pressures (e.g., from unexpected environmental changes or pressure from the government or public) may result in it becoming necessary to remove the wastes

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<sup>8</sup> As per nuclear industry practice, a brownfield is defined as a former industrial land that has the potential to be developed for new industrial uses.

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ahead of schedule. If adequate facilities are not in place, significant cost implications may be incurred.

It is therefore envisaged that, in future revisions of this PDP, strategies for managing such scenarios are developed, taking into account unexpected changes in the availability of a long-term disposal repository (or other resources).

OPG maintains a systematic care, maintenance, monitoring and inspection program, and implements the surveillance and Integrated Aging Management Program activities at PWMF. These activities will be continued to ensure that the PWMF remains in a safe, sustainable, and secure state until such time that the facility reaches the currently planned final decommissioning end-state site suitable for other industrial and commercial use.

### 3.3 Scope of the Preliminary Decommissioning Plan

This plan describes the decommissioning of the PWMF, comprising the following:

- The existing Phase I DSC Processing Building;
- The existing DSC Storage Buildings 1, 2 and 3, as well as DSC Storage Building 4;
- The planned DSC Storage Buildings 5 and 6;
- Site areas associated with the UFDS; and
- The RCSF and empty DSMs, after their contents have been removed and repackaged for disposal. Note: the removal, packaging and disposal of the DSMs' contents are covered in [R-26].

The PWMF is an operating facility that may be expanded to support OPG's future radioactive waste storage requirements. This plan describes the decommissioning of the PWMF (Phase I and II) as it exists at the end of March 2021, while taking into account any planned expansions up to and including 2027 (that is, until the end of this financial guarantee period).

This plan does not cover the decommissioning of PNGS or any buildings associated with the operation of the station.

This plan will be subject to periodic review to ensure that any future changes in the facility or scope of decommissioning are incorporated. This would include:

- Changes in site conditions, including climate;
- Changes to the proposed decommissioning objectives or strategy;
- Advances in decommissioning technology;
- Modifications to the facility;
- Updated schedule, cost and funding information;

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- Operational experience and lessons learned;
- Revised regulatory requirements;
- Revised records requirements; and
- Availability of long-term disposal facilities for used fuel and waste.

### 3.4 Objective of the Decommissioning

The objective of decommissioning is to permanently retire the PWMF from service in a manner that ensures that the health, safety, and security of workers, the public, and the environment are protected. Decommissioning involves removing any residual radioactive and other hazardous materials from the site and restoring the site to an agreed end state to remove the site from regulatory control. After decommissioning, OPG will retain ownership of the property and the site will then be available for other OPG uses.

### 3.5 Decommissioning Strategy

OPG has chosen a “Prompt Dismantling” strategy for decommissioning the PWMF. This strategy is consistent with international practice for similar waste management facilities. In general, after their operational life, waste management facilities are decommissioned as soon as is reasonably practical.

OPG’s decommissioning strategy for the PWMF is based on the assumption that used fuel and retube waste will be removed from the site (prior to execution of decommissioning) to their respective long-term waste management facilities as they become available (i.e., used fuel will be moved to the APM facility, and retube waste will be moved to a long-term disposal facility for ILW). Since little to no residual radioactivity is expected to be present at the PWMF after all the operational waste is removed, OPG does not currently anticipate the need for any deferral of decommissioning.

However, in order to take advantage of economies of scale, decommissioning of the PWMF is assumed to take place concurrent with PNGS decommissioning. The decommissioning work at the PWMF will continue until the site is in a condition that meets the criteria for the CNSC to remove the site from regulatory control. The contaminated material from decommissioning activities will be packaged in accordance with CNSC regulations, and is assumed to be disposed of in a long-term disposal facility for LLW.

An alternative decommissioning strategy (i.e., in-situ decommissioning) was considered but deemed to not be a reasonable decommissioning option for planned decommissioning of PWMF as removal is possible and practicable.

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### 3.6 Predicted Characteristics at Decommissioning

At the time of decommissioning, the PWMF will consist of:

- Phase I: DSC Processing Building, two DSC Storage Buildings, as well as the RCSF; and
- Phase II: up to four additional DSC Storage Buildings, all within the Pickering Nuclear site.

This section summarizes the expected radiological conditions of the PWMF buildings and site areas requiring decommissioning, as well as other hazards that may require consideration during decommissioning activities.

#### 3.6.1 Dry Storage Container Processing Buildings

No significant radiological or chemical hazards are expected to be present in the DSC Processing Building at the time of decommissioning. This is because any radioactive materials held or hazardous materials used within this building (including compressed gas, paint, helium and cleaning supplies) as part of normal operations will have been removed prior to this phase. General hazards that could be encountered during decommissioning include conventional hazards that would be associated with any structural demolition project.

The processing building has an active ventilation system due to the potential for low levels of contamination resulting from DSC processing activities. If contamination is present, it will be detectable by practical survey methodologies similar to those used to monitor for contamination during routine operations and disposed of appropriately.

Due to the nature of operations in the processing building, a variety of consumables are utilized, some of which are classified as hazardous materials (see Appendix B); these are assumed to be consumed or removed prior to start of decommissioning activities. There will be no laboratory or bulk chemical store in the building.

#### 3.6.2 Dry Storage Container Storage Buildings

No radiological or chemical hazards are expected to be present in the DSC Storage Buildings at the time of decommissioning.

The DSCs are designed to provide a storage life of at least 50 years, and to meet the shielding and containment requirements over this period.

The DSCs containing the used fuel are completely sealed and leak tested prior to transfer to the DSC Storage Buildings. In addition, periodic inspections are undertaken to check for signs of degradation such as corrosion or paint deterioration. If such damage is observed, the affected area is cleaned and repaired and/or recoated as required. An 'aging management' strategy that assesses the end-of-life for the DSCs and subsequently identifies an appropriate management strategy to maintain its integrity is also in place. These provisions significantly minimize any possibility of radiological contamination in the DSC Storage Buildings. Hence, the DSC Storage Buildings are not expected to become contaminated through PWMF operations. No hazardous wastes will be stored in the DSC Storage Buildings. General hazards that could be encountered

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during decommissioning include conventional hazards similar to those associated with any industrial structural demolition project.

No hazardous materials have been or will be used in the construction of the DSC Storage Buildings and no hazardous materials will be stored in these structures at the time of decommissioning.

### 3.6.3 Dry Storage Modules

The DSMs are designed to maintain shielding and containment of retube components in all weather conditions for a period of at least 50 years. The irradiated components stored in the DSMs consist of pressure tubes, the inboard section of the end fittings, garter springs, shield plugs and other components from the retubing of PNGS Units 1-4. The radionuclide inventory of the DSM contents is provided in [R-6].

During the decommissioning of PNGS, the DSMs are planned to be transferred to the PNGS central waste processing area where the retube components will be removed from the DSMs and packaged accordingly. Some residual contaminants (e.g., C-14) may remain on the internal surfaces of the empty DSMs, as a result of contact with the retube components during the removal and repackaging of the DSM contents. The external DSM surfaces are not anticipated to be contaminated.

Practical survey methodologies similar to those currently used to monitor the RCSF for contamination during routine operations will be continued. For example, runoff water from the DSM storage area is currently diverted to the PNGS B outfall. Catch basins are placed along the way allowing the routine sampling of the water. These measures will significantly reduce the possibility of radiological contamination being present within the RSC site areas at the time of decommissioning.

### 3.6.4 Pickering Waste Management Facility Site Areas

The PWMF Phase I site is not expected to become contaminated through UFDS operations or the storage of DSMs. The RCSF area is paved, and there is a controlled pathway for runoff via the drainage system. No contamination of the subsurface water is expected. This has been confirmed by measurements [R-8].

The site area associated with PWMF Phase II (the DSC Storage Buildings 3 and 4 and proposed Storage Buildings 5 and 6) is protected by a separate security fence outside the security perimeter of the PNGS site, but within the security protected area of the overall Pickering Nuclear site. The DSC and transporter are monitored prior to leaving for loose contamination (using handheld survey meters that detect and identify sources of radiation) prior to leaving the PNGS East Gate for processing at the DSC processing facility and transport to DSC storage buildings. Therefore, no contamination is expected on the site area associated with Phase II.

In summary, no radiological or chemical hazards are expected to be present outdoors within the PWMF site areas at the time of decommissioning. General hazards that could be encountered during decommissioning include conventional hazards that would be associated with removal of fencing and the excavation and removal of yard surfaces and demolition of the buildings.

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### 3.7 Canadian and International Decommissioning Strategies and Experience

There is a growing body of experience related to the decommissioning of nuclear facilities in Canada, the United States and overseas. Much of the international experience noted in the PNGS PDP [R-7] relates to decommissioning facilities that are far more complex and that present greater hazards than the PWMF. Therefore, the Canadian experience included in this section is more relevant to decommissioning of the PWMF.

OPG has successful decommissioning experience at both the Bruce Heavy Water Plant (BHWP) and the Spent Solvent Treatment Facility (SSTF), which are both located on the Bruce Nuclear site.

The BHWP was in continuous operation from April 1973 until March 1998, for the purpose of producing reactor-grade heavy water [R-27]. After it was no longer in operation, the BHWP decommissioning project was carried out in accordance with a DDP, remediation and an environmental assessment and follow-up program. Demolition began in October 2004 and was completed in 2006. The buildings were demolished using standard demolition techniques. The debris was removed from the site for recycling or disposal. Bioremediation of oil-contaminated soil in the effluent lagoons was required and began in 2006. It involved removing the contaminated soil and placing it in cells in a biopile based on the level of contamination in the soil. Aerobic enhancers and local chicken manure were added to the biopile to promote the growth of the native bacteria that were already digesting the oils. This process continued until November 2009. About 25% of the soil was bioremediated to below the end-state criteria, and was used as clean backfill in the immediate area. Any soil that did not meet the end state criteria was disposed of off-site at a licensed facility. The radiological end state was that no nuclear substances would remain within the BHWP facility boundaries and the remaining structures, equipment and grounds were free of significant radiological contamination. In order to demonstrate that this end state criterion was met, a final radiological survey was performed in 2012 using the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) methodology [R-28]. This survey found no radioactive contamination on the BHWP site [R-29][R-30] and a licence to abandon the facility was granted by the CNSC in 2014 [R-31].

From May to December 2018, OPG completed decontamination of all radiologically contaminated piping in the SSTF. As decontamination progressed, each room or section was systematically surveyed and sampled for radiation in accordance with the MARSSIM methodology. A Site Survey and Characterization report was prepared and approved by OPG in March 2019. This report concluded that radioactivity levels in the SSTF were below the site unconditional release criteria. The demolition of the above ground structure occurred in November 2019 and the underground infrastructure were removed in February 2020. In June 2020, the site was graded and final remediation was completed. The CNSC also concluded that OPG satisfactorily demonstrated that the SSTF was free of any contamination above the regulatory limits [R-32][R-33][R-34]. This resulted in CNSC acceptance of OPG's request to remove the SSTF from licensing control [R-35][R-34].

Some other domestic experience, including work performed at the Tunney's Pasture Isotope Processing Facility, the Whiteshell Laboratories, the Chalk River Laboratories, Bruce Heavy Water Plant [R-36] and Defense Research Establishment Suffield [R-37], is directly relevant to this plan and the experience gained during the course of this work has been considered in the development of this plan. The experience gained during the decommissioning of some other

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small nuclear facilities in Canada, including research reactors, fuel fabrication plants and research laboratories, has also been considered, as have reports of decommissioning work performed in other countries and guidance from international agencies, such as the IAEA [R-38] and the Nuclear Energy Agency within the Organisation for Economic Co-operation and Development.

This experience indicates that the strategy adopted for the decommissioning of the PWMF is technologically feasible and that the work can be completed in a manner that protects the health, safety and security of workers, the public and the environment.

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#### 4.0 DESCRIPTION OF PLANNED DECOMMISSIONING ACTIVITIES

Decommissioning of the PWMF will commence after the retube components, used fuel and hazardous materials have been removed from the facility and all necessary licences, permits and approvals have been obtained. Removal of radioactive material prior to decommissioning will avoid the need for additional safeguards to be in place for decommissioning operations. A DDP will be submitted and, subsequent to and in accordance with regulatory approvals, decommissioning activities are expected to begin following removal of the used fuel and retube components, and the receipt of a licence to perform decommissioning activities.

The major project milestones for decommissioning the PWMF are shown in Table 4-1. It is estimated that three years will be required to prepare for decommissioning of the PWMF, with a 2-year delay period (2059 and 2060) while the waste facility is shut down, before dismantling starts. Physical decommissioning activities are assumed to begin in 2061 and will take approximately one year to complete. After that, a CNSC review period of one year is assumed. It is estimated that the site will be removed from regulatory control in 2063.

**Table 4-1: Pickering Waste Management Facility Decommissioning – Project Milestones<sup>9</sup>**

Event*	Year
Begin preparation for decommissioning of PWMF	2058
PWMF shutdown (after all retube components and used fuel removed from PWMF)	2058
Begin decommissioning	2061
End of decommissioning and site restoration	2063
Removal from regulatory control	2063

\*For financial planning purposes only, any modifications associated with end of life of PNGS and in-service date of long-term disposal facilities may impact these dates.

<sup>9</sup> The decommissioning timeline provided in this PDP is based on the most recent OPG planning assumptions.

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## 4.1 Decommissioning Phases

The decommissioning work is divided into four main phases in accordance with CSA N294:19 [R-4]:

- Planning for Decommissioning;
- Preparation for Decommissioning;
- Execution of Decommissioning; and
- Completion of Decommissioning.

OPG is responsible for planning, including development of all required documents throughout the life cycle of decommissioning, executing and funding all phases of decommissioning.

The key requirements of this standard are summarized in the following subsections. These key stages will be more closely reviewed within the DDP.

### 4.1.1 Planning for Decommissioning

According to CSA N294:19, planning for decommissioning begins at the siting/design phase (or as early as possible) and continues throughout the lifecycle of the facility. A decommissioning strategy and a PDP are developed in this phase. The PWMF is currently considered to be in 'Phase 1 – Planning for Decommissioning', per CSA N294:19 [R-4].

Aspects that have been or will be considered as part of this phase include but are not limited to:

- Determine the regulatory and licensing requirements.
- Develop and review the decommissioning strategy, including assessment of optimal techniques and technologies. Planning considerations such as regulatory requirements, stakeholder input, potential environmental impacts, safety and availability of a final waste disposal facility will be considered in the development of a decommissioning strategy<sup>10</sup>.
- Develop and regularly review and update the PDP.
- Develop and maintain a record management system to ensure that all sources of information that affect decommissioning can be readily identified and retrieved.
- Review the history of the facility (operational and maintenance records) and assess how it could affect decommissioning.

<sup>10</sup> CSA N294:19 Clause 6.1.3 [R-4] lists the items to be considered when determining appropriate decommissioning strategy. This list is considered when selecting the appropriate decommissioning strategy for each site.

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#### 4.1.2 Preparation for Decommissioning

According to CSA N294:19, this phase begins with the regulators being informed of the intent to cease operations and prepare for decommissioning. This phase normally includes the further development of the PDP into a DDP and securing the necessary regulatory approvals, as required. Key activities within this phase of work include, but are not limited to:

- Notify regulator of intent to permanently shut down the facility.
- Review and update (if required) the decommissioning strategy.
- Obtain the necessary regulatory approvals/acceptance; see Section 4.1.2.1 for further details.
- Place the facility in a safe shutdown state, including removal of used fuel, retube components and hazardous materials. See Sections 4.1.2.2, 4.1.2.3 and 4.1.2.4 respectively for further details.
- Review the history of the facility (operational and maintenance records) and assess how it could affect decommissioning.
- Assess the state of the facility after shutdown.
- Perform a safety assessment (i.e., what operations could pose a significant hazard to operators, members of the public and the environment).
- Perform an impact assessment or environmental review, if required (see Section 7.0).
- Develop the DDP; see Section 4.1.2.5 for further details.
- Further develop a waste management plan.
- Refine public and stakeholder engagement program (see Section 12.0), if required.

##### 4.1.2.1 Regulatory Approvals

When OPG has made the decision to decommission the PWMF, it will notify the CNSC of the intention to decommission. OPG staff will prepare an application for a licence to perform decommissioning activities that contains the information required by the Class I Nuclear Facilities Regulations, along with such other information as may be appropriate. The DDP will form part of the application for the licence to perform decommissioning activities, as well as the plans and protocols for radiological monitoring. After obtaining CNSC acceptance of the decommissioning plans, OPG will obtain a licence to perform decommissioning activities for the

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PWMF, as required by the Class I Nuclear Facility Regulations, before any decommissioning work begins.

In addition, OPG and/or the DOC will obtain all of the other required permits and licences from federal, provincial and municipal agencies before starting any decommissioning work. A list of the required permits and licences will be included in the DDP.

#### **4.1.2.2 Removal of Used Fuel**

PWMF decommissioning will commence only after the removal of all used fuel from the facility. For planning purposes, transfer of used fuel to a long-term used fuel disposal facility (i.e., APM) is assumed to be completed by the end of 2058 and is not considered to be part of the decommissioning activities of the PWMF.

#### **4.1.2.3 Removal of Retube Components**

Prior to the decommissioning of the PWMF, it is assumed that the loaded DSMs will be taken, one at a time, to the PNGS decommissioning central waste processing area and the contents repackaged in licensed transportation containers. For planning purposes, transfer of retube components from the PWMF is assumed to be completed by the end of 2058

Special arrangements to control contamination and handle repackaging will be made as necessary. The new transportation containers will then be transported off-site together with decommissioning ILW from PNGS. Repackaging and transportation of the DSM contents will be undertaken as a separate project and is not considered part of the decommissioning activities of the PWMF.

#### **4.1.2.4 Removal of Hazardous Materials**

Hazardous waste that is not part of PWMF systems, structures or components will be removed prior to decommissioning (see planning assumptions in Section 3.2). Section 4.1.3.5 details the waste management steps that may be taken if conditions at the time so require.

It is expected that remaining inventories of non-radioactive hazardous materials, such as, but not limited to, small quantities of unused paint supplies and remaining chemical waste, will be disposed of in accordance with the applicable Ministry of Environment and Climate Change regulatory requirements in force at the time.

#### **4.1.2.5 Detailed Decommissioning Plan**

The DDP will be prepared when the decision is made to permanently shutdown the facility (i.e., cease the operations). The DDP will describe the actions required to permanently retire the facility from operation in a manner that ensures the health, safety, and security of workers, the public, and the environment. It will present a complete description of the work that will be performed and establish the clearance levels that will be used to determine if materials are suitable for uncontrolled release from the site, and if the site itself is suitable for release from further regulatory control. The content of the DDP will follow the regulatory requirements at the time of decommissioning. Currently, the content requirements for the DDP are contained in N294:19 [R-4].

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The DDP will be developed in accordance with the principles of the waste management hierarchy (Figure 4-1), whereby decommissioning techniques that minimize waste generation as far as possible are favoured. Where this is not possible, items requiring disposal will be volume-reduced (to optimize the loading capacity of the disposal space) prior to consignment to a conventional waste disposal facility for clean waste and a long-term disposal facility for LLW respectively.

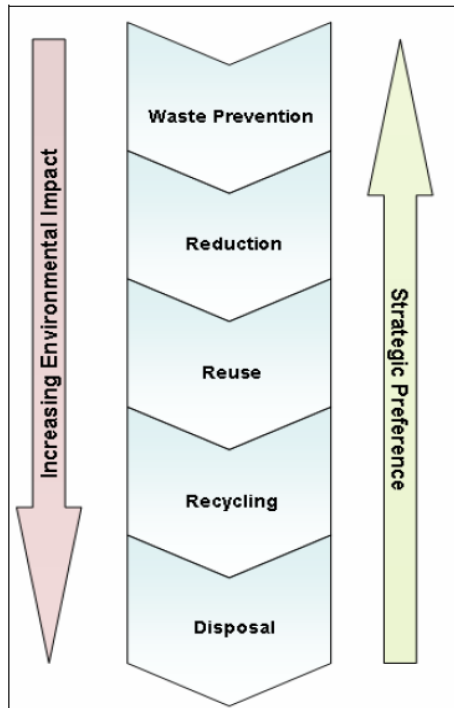


Figure 4-1: Summary of the Key Principles of the Waste Management Hierarchy

The DDP will describe the 'Decommissioning Planning Envelopes', which will be integrated with an overall plan to ensure the work is done efficiently, with safety being the top priority. The Decommissioning Planning Envelopes will include:

- The DSC Processing Building;
- The DSC Storage Buildings;
- The DSMs; and
- The PWF site areas (including the RCSF).

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Key activities that will be considered within the DDP for each envelope includes (but not limited to):

- Post-operational surveys (after used fuel, retube waste and hazardous materials have been removed);
- Site planning;
- Review of the operational history, including incidents or accidents that could affect decommissioning;
- Identification of the final radiological, physical and chemical end-state objectives;
- Decontamination of systems and structures;
- Review and update the applicable decommissioning strategy;
- Dismantling of systems, structures and DSMs;
- Identification of potential environmental effects and mitigation measures;
- Update the decommissioning cost estimates and any financial guarantee arrangements;
- Identification of the applicable programs (e.g., human and organizational factors, quality assurance, emergency response, etc.);
- Undertake public consultations;
- Post-decommissioning surveys; and
- Further develop a waste management plan.

Some of these activities may occur simultaneously. For example, surveys for any residual radiological and hazardous materials will be carried out prior to and throughout dismantling work.

#### 4.1.3 Execution of Decommissioning

According to CSA N294:19, this phase of work will begin with the implementation of the decommissioning plan after all necessary regulatory approvals have been obtained. The activities under this phase include the execution of the physical works (i.e., decontamination and dismantling of the facility).

The activities listed below can be performed with currently available technology, but the required procedures to complete the tasks will depend on the technology available at the time of

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decommissioning. The activities to be performed (but not limited to), may not be performed in the order listed, but can be divided into a series of conceptual stages:

- Post-operational surveys; see Section 4.1.3.1 for further details;
- Preparation and mobilization; see Section 4.1.3.2 for further details;
- Decontamination and dismantling of systems and structures; see Section 4.1.3.3 for further details;
- Site restoration; see Section 4.1.3.4 for further details;
- Waste management; see Section 4.1.3.5 for further details; and
- Surveys of decommissioning planning envelopes; see Section 4.1.3.6 for further details.

Decontamination, dismantling and waste management phases may occur simultaneously. Surveys for radioactive and other hazardous materials will be performed throughout the dismantling work, culminating in a final survey.

#### 4.1.3.1 Post-Operational Surveys

Surveys will be performed at the end of storage operations to identify and characterize any residual radioactive contamination of the DSMs, the DSC Processing Building, the DSC Storage Buildings and sites.

#### 4.1.3.2 Preparation and Mobilization

The initial phase of the project is intended to prepare the sites for subsequent decommissioning and dismantling work. Detailed procedures for the dismantling operations will be prepared to meet As Low As Reasonably Achievable (ALARA) guidelines for the protection of personnel and address the continued protection of health and safety of the public and the environment. The dismantling operations include decontamination, removal of residual radioactive materials and demolition of systems and structures.

The following activities are to be completed in this phase:

- Selecting a DOC to assume responsibility for decommissioning the PWMF.
- Performing a hazardous materials survey to confirm the location and identity of any hazardous materials that are stored on the site.
- Developing procedures for occupational exposure control, emergency programs, industrial safety, control and release of liquid and gaseous effluent, and processing of radioactive waste, including filter media, metallic and non-metallic components generated in dismantling.
- Cleaning all facility areas of loose contamination, and removing and processing liquid and solid wastes.

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- Disposing of any remaining furniture, cleaning products, paints and other hazardous materials that will not be required during the decommissioning.
- Preparing any required site support storage areas.
- Installing or restoring any site services (electric power, domestic and service water, sewage, active and inactive drainage, fire protection, etc.) that will be required during the dismantling work.
- Disconnecting and isolating the remaining site services, such as electric power, service water and sanitary services that are not required during dismantling.
- Staff will be provided with the required training.

#### 4.1.3.3 Decontamination and Dismantling of Systems and Structures

This phase involves the removal of all contaminated equipment and components from the PWMF, and the decontamination or removal of all concrete and metal. The decontamination and dismantling of the systems and structures will be performed by the DOC and they will provide the required power supply to carry out the work. The decontamination and dismantling must be undertaken using safe and effective methods that will be determined during the development of the DDP.

Some residual contaminants may remain on the internal surfaces of the empty DSMs as a result of contact with the retube components that were stored in them. These contaminants will be contained within the sealed DSMs. The external DSM surfaces are not anticipated to be contaminated, and no contamination of the subsurface water is expected. This has been confirmed by measurements [R-8] and, as such, it can be assumed that the RCSF surface area will be clean.

Little radioactive contamination is expected at the dry storage processing and storage areas. Components such as active ventilation filters and DSC vent hoses may show some contamination. However, these items are replaceable and would be disposed of prior to decommissioning. As the facility ages, the nature and extent of any radiological contamination will be monitored. If it is found to be significant, this will be included in future revisions of the PDP.

For planning purposes, it is conservatively assumed that the active ventilation system is contaminated and that, during operation, some contamination on the floors of the DSC Processing Building and DSC Storage Buildings has occurred. Depending on the effectiveness of decontamination techniques employed and the level of contamination found, the ventilation system will be carefully dismantled and may be sent for disposal as LLW.

In the event that contamination is found, a number of decontamination techniques will be employed as appropriate. Examples include, but are not limited to:

- Vacuuming of loose material;
- Chemical decontamination; and

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- Physical decontamination (e.g., scabbling, vacuum blasting).

On completion of decontamination activities, an endpoint radiological survey must be carried out in accordance with regulatory requirements, so that it can be determined with a high level of confidence that any residual contamination within the facility falls below the approved release criteria.

All decontamination and dismantling work performed will be in accordance with OPG's Radiation Protection Program [R-39].

#### Dry Storage Modules

The empty DSMs will be decontaminated and surveyed at the PNGS central waste processing area. Decontamination wastes from the DSMs are assumed to be LLW and will be segregated and packaged in accordance with CNSC regulations in place at the time of generation. The packaged wastes will then be transported to the LLW long-term disposal facility. After decontamination, the empty DSMs will be sectioned or reduced to their constituent materials for disposal as non-radioactive waste, or recycled as scrap.

#### Dry Storage Container Processing Building

All equipment, furniture and supplies in radiologically zoned areas will be surveyed and decontaminated as necessary prior to clearance for non-radiological use, recycle, or disposal. The active ventilation system will be dismantled and, depending on the feasibility of decontamination, will be consigned (as LLW) to the LLW long-term disposal facility along with other LLW generated.

In the event that some concrete cannot be decontaminated to desired levels, the affected material will be packaged and shipped to LLW long-term disposal facility. Remaining concrete that meets the release criteria will be crushed and graded, and used on-site as back fill.

Interior structural surfaces will be surveyed to identify areas requiring decontamination. The characterization survey will determine the nature and extent of contamination, for the purposes of hazard assessment as well as to facilitate and control decontamination work.

Decontamination activities may involve the following steps:

- Remove contaminated equipment and material from the DSC Processing Building;
- Remove contaminated concrete from surfaces and route for controlled disposition; and
- Remove, pack and dispose of contaminated piping, ducts and components in the facility systems.

On completion of decontamination work, a final clearance survey will be carried out. Non-radiologically zoned office space will be appropriately surveyed prior to clearance. If contamination is found in office areas, decontamination, followed by a clearance survey, will also be carried out.

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While there is no reason to expect particulate contamination to be released from the High Efficiency Particulate Air (HEPA)-filtered active ventilation system, a confirmatory survey of roof surfaces as appropriate will be carried out prior to radiological clearance of the DSC Processing Building. Drain openings will be surveyed and decontaminated if necessary and the drainage system will be removed.

When the structures have been verified to meet clearance levels, they will be released for demolition. The buildings will then be demolished using conventional demolition techniques. Concrete foundations and exterior walls are assumed to be removed up to the 'nominal removal depth' of 1 m below grade wherever possible. This allows for the placement of gravel for drainage and topsoil so that vegetation can be established for erosion control. Clean demolition material will be crushed, graded and reused on site (in accordance with the waste management hierarchy) as infill.

Dry Storage Container Storage Buildings

The DSC Storage Buildings are expected to be free from radiological contamination. However, when decontamination or dismantling of structural components takes place, a radiological survey will be carried out to identify the presence of any detectable contamination in each building. Since the buildings are unlikely to be contaminated, this initial characterization survey should be designed to meet the full requirements of a final clearance survey.

Spot decontamination, followed by a final survey of potentially affected areas, will be carried out. When the structures have been verified to meet clearance levels, and with CNSC approval, they will be released for demolition. Concrete foundations and exterior walls are assumed to be removed to a 'nominal removal depth' of 1 m below grade wherever possible. This allows for the placement of gravel for drainage and topsoil so that vegetation can be established for erosion control.

Based on the identified requirements and needs for dismantling, appropriate subcontractors will be identified and selected to support the various phase and project deliverables.

**4.1.3.4 Site Restoration**

Once all the buildings have been demolished, the protective fences and any remaining site structures will be dismantled. It is unlikely that contamination will be present on outdoor surfaces (i.e., on asphalt or concrete yard surfaces). Nevertheless, a final clearance survey will be carried out across the site surfaces to confirm that the site is within the clearance limits derived in the DDP. Concrete rubble and clean fill produced by demolition activities will be used on-site to backfill voids. Areas affected by the dismantling activities will be cleaned and the site will be graded and seeded, consistent with future usage plans to be set out in the DDP.

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### Contaminated Land Management

Although current evidence suggests that the land in and around the PWMF site should be free from contamination with radioactive or hazardous materials, a remedial action plan will be developed or at least considered. This can be developed and deployed as necessary in the event that unexpected levels of contamination are identified during land surveys carried out through the decommissioning process. A report has been compiled [R-40] reviewing potentially suitable land remediation techniques and technologies (both novel and industry standard approaches) that may be suitable for use at the PWMF site.

#### 4.1.3.5 Waste Management

Any contaminated materials removed during the dismantling operation will be routed for on-site processing, where they will be characterized and then packaged for ultimate disposal at a long-term disposal facility for LLW. The estimated size and weight will meet the waste acceptance criteria of the long-term disposal facilities.

Material found to be below the established 'clearance levels' for radioactive material will be released for recycling or disposal in accordance with the waste management hierarchy (see Figure 4-1). Clearance Levels will be developed based on CSA Standard N292.5-11 along with the Nuclear Substances and Radiation Devices Regulations and OPGN Governance [R-25] to determine clearance levels acceptable to CNSC prior to dismantling and demolition.

From the very start of the decommissioning process, techniques and technologies that prevent wastes being produced in the first instance will be utilized. Where the production of waste cannot be prevented, management techniques that minimize the quantity, volume or activity of waste requiring disposal will be favoured over options that require direct disposal. For example, materials will be reused or recycled wherever practicable (potentially following a pre-treatment stage, e.g., decontamination). If materials cannot feasibly be reused or recycled, treatment options that minimize the volume of waste to be disposed will be employed. Potentially viable options to achieve this include incineration, high-force compaction, in-drum compaction and shearing/shredding.

The sorting and segregation of wastes according to their physical, radiological and chemical properties will increase the effectiveness of this approach. Potentially contaminated material removed during the dismantling operation will be routed to an on-site processing facility, where they will be characterized, sorted, segregated and packed for disposal or alternative treatment at an appropriately licensed facility. All radioactive waste generated during decommissioning will be characterized as per CSA N292 series of Standards.

Where wastes have been cleared from further regulatory control, an alternative route (e.g., to a non-nuclear landfill site) will be defined. These routes will be identified during the development of the DDP.

Any hazardous material will be disposed of at a licensed hazardous waste storage or disposal facility.

All processing and packaging of decommissioning waste will be performed on site by the DOC and not by OPG.

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During the development of the DDP, a Waste Management Plan will be developed. This will provide more details on the proposed approach to waste management and will include:

1. Descriptions of procedures, equipment and criteria to be used to characterize, handle and segregate the waste streams;
2. Details of waste volume estimates for each category;
3. Specific plans for waste minimization, including reuse, recycling or disposal;
4. Options for volume reduction (such as supercompaction, shredding, incineration, etc.);
5. Clearance levels for decontaminated or otherwise clean items;
6. Long-term waste management strategy;
7. Cost-benefit analyses of the options available; and
8. Review of transportation requirements and waste receiver's acceptance criteria.

Radioactive Waste Management

OPG had planned to dispose of Low- and Intermediate-Level Waste (L&ILW) from its owned generating stations in a DGR at the Bruce Nuclear Site. Early in 2020, the L&ILW DGR Project was cancelled. OPG is exploring options and remains committed to permanent and safe disposal of its operational waste as well as future decommissioning waste.

OPG is also participating in Natural Resources Canada's work in public engagement on the existing Radioactive Waste Policy to ensure OPG is meeting international best practices. The Nuclear Waste Management Organization was asked to lead a dialogue to develop an integrated strategy for Canada's radioactive waste through close collaboration among waste owners and producers (including OPG), indigenous people and other interested Canadians. Any progress in regard to the policy and integrated strategy will be taken into consideration in OPG's decommissioning waste disposal strategy.

The majority of radioactivity from the facility in the form of used fuel and retube components will be transferred to a long-term used fuel management facility (i.e., APM) and a long-term disposal facility for ILW respectively, before decommissioning work commences. The disposal ready (steel – concrete – steel) containers developed for the retube wastes are not licensed for the offsite transport of wastes to the long-term disposal facilities. Therefore, these wastes will be repackaged within suitable transport containers. The refurbishment waste contained within the DSMs will be handled (i.e., packaged, transported and disposed) together with PNGS decommissioning waste.

The radioactivity expected to remain in the facility is LLW generated during the decontamination of the DSMs and the DSC Processing and Storage Buildings. It is expected that the LLW produced will be divided into three main categories: 'incinerable', 'compactable' and 'non-processible'. Volumes of non-processible waste will be kept as low as possible. There is potential for wastes identified as being 'non-processible' to be decontaminated, re-

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characterized and reclassified, optimizing the use of existing or future waste management techniques. All LLW will be packaged and transferred for disposal to the LLW long-term disposal facility.

The volume and characteristics of radioactive waste generated from the decommissioning will be estimated at the detailed decommissioning planning stage, when sufficient history of the facility conditions has been recorded, and further information is available. A preliminary estimate of the volume of LLW that will be generated during the decommissioning of the PWMF is shown in Table 4-2 [R-41]. The figures provided cover estimates for the financial guarantee period 2023 to 2027.

Special measures will be taken to handle and package contaminated soil and any liquids generated throughout the decontamination/decommissioning processes. It is expected that active liquid wastes will be transferred to a non-OPG off site and/or disposal facility where possible. A potential option for managing suitable fractions of this waste stream (particularly liquids contaminated with oil) is incineration. Any contaminated soils would be transferred for disposal to the LLW long-term disposal facility.

**Table 4-2: Low-Level Waste from Pickering Waste Management Facility Decommissioning**

Area/Systems	Estimate of Low-Level Waste Volumes (m <sup>3</sup> )	Estimate of Low-Level Waste Volumes (m <sup>3</sup> )
	Financial Guarantee Period 2023 to 2026	Financial Guarantee Period 2027
DSC Processing Buildings	49.9	49.9
DSMs (in RCSF)	11.9	11.9
DSC Storage Building 1	4.2	4.2
DSC Storage Building 2	12.1	12.1
DSC Storage Building 3	15.8	15.8
DSC Storage Building 4	15.8	15.8
DSC Storage Building 5 (in-service in 2027)	N/A	15.8
<b>Total</b>	<b>109.7</b>	<b>125.5</b>

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### Hazardous Waste Management

A small inventory of materials used in the DSC Processing Buildings, listed in Appendix B, is hazardous. These materials will be removed from the DSC Processing Buildings at the end of facility operations. If required, the following activities will be performed:

- Appropriate licensed storage or disposal facilities will be identified prior to the beginning of the decommissioning project.
- Hazardous wastes will be packaged for transport and disposal according to applicable regulations.
- Waste manifests will be prepared and submitted as required by federal and provincial regulations.
- Hazardous wastes will be transferred to an appropriate, licensed waste management facility(ies) for storage or disposal.

Any hazardous wastes that cannot be reasonably removed at the end of facility operations will be included as part of dismantling and demolition activities.

### Conventional Waste Management

Non-radioactive and non-hazardous waste, such as clean concrete, metals, roofing, cladding, etc., that has been free released will be recycled or disposed at an approved landfill site. Some clean concrete may be used to fill voids for site restoration.

#### **4.1.3.6 Surveys**

A series of surveys for radioactive and other hazardous materials will be performed throughout the course of the decommissioning work, based on available guidelines at the time of decommissioning. If this work were to be performed today, the surveys would be based on current available guidelines [R-42] [R-43] [R-28]. In accordance with CSA N294:19, surveys would be carried out at the end of each decontamination or demolition work package to ensure that the planned end state had been achieved. The results of such surveys would be submitted in a formal report. This would also contain information on the criteria used to define the end state, and the assessment criteria used to establish whether the end points were met. Several different types of surveys are likely to be performed at different stages of the decommissioning.

To ensure that the surveys are properly executed, they will be performed when the remaining structures and materials are still accessible. All of the surveys will be performed according to approved procedures that will be based on the recognized standards and guidelines in use at the time.

The procedures will describe:

- Sampling strategies and methods that will be employed during the survey;
- Instruments and laboratory methods that will be used;

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- Statistical techniques that will be used to analyze and interpret the data;
- Documentation that will be prepared and retained;
- Quality assurance and quality control program that will be in place;
- Performance and acceptance criteria;
- Roles and responsibilities; and
- Defined boundaries of survey.

Surveys will be carried out in each planning envelope to establish:

- Worker occupational safety and radiation protection programs;
- Environmental monitoring programs; and
- The processes required to release materials and equipment from site.

In addition, the surveys will help ensure that all radioactive materials in excess of permissible residual levels have been remediated.

The surveys conducted should be systematic and statistically robust. OPG’s sampling plan will take in consideration CSA N294:19 recommendations in Annex G on the use of Data Quality Objectives (DQO) approach. The key steps of the DQO process are:

1. Identify the purpose and objectives of the survey;
2. Identify and review available information;
3. Define the boundaries of the survey;
4. Identify potential sampling and analytical techniques;
5. Specify the performance and acceptance criteria; and
6. Develop the survey plan.

Point 6 from this list can be achieved utilizing software developed by Pacific Northwest National Laboratory – Visual Sampling Plan. Further information on the development of a sampling plan can be found within Appendix G of CSA N294:19, and more specifically, within the US Environmental Protection Agency’s guidance document on systematic planning and the DQO process [R-44].

As indicated in Section 4.1.3.1, a post-operational contamination survey will be performed, when the facility has ceased operation, in preparation for decommissioning. Characterization surveys may be performed to identify the nature and form of the remaining contamination in order to assist in the planning of the decontamination work.

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Contamination control surveys will be performed periodically throughout the decommissioning process in order to guide and monitor the decontamination work. They are used to control the exposure of decontamination workers to radiation and hazardous materials. Contamination control surveys are typically based on simple measurements, such as contact radiation dose rates or direct contamination checks.

Regular surveying at the site will also help monitor the effectiveness of any mitigation measures implemented at preventing or minimizing potential impacts on receptors throughout the decommissioning process. Review of mitigation strategies may be necessary following the results of site surveys. If shortfalls are found when comparing monitoring data with predicted environmental conditions, checks will need to be made to ensure measures have been correctly implemented or alternative/additional measures will need to be considered. The implementation of a mitigation strategy is considered in more detail in Section 7.3.

Final surveys will be performed when the decontamination work is believed to be complete in order to confirm that residual activity levels of radioactive and hazardous material in buildings, components and the sites are below the established clearance levels. When the results of these surveys have been accepted by the regulatory agencies, demolition work may proceed. The results of these surveys will (in accordance with CSA N294:19) be documented in interim end state reports as well as final end-state report that will include:

- The criteria used to define the end state.
- The methods and procedures used to ensure that the criteria were met.
- The measurement data, including appropriate statistical analysis and systematic approaches.

#### 4.1.4 Completion of Decommissioning

According to CSA N294:19, this phase is considered to be achieved when the agreed final end state has been verified to have been achieved and documented; risks to operators, the public and the wider environment have been reduced to agreed levels; and the site has been released from regulatory control. Key steps required to achieve this include, but are not limited to:

- The final end state of the facility; see Section 4.1.4.1 for further details.
- Release of licensed facility from regulatory control; see Section 4.1.4.2 for further details.

Once this is complete, decommissioning records will need to be retained for at least 10 years (or alternative period as outlined in the relevant Licence Condition in place at the time of final decommissioning).

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#### 4.1.4.1 End State

By the end of site restoration, the site areas will be free of hazards. All radioactive contamination in excess of the established clearance levels and all other hazardous materials will have been removed from the sites. All of the facility systems will have been dismantled and all of the buildings demolished. The sites will have been restored to a state similar in nature to that of the surrounding the PNGS site and will be suitable for other OPG uses. By the end of this phase, the PWMF sites will meet the release criteria as agreed with CNSC to remove the site from regulatory control.

#### 4.1.4.2 Release form Regulatory Control

A final end-state report on the decommissioning project will be prepared, describing the decommissioning work that has been performed, the outcome of that work, the results of the final surveys that were performed and the interpretation of those results. Other information required by the applicable regulations will also be included, including those required by the IAEA to confirm that no more safeguards will be required. The final end-state report will be submitted to the CNSC to support the application for release from regulatory control.

As an indicative guide, OPG is considering the recommendations put forward in the United States Code of Federal Regulations: Nuclear Regulatory Commission, Title 10 section 20.1402 (“Radiological Criteria for Unrestricted Use”); and Environmental Protection Agency, Title 40, Part 191, Subpart B, Section 191.15 (“Individual Protection Requirements”). Within these documents, maximum doses of 0.25 mSv/year (Nuclear Regulatory Commission) and 0.15 mSv/year (Environmental Protection Agency), including via drinking water, to an average member of a critical group is considered acceptable for future unrestricted use of the land.

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## 5.0 DECOMMISSIONING COST ESTIMATE AND FINANCIAL GUARANTEE

This section summarizes the estimated costs associated with decommissioning the PWMF and provision of a financial guarantee for the accumulated liability.

### 5.1 Cost Estimate

A decommissioning cost estimate update was prepared by TLG Services, LLC on behalf of OPG for decommissioning the PWMF [R-41]. The cost associated with decommissioning PWMF is estimated to be \$33.2M (2022 dollars) for years 2023 to 2026 and \$35.4M (2022 dollars) for year 2027 [R-41]. This cost is based on the facility expansion planning assumptions for the 2023 to 2027 financial guarantee period. Expansions occurring after this financial guarantee period are not included in these costs. A more detailed breakdown of this cost estimate is shown in Table 5-1 and Table 5-2 below. The decommissioning costs presented in this section are accurate as of the time of PDP approval. As OPG is currently in the process of finalizing its 2022 ONFA Reference Plan, these decommissioning costs may change pending further reviews.

**Table 5-1: Pickering Waste Management Facility Decommissioning Cost Summary for the Financial Guarantee Period 2023 to 2026**

Decommissioning Phase	Cost Estimate Stage	RCSF	DSC Process Facility and DSC Storage Buildings	Cost Estimate Financial Guarantee Period 2023 to 2026
Planning for Decommissioning	Planning and Preparation	1,744	6,888	8,632
Preparation for Decommissioning				
Execution of Decommissioning	Site Decommissioning	6,234	7,376	13,610
	Site Restoration	1,740	5,269	7,009
Completion of Decommissioning	N/A	-	-	-
N/A	Oversight (all stages)	1,492	2,470	3,962
<b>Total Cost</b>		<b>11,210</b>	<b>22,003</b>	<b>33,213</b>

Note: The estimated costs in Table 5-1 are a summary of the associated costs in [R-41]; the stages used for purposes of the cost estimate generally align with the decommissioning phases in CSA N294:19 as illustrated in the table. All costs are in 2022 k\$.

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**Table 5-2: Pickering Waste Management Facility Decommissioning Cost Summary for the Financial Guarantee Period 2027**

Decommissioning Phase	Cost Estimate Stage	RCSF	DSC Process Facility and DSC Storage Buildings	Cost Estimate Financial Guarantee Period 2027
Planning for Decommissioning	Planning and Preparation	1,744	7,148	8,892
Preparation for Decommissioning				
Execution of Decommissioning	Site Decommissioning	6,234	8,339	14,573
	Site Restoration	1,740	6,244	7,985
Completion of Decommissioning	N/A	-	-	-
N/A	Oversight (all stages)	1,492	2,470	3,962
<b>Total Cost</b>		<b>11,210</b>	<b>24,201</b>	<b>35,412</b>

Note: The estimated costs in Table 5-2 are a summary of the associated costs in [R-41]; the stages used for purposes of the cost estimate generally align with the decommissioning phases in CSA N294:19 as illustrated in the table. All costs are in 2022 k\$.

A summary of the cost estimate for decommissioning the PWMF can be found in Appendix C. The cost estimate will be updated when changes to PWMF planning assumptions occur. These changes may include addition of facilities, systems and equipment or other changes to planning assumptions.

The costs associated with the management of used fuel, including interim storage, transportation and disposal, are not included in this estimate. Plans and cost estimates for these activities are described in separate documents.

OPG will continue to provide an annual status report to the CNSC staff detailing amounts accumulated in applicable segregated funds for decommissioning and management of used fuel. The report will also identify any material changes in decommissioning plans or cost estimates, which may impact the financial liability incurred.

Only facilities and land within the licensed/protected area are covered by the decommissioning segregated funds.

## 5.2 Financial Guarantee

For the 2023 to 2027 Financial Guarantee liabilities calculations, the TLG cost estimates will be adjusted to incorporate costs from the Financial Guarantee year onwards. The Financial Guarantee will be submitted to the CNSC for all licensed OPG facilities in 2022.

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## 6.0 HUMAN AND ORGANIZATIONAL FACTORS

The change of mission from operations (DSC processing and storage and DSM storage) to decommissioning and the resulting loss of competence as facility staff leave for other duties is not expected to be a major human and organizational factor issue due to the small size of the operating staff. However, there may still be some risk that existing knowledge and experience will be lost as a result of staff retirement or redeployment. It is therefore essential that mechanisms are put in place to capture this information. Techniques may include but are not limited to staff interviews, questionnaires, succession planning, knowledge transfer, etc.

OPG will ensure that human and organizational factors issues are considered throughout the planning and execution of decommissioning. As development of the decommissioning plan progresses, OPG will liaise with the CNSC to establish a set of human and organizational factors requirements and expectations guided by CNSC's REGDOC-2.2.1, Human Factors [R-45], or a revised version available at the time of writing. These will be incorporated into the PWMFDDP. Special attention will be given to staffing and training in order to minimize potential problems resulting from the loss of experienced personnel over time.

OPG will be responsible for decommissioning throughout all four phases, and OPG will retain responsibility for the facility throughout the course of the preparation phase. A DOC will be contracted to perform the dismantling, demolition and site restoration work, but OPG will maintain oversight of its activities. The appropriate number of staff will be established for decommissioning based on OPG's forecasts and industry experience. The estimated staffing number for each phase of decommissioning will be based on activities in each phase, schedule, work difficulty factors and industry experience [R-41]. The staff numbers presented in the cost estimate should be considered preliminary (i.e., for cost estimating purposes only). Business plan staffing numbers have not yet been established and will be determined at a later date.

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## 7.0 POTENTIAL ENVIRONMENTAL AND SOCIO-ECONOMIC EFFECTS

Over the course of the decommissioning work, there may be impacts on the natural and socio-economic environment. The listing in this section is not intended to be exhaustive since, at this time, the PDP only highlights some of the potential effects.

As the decommissioning plan develops, and the nature and extent of potential impacts are better understood, it is expected that an 'environmental scope' would be defined. It is likely that the majority of the impacts identified will have very localized effects – restricted to areas within or very close to the site boundary. As a result, it is recommended that a spatial boundary is defined, beyond which environmental impacts would not be considered. This is due to the low risk of occurrence and/or low risk of harm being caused as pathways are interrupted and sources dispersed. This would be developed as results from initial survey data are collated.

It is recognized that the baseline conditions for each of these aspects would first need to be defined before decommissioning activities are commenced to allow impacts to be accurately quantified, and appropriate mitigation measures identified. It will also help to establish meaningful remediation targets.

Baseline data would be collated from data produced as a result of historical and continued monitoring programs. At the time of writing, it is recognized that an extensive and comprehensive radiological monitoring program is in place at the Pickering Nuclear site. It has been designed to measure environmental radioactivity in the vicinity of the PNGS from all sources. To achieve this, the radiation and radioactivity in air, water, soil, groundwater, foodstuffs and fish in the region are monitored. In addition, OPG has and will continue to have monitoring programs in place for non-radiological contaminants, to ensure compliance with applicable federal and provincial regulations.

In addition to the site-wide environmental monitoring program, the following PVMF effluent streams are monitored:

- Active ventilation exhaust (weekly);
- Active liquid waste (as needed, when sump requires emptying for transfer to active liquid waste); and
- RCSF surface area drainage (quarterly).

Contamination checks on DSCs, DSMs and the DSC Processing and Storage Buildings are also performed regularly. Where loose contamination is found, the area is isolated and the contamination is cleaned up immediately.

Historic and continued monitoring data, combined with the results of historical environmental assessments (for example the PVMF Phase I and II environmental assessments, the PNGS-A Return to Service environmental assessment and the PNGS-B Refurbishment and Continued Operation environmental assessment) will provide a fundamental basis for future impact assessment or environmental review work covering decommissioning activities, if required.

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The IAA [R-46] came into force in 2019 and is the legal basis for the federal environmental assessment process in Canada (also known as an Impact Assessment). In consultation with the CNSC and to comply with all applicable laws and regulations, OPG will determine the requirements for performing and impact assessment, if required, prior to Dismantling & Demolition to ensure that adequate provisions for the protection of the environment and the health and safety of persons are made during decommissioning.

## 7.1 Natural Environment

The decommissioning activities to be carried out at the PWMF have the potential to exert negative impacts on staff, local communities and the wider environment. OPG is therefore committed to running its site, from operational through to decommissioning and dismantling activities, in a way that minimizes impacts as much as possible.

Environmental impacts depend on the 'source → pathway → receptor' chain; if any of these links are removed, a potential impact cannot be realized. This is applicable to all the receptors discussed in the following subsections. It is recognized that where the source of an impact cannot be removed, disrupting the pathway to the receptor is often an effective management approach. If this is not possible, steps must be taken to mitigate or remediate identified impacts.

### 7.1.1 Air Quality

The heavy construction equipment used during the decommissioning work and the vehicles used for transport of waste and other materials will release particulates (dust) and exhaust gases into the atmosphere. These vehicles may also result in traffic and noise pollution. The nature and extent of these releases will depend on the type of equipment in use at the time of the decommissioning. Dusts, fumes and other emissions from cutting or blasting operations, particularly during the dismantling operations, may have some impact on air quality.

Traffic resulting from the movement of heavy vehicles to and from the PWMF during decommissioning may have an impact on the surrounding community but the additional impact on the environment should not be significant. Shipment of radioactive waste and used fuel from the site is governed by the Radioactive Materials Transportation program [R-47] and will be subject to strict application of the following transportation regulations [R-48], [R-49] and [R-50].

As described in Section 7.1.6, there may be noise pollution resulting from use of heavy equipment, but this should be limited to a small number of distinct events during the Dismantling and Demolition work.

### 7.1.2 Land Use

The site itself is anticipated to be used for other OPG uses, although it is recognized that this is subject to change – in particular in light of OPG's Repurposing Pickering initiative. PWMF decommissioning is anticipated to have minimal impact on the use of the surrounding lands.

### 7.1.3 Vegetation

The limited number of vegetated areas of the site and adjacent wetlands are not likely to be affected during the course of the decommissioning work since they are well removed from the

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facility. This is largely due to the fact that a substantial percentage of the open areas in and around the PWMF sites have either been paved or covered with gravel or granular type soil, thereby limiting the scope for impacts to be felt.

#### 7.1.4 Wildlife

The PWMF sites contain asphalt and gravel surfaces, limiting the quantity of habitats suitable for supporting a diverse range of fauna and flora. Wildlife activity within the PWMF sites during the operating phase is expected to be minimal (due to the lack of natural habitat). Minimal levels of wildlife activities will likely continue at the PWMF due to continuous human activity expected at the sites during the shutdown and decommissioning phases.

Potential effects on some species may be caused by dust, noise and sedimentary runoffs as a result of the dismantling work. Increased traffic volumes during some phases of the decommissioning may also have an impact on wildlife due to the traffic noise, as well as collisions between vehicles and animals. The latest annual species at risk monitoring reports such as that documented in [R-51] will be reviewed for reference and guidance to ensure compliance prior to decommissioning.

#### 7.1.5 Water Quality and Aquatic Life

Some temporary increase in turbidity of the water along the lakeshore may result from the dismantling and site restoration work. This may have a temporary effect on some aquatic life forms. All feasible measures will be taken to prevent sedimentary discharges reaching local water bodies from the decommissioning site.

#### 7.1.6 Noise

Heavy construction equipment may be used during the dismantling work performed towards the end of the decommissioning. This work may produce localized elevated noise levels in the immediate surroundings, but the effect will probably be limited to the PNGS site. Site workers and wildlife may be affected temporarily by the increased noise. The potential impacts of demolition noise will be assessed prior to dismantling and demolition and appropriate mitigation strategies will be put in place, such as not using certain demolition methods.

### 7.2 Human and Socio-Economic Environment

#### 7.2.1 Purpose

The Regulatory Guide G-219 [R-3] and CSA N294:19 [R-4] specifies that a PDP should include the “identification of any features of the surrounding natural and social environment that could be significantly affected by the decommissioning process”. The purpose of this section is to identify specific human environmental features that may experience impacts when decommissioning occurs. A range of potential sources of effects is discussed, focusing on the potential for socio-economic impacts, at the local, community and regional level, associated with the decommissioning of the PWMF.

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This section does not attempt to assess or evaluate what impacts may result at the time when decommissioning actually occurs. The determination of impact, or significance of effect, is made by those affected by these changes and, hence, socio-economic impacts are specific to time and place. The impacts resulting from the decommissioning process will be assessed in a future impact assessment or environmental review, if required, and their significance determined at that time.

### 7.2.2 Scope

At a future time, when an impact assessment or environmental review would be undertaken, if required, the scope of the socio-economic assessment considerations would include the other planned activities occurring in the same time period, such as decommissioning of the PNGS, which when taken together with the planned decommissioning of the PWF may have the potential for cumulative impact on the local communities.

Aspects to be considered include:

- Direct economic impacts – employment (local/non-local), skill groups required, labour supply, etc.;
- Indirect economic impacts – employee expenditure, suppliers, labour markets, etc.;
- Demographics – changes in population size and characteristics (long and short term);
- Housing; and
- Other local services – police, health, social, education, etc.

### 7.2.3 Definitions

Socio-economic impacts are defined as changes in people's wellbeing and/or changes in significant aspects of their communities as a result of a development or project.

Socio-Economic Impact Assessment (SEIA) is a process designed to identify and evaluate the potential social, cultural and economic effects of a proposed project, policy, program or plan on people, organizations, institutions, communities and social systems. The purpose of the SEIA is to recommend impact management measures that would improve a project by reducing negative community effects and enhancing community benefit.

Impact management involves the coordinated application of measures designed to mitigate, enhance, compensate, plan for contingencies, monitor, and to ensure continuing liaison. Measures could also include formal impact agreements.

SEIA and impact management improve projects by identifying and managing the costs and benefits, and by facilitating decision-making. A SEIA would be undertaken as part of the environmental assessment for decommissioning, if required.

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## 7.2.4 Temporal Considerations

As mentioned in Section 4.1, decommissioning of the PWMF is associated with several phases: planning, preparation, execution and completion of decommissioning.

Each of these phases will involve discrete activities that will result in effects on local communities. Socio-economic effects will begin with the commencement of activities that engage the local communities. For planning purposes, it is assumed that these effects will commence when the preparation phase begins and extend until the execution phase is complete. That is, the planning phase and the completion phase are not expected to cause any socio-economic effects on the local communities.

By 2058, all the used fuel and retube components will have been removed from the sites. The removal of retube components and used fuel by 2058 are changes that have the potential to affect the local community. The transfer of the used fuel will have associated activities, including planning, licensing and transportation. The nature and extent of any associated socio-economic effects would be determined at that time in separate impact assessments or environmental reviews, if required, perhaps in the context of licensing of the long-term used fuel management facility and/or the decommissioning of the PNGS.

In accordance with Table 4-1, the time period during which socio-economic effects may occur is five years (2058-2062). Actual activities associated with these planned phases will be intermittent; however, it is important to understand the overall flow of activities, as these will be the source of potential socio-economic impacts.

Under current assessment legislation, OPG will continue to pay the property tax on the same buildings and structures until they are removed. The tax amount paid after the dismantling of all buildings will depend on the future uses of the land. The PWMF site is anticipated for OPG's other uses after decommissioning. The future use of the site will be discussed/consulted with the local and regional community.

These issues will be evaluated in the decommissioning impact assessment or environmental review, if required, prior to the commencement of decommissioning, and an impact management plan will be developed.

### 7.2.4.1 Preparation for Decommissioning: Sources of Effects

Preparation for decommissioning will start in 2058 when the detailed planning activities are scheduled to commence. The preparation of the decommissioning impact assessment or environmental review, if required, and the DDP will involve the local community. This involvement and the associated concerns about the impending shutdown and decommissioning of the PWMF may have related socio-economic effects.

The size of the PWMF workforce will decline in the years before shutdown as used fuel storage operations will be moved elsewhere and the used fuel will be transferred to a long-term used fuel management facility. When the PWMF is shut down, the remaining operations workforce will no longer be required.

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Potential socio-economic effects will be evaluated as required. For planning purposes, it is assumed that the amount of local taxation would not change when the facility is no longer operating up to the end of decommissioning.

#### 7.2.4.2 Execution of Decommissioning: Sources of Effects

During the execution phase, the number of staff and trades will vary. This work may represent opportunities for the local labour force, but because of the short duration and the nature of the work, workers may commute from outside the region and seek only temporary accommodation.

Local spending associated with the dismantling activities may benefit local contractors and suppliers.

The concrete-based materials free of contamination and clean fill produced by the demolition work will be used on site for fill. The volume of the contaminated materials requiring shipping to a long-term disposal facility will not be large (see Section 4.1.3.5), so the number of truck trips will be small. These sources of effects will be evaluated in the impact assessment or environmental review, if required, at the time.

At the conclusion of this phase, the workforce will no longer be required, and any local spending associated with the decommissioning work will conclude.

### 7.3 Mitigation Measures

It is recognized that many of the decommissioning operations to be undertaken at the PVMF sites have the potential to have impacts both on and off site. There is scope for staff and members of the public and the wider environment to be affected. It is therefore recommended that, as the decommissioning plan develops, a mitigation strategy is also formed in conjunction. This will need to consider specific activities for which additional protection/mitigation procedures will be required.

The purpose of creating and implementing a mitigation strategy is to reduce or remedy significant adverse effects to the environment and human populations. Emphasis is placed on proactive mitigation measures that prevent identified impacts from occurring in favour of reactive measures that manage impacts once they have occurred. A diagram summarizing the hierarchy of mitigation measures is provided in Figure 7-1.

Mitigation measures can be grouped into four main categories: 'alternative options', 'physical controls', 'managerial controls' and 'deferred mitigation'. If a particular operation or technique is identified as being a potential source of harm, it is necessary to consider alternative options that are capable of producing the desired result, but also prevent or (where this is not possible) minimize the identified impact. Physical control measures are generally engineered solutions aimed at preventing identified impacts from reaching potential receptors. Examples could include: construction of physical barriers, such as bunds, enclosed structures for carrying out activities, landscaping to minimize visual or noise impacts, undertaking of regular maintenance work to sustain site conditions, and installation of sediment traps, etc. Managerial measures rely on controlling how activities are carried out on site to minimize impacts. Examples might include regulating certain activities, limiting the duration of noisy activities, ensuring work is carried out within normal working hours only, limiting the extent of the operation undertaken,

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ensuring work is carried out in accordance with approved method statements and operational controls, etc. Deferred mitigation might occur where an impact is unavoidable, and remedial/restorative action is required instead. This might include site decontamination, re-locating amenities to another area, site landscaping, etc.

When developing the mitigation strategy, it is essential that the process is carefully managed and reviewed to ensure that the proposed measures are effective, do not conflict with other mitigation measures or site activities, and do not simply shift the problem from one medium to another. It is also valuable at this stage to systematically record this process. It will be necessary to identify each impact, its source(s), receptors to the impact, and potential significance of the impact – in both a mitigated and unmitigated scenario. This will help determine whether the cost of implementing a mitigation measure is proportionate to the benefits gained.

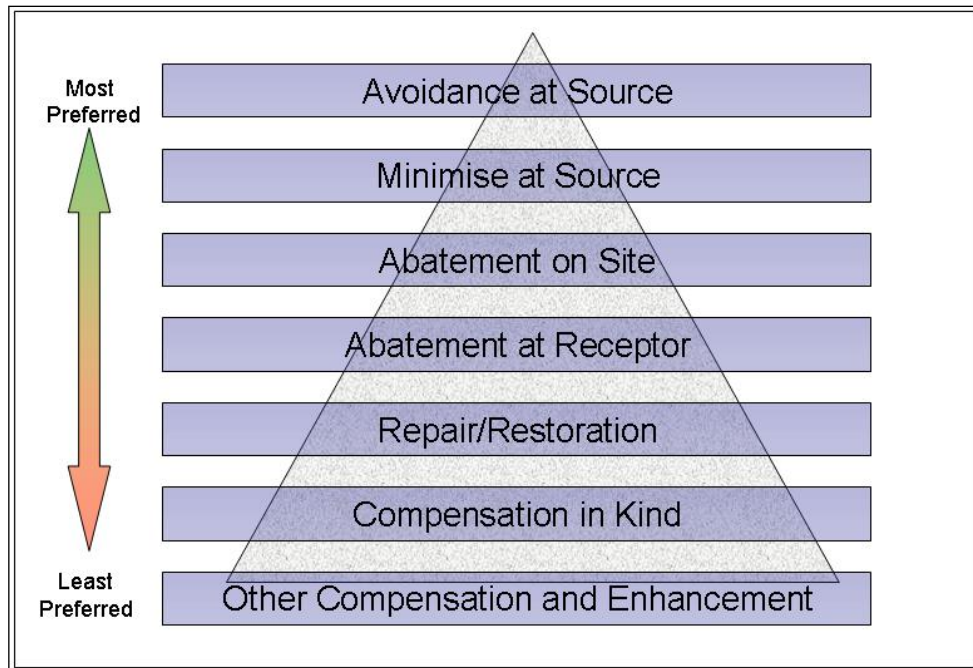


Figure 7-1: Hierarchy of Mitigation Options

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## 8.0 POTENTIAL HAZARDS AND HEALTH & SAFETY

During preparation for decommissioning, a safety assessment shall be performed to identify potential hazards to workers, the public and the environment from both routine decommissioning activities and credible accidents during decommissioning as per CSA N294:19 [R-4]. This safety assessment will describe potential hazards and methods to reduce the risk associated with the hazards.

### 8.1 Hazard Assessment

The radiological, chemical and construction hazards that might be encountered during the decommissioning will be similar to those that may arise during any industrial dismantling or demolition work. A thorough assessment of the hazards to workers, public and environment, as well as credible accidents that might be encountered during the decommissioning will be performed during the detailed planning process prior to shut down of the PWWF.

A workplace health and safety assessment will be carried out to formally identify and quantify the potential hazards to operators resulting from decommissioning activities. This will help OPG meet their obligations under the OHSA, in which it is the responsibility of the employer to inform all employees about the potential hazards that they may come into contact with as part of their day to day work. Specifically, an employer must: "*acquaint a worker or a person in authority over a worker with any hazard in the work and in the handling, storage, use, disposal and transport of any article, device, equipment or a biological, chemical or physical agent*". Approaches to hazard assessment (which are considered in numerous aspects of the OHSA) include:

- Carrying out detailed inspections and/or testing of the hazard;
- Recording of physical observations made by trained staff;
- Investigations of near misses;
- Conducting operator interviews; and
- Reviewing records such as first aid records and minutes of joint Health and Safety committee meetings.

In addition, under OHSA, it is also the legal obligation of staff to report unsafe conditions so that they can be promptly acted on.

In order to identify (and subsequently manage) the potential hazards, a workplace health and safety assessment will be carried out, in accordance with the applicable regulations at the time, to formally identify and quantify potential hazards to operators resulting from decommissioning activities. OPG will undertake a hazard assessment that will take into account the following:

1. The nature of the hazard;
2. The potential level of exposure of staff to the hazard;

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3. The frequency and duration of exposure of staff to the hazard;
4. The effects on the health and safety of employees;
5. Mitigation measures proposed to address the hazard; and
6. Any other relevant information, including staff reports on incidents or near misses.

To ensure the hazard assessment is comprehensive, the methodology used will detail the resources and timeframes required for assessing the hazards, the proposed record keeping system and a timeframe for reviewing and revising the methodology in light of additional information. In addition, the following information should be reviewed and included as appropriate:

- Hazardous occurrence reports;
- First aid/minor injury reports;
- Details of existing health and safety protection programs;
- Results of workplace inspections;
- Employee incident/near miss reports;
- Government or employer reports, studies and tests concerning the health and safety of employees;
- Records of holdings of hazardous substances; and
- Any other relevant information that might help identify and/or quantify potential hazards.

On completion of the hazard review, a 'hazard prevention program' should be developed from the results of the assessment. In addition to physical and managerial preventative measures, the program should include provisions for staff education.

This is a future activity, the results of which will be incorporated into later revisions of the decommissioning plan documentation.

Some of the possible hazards are summarized below.

The health and safety management system currently employed at the Pickering site meets the requirements of the Occupational Health and Safety Assessment Series 18001 standard. This system will continue to be followed during decommissioning.

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## 8.1.1 Radiological Hazards

### 8.1.1.1 Hazards to Workers

All of the stored used fuel and retube components will be removed from the PWMF prior to the start of decommissioning. The remaining radioactive material on the site will be low levels of contamination on the surface of equipment and structures. Radiation fields will be low and the external radiation hazard will be minimal. Contamination control will be the major focus of the radiation protection program.

### 8.1.1.2 Hazards to the Public

OPG radiation protection procedures will be maintained to prevent the unlikely occurrence of loose contamination being present on persons, packages or containers leaving the site. In addition, an environmental monitoring program looking at emissions and effluents will be maintained through waste removal and decommissioning operations.

The facility is physically remote from public use areas. The volume of LLW generated during the decommissioning will be small (shown in Table 4-2); hence, the frequency of off-site shipments should not cause any additional radiological risk to the public over current levels.

The risk to members of the public will be further reduced through the use of approved packages and containers, deployment of fully Suitably Qualified and Experienced Persons (SQEP) staff, use of approved procedures and adherence to applicable regulatory requirements regarding radioactive waste transport and disposal.

Finally, clearance surveys will be carried out to confirm that clearance objectives have been achieved for areas and materials destined for unrestricted public use.

### 8.1.1.3 Occupational Dose

Occupational doses are expected to be low, since the only radioactive materials remaining on-site at the beginning of decommissioning will be the low-level contamination on equipment and structures.

## 8.1.2 Chemical Hazards

During decommissioning, potential chemical hazards may come from the handling of cleaning agents used during the decontamination work, and from concrete dust generated during the dismantling work.

The risk of harm will be significantly reduced through the use of correct personal protective equipment and staff training. Chemical storage during decommissioning will also include appropriate storage requirements including separation of chemicals, where required, to avoid potential chemical hazards/explosions in case of spills or a common mode event (earthquake).

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### 8.1.3 Industrial and Demolition Hazards

Demolition hazards that might be encountered during the decommissioning activities will be similar to those encountered in any other industrial decommissioning project. These may include:

- The operation of heavy construction equipment in close proximity to workers;
- Fires caused by cutting torches and grinders;
- The collapse of equipment or structures during demolition;
- The use of blasting and other techniques to demolish concrete structures; and
- Falls, lifting of heavy objects, falling objects, use of hand tools and the other hazards routinely encountered during dismantling and demolition work.

### 8.2 Radiological Safety

All decommissioning activities will be carried out in accordance with the ALARA principle and OPG's approved radiation protection procedures. Where required, a radioactive work planning approach will be utilized.

Throughout the decommissioning phases, qualified staff will be used to perform the work assigned to them, using approved procedures to mitigate/eliminate hazards associated with potential release.

### 8.3 Chemical and Demolition Safety

OPG will ensure that decommissioning work will be conducted in accordance with the requirements of the applicable federal and provincial occupational health and safety regulations. OPG currently has a comprehensive occupational health and safety program that meets the requirements of the OHSA of Ontario. This program recognizes:

- The right of employees to know of the hazards associated with their work;
- The right of employees to participate in decisions related to health and safety; and
- The right of employees to refuse to perform work that is unsafe.

OPG will ensure that the DOC and any subcontractors maintain occupational health and safety programs that are compatible with OPG's programs.

### 8.4 Emergency Response Planning

During the preparation of the DDP, OPG will prepare an assessment of the potential hazards to workers, the public and the environment.

At all stages of the project, OPG will ensure that:

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- The required emergency response plans and procedures will be in place;
- The plans will be reviewed and exercised appropriately;
- An adequate number of personnel will be available to respond to a real or potential emergency situation that may occur; and
- The necessary equipment and supplies will be available for use by emergency response personnel.

## 9.0 SECURITY AND SAFEGUARDS

### 9.1 Security

During decommissioning, OPG will continue to comply with the CNSC regulations on the physical security of nuclear facilities.

OPG will be responsible for the security of the site throughout the course of the decommissioning, and the DOC and subcontractors will be required to comply with OPG procedures regarding physical security.

### 9.2 Safeguards

In accordance with an agreement between the Government of Canada and the IAEA, nuclear safeguards are implemented at OPG's nuclear generating stations. These international safeguards apply to the PWMF until all the used fuel is removed from the site. The decommissioning of the PWMF will not be impacted by safeguards requirements since all used fuel will have been removed from the site prior to the implementation of the decommissioning program. Once all the used fuel has been removed from the PWMF, OPG will provide the required information and access to the IAEA for confirmation that no more safeguards will be required.

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## 10.0 QUALITY ASSURANCE

OPG will incorporate quality programs as per CSA N286 to assure that all appropriate requirements, including occupational, public and environmental protection, are met during the decommissioning of the PWMF. The aspects that will be considered within the quality program may include but are not limited to:

- Development of a project organization chart, identifying key roles and responsibilities;
- A method for certifying/qualifying SQEP;
- A system for the production of documents and their control;
- A mechanism for the resolution of comments or project issues;
- A system for managing staff training requirements;
- A system for the control of procurement (i.e., ensuring that subcontractors, material suppliers, etc., conform to an equally high quality standard);
- A system for labelling, identifying and tracking waste packages;
- Systems for undertaking and checking calculations, models and analyses;
- Provisions for independent technical reviews;
- An approved document/record keeping system; and
- Provisions for the undertaking of quality assurance audits.

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## 11.0 DOCUMENTATION (RECORDS)

It is recognized that there is a potential for information about the PVMF to be lost as individual facilities within the site shut down, and staff numbers decrease. It is therefore necessary that measures be taken early on to preserve and improve the existing records database, capturing all potentially relevant information. Decommissioning-related documentation will be managed and maintained in accordance with OPG's Record Management requirements, CSA N294 and IAEA guidance related to record keeping (e.g., Technical Reports Series No. 411 [R-52]). These records include:

- Design of facilities and buildings included in the decommissioning plan;
- Details of the initial design and configuration of the facility and the modifications made over its operating lifetime;
- Descriptions of the nature and location of hazardous materials in the facility and the disposition of hazardous materials that have been removed;
- Records of the worker health and safety, including information required by applicable regulations and doses of ionizing radiation received by workers from the decommissioning work;
- Details of spills, releases of radioactive materials or environmentally hazardous substances that may have occurred during the facility's operational lifetime;
- Records will be kept in the storage medium for standard use at the time of the decommissioning;
- Duplicate copies will be maintained; and
- Records will be assembled and maintained in secure storage.

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## 12.0 PUBLIC AND STAKEHOLDER ENGAGEMENT PROGRAM

A public and stakeholder engagement program as well as an indigenous engagement program will support the development of the DDP. The program will include both information and consultation opportunities. It will be designed to involve a broad cross-section of stakeholders employing a variety of methods that will meet the needs of the participants and the objectives of the business.

The program will identify issues and concerns, ensure opportunities for involvement, ensure all input was considered in decommissioning planning and impact assessment or environmental review activities, if required, and include the documentation of the process and results. The program will also support the development of an integrated community impact management plan.

The public and stakeholder engagement program will comply with the applicable requirements of REGDOC-3.2.1 [R-21] and REGDOC-3.2.2 [R-53].

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### Appendix A: Pickering Waste Management Facility Major Systems and Components

In the following table, the main PWMF Phase I and Phase II systems and components – and their associated functions – are listed for purposes of this PDP. In light of the PWMF expansion with planned DSC Storage Building 5/6, it is recognized that the list is subject to change. Any such changes will be incorporated as part of future revisions of this PDP.

Item	System/Component	Function
1	DSC Processing Building, including: <ul style="list-style-type: none"> <li>Maintenance Provisions</li> <li>Control Rooms</li> <li>Equipment and Tool Rooms</li> <li>Offices</li> <li>IAEA Office</li> <li>Welding Provisions</li> </ul>	Provides for safe and efficient handling and processing of DSCs. See Figure 2-6 to 2-9 and Figure 2-12 to 2-14.
2	DSC Storage Buildings	Provides for indoor storage of DSCs and allows for access to and retrieval of any DSC at any time. Provides for paint provisions. See Figure 2-4, 2-6, 2-11, 2-12, 2-15 and 2-16.
3	DSC Transporter	Provides for safe transportation of new or loaded DSCs within the PWMF, and on-site to and from the PNGS.
4	Overhead Crane, Rails and Controls	Provides for lifting and transferring DSCs within the respective DSC Processing Building.
5	Welding Equipment and Controls	Provides for a seal weld between the lid and body of the loaded DSC and drain port plug welds.
6	Phased Array Ultrasonic Testing Equipment	Used for inspection of DSC seal weld.
7	DSC Vacuum Drying Equipment and Controls	Provides for vacuum drying of the DSC interior to ensure a moisture-free environment for the used fuel.
8	Helium Backfill Equipment and Controls	Provides for helium backfilling of the DSC after evacuation of its interior atmosphere.
9	Helium Leak Test Equipment and Controls, Including Bell Jar	Provides for leak testing of the final seal weld, drain and port welds and the drain port helium pin weld.
10	DSC	Provides for safe storage of used fuel from the PNGS. See Figure 2-3 and 2-4.
11	DSC Tools, Transfer Clamp(s) and Transfer Clamp Stands	Provides for handling and securing of the loaded DSC while in transit between PNGS and the PWMF.
12	DSC Lifting Beam and Storage Stand	Provides for lifting of the DSC by the overhead crane.
13	Workstation Platforms	Provides for working on the DSC during its various stages of processing.
14	DSC Commissioning Tools/Gauges	Provides for commissioning of new (unloaded) DSCs.
15	Radiation and Contamination Monitoring Equipment	Provides for radiation protection, contamination control and monitoring.

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<b>Item</b>	<b>System/Component</b>	<b>Function</b>
16	Lifting Devices and Slings for All Processing Equipment, Including Lift Truck/Tow Motor(s)	Provides for lifting/moving and maintenance of processing equipment.
17	Air Systems – Instrument Air	Provides for service air.
18	Water Systems	Provides domestic water for drinking, washroom and services and for fire protection.
19	Electrical Power, Distribution and Lighting Systems	Provides for normal operation of electrically operated components and systems, operation of security and safeguards systems under normal and abnormal conditions, which includes an uninterruptible power supply supported by an alternate power source for short-term power back-up (stand-by generator) in the event of loss of normal power.  Provides lighting for all buildings and yard, and for meeting security and safeguards requirements.
20	Heating, Ventilation, Air Conditioning and Active Ventilation Systems	Provides for control of interior ambient temperatures, prevents ventilation backflow in areas subject to airborne contamination, includes HEPA filters and pre-filters for removal of toxic, volatile and contaminated particles prior to being exhausted into the environment, and for measurement of air flow and collection of ventilation stack air samples.
21	Sanitary Systems	Provides for sewage collection and removal to existing site sewage system.
22	Drainage Systems (Inactive and Active)	Provides for collection and removal of inactive and active liquid waste to existing site system.
23	Fire Protection	Provides for detection, prevention and impeding the spread of fires.
24	Communications, Including Local Area Network, Public Address and Phone	Provides for normal communication within and between PWWF and the PNGS site, emergency communication under abnormal conditions and for security and safeguards.
25	Security/Access Control, Including Phase II Environmental Sampling Station, Bosik/Security Kiosk	Provides for a “protected area” designation under the CNSC Class I Nuclear Facilities Regulations and is designated as a Class II facility.
26	DSM	Provides protection and storage of retube components from PNGS A. See Figure 2-5.
27	RCSF	Provides for protection and storage of DSMs. See Figure 2-10.

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**Appendix B: Estimated Type and Location of Hazardous Materials Stored in the Dry Storage Container Processing Building**

In Table B-1, the type, estimated quantities and location of hazardous materials stored in the existing DSC Processing Building (Phase I) are provided.

**Table B-1: Hazardous Materials Stored in Each DSC Processing Building**

Material	Type	Estimated Quantities	Location
Compressed gas	Helium, oxy-acetylene, argon, carbon dioxide	6300 L (actual bottle volume)	Helium bottle store on main floor. Inert gas store on main floor.
Flammable chemicals	Paint, solvents, oil	250 L	Paint enclosure, flammable storage cabinets on main floor.
Corrosive chemicals	Cleaning agents	40 L	Janitor's room on ground floor.

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### Appendix C: Summary of Decommissioning Cost Estimate for the Pickering Waste Management Facility

This study, prepared for OPG by TLG, estimates the decommissioning costs of the PWF to be \$33.2M (2022 dollars) for financial guarantee years 2023 through 2026, and \$35.4M (2022 dollars) for year 2027 [R-41]. These costs are based on the unique features and expected condition of the facility after removal of the retube waste containers and all stored waste contained in the DSCs and planning assumptions for the 2023 to 2027 financial guarantee period. Expansions occurring after this financial guarantee period are not included in this estimate. A more detailed breakdown of the cost estimate is shown in Table C-1 and Table C-2 below.

The costs associated with the management of used fuel, including interim storage, transportation and disposal, are not included in this estimate. Plans and cost estimates for these activities are described in separate documents.

**Table C-1: PWF Decommissioning Cost Summary for the Financial Guarantee Years 2023 to 2026**

Decommissioning Phase	Cost Estimate Stage	RCSF	DSC Processing Facility and DSC Storage Buildings	Cost Estimate Financial Guarantee Period 2023 to 2026
Planning for Decommissioning	Planning and Preparation	1,744	6,888	8,632
Preparation for Decommissioning				
Execution of Decommissioning	Site Decommissioning	6,234	7,376	13,610
	Site Restoration	1,740	5,269	7,009
Completion of Decommissioning	N/A	-	-	-
N/A	Oversight (all stages)	1,492	2,470	3,962
<b>Total Cost</b>		<b>11,210</b>	<b>22,003</b>	<b>33,213</b>

Note: The estimated costs in Table C-1 are a summary of the associated costs in [R-41]; the stages used for purposes of the cost estimate generally align with the decommissioning phases in CSA N294:19 as illustrated in the table. All costs are in 2022 k\$.

**Table C-2: PWF Decommissioning Cost Summary for the Financial Guarantee Year 2027**

Decommissioning Phase	Cost Estimate Stage	RCSF	DSC Process Facility and DSC Storage Buildings	Cost Estimate Financial Guarantee Period 2027
Planning for Decommissioning	Planning and Preparation	1,744	7,148	8,892
Preparation for Decommissioning				
Execution of Decommissioning	Site Decommissioning	6,234	8,339	14,573
	Site Restoration	1,740	6,244	7,985
Completion of Decommissioning	N/A	-	-	-
N/A	Oversight (all stages)	1,492	2,470	3,962
<b>Total Cost</b>		<b>11,210</b>	<b>24,201</b>	<b>35,412</b>

Note: The estimated costs in Table C-2 are a summary of the associated costs in [R-41]; the stages used for purposes of the cost estimate generally align with the decommissioning phases in CSA N294:19 as illustrated in the table. All costs are in 2022 k\$.

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### Regulations:

The cost estimate was prepared following the guidance on decommissioning planning found in CNSC regulatory guide G-219, "Decommissioning Planning for Licensed Activities", and CSA N294:19 "Decommissioning of Facilities Containing Nuclear Substances". The regulatory guidance document and standard provide guidance regarding the preparation of decommissioning plans as well as the basis for calculating financial guarantees. Regulatory guide G-219 provides CNSC guidance recommended for meeting regulatory requirements associated with decommissioning nuclear facilities. It addresses requirements for choosing a basic strategy for decommissioning, materials and waste management, radiological surveys, human and organizational factors, conventional health safety and security, environmental assessment, emergency response, quality assurance and final end-state reporting. The CSA standard N294:19 also highlights the requirement for a decommissioning cost estimate, stating in Section 6.2.3 that "cost estimates shall include all decommissioning activities from operations, during shutdown to the final release from regulatory control...". It also recommends that the estimate is periodically reviewed to reflect changes in the facility, economic climate, regulatory requirements or available technologies.

### Methodology:

The methodology used to develop this decommissioning cost estimate follows the basic approach originally presented in the cost estimating guidelines<sup>11</sup> developed by the Atomic Industrial Forum (now Nuclear Energy Institute). This reference describes a unit cost factor method for estimating decommissioning activity costs. The unit cost factors used in this plan reflect site-specific costs, as well as the latest available information about worker productivity in decommissioning. An activity duration critical path is used to determine the total decommissioning program schedule required for calculating the carrying costs, which include program management, administration, field engineering, equipment rental, quality assurance and security. This systematic approach employed to assemble the decommissioning estimates ensures confidence in the reliability of the results.

### Allowance:

Consistent with accepted cost estimating practice, allowances are applied to the decontamination and dismantling costs developed as 'specific provision for unforeseeable elements of cost within the defined project scope, particularly important where previous experience relating estimates and actual costs has shown that unforeseeable events which will increase costs are likely to occur.'<sup>12</sup> The cost elements in the estimate are based on ideal conditions; therefore, the types of unforeseeable events that are almost certain to occur in decommissioning, based on industry experience, are addressed through a percentage allowance applied on a line-item basis. This allowance factor is a nearly universal element in all large-scale construction and demolition projects. It should be noted that allowance, as used in this estimate, does not account for price escalation and inflation in the cost of decommissioning over the remaining operating life of the station and subsequent storage period.

The use and role of allowances within decommissioning estimates are not a safety factor issue. Safety factors provide additional security and address situations that may never occur. Allowance funds, by

<sup>11</sup> T.S. LaGuardia et al., "Guidelines for Producing Commercial Nuclear Power Plant Decommissioning Cost Estimates," AIF/NESP-036, May 1986.

<sup>12</sup> Project and Cost Engineers' Handbook, Second Edition, American Association of Cost Engineers, Marcel Dekker, Inc., New York, New York, p. 239.

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contrast, are expected to be fully expended throughout the program. Inclusion of allowance is necessary to provide assurance that sufficient funding will be available to accomplish the intended tasks.

### Radioactive Waste Management:

Allowance is made for the generation of 109.7 m<sup>3</sup> of LLW during the decommissioning for financial guarantee years 2023 to 2026. Due to the expected addition of another DSC Building this allowance is increased to 125.5 m<sup>3</sup> for financial guarantee year 2027 (see Table 4-2 for details). This study uses unit costs adopted by other OPG cost studies to estimate waste packaging and disposal costs for this waste.

### Site Restoration:

Site restoration, which includes the demolition of 'clean' structures, will occur promptly after radioactive material has been removed from the facility (site meets radiological release criteria).

This study assumes that site structures within the restricted access area are removed to a nominal depth of 1 m below the local grade level wherever possible. Foundation grade slabs greater than 1 m in thickness (if any) will be abandoned in place and covered over with a layer of backfill. The site is then graded and stabilized.

### Summary:

An estimate is provided in 2022 Dollars for the cost of decommissioning the PWMF under current requirements, based on present-day costs and available technology.

The cost study is designed to provide sufficient information to assess financial obligations. The estimate was prepared by developing an inventory of installed components and structures based on drawing and document reviews. Costs for labour, materials, equipment, waste disposal, insurance, taxes and program management were estimated using OPG (or regional) specific cost data.

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**Appendix D: Compliance Matrix with CSA N294:19**

**Table D-1: Compliance Matrix with CSA N294:19 (Mandatory Requirements)**

Section in CSA N294:19	Requirement in CSA N294:19	Section in This PDP
4.1	The owner of a nuclear facility shall be responsible for planning, executing, and funding all phases of decommissioning.	4.1
4.2	Decommissioning activities shall be planned and executed in accordance with relevant regulations and standards and in keeping with relevant guides.	3.1
	Responsibilities for decommissioning, preparing documents, and recordkeeping shall be clearly established throughout the life cycle of a facility.	4.1, 6.0, 11.0
	Responsibility for the funding of the decommissioning shall be identified and financial guarantee shall be established to ensure adequate funding for decommissioning	5.0
4.3	The owner shall consider the requirements of CSA N286 when executing decommissioning works, including the following:	10.0
	a) protecting the health and safety of workers and the public;	8.0
	b) protecting the environment;	7.0
	c) complying with requirements of the AHJ;	3.1
	d) keeping radiation exposures as low as reasonably achievable (ALARA);	4.1.3.2; 8.2
	e) managing all radioactive and hazardous materials generated by the decommissioning;	4.1.3.5
	f) security; and	9.1
g) safeguards	9.2	
4.4	Programs shall be developed and implemented to support decommissioning.	6,7,8,9,10,11,12
5.1.1.3	A financial guarantee for decommissioning shall be established to ensure that adequate funding is available at the time of decommissioning.	5.0
	The financial guarantee for decommissioning shall be maintained throughout the life cycle of the facility.	
5.1.6	The final end-state shall be considered reached when the end-state objectives as set in the DDP are verified to have been achieved (Annex F describes how to establish the end-state objectives).	This pertains to the completion of decommissioning and is, as such, not applicable for this PDP.
5.1.7	The party accountable for decommissioning shall identify the applicable institutional control requirements following decommissioning as well as the available administrative processes in the jurisdiction in which they are located.	This will be done as part of preparing the DDP (described in 4.1.2.5).

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Section in CSA N294:19	Requirement in CSA N294:19	Section in This PDP
<b>5.2.5</b>	Decommissioning records shall include, as applicable, <ul style="list-style-type: none"> <li>a) the DDP(s);</li> <li>b) public and Indigenous engagement/communication records (as per CNSC REGDOC-3.2.2);</li> <li>c) if required by the AHJ, an impact assessment or environmental review in accordance with applicable legislation;</li> <li>d) licences and permits required for the decommissioning work;</li> <li>e) the plans and procedures used in decommissioning;</li> <li>f) reports and other documents that describe                             <ul style="list-style-type: none"> <li>i) the criteria used to define radioactive and hazardous materials and to distinguish contaminated from uncontaminated materials;</li> <li>ii) the criteria used to define the final contamination status of the facility;</li> <li>iii) the principles and models used in deriving the criteria in Items i) and ii);</li> <li>iv) the residual radionuclide inventory after decontamination;</li> <li>v) the amounts of radioactive and hazardous materials removed and the disposition method;</li> <li>vi) waste management and transfer records;</li> <li>vii) the equipment and materials removed from the facility for recycling or use elsewhere, their treatment prior to removal from the site, and the disposition method;</li> <li>viii) the survey methods and the types of instruments used;</li> <li>ix) the equipment, nuclear and non-nuclear materials, and structures remaining at the end of decommissioning; and</li> <li>x) land remediation undertaken, results of verification analyses as compared to criteria used or derived for soil and water quality, and the disposition of affected media;</li> </ul> </li> <li>g) reports, other documents, and photographs describing findings from inspections, modifications, and repairs to SSCs;</li> <li>h) reports and other documents that describe unplanned or unusual occurrences;</li> <li>i) results and interpretations of environmental monitoring programs;</li> <li>j) occupational dose records;</li> <li>k) deviations from plans and procedures;</li> <li>l) quality assurance records;</li> <li>m) storage-with-surveillance plans;</li> <li>n) facility inspection, maintenance, and equipment records;</li> <li>o) the final radiological and hazardous materials surveys; and</li> <li>p) interim and final end-state reports.</li> </ul>	This pertains to records following the completion of decommissioning.
<b>5.4.2</b>	The facility shall be characterized. See Annex G for guidance.	4.1.3.1, 4.1.3.6
<b>5.4.3</b>	All radioactive waste generated shall be characterized as per the CSA N292 series of Standards.	4.1.3.5
<b>5.5.1</b>	A strategy shall be developed for the management of all radioactive, hazardous, and conventional waste that will be generated throughout the course of the decommissioning.	4.1.3.5
<b>5.6</b>	A hazard assessment commensurate with the tasks to be performed shall be completed prior to decommissioning.	8.1
<b>5.8.1</b>	A quality assurance program shall be implemented.	10.0

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Section in CSA N294:19	Requirement in CSA N294:19	Section in This PDP
6.1.1	The owner shall demonstrate that, under the strategy selected, the facility will be maintained in a safe configuration at all times.	8.0, In addition, development of PDPs in itself addresses this requirement.
6.1.2.2	In such cases where the end-state for in-situ decommissioning results in a waste disposal site, an applicant shall satisfy all regulatory requirements for a radioactive waste disposal facility and demonstrate safety via a safety case and post-closure safety assessment of a disposal facility.	Not Applicable.
6.2.1	For sites with more than one facility, a site decommissioning plan shall be developed to ensure that interdependencies are taken into account.	2.2.5
6.2.3	<p>Cost estimates shall include all decommissioning activities from operations, during shutdown to the final release from regulatory control.</p> <p>The cost estimate for decommissioning shall address the cost of the following principal activities, if applicable:</p> <ul style="list-style-type: none"> <li>a) preparation for final shutdown;</li> <li>b) site characterization, site surveys;</li> <li>c) facility shutdown activities;</li> <li>d) additional activities for safe enclosure;</li> <li>e) decontamination and dismantling activities;</li> <li>f) processing, storage and disposal of all waste including used fuel;</li> <li>g) project management, engineering, and site support;</li> <li>h) site clean-up, landscaping, and restoration;</li> <li>i) long-term management of radioactive waste and used fuel;</li> <li>j) long-term monitoring and maintenance of the site and institutional control;</li> <li>k) licensing costs; and</li> <li>l) miscellaneous expenditures.</li> </ul>	Section 5 and Appendix C
7.1.1	<p>Preparation for decommissioning shall include</p> <ul style="list-style-type: none"> <li>a) an assessment of the records from the previous life cycle stages and the state of the facility (e.g., baseline configuration) at the time of shutdown;</li> <li>b) an impact assessment or environmental review in accordance with applicable legislation, if required;</li> <li>c) a safety assessment for decommissioning;</li> <li>d) ensuring that there is a sufficient number of qualified staff to ensure safe operation during the approach to shutdown;</li> <li>e) further development of the PDP into the DDP;</li> <li>f) placing a facility in a permanent shutdown state; and</li> <li>(a) any additional requirements specified by the AHJ.</li> </ul>	4.1.2 describes overall activities involved preparation for decommissioning requirements however, it should be noted that these requirements pertain to the actual preparation phase and are, as such, not applicable for this PDP.

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<b>7.1.2</b>	The owner shall ensure that processes, systems, and personnel are in place to maintain the facility in a safe state during the transition to decommissioning.	4.1.2 describes the overall activities for preparation for safe transition to decommissioning. However, it should be noted that that this requirement pertains to actual transition/preparation phase and as such, not applicable to this PDP.
<b>7.4.1.1</b>	To ensure a smooth transition from operation to decommissioning, the facility shall be prepared to complete stabilization activities as soon as practical after the permanent shutdown date.	These requirements pertain to the preparation phase.
<b>7.4.3</b>	During the transition period between shutdown and decommissioning, monitoring and maintenance activities shall be conducted to ensure the health and safety of persons and the protection of the environment.	These requirements pertain to the preparation phase.
<b>7.5.1</b>	An assessment of the state of the facility shall be performed to provide baseline information for condition of the building and SSC, and evaluation of the hazards to be controlled during decommissioning.  A thorough survey shall be performed and supplemented by a review of existing records, as applicable.	4.1.2 describes the overall activities for preparation for safe transition to decommissioning. However, is should be noted that that this requirement pertains to actual transition/preparation phase and as such, not applicable to this PDP.
<b>7.5.2.1</b>	The following hazards shall be investigated and assessed: a) radiological hazards; b) biologically, chemically, and physically hazardous materials; c) hazards from concealed or hidden services; and d) structural hazards.	These requirements pertain to the preparation phase.
<b>7.5.2.2</b>	Historical information shall be preserved that is relevant to the eventual decommissioning of the facility.	11.0
<b>7.6.1</b>	A DDP shall be developed for nuclear facilities, in accordance with Annex C and regulatory requirements, and submitted to the AHJ for acceptance.	4.1.2.5 describes the development of a DDP, however these requirements pertain to the actual DDP preparation for the Dismantling & Demolition phase.  Relevant for the DDP not the PDP.
<b>7.6.2.1</b>	The DDP shall meet the content provisions of Annex C.	Same as above.

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Section in CSA N294:19	Requirement in CSA N294:19	Section in This PDP
<b>7.6.3</b>	<p>If deferred decommissioning is the preferred decommissioning strategy, in addition to a DDP, a SWS plan shall be developed.</p> <p>If a SWS plan is standalone, it shall be submitted to the AHJ.</p>	Not Applicable
<b>7.6.4</b>	<p>A safety assessment shall be performed to identify potential hazards to workers, the public, and the environment, from both routine decommissioning activities and credible accidents during decommissioning.</p> <p>The assessment shall describe the relative importance of the potential hazards and identify the methods for mitigating the risks associated with such hazards.</p> <p>If fissile material is involved, a criticality safety assessment and the planned actions involving fissile material shall be included.</p> <p>The assessment shall also address the residual risks to the public, if any, after decommissioning is completed.</p> <p>In-situ decommissioning may result in a waste disposal site. In such a case, an applicant shall satisfy all regulatory requirements for a radioactive waste disposal facility and demonstrate safety via a safety case and post-closure safety assessment of a disposal facility.</p>	<p>8.0, however these requirements pertain to the preparation phase.</p> <p style="text-align: center;">N/A</p> <p style="text-align: center;">N/A</p>
<b>7.6.5.1</b>	<p>The strategy for managing all wastes from decommissioning shall include a management plan covering both the short term and, where possible, the long term.</p>	<p>4.1.3.5 provides high level plan for waste management strategies during decommissioning. However, it should be noted that These requirements pertain to the preparation phase, during the development of DDP.</p>

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Section in CSA N294:19	Requirement in CSA N294:19	Section in This PDP
<b>7.6.5.2</b>	<p>The waste management program shall cover the following processes, as applicable:</p> <ul style="list-style-type: none"> <li>a) characterization;</li> <li>b) classification;</li> <li>c) minimization;</li> <li>d) segregation;</li> <li>e) clearance;</li> <li>f) handling;</li> <li>g) volume reduction;</li> <li>h) treatment;</li> <li>i) packaging;</li> <li>j) storage;</li> <li>k) transportation; and</li> <li>l) final disposition.</li> </ul> <p>Transportation requirements and the waste receiver's acceptance criteria shall be reviewed to ensure that the waste is appropriate for shipment and acceptable to the waste receiver.</p>	<p>4.1.3.5 provides high level plan for waste management strategies during decommissioning. However, it should be noted that these requirements pertain to the preparation phase, during the development of DDP.</p>
<b>8.1.2</b>	<p>The work to be performed during the decommissioning shall be described in a DDP.</p>	<p>This requirement pertains to the preparation phase.</p>
<b>8.1.3</b>	<p>The physical work to be carried out shall be defined in terms of work packages and work procedures to the level of detail required for safe, effective, and efficient decommissioning.</p>	<p>These requirements pertain to the execution phase and are, as such, not applicable for this PDP.</p>
<b>8.1.7.1</b>	<p>Where decontamination is being used as part of decommissioning, the following shall be identified:</p> <ul style="list-style-type: none"> <li>a) the areas, locations, and equipment to be decontaminated;</li> <li>b) the objectives of the decontamination (e.g., decontamination of equipment for salvage and reuse, decontamination of metals for recycling, decontamination of building foundations that are to remain in place, decontamination for clearance of materials to be disposed of as non-radioactive);</li> <li>c) the decontamination methods to be employed; and</li> <li>d) the residual level of radioactivity that is to be achieved.</li> </ul>	<p>These requirements pertain to the execution phase.</p>
<b>8.1.8.1</b>	<p>A demolition plan shall be prepared.</p> <p>The equipment and structures to be dismantled or demolished shall be identified.</p> <p>The equipment and structures that are to remain at the completion of decommissioning shall also be identified.</p> <p>Procedures for dismantling and demolition shall take into account the associated hazards.</p>	<p>These requirements pertain to the execution phase.</p>

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Section in CSA N294:19	Requirement in CSA N294:19	Section in This PDP
<b>8.1.8.2</b>	<p>The following factors shall be considered when selecting dismantling/demolition methods:</p> <ul style="list-style-type: none"> <li>a) availability of professional competence associated with the operations of the chosen equipment;</li> <li>b) the equipment should be simple to operate, decontaminate, and maintain;</li> <li>c) remaining structural elements shall be kept in a physically stable state;</li> <li>d) measures to prevent unintentional releases to the environment;</li> <li>e) planned discharges to the environment shall be controlled as per licence conditions and previous commitments;</li> <li>f) when underwater dismantling and cutting is used, provisions shall be made to process the water to promote and assist in effluent treatment;</li> <li>g) the effect of dismantling tasks on adjacent systems and structures and on other work in progress shall be evaluated;</li> <li>h) waste containers, handling systems, and routes shall be defined before the start of dismantling work; and</li> <li>i) federal, provincial/territorial and/or municipal requirements.</li> </ul>	<p>These requirements pertain to the execution phase.</p>
<b>8.1.9.1</b>	<p>Surveys during decommissioning shall be performed to comply with</p> <ul style="list-style-type: none"> <li>a) worker occupational safety and radiation protection limits;</li> <li>b) environmental monitoring criteria; and</li> <li>c) processes to release materials and equipment from the site.</li> </ul>	<p>4.1.3 and 4.1.3.1 provides high level plan for surveys to be performed during decommissioning. However, it should be noted that these requirements pertain to execution phase.</p>
<b>8.1.9.2</b>	<p>At the completion of a decontamination or dismantling work package, a survey shall be performed, if required, to demonstrate that the planned end-state has been achieved.</p> <p>The results of the survey shall be documented in a report that includes</p> <ul style="list-style-type: none"> <li>a) the criteria used to define the end-state;</li> <li>b) the methods and procedures used to ensure that the criteria were met; and</li> <li>c) the measurement data, including appropriate statistical analysis and systematic approaches.</li> </ul>	<p>4.1.3.6 provides high level plan for surveys to be performed after decontamination or dismantling. However, it should be noted that these requirements pertain to execution phase.</p>
<b>8.2</b>	<p>Where decommissioning of the facility is to take place in discrete stages, an interim end-state report shall be prepared when each planned interim end-state is achieved.</p>	<p>These requirements pertain to the execution phase.</p>
<b>8.3</b>	<p>A plan for surveillance, monitoring, physical protection, and maintenance of the facility during such periods shall be developed and implemented to</p> <ul style="list-style-type: none"> <li>a) maintain the facility in a safe state;</li> <li>b) control the release of materials to the environment;</li> <li>c) prevent access by unauthorized persons; and</li> <li>d) mitigate infestations of vermin and other organisms.</li> </ul>	<p>These requirements pertain to the execution phase.</p>

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<b>8.4</b>	Lands associated with a facility or a standalone site that might have been impacted by previous nuclear activities shall be remediated to the degree required to meet the end-state criteria.	4.1.3.4 provides high level plan for land remediation, however, this requirement pertains to completion of decommissioning.
<b>8.5</b>	<p>At the completion of this phase, final surveys of residual radioactive and hazardous materials shall be performed and documented to demonstrate that the final end-state for remaining equipment, structures, and the site has been achieved in accordance with the criteria specified in the DDP.</p> <p>The results of the final survey shall be documented in a report that includes</p> <ul style="list-style-type: none"><li>a) the criteria used to define the end-state;</li><li>b) the methods and procedures used to ensure that the criteria were met; and</li><li>c) the measurement data, including appropriate statistical analysis and systematic approaches.</li></ul>	This pertains to the completion of decommissioning.
<b>9.1</b>	<p>Following the completion of decommissioning, a final end-state report shall be prepared and retained.</p> <p>Where a decommissioning program involves completing a number of separately approved decommissioning projects, interim end-state reports shall be submitted for each project.</p>	4.1.4.2 provides high level plan for the final end state report, however, this requirement pertains to completion of decommissioning.

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**Table D-2: Compliance Matrix with CSA N294:19 Annex A (Non-Mandatory Requirements)**

Section in CSA N294:19 Annex A	Requirement in CSA N294:19	Section in This PDP
<b>A.2</b>	A PDP may include the following, unless they are not applicable to the facility:	
<b>A.2 a)</b>	a description of the location of the facility, including <ul style="list-style-type: none"> <li>i) a map of the facility and its specifications;</li> <li>ii) geographic information;</li> <li>iii) details regarding the surrounding environment;</li> <li>iv) land uses; and</li> <li>v) illustrations and maps of the facility in relation to the municipality;</li> </ul>	2.2 2.1 2.1; 2.3 2.3 2.3.4 Figure 2-1
<b>A.2 b)</b>	purpose and description of the facility, including <ul style="list-style-type: none"> <li>i) primary components and systems;</li> <li>ii) building type and construction, including location of any hazardous building materials (e.g., asbestos, PCBs);</li> <li>iii) building services (e.g., power, heating, ventilation, sewer, water, fire protection);</li> <li>iv) laboratories and other hazardous handling areas;</li> <li>v) type, quantity, and form of radioactive and hazardous materials stored, produced, or used during operation; and</li> <li>vi) design features used to reduce the spread of contamination and facilitate decontamination and dismantling;</li> </ul>	1.0 2.2; Appendix A 2.2 2.2; Appendix A 2.2; Appendix A 2.2; Appendix B 2.2; 3.6
<b>A.2 c)</b>	post-operational conditions, including <ul style="list-style-type: none"> <li>i) a summary of the shutdown process, including planned removal of stored inventories of hazardous or radioactive materials;</li> <li>ii) the predicted nature and extent of contamination remaining in the primary systems and components (in list or table format with reference to applicable illustrations);</li> <li>iii) the predicted nature and extent of contamination on floors, walls, work surfaces, ventilation systems, etc.;</li> <li>iv) the identification of any separate planning envelopes; and</li> <li>v) an overview of the principal hazardous conditions anticipated to exist;</li> </ul>	3.5; 4.1.2 3.6 3.6; 8.1.1 4.1.2.5 8
<b>A.2 d)</b>	the decommissioning strategy, including <ul style="list-style-type: none"> <li>i) the final end-state objective;</li> <li>ii) rationale for               <ul style="list-style-type: none"> <li>1) the decommissioning strategy selected;</li> <li>2) interim end-states;</li> <li>3) periods of SWS; and</li> <li>4) in-situ decommissioning concepts;</li> </ul> </li> <li>iii) the requirements for long-term institutional controls; and</li> <li>iv) the assessment of alternative strategies (or a rationale for why alternatives do not exist or do not warrant consideration);</li> </ul>	3.5 4.1.4.1 3.5 Not applicable. Not applicable. Not applicable. N/A: No long-term institutional controls will be established 3.5

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Section in CSA N294:19 Annex A	Requirement in CSA N294:19	Section in This PDP
A.2 e)	a plan of the decommissioning work, including <ul style="list-style-type: none"> <li>i) a work breakdown structure;</li> <li>ii) a summary of the main steps for decontamination/disassembly/removal of each of the systems (preferably grouped into work packages);</li> <li>iii) for each work package, identification of those types of activities that could pose a significant hazard to workers, the public, or the environment;</li> <li>iv) the role of existing operational standard procedures for radiation protection, hazardous materials handling, industrial safety, and environmental protection in managing hazards;</li> <li>v) specific activities for which additional protection/mitigation procedures will be required at the detailed planning stage;</li> <li>vi) a summary of the final dismantlement of the structures; and</li> <li>vii) a conceptual schedule showing the approximate year of facility shutdown and the approximate sequencing and duration of the decommissioning work packages and, where relevant, storage periods;</li> </ul>	4.1 4.1.3 4.1.3; 8.0 8.0 7.3 4.1.3 Table 4-1
A.2 f)	radiological monitoring and survey commitments, including <ul style="list-style-type: none"> <li>i) a program for conducting periodic contamination surveys and the recording of contamination events during facility operation;</li> <li>ii) a commitment to conduct detailed post-operation surveys in support of DDP development; and</li> <li>iii) a commitment to develop plans and protocols acceptable to the AHJ at the detailed planning stage for monitoring               <ul style="list-style-type: none"> <li>1) work hazards during decommissioning;</li> <li>2) personnel dosimetry;</li> <li>3) environmental emissions and effluents; and</li> <li>4) materials, sites, and structures to be cleared from regulatory control;</li> </ul> </li> </ul>	8.0; 11.0 4.1.2.5; 4.1.3.1; 4.1.3.6 4.1.2; 4.1.2.1, 8.0
A.2 g)	a waste management strategy specifying <ul style="list-style-type: none"> <li>i) the approximate quantities and characteristics of radioactive and chemically hazardous wastes expected to arise from the decommissioning (tied to specific work packages, if possible);</li> <li>ii) the anticipated final disposition of radioactive and chemically hazardous materials; and</li> <li>iii) a commitment to segregate as much material as possible for reuse and recycling;</li> </ul>	4.1.3.5
A.2 h)	a commitment to prepare a DDP for regulatory approval prior to dismantling and demolition;	1.0; 4.1.2.5
A.2 i)	a commitment to periodically review and update the PDP until a DDP is prepared, in accordance with Clause 6.2.2;	1.0; 3.3
A.2 j)	the physical state of the facility at <ul style="list-style-type: none"> <li>i) the end of operations; and</li> <li>ii) the start of decommissioning;</li> </ul>	3.5 3.6
A.2 k)	the records required for decommissioning, including a description of the facility operational records that will be maintained to periodically update the PDP and prepare the DDP(s);	11.0

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Section in CSA N294:19 Annex A	Requirement in CSA N294:19	Section in This PDP
A.2 l)	a public engagement plan, including a public information program and avenues for public participation;	12.0
A.2 m)	an Indigenous engagement plan as per the requirements and guidance of CNSC REGDOC-3.2.2; and	2.3.7.1, 12.0
A.2 n)	the cost and a financial guarantee, specifying <ul style="list-style-type: none"><li>i) an estimate of the total present-value cost of the decommissioning;</li><li>ii) a reasonable basis for how cost estimates were derived; and</li><li>iii) a description of how the required funds will be provided;</li></ul>	5.0; Appendix C