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Preliminary Decommissioning Plan – RWOS1, CMLF and CSF

Preliminary Decommissioning Plan
RWOS1, CMLF and CSF

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Table of Contents

Page

List of Figures

Page

List of Tables

Page

Revision Summary

Revision Number	Date	Comments
R002	December 2021	• Entire document revised to reflect compliance with CSA N94:19 as per licensing basis for RWOS1 • Entire document revised to remove SSTF. SSTF has been successfully decommissioned in 2020 • Entire document revised to include Central Storage Facility (CSF) in the preliminary decommissioning plan • Entire document revised to remove L&ILW DGR planning assumptions and updated with current planning assumption • Section 1 – updated to include a footnote in paragraph 1 which describes the location and access to Bruce Nuclear Site, updated Figure 1-1 and Figure 1-2 – updated to remove SSTF and L&ILW DGR, and include CSF • Section 1.1 – Section 1.3 – revised to include current planning assumptions • Section 1.4 – removed planning assumption for SSTF and replaced it with CSF planning assumptions • Section 2.0 – minor wording change. Added “as well as current use of adjacent land use” • Added new Section 3 ‘Interfaces’ to comply with CSA N294:19 requirements • Section 4.1 – updated to include the following wording “OPG is responsible for planning, including development of all required documents throughout the life cycle of decommissioning, executing and funding all phases of decommissioning” • Section 4.3 – minor wording changes • Section 4.3.1 – included DDP as part of necessary documentation • Section 4.3.2 – minor wording change • Added new section 4.3.4 ‘Detailed Decommissioning Plan’ • Section 4.4.2 – minor wording change associated with gaseous effluents • Section 4.4.4 – revised to include minor wording changes to reflect compliance with CSA N294:19 • Section 4.5 – added following text “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)” • Section 4.5.2 – revised section heading to ‘Release from Regulatory Control’ • Section 4.6 – new section added on Canadian and International Decommissioning Strategies and Experience • Section 5.2 – removed text related to Bruce Nuclear Site location and access. This text is now included in Section 1 as a footnote • Section 5.5 – updated licence number, included licence reference and minor wording change to reflect RWOS1 is in operational phase. • Added New Section 5.6 ‘Decommissioning Strategy’ • Table 5-1 – updated based on current assumptions • Section 6 – made changes throughout all the sections to remove laundry services as the facility no longer provides this service. Minor wording throughout subsections associated with Section 6. Removed reference to Safety Report for CMLF as the safety report will not be updated in the future. • Section 6.1 – revised to include that this facility is now operated under PROL and not WNSL

Revision Number	Date	Comments
		• Section 6.3.1 – removed Figure 6-2 'Layout of Key CMLF Areas' • Section 6.4.1 – wording change in paragraph 1 to reflect current Bruce Power procedures • Added New Section 6.5 'Decommissioning Strategy' • Table 6-1 – updated based on current assumptions • Section 7 – removed information related to SSTF as this facility is now decommissioned. Added PDP for CSF. All subsections revised to include information related to CSF • Section 8 – revised to include current financial guarantee information • Section 10.1 – revised wording to reflect the current environmental assessment requirements • Section 10.3.1 – revised wording in paragraph # 1 to reflect compliance with CSA N294:19 • Section 11.0 – added paragraph # 2 to reflect compliance with CSA N294:19 • Section 13.1 – included CSA N294:19 • Section 15 – added compliance with REGDOC-3.2.1 and REGDOC-3.2.2 • References – made changes as applicable. Removed reference to CMLF SAR as there are no plans of updating the SAR • Added Appendix A • Appendix B (previously Appendix A)– revised to include current financial guarantee • Appendix C (previously Appendix B) – replaced Appendix C compliance with CNSC Guide G-219 with CSA N294:19 compliance matrix

Acronyms

Abbreviation	Definition
ALARA	As Low As Reasonably Achievable
BASS	Bruce Alternate Steam Supply
BHWP	Bruce Heavy Water Plant
BNPD	Bruce Nuclear Power Development
BNGS	Bruce Nuclear Generating Station
BPHPL	Bruce Power Health Physics Lab
CCA	Contamination Control Area
CEAA	Canadian Environmental Assessment Act
CMLF	Central Maintenance and Laundry Facility
CMF	Central Maintenance Facility
CNSC	Canadian Nuclear Safety Commission
CSA	Canadian Standards Association
CSF	Central Storage Facility
CTSF	Contaminated Tool Storage Facility or Contaminated Tooling Storage Facility
CVI	Calandria Vessel Inspection
DDP	Detailed Decommissioning Plan
DGR	Deep Geologic Repository
DOC	Decommissioning Operations Contractor
DQO	Data Quality Objectives
EAMS	Electronic Asset Management System
EPSCA	Electrical Power Services Construction Agreement
FCFR	Fuel Channel and Feeder Replacement
HEPA	High Efficiency Particulate Air
IAEA	International Atomic Energy Agency
ILW	Intermediate-Level Waste
L&ILW	Low- and Intermediate-Level Waste
LLW	Low-Level Waste
MARSSIM	Multi-Agency Radiation Surveys and Site Investigation Manual
MCR	Major Component Replacement
MECP	Ministry of the Environment, Conservation and Parks
NGS	Nuclear Generating Station
NSDF	Near Surface Disposal Facility
OHSA	Occupational Health and Safety Act
ONFA	Ontario Nuclear Funds Agreement
OPG	Ontario Power Generation
PCBs	Polychlorinated Biphenyls
PDP	Preliminary Decommissioning Plan
PNGS	Pickering Nuclear Generating Station
PROL	Power Reactor Operating Licence
RWOS1	Radioactive Waste Operations Site 1
SCADA	Supervisor Control and Data Acquisition
SDS	Safety Data Sheet
SQEP	Suitably Qualified and Experienced Person

Abbreviation	Definition
SSCs	Systems, Structures and Components
SSTF	Spent Solvent Treatment Facility
TLG	TLG Services, LLC.
WHMIS	Workplace Hazardous Materials Information System
WNSL	Waste Nuclear Substance Licence
WWMF	Western Waste Management Facility

Abstract

This Preliminary Decommissioning Plan (PDP) describes the activities that will be required to decommission Radioactive Waste Operations Site 1 (RWOS1), the Central Maintenance and Laundry Facility (CMLF) and the Central Storage Facility (CSF).

This plan has been prepared to satisfy the Canadian Nuclear Safety Commission's (CNSC's) request to require financial guarantees for Waste Nuclear Substance Licences, and to develop PDPs for these facilities [R-1] [R-2]. This PDP is valid provided that these facilities operate under a licence under the Nuclear Safety and Control Act and remain under the control of the CNSC. It has been written to meet the requirements of CNSC Regulatory Guide G-219 – Decommissioning Planning for Licensed Activities (June 2000) and Canadian Standards Association (CSA) N294:19 – Decommissioning of Facilities Containing Nuclear Substances. Appendix C 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 plan demonstrates that the decommissioning of RWOS1, the CMLF and the CSF is feasible with existing technology and provides a basis for estimating the cost of the associated decommissioning efforts.

1.0 INTRODUCTION

Ontario Power Generation (OPG) maintains an ongoing program to prepare for the eventual decommissioning of its waste management and maintenance facilities. This Preliminary Decommissioning Plan (PDP) has been produced for the following three facilities located on the Bruce Nuclear Site in Tiverton, Ontario, see Figure 1-1 and Figure 1-2[1]:

- Radioactive Waste Operations Site 1 (RWOS1), described in Section 5.0;
- The Central Maintenance and Laundry Facility (CMLF), also referred to as the Central Maintenance Facility, described in Section 6.0; and
- The Central Storage Facility (CSF) also referred to as Contaminated Tools Storage Facility or Contaminated Tooling Storage Facility (CTSF), described in Section 7.0.

This PDP defines the areas of each of the facilities, as well as the general structure and sequence of the proposed decommissioning work to be undertaken. It forms a structured basis for establishing financial guarantees for the work, as well as a baseline approach for future decommissioning planning. Ultimately, this plan provides the foundations of a decommissioning approach that is sufficient to protect the health and safety of workers, the public and the environment.

This is a living, iterative document. At this stage it is not intended to provide a detailed decommissioning approach; rather, it is subject to periodic review in recognition of the fact that decommissioning is interdependent with all other phases of each facility's life cycle, as well as other external factors. For example, modifications to the facility design or operational activities, or developments in available decommissioning techniques and technologies, will influence the final decommissioning methodology. In addition, the periodic reviews of this document provide the opportunity to capture additional information, including advances in knowledge and understanding of key issues, revised regulatory or records requirements, changes in site conditions or decommissioning strategy, and updated costing or funding information.

This plan has been prepared to satisfy a CNSC request to develop PDPs for these facilities [R-1] [R-2]. This plan has been compiled in accordance with the requirements in CNSC Regulatory Guide G-219[2] [R-3] and CSA Standard N294:19 [R-4]. Appendix C 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]. It is recognized that the level of requirements imposed on

[1] The Bruce Nuclear Site itself is situated midway between Kincardine and Port Elgin, and approximately 250 km from Toronto, occupying an area of approximately 10 km^2. Access to the Bruce Nuclear Site is provided by Provincial Highway No. 21 via one of two roads: Bruce County Road 20 and Concession 2. Private roads running throughout the Bruce Nuclear Site provide access to each of the facilities.

[2] 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].

decommissioning activities should be commensurate with the type and complexity of the facility through applying the graded approach principle.

This PDP demonstrates that the decommissioning of RWOS1, the CMLF and the CSF is technically and financially feasible given existing knowledge, and has been planned taking into consideration health, safety, security and protection of the environment. It serves to:

- Describe the facilities to be decommissioned;
- Provide the facilities' history and current status;
- Assess the radiological and conventional safety issues associated with the decommissioning;
- Outline the potential environmental and socio-economic impacts of the decommissioning;
- Define the decommissioning strategy that will be employed;
- Outline the work that will be required to complete the decommissioning;
- Estimate the inventory of the radioactive wastes that will be generated during decommissioning;
- Propose a schedule for the decommissioning work; and
- Discuss the decommissioning cost estimate and financial guarantee.

Figure 1-1 – Location of the Bruce Nuclear Site (also referred to as Bruce Nuclear Power Development (BNPD))

Figure 1-2 – Location of RWOS1, CMLF and CSF within the Bruce Nuclear Site

1.1 Planning Assumptions – Common

Based on existing knowledge, the following assumptions – common to all three facilities – form the basis of this PDP:

1. OPG had planned to dispose of Low- and Intermediate- Level Waste (L&ILW) from its owned generating stations in a Deep Geologic Repository (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.

2. All operational waste is assumed to be removed prior to start of decommissioning.

3. It is expected that the decommissioning of RWOS1, the CMLF and the CSF will be performed together concurrently with decommissioning of the WWMF L&ILW Buildings [R-6].

4. OPG will retain ownership of each of the site areas throughout the course of decommissioning.

5. In-ground waste storage structures that cannot easily be removed will be surveyed for contamination and decontaminated, if required. Consistent with international practices, they will be dismantled to a minimum depth of 1 m below grade (minimum removal depth), backfilled with clean concrete rubble and soil, and graded over. This minimum depth allows for the placement of both gravel for drainage and topsoil for erosion control through vegetation. It should be noted that surveys may be required to accurately determine the depth to which the structures will be dismantled, to ensure that all residual contamination is removed to levels that are in line with the site release criteria.

6. Underground piping and utility lines will be de-energized, capped and abandoned in-situ. OPG will investigate the requirements for capping and/or abandoning the underground piping and utility lines while abiding by provincial and/or federal regulations at the time of dismantling and demolition.

7. Non-radioactive hazardous waste and designated substances (if any) found during decommissioning will be disposed of at approved disposal facilities.

8. Above-ground structures will be surveyed for contamination, decontaminated, if required, and dismantled and demolished. Contaminated concrete surfaces will be decontaminated via common techniques, such as scabbling, vacu-blasting or planing. Where contamination is found at depth, chipping or cutting techniques may be used.

9. Secondary radioactive waste produced as a result of decontamination operations (including radioactively contaminated building rubble that could not otherwise be decontaminated) is planned to be disposed of in the LLW and ILW long-term disposal facilities. Contaminated metals may be disposed of similarly if attempts to decontaminate are unsuccessful. It is anticipated that the decontaminated demolition material will preferentially be crushed and reused on site as infill or sent to an appropriately licensed municipal waste landfill site for permanent disposal (in accordance with the waste management hierarchy in Figure 4-1).

10. The decommissioning of each facility will be to the extent that none of the facilities will rely on institutional controls, following decommissioning, to protect the workers on site or the general public.

11. The respective site areas will eventually be made available for other OPG uses.

12. All decommissioning waste arising from RWOS1, the CMLF and the CSF is assumed to be characterized as LLW.

13. No salvage credit is assigned to equipment and components removed during decommissioning, such equipment is considered waste for costing purposes; however, recycling of clean materials will be pursued.

14. Clearance Levels will be developed based on CSA Standard N292.5 along with the Nuclear Substances and Radiation Devices Regulations and OPGN Governance [R-7] to determine clearance levels acceptable to the 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.

Planning for the eventual decommissioning of RWOS1, the CMLF and the CSF is an ongoing process, and the planning assumptions are expected to evolve over time. This document describes the preliminary plan as it exists at the time of writing.

Before any physical decommissioning work will begin, the decommissioning will be planned in further detail. As part of that, the appropriate methods and technologies available for use at the time of decommissioning will be reviewed and, where applicable, will be adopted and described.

1.2 Planning Assumptions – RWOS1

Planning assumptions exclusive to RWOS1 include the following:

1. A Decommissioning Operations Contractor (DOC), a company or consortium selected on the basis of experience, safety record, overall approach and cost, will perform all decommissioning work and will bring in the required power supply to carry out the work. OPG will provide the necessary oversight during this time period.

2. Removal of any stored waste (non-radioactive, radioactive, hazardous/ designated materials, etc.) that does not form part of the facility's structure is not included in the decommissioning activities. It is assumed that these will be removed prior to dismantling and demolition.

3. For the lined holes, the soil beneath and around all concrete enclosures is assumed to be below the applicable material release criteria [R-8].

4. With regards to the concrete trenches and monolith, approximately 50% of the surface area of each interior concrete wall is assumed to require decontamination using vacu-blasting (or similar technique). Of the floor area, 100% is assumed to require decontamination to a depth of half an inch. All exterior surfaces of the concrete walls and floors are considered clean to release levels. Tritium concentrations in concrete are assumed to be below release levels [R-8].

5. It is assumed that 10 m^3 of contaminated soil exists at RWOS1.

6. The slab on grade pad located near the entrance to the facility and the soil beneath it is assumed to be below the applicable material release criteria.

7. Decontamination of all interior enclosures will be performed prior to demolition.

Note: Assumptions will be verified via the appropriate survey(s) during decommissioning.

1.3 Planning Assumptions – CMLF

Planning assumptions exclusive to the CMLF include the following:

1. A DOC, a company or consortium selected on the basis of experience, safety record, overall approach and cost, will perform all decommissioning work and will bring in the required power supply to carry out the work. OPG will provide the necessary oversight during this time period.

2. Removal of any stored waste (non-radioactive, radioactive, hazardous/ designated materials, etc.) that does not form part of the facility's systems, structures and components (SSCs) is not included in the decommissioning

activities. It is assumed that these will be removed prior to dismantling and demolition.

3. The soil on the CMLF site is assumed to be below the applicable material release criteria. This will be verified during site characterization activities.

1.4 Planning Assumptions – CSF

Planning assumptions exclusive to the CSF include the following:

1. A DOC, a company or consortium selected on the basis of experience, safety record, overall approach and cost, will perform all decommissioning work and will bring in the required power supply to carry out the work. OPG will provide the necessary oversight during this time period.

2. Removal of any stored waste (non-radioactive, radioactive, hazardous/ designated materials, etc.) that does not form part of the SSCs is not included in the decommissioning activities. It is assumed that these will be removed prior to dismantling and demolition.

3. The soil on the CSF site is assumed to be below the applicable material release criteria. This will be verified during site characterization activities.

2.0 ENVIRONMENT

Due to the close proximity of RWOS1, the CMLF and the CSF to the WWMF, information on the natural and human environment as well as current use of adjacent land use is provided in Section 2.0 of the WWMF PDP [R-6] and Section 2.0 of the WWMF Safety Report [R-9].

3.0 INTERFACES

A number of other licensed nuclear facilities are located on the Bruce Power site in the immediate vicinity of RWOS1, the CMLF and the CSF. These include Bruce Nuclear Generating Station (BNGS) A and B, the WWMF, and the Douglas Point Waste Management Facility. The Bruce Power Site also contains a number of technical and administration buildings. More information on the Bruce Nuclear Site is provided in [R-10].

Interfaces exist between OPG lands and operations and Bruce Power programs, structures and services. In summary, services provided by Bruce Power include:

- Security services;
- Emergency response services;
- Electricity;
- Fire water and domestic water;
- Sewage;
- Storm water management;
- Traffic management;
- Vehicle monitoring;
- Facility access and working rights; and
- Public address system.

Facility-specific interfaces are provided in subsections below.

3.1 RWOS1 Interfaces

- **Environmental monitoring:** the groundwater well network around RWOS1 is monitored by the OPG staff. The laboratory services are provided by Bruce Power Health Physics Lab (BPHPL) and results are provided to OPG's Performance Engineering. The surface water monitoring is also part of the environmental monitoring, similarly, completed by OPG staff, analyzed at BPHPL and results managed by OPG.

- Security Services, emergency response, traffic management, vehicle monitoring, facility access, and the public address system are provided by Bruce Power.

3.2 CMLF Interfaces

- **Electrical:** Power to the CMLF originates from Hydro One Networks at 230 KV at the Bruce Heavy Water Plant B Substation. It is then transformed down to 13.8 KV and feeds Switchgear #3. The Switchgear #3 then feeds the CMLF at 13.8 KV and is transformed down to 600 V by four transformers within the CMLF. There are four 13.8 KV feeds to the CMLF and through tie breakers, the feed has redundancy through four Motor Control Centers within the CMLF.

- **Domestic Water:** Domestic drinking water is fed to the CMLF through the Center of Site Domestic Water Distribution piping. This is a single feed that originates from the Bruce B Domestic Water Plant.

- **Fire Water**: CMLF Fire Water is supplied from the Center of Site Fire Water Pumphouse under normal operating conditions. A secondary fire water supply is available from the Bruce B Fire Water Pumphouse.

- **Fire Alarm System**: The CMLF fire alarm system consists of both heat/smoke detectors and fusible sprinklers. The fire alarm system is monitored by the Bruce Alternate Steam Supply (BASS) Control Room through a Supervisor Control and Data Acquisition (SCADA) system and by the Emergency and Protective Services through a slave panel display.

- **Security**: Security to the CMLF is provided by the Emergency and Protected Services.

3.3 CSF Interfaces

- **Electrical:** Power to the CSF originates from Hydro One Networks at 230 KV at the BNGS B Main Substation. It is then transformed down to 13.8 KV and a dual supply feeds Vista Switchgear BU4 at the CSF. The Vista Switchgear BU4 through tie breakers then feeds the CSF at 13.8 KV and is transformed down to 600 V by a transformer within the CSF. There are two 13.8 KV feeds to the CSF and through tie breakers at the Vista Switchgear has a redundant feed to the CSF.

- **Domestic Water:** Domestic water is fed to the CSF through the Center of Site Domestic Water Distribution piping. This is a single feed that originates from the Bruce B Domestic Water Plant.

- **Fire Water:** CSF Fire Water is supplied from the Center of Site Fire Water Pumphouse under normal operating conditions. A secondary fire water supply is available from the Bruce B Fire Water Pumphouse.

- **Fire Alarm System:** The CSF fire alarm system consists of both heat/smoke detectors and fusible sprinklers. The fire alarm system is monitored by the BASS Control Room through a SCADA system and by the Emergency and Protective Services through a slave panel display.

- **Security:** Security to the CSF is provided by the Emergency and Protected Services.

4.0 OVERVIEW OF DECOMMISSIONING

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.

The key aspects of each of the phases are summarized in the following subsections.

During preparation for decommissioning, when more detailed plans are prepared, the key aspects outlined below will be reviewed. As such, the description and sequence of the activities below are subject to change, and may differ between different facilities.

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

4.2 Planning for Decommissioning

According to CSA N294:19, planning for decommissioning generally begins at the siting/design phase (or as early as possible) and continues throughout the life cycle of the facility. A decommissioning strategy and a PDP are developed in this phase. RWOS1, the CMLF and the CSF are 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 update 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; and

- Develop and update a PDP. As part of updating the PDP, a review of records that affect decommissioning would be assessed together with a review of the history of the facility (operational and maintenance records) and how it could affect decommissioning.

4.3 Preparation for Decommissioning

As per 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 developing more detailed plans, including Detailed Decommissioning Plan (DDP) for the decommissioning and securing the necessary regulatory approvals, as required.

Aspects that are considered part of this phase include (but are not limited to):

- Notify the regulator of intent to shut down the facility;
- Obtain the necessary regulatory approvals/acceptance in accordance with Section 4.3.1;
- Place the facility in a safe shutdown state, which requires the removal of non-structural hazardous/designated materials and radioactive materials. Structural hazardous/designated materials will be removed before any demolition work occurs;
- 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;
- As necessary, perform a safety hazard assessment to more clearly understand which decommissioning operations could pose a significant hazard to workers, members of the public and the environment;
- Perform an environmental review (if required);
- Review and update the decommissioning strategy;
- Plan for decommissioning in further detail, such as development of DDP (see note 1 below);
- Further develop a plan for managing the waste (see note 1 below); and
- Refine public and stakeholder engagement program, if required.

Note 1: These plans may be submitted prior to the dismantling and demolition stage, as required.

4.3.1 Regulatory Approvals

When OPG has made the decision to decommission a facility, it will notify the CNSC of its intentions. OPG staff will prepare the necessary documentation, including the DDP and obtain the necessary regulatory approvals in accordance with the Nuclear Substances and Radiation Devices Regulations before any decommissioning work begins to obtain licence to perform decommissioning activities for RWOS1, the CMLF and the CSF.

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.

4.3.2 Shutdown of Facilities

While the precise shutdown procedures for each facility will vary, the following is a list of some activities that may be undertaken during this stage:

- Removing non-structural hazardous/designated materials and radioactive materials (e.g., stored or transient materials, such as filter media and liquids) from facility areas. The hazardous material inventory for the CMLF and CSF is provided in Appendix A;

- De-energizing systems that are no longer required. Systems such as fire protection and electrical may remain operational if the dismantling and demolition stage are deferred; and

- Site characterization and historical site assessment; note that this assessment must be performed prior to the dismantling and demolition stage and may be performed, in part, before shutdown.

4.3.3 Removal of Hazardous/Designated Materials and Stored L&ILW

As part of preparation for decommissioning, an appraisal and description of non-nuclear hazardous/designated materials contained within each facility's SSCs will be documented. This will include but not be limited to:

- Hazardous materials – e.g., acids, alkalis, solvents, polychlorinated biphenyls (PCBs) and hydrocarbons remaining in systems; and

- Designated substances – e.g., asbestos-containing materials, such as pipe insulation and floor tiles, lead in old paint and old plumbing solder.

Removal of any stored waste (non-radioactive, radioactive, hazardous/ designated materials, etc.) that does not form part of a facility's SSCs is not included in the decommissioning activities. It is assumed that these will be removed prior to dismantling and demolition.

4.3.4 Detailed Decommissioning Plan

The DDP for each facility 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 CSA N294:19 [R-4].

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 long-term disposal facilities for LLW.

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

- Post-operational surveys (after radioactive 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 and structures;
- 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.

4.4 Execution of Decommissioning

According to CSA N294:19, this phase begins 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 decommissioning.

Aspects that are considered as part of this phase include (but are not limited to):

- Post-operational surveys;
- Preparation and mobilization;
- Decontamination and dismantling of systems and structures;
- Waste management;
- Site restoration; and
- Site radiological surveys.

Note: Information specific to each of the three facilities (regarding the aspects listed above) is provided in the respective section in this plan where each of the facilities is described in detail.

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

4.4.1 Post-Operational Surveys

Surveys/assessments will be performed prior to dismantling and demolition to identify, characterize and quantify the remaining hazardous/designated materials, radiation fields and contamination in each building, structure and site area. Furthermore, this information will aid in determining decontamination and demolition techniques to be employed.

4.4.2 Preparation and Mobilization

This phase of the project is intended to prepare the sites for subsequent decontamination and dismantling work. Detailed procedures for the dismantling operations will be prepared to meet the As Low As Reasonably Achievable (ALARA) guidelines for the protection of personnel from radiation exposure and address the continued protection of health and safety of workers, the public and the environment. The work performed during this phase will include, but is not limited to:

- If applicable, selecting a DOC to assume responsibility for decommissioning. OPG staff will be provided with the required training for oversight;
- As required, developing procedures for occupational exposure control, emergency programs, industrial safety, control and release of gaseous emissions and liquid effluents, metallic and non-metallic components and processing of radioactive waste generated through dismantling;
- Disconnecting and isolating any site services that are not required during decommissioning;
- Cleaning all facility areas of any remaining loose contamination, removal and processing of any remaining liquid and solid wastes, if any remain;
- Disposing any remaining furniture, cleaning products, paints and other hazardous/designated materials that will not be required during the decommissioning, if any remain;
- Preparing any required site support and storage facilities; and
- Installing or restoring any temporary site services (electric power, domestic and service water, sewage, active and inactive drainage, fire protection, etc.) that will be required during the dismantling work.

4.4.3 Decontamination and Dismantling of Systems and Structures

To the extent practicable, all structures will be cleaned of loose contamination and any contaminated portions will be removed as needed. Systems will be decontaminated as much as possible.

Dismantling activities may involve the following steps:

- Removing equipment and material found to be above the approved clearance level from the facility;
- Removing concrete found to be above the approved clearance level from surfaces, for controlled disposition, through scabbling, vacu-blasting, planing or other appropriate methods; and
- Removing, packaging and disposing of contaminated piping, ducts and components from the facility systems.

Surveys will be conducted to determine if the asphalt surfaces, soil or groundwater around the decommissioning sites have become contaminated. Drainage pipes, ditches, valves and other services will be surveyed for contamination. Drainage pipes found to be above approved levels will be excavated and removed. The material will be decontaminated or packaged for disposal. Any soil found to be above the approved clearance level will be removed as needed, utilizing standard excavation techniques, or vacuumed and collected for disposal, if identified levels of contamination are sufficiently small and localized.

For planning purposes, it has been assumed that a small amount of buried piping on each site is above the approved clearance level. Piping found to be above the approved clearance level will be de-energized and excavated in a controlled manner for disposal (if required). Uncontaminated piping and utility lines will be de-energized, capped (if required) and abandoned in place, if practical.

When structures have been verified to meet clearance levels, they will be released for demolition. The building/structures will then be demolished using conventional demolition techniques. For structures that are deeper than 1 m, an assessment will be made prior to demolition, to analyze if the structure can be abandoned in place or if it has to be removed. This will depend on factors, such as the amount of contamination present and the regulations in place at the time of decommissioning. Any at-grade slabs exceeding 1 m in thickness will be abandoned in place and covered over with a 1 m thick layer of backfill. Any materials that can be reused on site (or recycled elsewhere) will be, while those that cannot, will be disposed of at a conventional waste disposal facility.

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

All decontamination and dismantling work performed will be in accordance with OPG's Radiation Protection Program [R-11].

4.4.4 Waste Management

All wastes generated as a result of decommissioning RWOS1, the CMLF and the CSF will be managed in accordance with the principles of the waste management hierarchy (as summarized in Figure 4-1). 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 or volume of waste requiring disposal will be favoured over options that require its 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 or economically be reused or recycled, treatment options that minimize the disposal waste volume will be employed. Potentially viable options to achieve this include incineration, compaction, in-drum compaction and shearing/shredding.

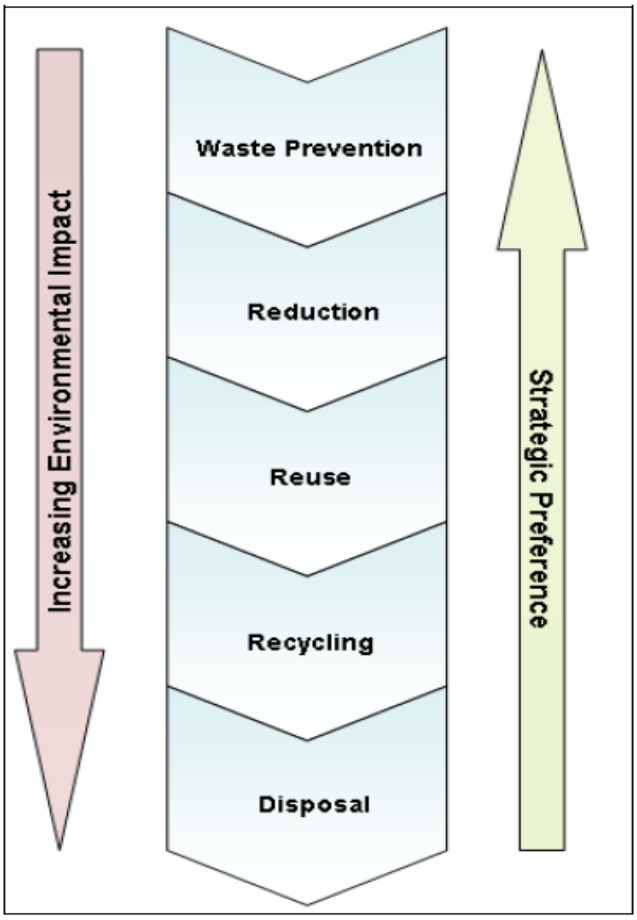


Figure 4-1 – Summary of Key Principles of the Waste Management Hierarchy

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 (under current planning assumptions) packed and ultimately disposed of in a LLW and ILW long-term disposal facilities. All radioactive waste generated during decommissioning will be characterized as per CSA N292 series of Standards.

Where wastes have been characterized as being 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. Material certified to be below the established clearance levels for radioactive material will be released for recycling or disposal.

Any hazardous/designated materials will be disposed of at a licensed disposal facility.

As part of preparation for decommissioning (i.e., development of the DDP), a plan for managing the waste will be developed. This will provide more detail 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 (e.g., compaction, sorting, metal melt and incineration);

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.

4.4.5 Site Restoration

Any voids remaining after the structures have been demolished will be filled with clean, crushed concrete or another suitable earthen material and graded.

For planning purposes, it is assumed that the site areas will be graded (to prevent pooling) and natural drainage restored, before being covered with topsoil that will be seeded for soil stabilization and erosion control. Actual surface restoration may depend on OPG's plans for subsequent usage.

Any site services, such as utilities, drainage, ditches or sampling and monitoring, that have been provided by or run through the dismantled facilities' site areas will be restored as necessary.

4.5 Completion of Decommissioning

As per CSA N294:19, this phase involves verifying that all decommissioning activities have been completed satisfactorily, the agreed final end state has been reached, and all documentation has been completed. Aspects that are considered part of this phase include (but are not limited to):

- Final radiological surveys;
- Confirmation of the final end state of the site; and
- Release of facility from regulatory control, as applicable.

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).

4.5.1 End State

By the end of site restoration, all industrial hazards, any radioactive contamination in excess of the established clearance levels and all other hazardous/designated materials will have been removed from the site. Facility systems will have been dismantled and all of the buildings demolished. The site will have been restored to a state similar in nature to the restoration requirements of the surrounding Bruce Nuclear Site, to be suitable for other uses by OPG.

Final surveys of residual radioactive and hazardous materials will be performed and documented to demonstrate that the agreed upon final end state of the site has been achieved in accordance with the specified release criteria. It is expected that the sites will meet the criteria established to release the facility from regulatory control, as applicable.

4.5.2 Release from Regulatory Control

A final end-state report on the decommissioning 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 (i.e., whether remediation activities have achieved the approved levels of residual contamination).

Other information required by the applicable regulations will also be provided, including documentation that shows that the nuclear substances have been received by another licensee who is authorized to possess these materials. The final end-state report will be submitted to the CNSC to support a request to release the facility from regulatory control, as applicable.

4.6 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 Bruce Nuclear Site PDP [R-10] relates to decommissioning facilities that are far more complex and that present greater hazards than ROWS1, the CMLF and the CSF. Therefore, the Canadian experience included in this section is more relevant to decommissioning of RWOS1, the CMLF and the CSF.

OPG has successful decommissioning experience at both the Bruce Heavy Water Plant (BHWP) and the 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-12]. 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-13]. This survey found no radioactive contamination on the

BHWP site [R-14][R-15] and a licence to abandon the facility was granted by the CNSC in 2014 [R-16].

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-17][R-18][R-19]. This resulted in CNSC acceptance of OPG's request to remove the SSTF from licensing control [R-20].

Some 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-21] and Defense Research Establishment Suffield [R-22], 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 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 International Atomic Energy Agency (IAEA) [R-23] 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 RWOS1, the CMLF and the CSF 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.

5.0 RWOS1 – PRELIMINARY DECOMMISSIONING PLAN

5.1 Facility Introduction

The prime function of RWOS1 is to safely store L&ILW generated by Douglas Point and, later, the Pickering Nuclear Generating Station (PNGS) A. The RWOS1 site comprises a number of in-ground waste storage structures, including concrete-lined trenches and steel-lined concrete holes. These structures were designed with a lifespan of 50 years or more, with inspection and maintenance regimes in place to help achieve this [R-24].

5.2 Facility Location and Site Access

RWOS1 is situated in the south central area (behind BNGS B) of the Bruce Nuclear Site on the east shore of Lake Huron. RWOS1 is connected to the site access network via an access road (on its western corner), which is joined to the Bruce Nuclear Site South Access Road.

Figure 5-1 – Location of the RWOS1 Site Relative to BNGS B
(Retrieved from Google Maps, 2012)

The perimeter of RWOS1 is outlined by a fence, and access is granted through a gate.

The waste storage structures at the RWOS1 site are detailed in Section 5.4. There are no permanent buildings or above-ground structures associated with the RWOS1 site, with the exception of the small shed shown in Figure 5-2. This is a

temporary structure previously used as a weather enclosure for an operator hut, and no significant decommissioning effort is expected to be required.

Figure 5-2 – RWOS1 Facility Temporary Shed

5.3 Waste Classifications

RWOS1 provides storage capacity for three types of solid waste:

- Type 1 are wastes with a contact dose rate less than or equal to 2 mSv/h (200 mR/h) before any volume reduction process;
- Type 2 are wastes with a contact dose rate less than or equal to 0.15 Sv/h (15 R/h) but greater than 2 mSv/h (200 mR/h) before any volume reduction process; and
- Type 3 are those wastes with a contact dose rate greater than 0.15 Sv/h (15 R/h) before any volume reduction process.

5.4 Waste Storage Structures

Multiple in-ground structures currently exist at RWOS1. These structures include:

- Two trenches (three sections each);
- One trench monolith (containing 13 sections);
- Tile holes in monolith (in five of the trench monolith sections, each section containing 8-9 tile holes); and
- One assembly of lined holes (four cylinders per assembly).

The layout of the site is displayed in Figure 5-3 [R-24], and the structures are described below.

Trenches and Trench Monolith

There are two trenches on the site, each lined with a 20 cm thick layer of concrete. They are each divided into three sections with dimensions of 13.06 m (length) x 3.05 m (width) x 3.05 m (depth) to provide a usable volume of 109 m^3 [R-24]. These trenches provide storage for Type 1 and 2 wastes. The waste was loaded into the trenches in discrete packages, including drums, bags and boxes, before being in-filled with sand or similar granular material.

During waste loading operations, temporary covers were used for the compartments to offer protection when not in use. Once each compartment was filled, these temporary covers were replaced with galvanized-steel trench covers [R-24]. Since then, the covers have been replaced with more secure concrete covers [R-25].

The trench monolith is very similar in design to the trenches. It is divided into 13 sections, each with dimensions of 3.05 m x 3.05 m x 3.05 m [R-24]. Eight of these sections were used for storage of Type 1 and 2 wastes.

Tile Holes in Monolith and Lined Holes

Tile holes in monolith storage structures were built into the remaining five sections of the trench monolith described above [R-24]. Each tile hole had a useable volume of ~0.6 m^3, with 8-9 tile holes in each of the five trench sections. They were used for storage of Type 3 waste, which included ion exchange resins, ion exchange columns and filters from reactor systems, as well as miscellaneous high-dose-rate, irradiated core components.

A final set of four tile holes were embedded in a hole lined with steel and concrete, which was in-filled to form a solid monolithic block. The steel-lined concrete tile holes are 0.91 m in diameter and 2.9 m deep, which provided a usable volume of 1.75 m^3 (each) for waste with high specific activities. Type 3 waste was stored within these structures.

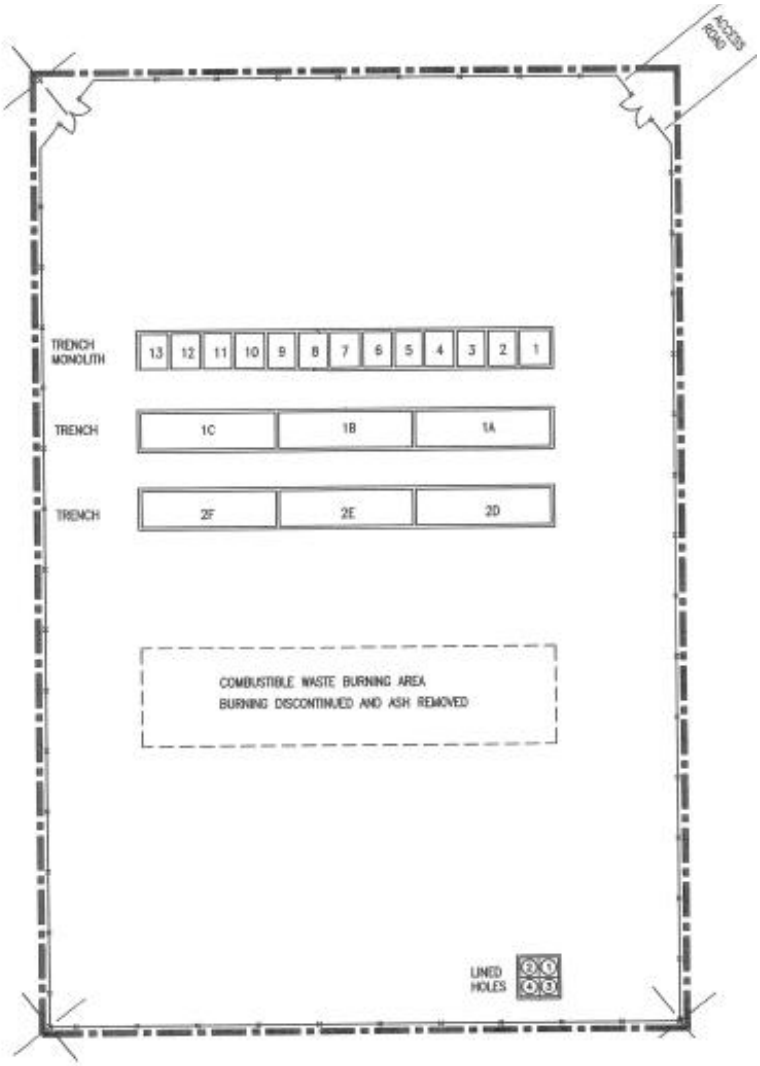


Figure 5-3 – Location of the Waste Management Structures on the RWOS1 Site

5.5 History and Current Status

The construction licence for RWOS1 was received in mid-1960. As the site began to reach capacity, it was shut down and placed into a state of care and maintenance in 1976. Currently, OPG holds a Waste Nuclear Substance Licence (WNSL) for RWOS1 (Licence Number WNSL-W1-320.052029, August 17, 2020 [R-26]).

After 1976, some of the wastes at RWOS1 were consigned to the WWMF, which formerly was known as RWOS2. Campaigns to remove waste from RWOS1 have already occurred, in which 23 tile holes were removed, along with some waste from the trenches. This waste was relocated to the WWMF. More details concerning these campaigns are given in Section 5.5.1.

All the waste is passively stored in ground at RWOS1 and there is currently no waste removal/transfer at the facility. RWOS1 will be decommissioned once the site is permanently closed and the waste is removed.

5.5.1 Waste Removal Campaigns

Waste removal campaigns were performed during which much of the waste that was stored at RWOS1 has been removed.

Removal of Waste from Trenches

Two campaigns were conducted in the 1990s to retrieve waste from the trenches. In 1992-1993, waste was removed from trench section 1A. In 1997-1998, waste was removed from trench sections 1B, 2E and 2D [R-27].

Tile Holes Removal

All 23 tile holes were removed in 2001-2002 and are now stored in a Low-Level Storage Building at the WWMF.

5.6 Decommissioning Strategy

OPG has chosen a prompt decommissioning strategy for RWOS1. This strategy is consistent with the international practice for similar waste management facilities and is consistent with the decommissioning strategy selected for OPG's WWMF. In general, after the operational life of waste management facilities, these facilities are decommissioned as soon as is reasonably practical.

OPG decommissioning strategy is based on the assumption that all waste will be removed from the site (prior to execution of decommissioning) to the respective long-term waste management facilities, as they become available. Since little to no residual radioactivity is expected to be present at RWOS1 after all the operational waste is removed, OPG does not currently anticipate the need for any deferment of decommissioning.

The decommissioning work at RWOS1 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 LLW long-term disposal facility.

5.7 Scope of Decommissioning

The scope for decommissioning the RWOS1 site involves the safe and effective removal of the above-ground and in-ground structures, waste management, and site remediation and restoration. The structures detailed in Section 5.4, the temporary shed and the slab on grade located near the facility entrance, are within the scope of this decommissioning plan.

At the end of the care and maintenance period, all stored wastes at the RWOS1 site will have been removed. As such, the only remaining radioactive material when decommissioning begins will be low levels of contamination.

The DOC will prepare a plan that will form the basis for proceeding to the execution phase of the decommissioning. The DOC will assemble and mobilize the organization required to safely manage the decommissioning activities. OPG will maintain a small organization of personnel to provide oversight throughout the decommissioning project.

The ultimate objective of decommissioning RWOS1 is to confirm that the site meets the safety criteria necessary to protect the health and safety of local populations and the wider environment, thus making the site available for other OPG uses.

5.8 Execution of Decommissioning

5.8.1 Proposed Schedule for Decommissioning Activities

The schedule presented below is for planning purposes only. These dates may be adjusted at the time of execution to derive synergies/economies of scale with other decommissioning activities occurring at the neighbouring facilities on site (e.g., WWMF). Table 5-1 summarizes the assumed timing of key decommissioning activities for the RWOS1 site.

Table 5-1 – Planned Project Milestones – RWOS1 Decommissioning

Event	Date*
Removal of all radioactive waste and facility shutdown	2064
Begin preparation for decommissioning of RWOS1, CMLF and CSF	2066
Begin decommissioning	2067
End of decommissioning and site restoration	2068
Removal from regulatory control	2069

*All dates are nominal. Any modifications associated with shutdown dates may impact these dates.

5.8.2 Radiological Control

The following radiological control measures will be implemented to promote safe working conditions:

- Site access control (through the use of physical boundaries, signage, etc.) to prevent access by unauthorized personnel;
- Dust suppression (including the pre-selection of tools and techniques that minimize dust generation);
- Airborne radioactivity will be monitored on a work area level and at the boundary of the licensed area with portable air samplers. This will ensure internal conditions and atmospheric discharges remain well within approved limits and authorizations. This will also serve to help determine whether any additional mitigation measures are required;
- Personnel dosimetry will be used in those work areas where an individual could receive an occupational radiation dose. This will be applied, as necessary, based on the results of preliminary monitoring by Health Physics;
- Use of personal protective equipment, such as, respirators and protective clothing;
- Construction of a temporary enclosure with High Efficiency Particulate Air (HEPA) filters, if deemed appropriate;
- Any silt run-off will be controlled with temporary barriers; and

- Remote handling equipment, where appropriate (based on the results of radiological surveys).

Details concerning these radiological controls, as well as any others that are deemed appropriate, will be developed and documented during the preparation for decommissioning phase. These measures will be utilized throughout decommissioning, where appropriate.

5.8.3 Decommissioning Work Packages

Decommissioning work will be performed according to the following work packages:

- Site survey – The site will be characterized with respect to radiological activity level and contamination. A series of surveys for radioactive and hazardous/designated materials will be performed throughout the course of the decommissioning work, based on available guidelines at the time of decommissioning. The surveys conducted will 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;

- Decontamination – Underground structures will be cleaned of surface contamination via vacu-blasting or scabbling, and contaminated concrete will be removed, as much as is prudent, through mechanical techniques, such as chipping, cutting or planing. Under the current planning assumption, contaminated concrete will be packaged and ultimately disposed of in the respective LLW and ILW long-term disposal facilities. Contamination levels for trench and tile hole covers, as well as inside surfaces, will be determined via radiological surveys. Soil remediation work will also be performed to achieve the accepted end state;

- Dismantling and demolition of structures – Storage structures will be dismantled and removed in order to achieve the desired site end state. It will be determined during decommissioning whether the structures that are below the nominal depth of 1 m can be disposed of in-situ without posing a risk to workers or the public;

- Decommissioning waste retrieval, processing and packaging – It is anticipated that waste from decontamination and demolition activities will be handled in the same manner as that retrieved prior to decommissioning. The waste will be sorted as much as is practical, so as to reduce the amount of waste produced. Waste will be packaged on site;

- Waste transportation – Following waste segregation and packaging, the current planning assumption is that decommissioning waste will ultimately be transferred to the LLW and ILW long-term disposal facilities; and

- Site restoration – This will involve filling of voids with crushed, clean concrete and soil, and grading and seeding the ground to prevent soil erosion.

These activities are detailed further in the sections that follow.

5.8.4 Dismantling/Demolition of Structures and Soil Removal

Depending on the contamination present, concrete structures will either be removed entirely or abandoned in place to a nominal depth of 1 m below ground. If they are to be removed entirely, this can either be accomplished by removing the dirt surrounding the structure with a backhoe and then extracting the concrete structure or through direct extraction via crane.

It is anticipated, however, that these structures (especially the trenches) will be too large to be removed as a single piece. If this is the case, then conventional concrete cutting tools, such as a diamond-tipped concrete saw or diamond-wire saw, will be utilized to section the structure into a more manageable size, in order to facilitate extraction and subsequent crushing. This cutting technique may also be utilized if the decision is made to remove the structure to a nominal depth of 1 m.

In order to prevent harm to workers, the following precautions will be enacted while concrete sectioning is being performed [R-28]:

- Wet dust suppression – The saw blade will be kept wet to lower the production of dust. Utilization of this technique will preclude the use of electric-powered saws but will extend the life of the blades; and

- Personal respiratory equipment – If the situation dictates that workers will be exposed to any dust generated from the cutting process, then they will be supplied with and required to wear personal respiratory equipment at all times during this process.

Other safety measures may be deemed necessary during the detailed planning in preparation for decommissioning. Decontamination will be performed prior to dismantling activities, so that only regular industrial hazards will be present during demolition.

5.8.5 Waste Management

As discussed in Section 5.5, much of the operational waste stored at RWOS1 has been removed. Any residual stored waste will be retrieved prior to the start of decommissioning, hence minimizing the risk of radiological and conventional hazards.

All waste generated from RWOS1 during decommissioning will be managed in accordance with the principles of the waste management hierarchy (see Section 4.4.4). Tools and techniques that prevent the generation of waste in the first instance will be used, as far as practicable. Where this is not possible, techniques that minimize the quantity, volume or activity of the wastes will be implemented. Waste management options that facilitate the reuse or recycling of material are preferred over those that result in direct disposal.

The generation of radioactive waste will be minimized through the use of decontamination techniques. All waste material generated through the decontamination process will be assessed and consigned to the most appropriate waste stream. As much recovered material as possible will be designated for free release, as determined through surveying, and will be reused as infill, where appropriate, or disposed of at a conventional facility.

Under the current planning assumption, waste that remains above the material release criteria will ultimately be transferred to the LLW long-term disposal facilities. OPG and DOC staff will also receive the necessary training to ensure that they carry out decommissioning activities safely, effectively and in accordance with all applicable regulatory requirements and standards.

The total amount of waste resulting from decommissioning of RWOS1 is estimated to be 51 m^3 of LLW [R-8]. No intermediate-level waste is expected to be produced by these decommissioning activities. The waste estimate will be reviewed in subsequent revisions of the PDP, as more information becomes available.

Under the current planning assumption, contaminated equipment used to recover the radioactive waste and site structures will be dismantled, packaged and ultimately transported to the LLW long-term disposal facility. Any hazardous/designated material will be disposed of at a licensed disposal facility.

5.8.6 Site Surveys and Monitoring

Prior to dismantling activities, site surveys will be undertaken to obtain actual radiological conditions.

Site surveys will cover the following:

- Site footprint;
- Soil contained within the site and outside it according to initial survey results;
- Waste structures;
- Monitoring wells; and
- Equipment used during decommissioning.

Although the need for radiation shielding is unlikely, such resources will be made available so that they can be deployed, if such protection is found to be appropriate. Contamination surveys will be performed throughout the decommissioning process, in order to guide and monitor the decontamination work. They will be used to control worker exposure to radiation. These surveys are typically based on simple measurements, such as contact radiation dose rates or direct contamination checks.

Periodic off-site monitoring will be undertaken to ensure that discharges remain within regulatory limits, determine the effectiveness of mitigation measures in place and establish whether improved or additional measures are required.

At the end of demolition, the footprint of the RWOS1 site will be subjected to a comprehensive land contamination survey. In the event that contamination is found, a program of targeted decontamination will be implemented.

At the end of decommissioning, a final site survey will be performed to demonstrate that the final end state for the site has been achieved. If the site is found to be above the established clearance criteria[3], further remedial work will be undertaken and the site resurveyed. This will be repeated until the site meets the clearance levels required for release of the licensed area from regulatory control.

[3] Clearance Levels/ Clearance Criteria will be developed based on CSA Standard N292.5 along with the Nuclear Substances and Radiation Devices Regulations and OPGN Governance [R-7] 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.

5.8.7 Site Restoration

Following site remediation, voids will be backfilled with clean, crushed concrete and the site profiles will be graded. Restoration will conclude with the placement of topsoil and seeding of the site for soil stabilization, erosion control and maintenance of soil quality. The fence outlining the site's perimeter will also be removed.

5.8.8 Significant Hazards

OPG does not foresee decommissioning activities posing significant hazards to workers, the public or the environment. However, a workplace health and safety assessment will be carried out during the detailed planning process to formally identify and quantify the potential hazards resulting from decommissioning activities.

5.9 Completion of Decommissioning

5.9.1 End State

As stated in Section 4.5.1, by the end of site restoration, radioactive contamination and hazardous/ designated materials will have been removed from the site to the extent that it meets the desired end state, as agreed upon with the CNSC. The site will then be suitable for other uses by OPG.

At the completion of decommissioning, the DOC will have:

- Performed the decommissioning according to the plans and procedures that are required to meet the needs and expectations of the site owner and the regulator;
- Completed the final site survey;
- Placed topsoil and landscaped the site for soil stabilization and erosion control; and
- Demobilized.

5.9.2 Release from Regulatory Control

A final end-state report on the decommissioning 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 (i.e., whether remediation activities have achieved the approved levels of residual contamination).

Other information required by the applicable regulations will also be provided, including documentation that shows that the nuclear substances have been received by another licensee who is authorized to possess these materials. The

final end-state report will be submitted to the CNSC to support a request to release the facility from regulatory control, as applicable.

6.0 CMLF – PRELIMINARY DECOMMISSIONING PLAN

6.1 Facility Introduction

The CMLF[4], located within the Bruce Nuclear Site, is owned by OPG and operated by Bruce Power under Bruce Power's Power Reactor Operating Licence (PROL) [R-29] and will be handed back to OPG on return of the site at the end of the leased period. Under the PROL, Bruce Power has the authority and responsibility for the building and equipment maintenance. Bruce Power is also responsible for the safety of all activities occurring within the CMLF.

The CMLF is designed to support the maintenance activities of BNGS A & B and other site facilities. The facility has the capacity for managing radioactive and non-radioactive materials and operations.

The purpose of the CMLF is to provide efficient and economical maintenance due to its possession of the following unique abilities/assets:

- Major maintenance equipment of low use in individual departments/divisions;
- Special maintenance skills of infrequent application in individual departments/divisions; and
- Common function most economically performed by a single work group in a single, specialized facility.

The facility conducts mechanical, control and civil maintenance. Mechanical maintenance operations include fabrication activities, machining and equipment reconditioning. Control maintenance activities largely involve the repair and calibration of process and radiation instrumentation. Civil maintenance operations are more diverse and cover fabrication and repair work, carpentry activities, painting, grit blasting, and decontamination and assaying of materials.

[4] The Central Maintenance and Laundry Facility (CMLF) is also known as the Central Maintenance Facility (CMF).

6.2 Facility Location and Site Access

The CMLF is located on the Bruce Nuclear Site, adjacent to the Central Materials Management Facility. The main building of the CMLF has a total floor area of about 15,000 m^2. A diagram of the facility's outward appearance is shown in Figure 6-1. In addition to the main building, the CMLF includes a Mechanical Laydown Yard, Transport and Work Equipment Yard, Container Lay-Down Area and an area for vehicle washing and fuelling. A Temporary Emergency Response Facility is also present on site. The total CMLF property is about 7 ha.

Access to the facility is provided by the central site access road and 28th Street, adjacent to the supply Chain Warehousing and Logistics Facility. The shipping and receiving areas of the building can be accessed via 28th Street. Radioactive Shipping and Receiving is located at the front of the building, while Inactive Shipping and Receiving is located on the southwest side. Parking for the CMLF is located near the rear of the building and is accessed from the Central Services Road.

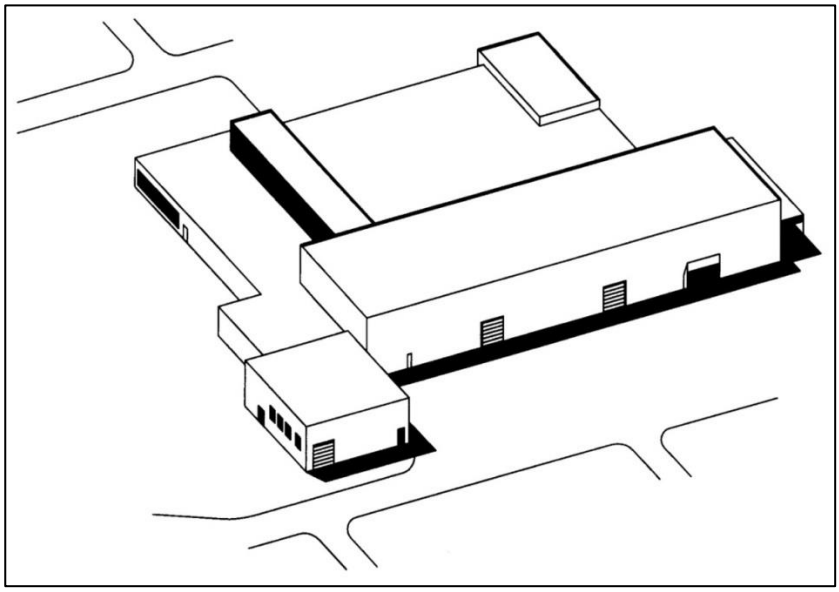


Figure 6-1 – The CMLF Facility

6.3 Building Structure and Systems

The CMLF is a steel-framed building with exterior precast, insulated concrete panels. This structure is supported by a poured concrete floor bearing on reinforced concrete foundations. Internal walls consist of hollow concrete blocks and partition walls. The roof is a steel deck type with an inverted roofing assembly.

The overall facility is divided into the following sections:

- Basement mechanical room;
- Building systems;
- Electrical workshops;
- Lockers/change room;
- Laundry room;
- Mezzanine electrical equipment;
- Machine shop area;
- Zone 1 areas;
- Mechanical equipment area Zone 1 and 2; and
- The ground footprint of the CMLF.

The CMLF is supported by a number of auxiliary systems, including:

- Ventilation;
- Radioactive liquid drainage;
- Sanitary sewage (covering washrooms, showers and other non-radioactive effluents);
- Water (domestic and fire suppression);
- Heating;
- Service air (compressed gas for pneumatic tools and some instrumentation);
- Smoke detection;
- Fuel oil;
- Air conditioning; and
- Electrical (Class IV).

Two systems of note, due to their role in reducing the spread of radiation, are the ventilation system and the radioactive liquid drainage system.

The ventilation system is designed so that air flows from non-radioactive areas through to the radiological zones where radioactive contamination is more likely. The air temperature is adjusted in cold weather, and the air is subject to dry cartridge and HEPA filtration in Zones 2 and 3. Air exhausted from Zone 3 is handled via a separate ventilation system due to the potential for radioactive contamination and is not re-circulated. Areas within Zone 3 are maintained under negative pressure relative to the surrounding areas.

The radioactive liquid drainage system is used to collect radioactive effluents generated in Zones 2 and 3. Low-activity effluents are collected in one of two storage tanks that form part of the drainage system. The tanks are located in dykes within the basement of the CMLF. They are made of epoxy-coated carbon steel and are positioned such that all sides, including the base, are clearly visible and therefore can be easily inspected for leaks. The accumulated effluents are periodically transferred to the active liquid waste management system located in BNGS A. Low-volume, high-activity effluents are instead collected at their source in drums.

Sanitary sewage effluent from all building washrooms, showers and inactive services are collected in the sanitary drainage system and run by gravity flow into the sanitary sewer (in front of the CMLF building), which flows to the Bruce Nuclear Site Sewage Processing Plant.

Domestic water is supplied by BNGS B. The water distribution system supplies the facility's drinking water requirements. The fire protection water system supplied from center of site fire water pumphouse serves the CMLF building sprinkler system, fire hose stations and yard fire hydrants.

The building is heated by a steam-heated glycol-water mixture. Individual heating units are designed to suit the requirements of each work area. This system will be replaced by a capital project prior to 2024. The new system will be heated by natural gas rather than steam. The planned systems will not use hydronic systems and will not contain glycol.

Compressed air is supplied to the facility to operate all pneumatic shop tools and the building instrumentation with instrument air that is dried.

The heat and smoke detection system is provided to give early warning of fire in any work area.

The fuel oil system is located near the Wash Bay building, and it consists of three steel, single-walled, underground fuel storage tanks, which are currently in use. The top of these storage tanks are located approximately 3 feet underground, and each tank is connected to its associated galvanized, single-walled steel piping system. The piping is connected to three suction pump style fuel dispenser pumps which provide fuel to motor vehicles. The entire system was installed in 1983. Each tank is 10,000 imperial gallons (~45,400 L). One tank contains gasoline, one contains coloured diesel and the third tank contains clear diesel fuel. Planned projects will remove the fuel tanks and replace them with above grade tanks by 2025.

Power for the CMLF is Class IV at nominal voltage levels of 600/347 V and 208/120 V, 60 Hz. Emergency lighting is available to provide adequate illumination for personnel egress during a loss of Class IV power.

6.3.1 Radiological Zoning

The CMLF is divided in three radiological zones, Zone 1, Zone 2 and Zone 3. The Zone 3 areas of the CMLF present the greatest radiological risk, Zone 2 areas have limited radioactive activities undertaken and Zone 1 areas are considered non-radioactive ("clean") areas. The zoning boundaries will be verified prior to the commencement of any physical decommissioning work.

These zones will help facilitate decommissioning, since they provide an indication of where radioactive hazards are likely to be present. The radiological zones are described in detail below.

Zone 1

Zone 1 comprises areas free from contamination and contains offices, the lunchroom, washrooms and locker rooms. Shop and lab areas include the sheet metal shop, mechanical maintenance shop, tool crib, garage, breaker and motor starter shops and various small shops.

Zone 2

Zone 2 comprises areas where work with radioactive materials is undertaken periodically, and where there therefore is potential for cross contamination to occur. Each area where this occurs is listed below, with its corresponding activities that involve radioactive materials:

- Truck Bay – Decontamination of vehicle loading bay;
- Machine Shop – Machining and repair of radioactive components;
- Mechanical Equipment Mezzanine – Contains intake filters, fans, heating coils, air exhaust filters and exhaust fans. Radioactive airborne emissions monitors for building ventilation and exhaust are also located in this area;

- Mechanical Equipment Basement – Area containing ventilation system pumps, heat exchangers and holding tanks; and

- Locker Rooms and Washrooms – Area designated for work clothing changes and controlled passage from Zone 1 to Zone 2.

Zone 3

This is the main area for operations involving radioactive materials. Each area is listed below, with its corresponding activities:

- Decontamination Area – Decontamination of small tools and equipment, such as portable radiation instruments;

- Zone 3 Ventilation System – Air exhausted from Zone 3 work areas is handled by a separate ventilation system for direct discharge via HEPA filters and the CMLF exhaust stack; and

- Radioactive Liquid Drainage System – Handling of radioactive liquid waste originating from sinks, floor drains and decontamination operations.

The CMLF has a small mezzanine area (Figure 6-2) that contains mechanical and electrical equipment. This area is comprised of Zone 1 and 2. There is also a small basement section (Figure 6-3) that contains both Zone 2 and 3. This area contains equipment supporting the active drainage system.

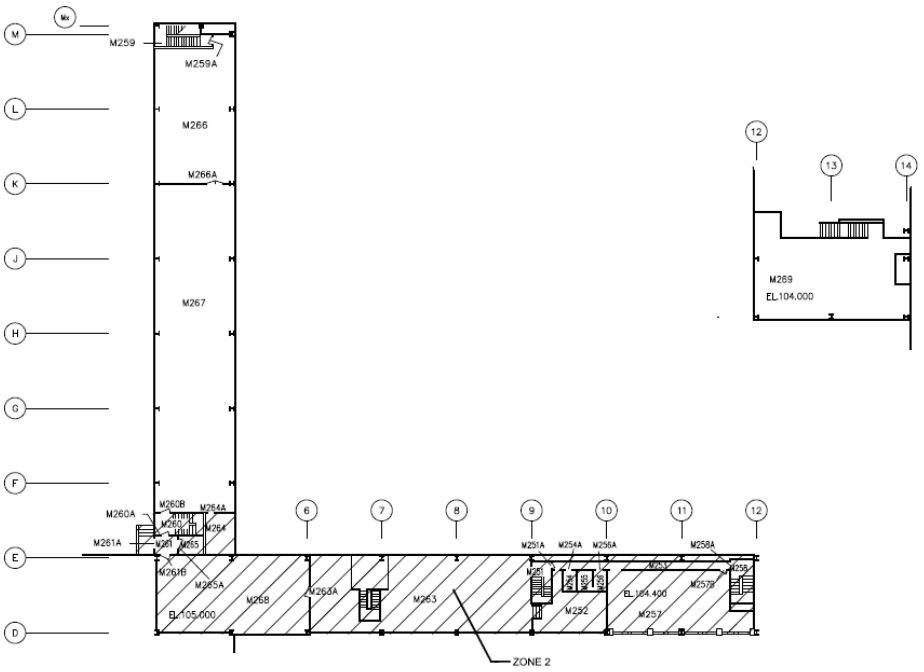


Figure 6-2 – Mezzanine Areas of CMLF

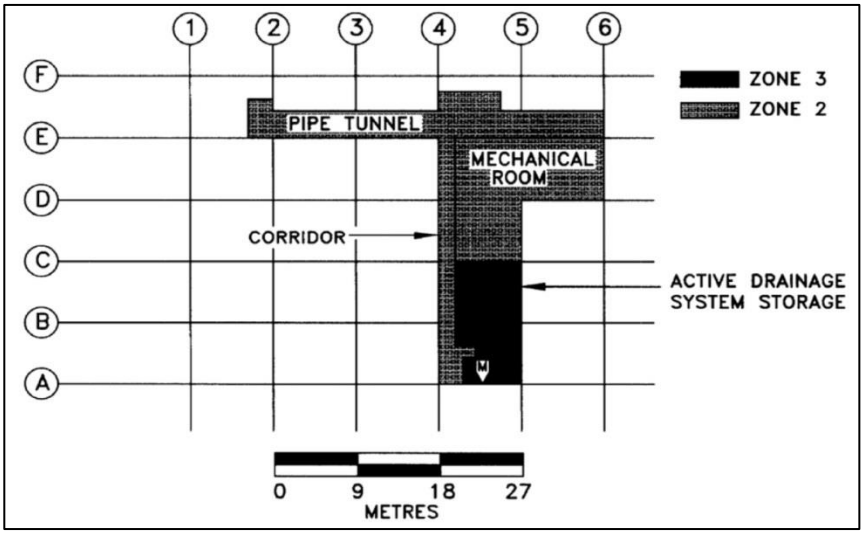


Figure 6-3 – Basement Areas of CMLF

6.4 History and Current Status

6.4.1 Stored and Structural Hazardous Materials

All hazardous materials used in the CMLF are required to be assessed through BP-PROC-00306, Chemical Risk Management Procedure [R-30], which results in an electronic assessment record in an Electronic Asset Management System (EAMS) for each product. This process also requires hazardous product containers to be labelled with a "Chemical Risk Management label" which provides a graded risk rating from an environmental, safety, fire and chemical compatibility perspective. This label is in addition to legally required hazard labels such as those required for Consumer Products or Workplace Hazardous Materials Information System (WHMIS)-controlled chemicals. For most hazardous products (e.g., WHMIS-controlled), a Safety Data Sheet (SDS) is available which will provide guidance on the safe handling, storage and disposal of the product.

Hazardous materials used at the CMLF include: disinfectants, solvents, degreasers, cleaning and stripping agents, waxes, spot removers, heat transfer fluids, greases, lubricants, fuels, welding gases and cutting fluids. As a result of WHMIS, a ready record exists of hazardous materials that may potentially be encountered during decommissioning operations. Appendix A provides inventory of hazardous material used at the CMLF.

Hazardous materials will be removed prior to the start of facility decommissioning. This approach is preferred, since operational staff will be more familiar with any hazardous substances present, allowing for the safer handling of materials.

Furthermore, this approach reduces the burden of materials management during decommissioning.

Despite the planned removal of hazardous materials before decommissioning and OPG's exercise of due diligence with respect to hazardous waste disposal during operations, there is a risk that residual hazardous materials will remain within the facility. Appropriate procedures and personal protective equipment will be utilized to ensure worker safety. Additional precautions will be utilized when dismantling any drainage system components located in rooms where cleaning activities (such as clothing laundering and drum cleaning) or any other hazardous materials were handled.

Asbestos installation was formerly installed on the piping that runs between the two CMLF floors, but this has been removed. The facility will be inspected prior to demolition to identify any other hazardous materials (including asbestos) that may remain. The results from this survey, as well as the appropriate actions to respond to the presence of structural hazardous materials, will be documented as part of preparation for decommissioning. Removal procedures will be in accordance with applicable legislation.

6.4.2 Nature of Contamination

Gaseous emissions and liquid effluents generated by the CMLF are subject to monitoring prior to discharge, to ensure that radioactive emissions and effluents remain well within regulatory and facility limits, and to confirm the current radiological status of the facility.

Airborne radiological emissions monitoring occurs at the contaminated stacks of the CMLF. Aqueous radioactive emissions are not directly released from the CMLF. Active liquid wastes are disposed of through the active liquid waste management system at BNGS A. Bruce Power has requested and received approval for an alternative release avenue of active liquid waste to the Sewage Processing Plant. This avenue would be used only if the CMLF liquid fails to meet the requirements for the Bruce A active liquid waste system, or if the Bruce A active liquid waste system is not available at a time when the transfer must be made.

The nature and extent of contamination released from the CMLF is documented in the Bruce Power Environmental Monitoring Program submitted annually to the CNSC.

6.4.3 Extent of Contamination According to Zone

The following is a breakdown of the predicted extent of contamination according to each of the three zones within the facility.

Zone 1

All equipment and systems in Zone 1 are considered radiologically clean and will be removed and disposed of as clean material (after a radiological survey for confirmation). This will be achieved using standard techniques, as used in non-radioactive facilities.

All floor or sanitary drains originating in Zone 1 of the building are considered radiologically clean. However, they must be subjected to a final radiological survey to verify that condition.

Zone 2

Selective equipment, air handling systems and floor drains located within Zone 2 are considered potentially contaminated. These are likely to be removed and disposed of as radioactively contaminated material, unless surveys confirm that contamination levels are below clearance limits.

Surfaces within Zone 2 are assumed to be contaminated as follows:

- Approximately 20% of the floor surface area is expected to be contaminated. It is anticipated that these surfaces will be decontaminated using the vacu-blast technique;
- Concrete block walls are assumed to be 100% contaminated due to the difficulty of decontaminating and surveying this type of material. The bulk material will therefore be consigned as radioactive waste;
- Secondary division walls, such as wallboard or movable partitions, will be assumed to be 100% contaminated. This is due to the difficulty of accurately assaying and decontaminating this type of material. This material will therefore be automatically consigned as radioactive waste;
- Metal siding and roofing are likely to be removed and disposed of as radioactively contaminated material. Again, this is due to the difficulty of decontaminating and surveying interior and other hidden portions of this type of material; and
- The internal surfaces of all floor and sanitary drains are considered internally contaminated.

Zone 3

Numerous structural surfaces in Zone 3 are assumed to be contaminated. These include:

- All walls and dividers, including metal siding and roofing;
- All roof-mounted equipment;
- All concrete blocks;
- All poured concrete surfaces to a depth of ½ inch; and
- The internal surfaces of floor and sanitary drains.

The contaminated surfaces will be decontaminated as far as possible, with the aim of re-classifying the waste to a lower category. It is preferable to achieve sufficient decontamination to meet clearance levels, facilitating the reuse or recycling of material, as opposed to disposal. Techniques to be considered include vacu-blasting, chemical cleaning, scabbling or planing. Some structures may not be suitable for decontamination. For example, surfaces may be difficult to access, or contamination may have migrated into the bulk material of the structure. It is likely that these materials will be automatically consigned as radioactive waste, unless they can be further dismantled and surfaces more accurately assessed.

Details on the actual radiological conditions within the facility (including surface contamination levels and dose rates, etc.) will be provided as part of preparation for decommissioning, once the operations activities have ceased. A history of spills and accidents will also be documented, as appropriate.

It is worth noting that the CMLF previously included an additional Zone 3 area, which was used for active drum cleaning. It has since been rezoned to Zone 2.

6.4.4 Facility Shutdown

The following is a list of anticipated activities to be performed during shutdown of the CMLF:

- Removing non-structural hazardous/designated materials and radioactive material from facility areas (note that this activity may extend post-facility shutdown); and
- De-energizing systems that no longer are required. As required, systems such as fire protection and electrical may remain operational, if the dismantling and demolition stage is deferred.

6.5 Decommissioning Strategy

OPG has chosen a prompt decommissioning strategy for the CMLF. This strategy is consistent with the international practice for similar waste management facilities and is consistent with the decommissioning strategy selected for OPG's WWMF.

OPG decommissioning strategy is based on the assumption that all waste will be removed from the site and transferred to the respective long-term waste management facilities prior to the beginning of decommissioning. Since little to no residual radioactivity is expected to be present at the CMLF after all the operational waste is removed, OPG does not currently anticipate the need for any deferment of decommissioning.

The decommissioning work at the CMLF 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 LLW long-term disposal facility.

6.6 Scope of Decommissioning

In anticipation of the cessation of plant operations and removal of stored waste from the facility, preparations will be made to assist the transition from plant operations to facility decommissioning.

At the end of plant operations, as well as at the start of decommissioning, all stored wastes and non-structural hazardous/designated materials will have been removed from the facility. As such, the only remaining radioactive material when decommissioning begins will be low levels of contamination.

The DOC will prepare a plan that will form the basis for proceeding to the execution phase of the decommissioning. The DOC will assemble and mobilize the organization required to safely manage the decommissioning activities. OPG will maintain a small organization of personnel to provide oversight throughout the decommissioning project.

The reuse of the facility is preferred to minimize the generation of waste, thereby supporting the principles of the waste management hierarchy. However, no alternative uses for this facility are known or anticipated at this time. Also, Zones 2 and 3 of the facility, as well as the ventilation and radioactive liquid drainage systems, are expected to be contaminated in a manner that requires their dismantling and demolition. As a result, the end state of decommissioning this facility is likely to include the demolition of the entire CMLF and subsequent site restoration. The site will then be available for other uses by OPG. This strategy will be reassessed, as planning for decommissioning progresses.

The objective of decommissioning the CMLF is to dismantle and demolish the facility in a manner that aims to ensure that the health, safety and security of

workers, the public and the environment are protected, and to release the facility from CNSC regulatory control, as applicable.

The specific areas, structures and components within the CMLF that are covered within the scope of the CMLF decommissioning plan are listed in Section 6.3 This list may be expanded as decommissioning approaches.

6.7 Execution of Decommissioning

6.7.1 Proposed Schedule for Decommissioning Activities

The schedule presented below is for planning purposes only. These dates may be adjusted at the time of execution to derive synergies/economies of scale with other decommissioning activities occurring at the neighbouring facilities on site (e.g., WWMF). Table 6-1 summarizes the assumed timing of key decommissioning activities for the CMLF site.

Table 6-1 – Planned Project Milestones – CMLF Decommissioning

Event	Date*
Removal of all radioactive waste and facility shutdown	2064
Begin preparation for decommissioning of RWOS1, CMLF and CSF	2066
Begin decommissioning	2067
End of decommissioning and site restoration	2068
Removal from regulatory control	2069

*All dates are nominal. Any modifications associated with shutdown dates may impact these dates.

As an alternative to the schedule and sequence outlined above, it is worth noting that, for this facility, it may be more conducive to release the facility from regulatory control earlier. Whether OPG will pursue this approach or not for this facility will be assessed and confirmed as part of preparation for decommissioning.

6.7.2 Radiological Control

The maintenance of safe working conditions during decommissioning operations is of paramount importance. It is assumed that there will be no stored radioactive or hazardous/designated materials present within the facility at the start of decommissioning, although there is a possibility that hazardous/ designated materials may be found embedded in building materials. As a result, hazards remaining within the facility are expected to be minimal, and therefore only baseline radiological controls are likely to be required. This assumption will be verified via the appropriate surveys.

The baseline radiological controls to ensure the safe execution of decommissioning include:

- Airborne radioactivity will be controlled as far as possible using local controls. This will include using decommissioning tools and techniques that minimize dust generation, such as tie-down coatings and plastic sheeting for wrapping and covering objects and exposed surfaces;

- Airborne radioactivity will be monitored on a work area level and at the boundary of the licensed area with portable air samplers. This will ensure that internal conditions and atmospheric discharges remain well within approved limits. This will also help determine whether any additional mitigation measures are required;

- A physical boundary will be established around the licensed area (in the form of a construction fence) to control personnel access to the site;

- Personnel dosimetry will be used in those work areas where an individual could receive an occupational radiation dose. This will be applied as necessary, based on the results of preliminary monitoring by Health Physics;

- Floor drains will be sealed prior to decontaminating building surfaces or removing building equipment. This is to control the spread of contamination, preventing it from reaching the internal surfaces of the drainage system; and

- Any silt run-off will be controlled with temporary barriers.

6.7.3 Decommissioning Work Packages

Decommissioning work will be performed according to the following work packages:

- Site survey – The site will be characterized with respect to radiological activity level and contamination. These surveys will allow the aforementioned assumptions concerning the extent of radiological contamination to be validated, modified or rejected. All clean materials will be removed from the site after being cleared for release through survey. There is also a survey performed after decontamination, to clear the facility for demolition, as well as one for site release. The surveys will be systematic and statistically robust. OPG's sampling plan will take in consideration CSA N294:19 recommendations in Annex G on the use of DQO approach;

- Utility isolation – Any utilities, such as electricity, phone lines, gas supplies, sewage and water systems, that are still energized at the facility will require isolation. A generator and/or battery-powered equipment and systems will be used where a power supply is required. This will also serve to facilitate a safe working environment;

- Decontamination – Decontamination of equipment will involve the washing of surfaces with water and/or solvents and possibly the removal of paint from surfaces. Decontamination of Zone 3 and certain areas of Zone 2 will be similar to decontamination of equipment. This will involve washing of surfaces

(walls, floors and ceiling) with water and/or solvents. Vacu-blasting or other surface removal techniques will be utilized, if necessary. In the event that contamination has migrated into the bulk material of concrete structures, the affected areas will be removed via chipping, cutting or planning, to the extent that is prudent to reduce the generation of radioactive waste;

- Dismantling and demolition – Structures and systems will be dismantled and removed, in order to achieve the desired site end state. It will be determined during decommissioning whether the structures and systems (specifically floor drains) that are below the nominal depth of 1 m can be disposed of in-situ without posing a risk to workers, public or the environment;

- Decommissioning waste processing and packaging – Waste from decommissioning will be packaged for transportation and, under the current planning assumption, disposed of in LLW long-term disposal facility. Some volume reduction may be performed. Decontaminated equipment will be reused if it is sufficiently decontaminated and still useful;

- Waste transportation – Following waste segregation and packaging, the current planning assumption is that decommissioning waste will ultimately be transported to the LLW long-term disposal facility; and

- Site restoration – This will involve filling of voids with crushed, clean concrete and soil, and grading and seeding of the ground to prevent soil erosion.

6.7.4 Dismantling/Demolition of Structures and Systems

It is expected that conventional (off-the-shelf) tools and techniques will be adequate for undertaking dismantling and demolition activities.

The exterior walls of the CMLF consist of concrete panels and can thus be dismantled by removing panel supports and transporting the panels one at a time. The panels may be crushed and reused on site as infill or, if they are contaminated above release limits, sized (i.e., cut) to meet the applicable waste acceptance criteria for long-term disposal facility.

Multiple techniques are available for sectioning the steel frame of the building for removal. A few, which may be appropriate, include: friction sawing, cold sawing and oxygen-acetylene flame cutting [R-31]. This equipment may also be used in the dismantling of systems within the facility.

Demolition of the reinforced concrete foundations is likely to be performed by mechanical technologies, such as jackhammers or hydraulic or pneumatic breakers attached to demolition vehicles [R-32]. Unconventional options may also be considered, such as expansive grouts, microblasting or hydrodemolition [R-33].

6.7.5 Waste Management

The generation of radioactive waste will be minimized through the use of decontamination techniques. All recovered waste material generated through the decontamination process (or bulk material where contamination has migrated) will be assessed and consigned to the most appropriate waste stream. As much recovered material as possible will be designated for free release, as determined through surveying, and will be reused as infill, where appropriate, or disposed of at a conventional facility.

Under the current planning assumption, contaminated equipment and concrete will be segregated, packaged and ultimately transferred to the LLW long-term disposal facilities. Contaminated steel and other metals may also be transferred to this disposal facility. Remaining concrete that meets the release criteria will be crushed and graded, and used on site as clean fill, to the greatest extent possible. All other waste that meets the free-release criteria will be sent to a landfill.

The total amount of waste resulting from decommissioning of the CMLF is estimated to be 1,055 m^3 of LLW [R-8]. No intermediate-level waste is expected to be produced by these decommissioning activities. The waste estimate will be reviewed in subsequent revisions of the PDP, as more information becomes available.

6.7.6 Site Surveys and Monitoring

Site surveys will be performed throughout decommissioning. These surveys will be undertaken in accordance with the recommendations in MARSSIM [R-13]. Implementation of this approach provides a high degree of confidence that the results reflect the true condition of the site.

Upon completing the decontamination and removal activities, a detailed and comprehensive radiological survey of the remaining structures and yard areas will be performed. This will verify whether the remaining structures and yard areas meet the release criteria.

Once this has been confirmed, remaining buildings and structures will be demolished, with the resultant rubble reused, as far as possible. This material will be crushed and used as backfill.

6.7.7 Site Restoration

Following site remediation, voids will be backfilled with clean, crushed concrete and the site profiles will be graded. Restoration will conclude with the placement of topsoil and seeding of the site for soil stabilization, erosion control and maintenance of soil quality.

6.7.8 Significant Hazards

OPG does not foresee decommissioning activities posing significant hazards to workers, the public or the environment. However, a workplace health and safety assessment will be carried out during the detailed planning process, to formally identify and quantify the potential hazards resulting from decommissioning activities.

6.8 Completion of Decommissioning

6.8.1 End State

As stated in Section 4.5.1, by the end of site restoration, radioactive contamination and hazardous/ designated materials will have been removed from the site, to the extent that it meets the desired end state, as agreed upon with the CNSC. The site will then be suitable for other uses by OPG.

At the completion of decommissioning, the DOC will have:

- Performed the decommissioning program plans and procedures that are required to meet the needs and expectations of the site owner and the regulator;
- Completed the final site survey;
- Placed topsoil and landscaped the site for soil stabilization and erosion control; and
- Demobilized.

6.8.2 Release from Regulatory Control

A final end-state report on the decommissioning 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 (i.e., whether remediation activities have achieved the approved levels of residual contamination).

Other information required by the applicable regulations will also be provided, including documentation that shows that the nuclear substances have been received by another licensee who is authorized to possess these materials. The final end-state report will be submitted to the CNSC to support a request to release the facility from regulatory control, as applicable.

7.0 CSF – PRELIMINARY DECOMMISSIONING PLAN

7.1 Facility Introduction

The CSF, located within the Bruce Nuclear Site, is owned by OPG and operated by Bruce Power under Bruce Power's PROL [R-34] and will be handed back to OPG on return of the site at the end of the leased period. The CSF will conduct licensed activities in support of outages related to the Major Component Replacement (MCR) and Life Extension Projects. The function of the CSF is to receive and store all MCR tools, equipment and material from MCR outages and to refurbish the Fuel Channel and Feeder Replacement (FCFR) and Calandria Vessel Inspection (CVI) tools and equipment for reuse in future MCR outages. In doing so, radioactive material will be introduced into the CSF through the reactor tooling that will be maintained in the facility.

A brief description of the main activities that will be performed at the CSF is proved below:

- **Operations**: provide support to MCR outages including; receiving shipments, loading, unloading, packing, unpacking and securing loads into sea cans, storing sea cans into assigned locations in the CSF, retrieve and unpack sea cans, and load tools or materials onto transport trailers for shipping to stations or other locations.

- **Tool refurbishment**: refurbish all FCFR and CVI tooling, as required, from the Unit 6 execution program for reuse in future MCR outages.

- **Steam Generator Program**: In addition to storage and refurbishment of tools and equipment, the CSF will provide a location for the Steam Generator Replacement program to sever the Bruce B steam generator drums.

- **Decontamination**: While the CSF is not intended to be used as a decontamination facility, some decontamination capacity will be available to deal with emergent situations, should it be required.

Although not exclusively, the majority of the refurbishment work will be associated with tools and equipment for the FCFR program. While OPG is the owner of the CSF, under the lease agreement, Bruce Power holds the WNSL for the site and has the authority and responsibility for the building and equipment maintenance. Bruce Power is also responsible for the safety of all activities occurring within the CSF.

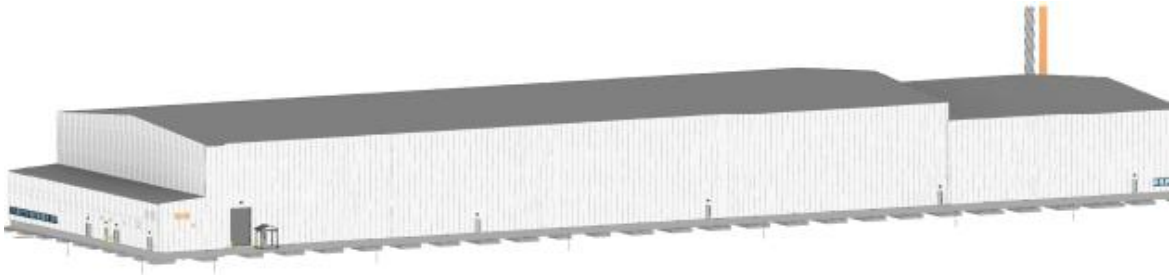
7.2 Facility Location and Site Access

The CSF is located roughly in the centre of the Bruce Nuclear Site, Northeast of Bruce B as shown in Figure 7-1 (Building B44). The overall area of the building is approximately 120,000 ft^2 with approximately 20,000 ft^2 of Zone 3 Space (tool maintenance area), 10,000 ft^2 of Zone 2 space containing tooling stores, loading dock, workstations, locker and meeting room, 10 000 ft^2 of Zone 1 space

containing offices, lunchrooms, mechanical and electrical room, washrooms, and 80,000 ft^2 of warehouse (i.e., unzoned) space for storage of sea cans. A diagram of the facility's outward appearance is shown in Figure 7-2. The CSF property is about 2.4 ha.

Access to the facility is via Douglas Point Road and 12th Street. During the normal operations of the CSF, the facility will remain secured with no access to personnel that are not members of the Bruce Power I SPG integrated team responsible for operations and maintenance of the facility. All personnel doors will remain secured outside of normal operating hours.

Figure 7-1 – Location of CSF (Building B44) within Bruce Nuclear Site



7.3 Building Structure and Systems

The CSF is a steel-framed insulated building supported by a poured concrete floor bearing on reinforced concrete foundation. The roof is a sloped steel design with a high bay over the warehouse and a lower bay over the Zone 3 area.

The overall facility is divided into the following sections:

- **West corridor (Zone 1 area)** includes main entrance, main office, lunchroom and washrooms, main mechanical and IT room.
- **Central Warehouse (Unzoned area)** includes 40-ton overhead crane bays for stacking and storing sea cans (sea cans stacked three high to maximize storage) on both North and South side of the warehouse.
- **East bay (Zone 3 area)** includes Contamination Control Area (CCA) and tool test mock-up area. The Zone 3 area has a 15 ton overhead crane bays on North and South side for performing tool maintenance.
- **East corridor (Zone 2 area)** include Radiation Protection office, mechanical room, HEPA system room, washrooms/showers and small meeting room. The area also include a loading dock for radiation protection support and related activities

The CSF is supported by a number of auxiliary systems, including:

- Ventilation;
- Sanitary sewage (covering washrooms, showers and other non-radioactive effluents);
- Water (domestic and fire suppression);
- Heating;
- Service Air (compressed gas for pneumatic tools and some instrumentation);
- Breathing Air (for respiratory protective equipment);
- Smoke Detection; and
- Air Conditioning.

The facility ventilation system is designed so that air flows from non-radioactive areas through to the radiological zones where radioactive contamination is more likely.

The air temperature is adjusted in cold weather, and the air is subject to HEPA filtration in Zones 2 and 3. Air exhausted from Zone 3 is handled via a separate

HEPA ventilation system due to the potential for radioactive contamination and is not re-circulated. Areas within Zone 3 are maintained under negative pressure relative to the surrounding areas.

The CSF sanitary sewage effluent from all building washrooms, showers and inactive services are collected in the sanitary drainage system and run by gravity flow into the sanitary sewer (in front of the CSF building), which flows to the Bruce Nuclear Site Sewage Processing Plant.

Domestic water is fed to the CSF through the Center of Site Domestic Water Distribution piping. This is a single feed that originates from the Bruce B Domestic Water Plant. The water distribution system supplies the facility's drinking water requirements.

The CSF Fire Water is supplied from the Center of Site Fire Water Pumphouse under normal operating conditions. A secondary fire water supply is available from the Bruce B Fire Water Pumphouse.

The building is heated and cooled by the water-glycol cooled, natural gas/propane heated HVAC system. The original heating source was propane which is to be converted over to natural gas by the end of 2021.

Compressed air system located in the West corridor main mechanical room is supplied to the facility to operate all pneumatic shop tools and equipment.

A breathing air system located in the East corridor mechanical room complete with filters and dryers, provides breathing air to respiratory protective equipment used in the Zone 3 area operations requiring it.

The heat and smoke detection system is provided to give early warning of fire in any work area. The fire alarm system is monitored by the BASS Control Room through a SCADA system and by the Emergency and Protective Services through a slave panel display.

The Power for the CSF is Class IV at nominal voltage levels of 600/347 V and 208/120 V, 60 Hz. Emergency lighting is available to provide adequate illumination for personnel egress during a loss of Class IV power.

7.3.1 Radiological Zoning

Figure 7-3 shows the radiological zoning of the CSF. The red shaded area shown in the figure below are the Zone 3 areas which present the greatest radiological risk. The green shaded area represent Zone 2 areas, where limited radioactive activities are undertaken. The blue shaded area represents Zone 1 areas, which are considered non-radioactive ('clean') areas. The grey shaded areas represents 'unzoned' area and is designated as the warehouse area. Found below is a breakdown of which sections of the facility are in each zone.

The zoning boundaries will be verified prior to the commencement of any physical decommissioning work. These zones will help facilitate decommissioning, since they provide an indication of where radioactive hazards are likely to be present.

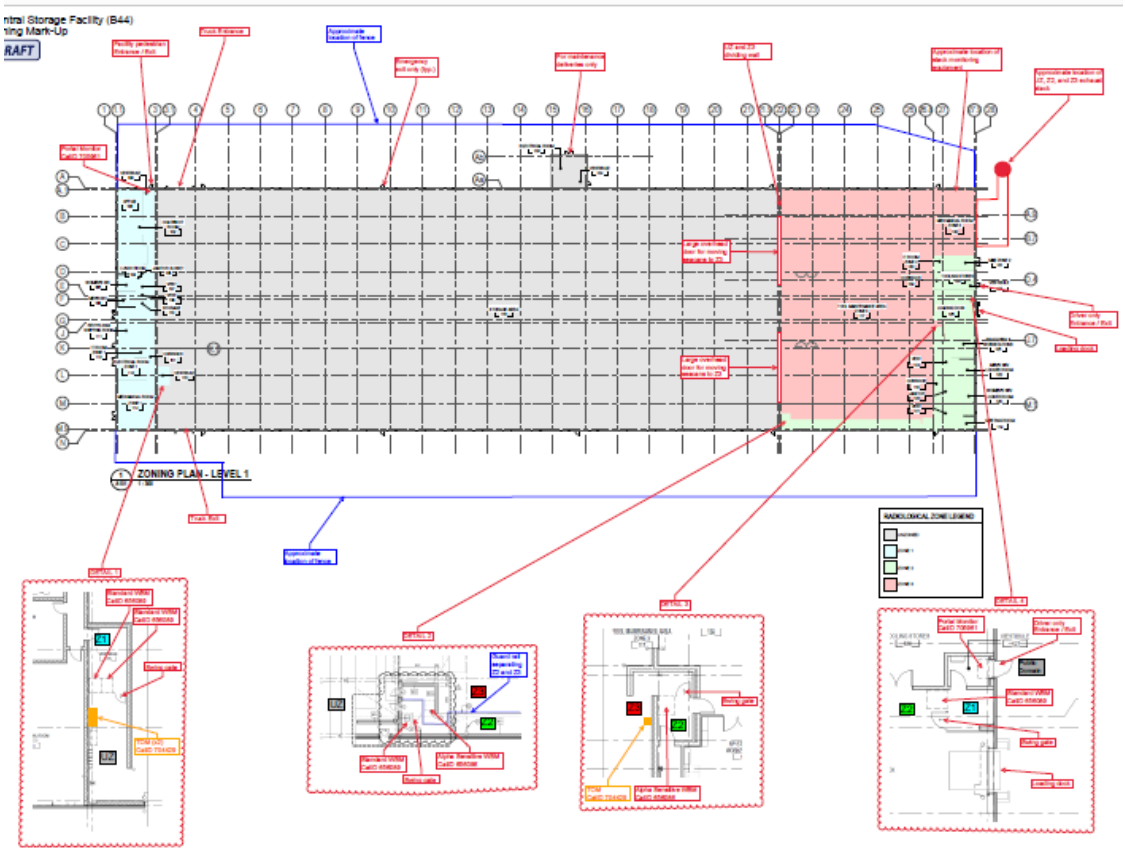


Figure 7-3 – Layout of Key CSF Areas

Zone 1

Zone 1 comprises areas free from contamination and contains offices, the lunchroom, washrooms and the main mechanical room.

Zone 2

Zone 2 comprises areas where work with radioactive materials is undertaken periodically, and where there therefore is potential for cross contamination to occur. Each area where this occurs is listed below, with its corresponding activities that involve radioactive materials:

- Radiation Protection office for resident radiation protection staff and lockup storage of radiation protection equipment and sealed sources;
- Bulk Radioactive Laundry Monitoring System – For surveying workers Zone 3 radiation protection personal equipment laundry prior to exiting the facility;
- Truck level dock for radiation protection related shipments such as laundry or active liquid waste transport;
- Mechanical room for breathing air system; and
- Men's and Women's locker rooms, showers and washrooms - Area designated for work clothing changes and controlled passage from Zone 1 to Zone 2.

Zone 3

This is the main area for operations involving radioactive materials. Each area is listed below, with its corresponding activities:

- The main tooling and equipment contaminated maintenance area (20,000 ft^2) has North and South 15-ton crane bays. Sea cans are moved into the Zone 3 area via two roll up doors providing access to the North and South bays (Note: these doors are interlocked so that only one rollup door can be open at a time and the main Warehouse overhead trucking doors must be closed). These two rollup access doors are located in the partition wall that separate the main warehouse from the Zone 3 area (at building grid/column line 22).
- There are four dedicated CCAs in the Zone 3 for performing the refurbishment activities, two of these are Abraflex tents (one which can be divided into two separate CCA areas) and a one-dimensional CCA in the South bay. Also, in the North bay is a tool test area CCA for testing tools after refurbishment prior to going into the next MCR.
- The HEPA system room with three separate HEPA banks and dedicated fan systems that exhaust to the HEPA stack located outside the facility adjacent to the HEPA system room. Two HEPA systems are always on-line with an

auto start (third system) stand-by in case one system goes down to maintain the negative pressure in the Zone 3 area. Also located inside the HEPA system room are two stack monitoring systems, one for tritium and one for particulate. The system is operated according to the Environmental Regulations with daily readings taken and weekly samples sent to the Bruce Power Radiation Protection lab for analysis.

Note there is no active liquid waste handling system at the CSF and therefore no floor drains to sewer. All liquid waste is collected via the floor cleaning equipment or other manual means and collected into totes with spill protection according to Bruce Power procedures. The emergency showers in the Zone 3 collect water into contained concrete pits which can also be evacuated out into the active liquid waste totes. All collected active liquid waste in the totes is surveyed and dispositioned for disposal in accordance with active liquid waste disposal procedures.

7.4 History and Current Status

The function of the CSF is to receive and store all MCR tools, equipment and materials from MCR outages, and to refurbish the FCFR and CVI tools and equipment for reuse in future MCR outages.

The facility opened as a licensed facility in November 2020 and the Zone 3 area was approved to go into service in January of 2021. Contaminated tools and equipment coming out of the Unit 6 MCR is gross decontaminated at the station, wrapped, surveyed and placed into sea cans and transported to CSF. Once arrived at the CSF, the sea cans are off-loaded with the overhead cranes and put into the designated radioactive material storage area of the warehouse and put into stacks of three high. The location of the sea cans relative to the exterior walls is organized based on the survey data to minimize exposure to the workers in the facility and the exterior of the building.

Currently, the radioactive material storage area is taking approximately 30% of the total warehouse area. The refurbishment of the Unit 6 MCR tooling in the CSF Zone 3 has recently begun and will begin to ramp up significantly in the third quarter of 2021.

7.4.1 Stored and Structural Hazardous Materials

All hazardous materials used in the CSF are required to be assessed through BP-PROC-00306, Chemical Risk Management Procedure [R-30], which results in an electronic assessment record in EDMS for each product. This process also requires hazardous product containers to be labelled with a "Chemical Risk Management label" which provides a graded risk rating from an environmental, safety, fire and chemical compatibility perspective. This label is in addition to legally required hazard labels such as those required for Consumer Products or WHMIS-controlled chemicals. For most hazardous products (e.g.: WHMIS-controlled), an SDS is available which will provide guidance on the safe handling, storage and disposal of the product

Hazardous materials used at the CSF include: bleaches, disinfectants, solvents, degreasers, cleaning and stripping agents, waxes, heat transfer fluids, greases, lubricants, fuels, welding gases, batteries, aerosols and cutting fluids. As a result of WHMIS, a ready record exists of hazardous materials that may potentially be encountered during decommissioning operations. Appendix A provides inventory of hazardous material used at the CSF.

Hazardous materials will be removed prior to the start of facility decommissioning. This approach is preferred, since operational staff will be more familiar with any hazardous substances present, allowing for the safer handling of materials. Furthermore, this approach reduces the burden of materials management during decommissioning.

Despite the planned removal of hazardous materials before decommissioning and OPG's exercise of due diligence with respect to hazardous waste disposal during operations, there is a risk that residual hazardous materials will remain within the facility. Appropriate procedures and personal protective equipment will be utilized to ensure worker safety. Additional precautions will be utilized when dismantling any drainage system components located in rooms where cleaning activities or any other hazardous materials were handled.

Prior to demolition, the facility will be inspected to determine whether hazardous materials are present. The results from this survey, as well as the appropriate actions to respond to the presence of structural hazardous materials, will be documented as part of preparation for decommissioning. Removal procedures will be in accordance with applicable legislation.

7.4.2 Nature of Contamination

Airborne emissions and aqueous effluents generated by the CSF are subject to monitoring prior to discharge, to ensure that radioactive emissions and effluents remain well within regulatory and facility limits, and to confirm the current radiological status of the facility.

Airborne radiological emissions monitoring occurs at the contaminated stack of the CSF. Aqueous radioactive effluent is not directly released from the CSF.

Active liquid wastes are disposed of through the active liquid waste management system at BNGS A.

The nature and extent of contamination released from the CSF is documented in the Quarterly Report on Safety Performance Indicators (QRSPI) and annual Bruce Power Environmental Protection Report, both of which are submitted annually to the CNSC.

7.4.3 Extent of Contamination According to Zone

The following is a breakdown of the predicted extent of contamination according to each of the three zones within the facility.

Zone 1

All equipment and systems in Zone 1 are considered radiologically clean and will be removed and disposed of as clean material (after a radiological survey for confirmation). This will be achieved using standard techniques, as used in non-radioactive facilities.

All floor or sanitary drains originating in Zone 1 of the building are considered radiologically clean. However, they must be subjected to a final radiological survey to verify that condition.

Zone 2

Selective equipment and air handling systems located within Zone 2 are considered potentially contaminated. These are likely to be removed and disposed of as radioactively contaminated material, unless surveys confirm that contamination levels are below clearance limits.

Surfaces within Zone 2 are assumed to be contaminated as follows:

- Approximately 20% of the floor surface area is expected to be contaminated. It is anticipated that these surfaces will be decontaminated using the vacu-blast technique;
- Concrete block walls are assumed to be 100% contaminated due to the difficulty of decontaminating and surveying this type of material. The bulk material will therefore be consigned as radioactive waste;
- Secondary division walls, such as wallboard or movable partitions, will be assumed to be 100% contaminated. This is due to the difficulty of accurately assaying and decontaminating this type of material. This material will therefore be automatically consigned as radioactive waste;
- Metal siding and roofing are likely to be removed and disposed of as radioactively contaminated material. Again, this is due to the difficulty of

decontaminating and surveying interior and other hidden portions of this type of material; and

Zone 3

Numerous structural surfaces in Zone 3 are assumed to be contaminated. These include:

- All walls and dividers, including metal siding and roofing;
- All roof-mounted equipment;
- All concrete blocks;
- All poured concrete surfaces to a depth of ½ inch; and
- The internal surfaces of floor and sanitary drains.

The contaminated surfaces will be decontaminated as far as possible, with the aim of re-classifying the waste to a lower category. It is preferable to achieve sufficient decontamination to meet clearance levels, facilitating the reuse or recycling of material, as opposed to disposal. Techniques to be considered include vacu-blasting, chemical cleaning, scabbling or planing. Some structures may not be suitable for decontamination. For example, surfaces may be difficult to access, or contamination may have migrated into the bulk material of the structure. It is likely that these materials will be automatically consigned as radioactive waste, unless they can be further dismantled and surfaces more accurately assessed.

Details on the actual radiological conditions within the facility (including surface contamination levels and dose rates, etc.) will be provided as part of preparation for decommissioning, once the operations activities have ceased. A history of spills and accidents will also be documented, as appropriate.

7.4.4 Facility Shutdown

The following is a list of anticipated activities to be performed during shutdown of the CSF:

- Removing non-structural hazardous/designated materials and radioactive material from facility areas; and
- De-energizing systems that no longer are required. As required, systems such as fire protection and electrical may remain operational, if the dismantling and demolition stage is deferred.

7.5 Decommissioning Strategy

OPG has chosen a prompt decommissioning strategy for the CSF. This strategy is consistent with the international practice for similar waste management facilities and is consistent with the decommissioning strategy selected for OPG's WWMF.

OPG decommissioning strategy is based on the assumption that all waste will be removed from the site and transferred to the respective long-term waste management facilities prior to the beginning of decommissioning. Since little to no residual radioactivity is expected to be present at the CSF after all the operational waste is removed, OPG does not currently anticipate the need for any deferment of decommissioning.

The decommissioning work at the CSF 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 LLW long-term disposal facility.

7.6 Scope of Decommissioning

At the end of the facility operations, as well as at the start of decommissioning, all stored materials/tools (including contaminated materials/tools), wastes and non-structural hazardous/designated materials will have been removed from the facility. As such, the only remaining radioactive material when decommissioning begins will be low levels of contamination.

The DOC will prepare a plan that will form the basis for proceeding to the execution phase of the decommissioning. The DOC will assemble and mobilize the organization required to safely manage the decommissioning activities. OPG will maintain a small organization of personnel to provide oversight throughout the decommissioning project.

The reuse of the facility is preferred to minimize the generation of waste, thereby supporting the principles of the waste management hierarchy. However, no alternative uses for this facility are known or anticipated at this time.

The objective of decommissioning the CSF is to dismantle and demolish the facility in a manner that aims to ensure that the health, safety and security of workers, the public and the environment are protected, and to release the facility from regulatory control, as applicable.

The specific areas, structures and components within the CSF that are covered within the scope of the CSF decommissioning plan are listed in Section 7.3. This list may be expanded as decommissioning approaches.

7.7 Execution of Decommissioning

7.7.1 Proposed Schedule for Decommissioning Activities

The schedule presented below is for planning purposes only. These dates may be adjusted at the time of execution to derive synergies/economies of scale with other decommissioning activities occurring at the neighbouring facilities on site (e.g., WWMF). Table 7-1 summarizes the assumed timing of key decommissioning activities for the CSF site.

Table 7-1 – Planned Project Milestones – CSF Decommissioning

Event	Date*
Removal of all radioactive waste and facility shutdown	2064
Begin preparation for decommissioning of RWOS1, CMLF and CSF	2066
Begin decommissioning	2067
End of decommissioning and site restoration	2068
Removal from regulatory control	2069

*All dates are nominal. Any modifications associated with shutdown dates may impact these dates.

7.7.2 Radiological Control

The maintenance of safe working conditions during decommissioning operations is of paramount importance. It is assumed that there will be no stored radioactive or hazardous/designated materials present within the facility at the start of decommissioning, although there is a possibility that hazardous/ designated materials may be found embedded in building materials. As a result, hazards remaining within the facility are expected to be minimal, and therefore only baseline radiological controls are likely to be required. This assumption will be verified via the appropriate surveys.

The baseline radiological controls to ensure the safe execution of decommissioning include:

- Airborne radioactivity will be controlled as far as possible using local controls. This will include using decommissioning tools and techniques that minimize dust generation, such as tie-down coatings and plastic sheeting for wrapping and covering objects and exposed surfaces;

- Airborne radioactivity will be monitored on a work area level and at the boundary of the licensed area with portable air samplers. This will ensure that internal conditions and atmospheric discharges remain well within approved limits. This will also help determine whether any additional mitigation measures are required;

- A physical boundary will be established around the licensed area (in the form of a construction fence) to control personnel access to the site;

- Personnel dosimetry will be used in those work areas where an individual could receive an occupational radiation dose. This will be applied as necessary, based on the results of preliminary monitoring by Health Physics;

- Floor drains will be sealed prior to decontaminating building surfaces or removing building equipment. This is to control the spread of contamination, preventing it from reaching the internal surfaces of the drainage system; and

- Any silt run-off will be controlled with temporary barriers.

7.7.3 Decommissioning Work Packages

Decommissioning work will be performed according to the following work packages:

- Site survey – The site will be characterized with respect to radiological activity level and contamination. These surveys will allow the aforementioned assumptions concerning the extent of radiological contamination to be validated, modified or rejected. All clean materials will be removed from the site after being cleared for release through survey. There is also a survey performed after decontamination, to clear the facility for demolition, as well as one for site release. The surveys conducted will be systematic and statistically robust. OPG's sampling plan will take in consideration CSA N294:19 recommendations in Annex G on the use of DQO approach;

- Utility isolation – Any utilities, such as electricity, phone lines, gas supplies, sewage and water systems, that are still energized at the facility will require isolation. A generator and/or battery-powered equipment and systems will be used where a power supply is required. This will also serve to facilitate a safe working environment;

- Decontamination – Decontamination of equipment will involve the washing of surfaces with water and/or solvents and possibly the removal of paint from surfaces. Decontamination of Zone 3 and certain areas of Zone 2 will be similar to decontamination of equipment. This will involve washing of surfaces (walls, floors and ceiling) with water and/or solvents. Vacu-blasting or other surface removal techniques will be utilized, if necessary. In the event that contamination has migrated into the bulk material of concrete structures, the affected areas will be removed via chipping, cutting or planing, to the extent that is prudent to reduce the generation of radioactive waste;

- Dismantling and demolition – Structures and systems will be dismantled and removed, in order to achieve the desired site end state. It will be determined during decommissioning whether the structures and systems (specifically floor drains) that are below the nominal depth of 1 m can be disposed of in-situ without posing a risk to workers, public or the environment;

- Decommissioning waste processing and packaging – Waste from decommissioning will be packaged for transportation and, under the current planning assumption, disposed of in LLW long-term disposal facility. Some volume reduction may be performed. Decontaminated equipment will be reused if it is sufficiently decontaminated and still useful;

- Waste transportation – Following waste segregation and packaging, the current planning assumption is that decommissioning waste will ultimately be transported to the LLW long-term disposal facility; and

- Site restoration – This will involve filling of voids with crushed, clean concrete and soil, and grading and seeding of the ground to prevent soil erosion.

7.7.4 Dismantling/Demolition of Structures and Systems

It is expected that conventional (off-the-shelf) tools and techniques will be adequate for undertaking dismantling and demolition activities.

The exterior walls of the CSF will be demolished using the standard demolition techniques.

Multiple techniques are available for sectioning the steel frame of the building for removal. A few, which may be appropriate, include: friction sawing, cold sawing and oxygen-acetylene flame cutting [R-31]. This equipment may also be used in the dismantling of systems within the facility.

Demolition of the reinforced concrete foundations is likely to be performed by mechanical technologies, such as jackhammers or hydraulic or pneumatic breakers attached to demolition vehicles [R-32]. Unconventional options may also be considered, such as expansive grouts, microblasting or hydrodemolition [R-33].

7.7.5 Waste Management

The generation of radioactive waste will be minimized through the use of decontamination techniques. All recovered waste material generated through the decontamination process (or bulk material where contamination has migrated) will be assessed and consigned to the most appropriate waste stream. As much recovered material as possible will be designated for free release, as determined through surveying, and will be reused as infill, where appropriate, or disposed of at a conventional facility.

Under the current planning assumption, contaminated equipment and concrete will be segregated, packaged and ultimately transferred to the LLW long-term disposal facility. Contaminated steel and other metals may also be transferred to this disposal facility. Remaining concrete that meets the release criteria will be crushed and graded, and used on site as clean fill, to the greatest extent possible. All other waste that meets the free-release criteria will be sent to a landfill.

The total amount of waste resulting from decommissioning of the CSF is estimated to be 16 m^3 of LLW [R-8]. No intermediate-level waste is expected to be produced by these decommissioning activities. The waste estimate will be reviewed in subsequent revisions of the PDP, as more information becomes available.

7.7.6 Site Surveys and Monitoring

Site surveys will be performed throughout decommissioning. These surveys will be undertaken in accordance with the recommendations in the MARSSIM [R-13]. Implementation of this approach provides a high degree of confidence that the results reflect the true condition of the site.

Upon completing the decontamination and removal activities, a detailed and comprehensive radiological survey of the remaining structures and yard areas will be performed. This will verify whether the remaining structures and yard areas meet the release criteria.

Once this has been confirmed, remaining buildings and structures will be demolished, with the resultant rubble reused, as far as possible. This material will be crushed and used as backfill.

7.7.7 Site Restoration

Following site remediation, voids will be backfilled with clean, crushed concrete and the site profiles will be graded. Restoration will conclude with the placement of topsoil and seeding of the site for soil stabilization, erosion control and maintenance of soil quality.

7.7.8 Significant Hazards

OPG does not foresee decommissioning activities posing significant hazards to workers, the public or the environment. However, a workplace health and safety assessment will be carried out during the detailed planning process, to formally identify and quantify the potential hazards resulting from decommissioning activities.

7.8 Completion of Decommissioning

7.8.1 End State

As stated in Section 4.5.1, by the end of site restoration, radioactive contamination and hazardous/ designated materials will have been removed from the site, to the extent that it meets the desired end state, as agreed upon with the CNSC. The site will then be suitable for other uses by OPG.

At the completion of decommissioning, the DOC will have:

- Performed the decommissioning program plans and procedures that are required to meet the needs and expectations of the site owner and the regulator;
- Completed the final site survey;
- Placed topsoil and landscaped the site for soil stabilization and erosion control; and
- Demobilized.

7.8.2 Release from Regulatory Control

A final end-state report on the decommissioning 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 (i.e., whether remediation activities have achieved the approved levels of residual contamination).

Other information required by the applicable regulations will also be provided, including documentation that shows that the nuclear substances have been received by another licensee who is authorized to possess these materials. The final end-state report will be submitted to the CNSC to support a request to release the facility from regulatory control, as applicable.

8.0 DECOMMISSIONING COST ESTIMATES AND FINANCIAL GUARANTEE

This section summarizes the estimated costs associated with decommissioning RWOS1, the CMLF and the CSF and the provision of a financial guarantee for the accumulated liability. Further information regarding the cost estimates for RWOS1 and CMLF can be found in Appendix B.

8.1 RWOS1 and CMLF

A decommissioning cost estimate update was prepared by TLG Services, LLC on behalf of OPG [R-8]. This estimate considered each facility's unique features and expected conditions after removal of all stored radioactive waste. The total estimated cost to decommission RWOS1 and the CMLF is $46.2 million (2022 dollars) [R-8]. A breakdown of the estimated costs is provided in Appendix B.

8.2 CSF

A decommissioning cost estimate was prepared by TLG Services, LLC on behalf of OPG [R-8]. This estimate considered the facility's unique features and expected conditions at the start of decommissioning. The total estimated cost to decommission the CSF is $15.5 million (2022 dollars) [R-8]. A breakdown of the estimated costs is provided in Appendix B.

8.3 Financial Guarantee

For the 2023-2027 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.

9.0 HUMAN AND ORGANIZATIONAL FACTORS

OPG will ensure that human and organizational factors are considered throughout the planning and execution of the 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 in accordance with CNSC's guidance document REGDOC-2.2.1 – Human Factors [R-35]. It is expected that 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-8]. The staff numbers presented in the cost estimate [R-8] should be considered preliminary (i.e., for cost estimating purposes only). Business plan staffing numbers have not yet been established and will be determined a later date.

10.0 POTENTIAL ENVIRONMENTAL AND SOCIO-ECONOMIC EFFECTS

An assessment of the environmental and socio-economic impacts of the decommissioning project for RWOS1, the CMLF and the CSF will be undertaken during the detailed planning process. The level of detail necessary will be agreed with the CNSC. As the decommissioning plan develops and the nature and extent of potential impacts are better understood, it is expected that an 'environmental scope' will be defined.

It is recognized that the baseline conditions for each of these aspects must be defined before decommissioning activities are commenced, to allow impacts to be accurately quantified and appropriate mitigation measures identified.

Baseline data will be collated from data produced as a result of historical monitoring programs. It is known that these sites are currently subject to monitoring programs, whose function is to monitor environmental radioactivity in and around the site resulting from all identified sources.

Monitoring is undertaken at fixed locations around the Bruce Nuclear Site. Media sampled includes water, aquatic organisms, sediments and terrestrial food sources. The specific objectives of these monitoring programs include:

- To confirm that discharges are within permitted limits;
- To verify assumptions made on expected discharges;
- To calculate potential public doses resulting from known emissions; and
- To develop improved environmental models, to understand the behaviour of radionuclides in the environment.

Non-radioactive emissions are also monitored by OPG to ensure maintained compliance with the Environmental Compliance Approval issued by Ontario's Ministry of the Environment, Conservation and Parks (MECP).

10.1 Environmental Management

Prior to commencing the decommissioning, OPG will complete an environment review (if required), in accordance with the regulatory requirements that exist at that time.

OPG will determine the environmental requirements in advance of future decommissioning projects to ensure that adequate provisions for the protection of the environment are made during decommissioning.

10.2 Natural Environment

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

10.2.1 Air Quality

The heavy construction equipment used during the decommissioning work, and the vehicles used for transport of waste and other materials, may release 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. Some localized, temporary degradation of air quality may result from the dusts released during cutting operations, particularly during the dismantling operations. Dust suppression technology will be employed, where possible, to reduce the impact of localized dust generation.

10.2.2 Land Use

Since it is expected that the site itself will continue to be used for industrial uses, the current land use type will not change. It is not anticipated that the decommissioning itself will have any impact on the use of the surrounding lands.

10.2.3 Vegetation

The operating area of these facilities is highly developed with most of the non-building areas having an asphalt and/or gravel surfaces. The exception to this is the RWOS1 site, which contains large areas of bare earth. The most heavily vegetated areas surrounding the sites are not likely to be impacted during the course of decommissioning work, but the dust produced during the dismantling and site restoration work may have a temporary impact on some of the vegetation in the immediate vicinity of these facilities.

10.2.4 Wildlife

Wildlife activity within the site boundaries during operating phases is expected to be minimal. Many of the birds and the larger mammals are highly mobile and move around the surrounding site area in search of food. There will be a short period of time during the preparation and mobilization activities when there will be little or no activity on the site areas. The level of activity will increase during the dismantling, demolition and site restoration activities and may have some impact on wildlife populations, but the level of activity is unlikely to be significantly higher than during normal operations at the WWMF.

Potential effects may be caused by dust, noise and suspended sediment in surface runoff, as a result of the dismantling and/or demolition work, and may have an impact on some species. Increased traffic volumes during some phases of the decommissioning may also adversely affect wildlife, due to the traffic noise, as well as collisions between vehicles and animals.

10.2.5 Water Quality and Aquatic Life

These sites are well removed from the lakeshore of Lake Huron, and decommissioning activities should not have any direct impact on the lake. Some increase in turbidity of the water where these sites drain may result from dismantling and site restoration work. This may have a temporary impact on the aquatic life in the area, although all efforts will be taken to physically prevent sedimentary discharges from the decommissioning site.

10.2.6 Noise

Heavy construction equipment may be used during the dismantling/demolition 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 nuclear site. Site workers and wildlife may be impacted by the increased noise. Activities will comply with municipal noise by-laws.

The potential impacts of demolition noise will be assessed prior to dismantling and demolition. Appropriate mitigation strategies will be put in place.

10.3 Human and Socio-Economic Environment

10.3.1 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.

This section does not attempt to assess or evaluate what impacts may actually result at the time when decommissioning will occur. 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 environmental review, if required, and their significance determined at that time.

10.3.2 Scope

It is recognized that some of the socio-economic impacts considered within this decommissioning plan are not considered to be 'environmental effects'. However, the scope of the socio-economic assessment has been expanded here to consider other effects, in accordance with the requirements of CNSC Regulatory Guide G-219.

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.

10.4 Mitigation Measures

It is recognized that many of the decommissioning operations to be undertaken on site have the potential to have impacts both on and off site. There is potential for staff, members of the public and the wider environment to be affected. As the decommissioning plan develops, a mitigation strategy will also be developed in conjunction.

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 10-1. This can be applied to both socio-economic and environmental effects.

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 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.

Managerial measures rely on controlling how activities are carried out on site to reduce 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, and ensuring that work is carried out in accordance with approved method statements and operational controls.

Deferred mitigation might occur where an impact is unavoidable and remedial/restorative action is required instead. This might include site decontamination and site landscaping.

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 when developing the mitigation strategy to systematically record this process. This facilitates the production of an auditable trail to justify subsequent decisions made. 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.

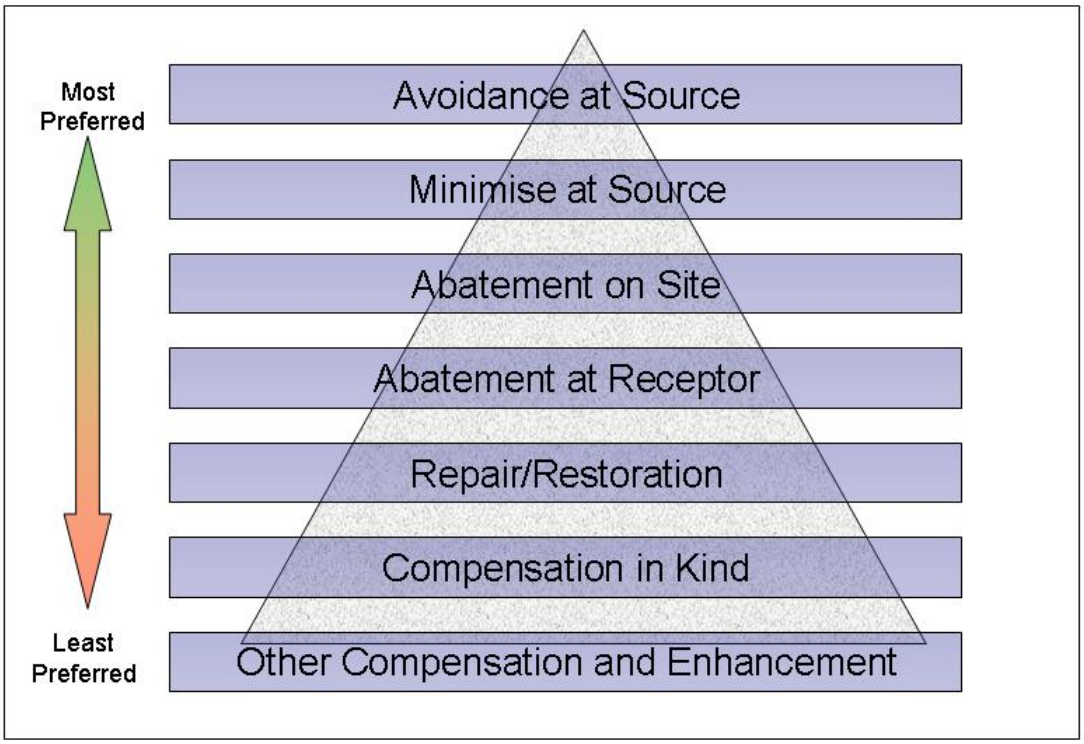


Figure 10-1 – Hierarchy of Mitigation Measures

10.5 Temporal Considerations

As described in Section 4.1, the four main phases associated with decommissioning are: Planning for Decommissioning, Preparation for Decommissioning, Execution of Decommissioning and Completion of Decommissioning.

Each of these phases will have 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.

10.5.1 Planning and Preparation for Decommissioning: Sources of Effects

The 'Planning for Decommissioning' phase begins at the design phase and ends when the decision to cease operation has been made; this denotes the start of the second phase: Preparation for Decommissioning.

One such effect will be the changes in the size of the workforce leading up to the shutdown of operations, especially when considered together with the WWMF.

The positions and level of personnel staffing are not fixed for the length of the project but are adjusted, depending on the type of expertise needed to support the activities being performed during each period.

Some displaced workers and their families may not move away from the community and may or may not find employment locally. Other workers and their families may move away from the community. The loss of jobs, income and population will affect the local communities in a variety of ways, including effects in the housing market, services, consumer spending and social aspects.

The social implications of the risks associated with decommissioning would also be a potential source of socio-economic effects and would be included in an environmental assessment, if required.

Under current assessment legislation, tax will continue to be paid on the same buildings and structures. The amount of taxes paid after the dismantling and demolition of all buildings will depend on the new land uses.

10.5.2 Execution of Decommissioning: Sources of Effects

Decommissioning of these facilities may represent opportunities for the local labour force, but it is also possible that, 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. These changes may affect the local and regional community.

These sources of effects will be evaluated in the environmental review at the time, if required.

10.5.3 Completion of Decommissioning: Sources of Effects

Following the execution of decommissioning phase, OPG will verify that all decommissioning activities have been completed satisfactorily, the final end state has been reached and all documentation has been completed. At the conclusion of this phase, the workforce will no longer be required, and any local spending associated with the decommissioning work will conclude. The site will likely remain an industrial zone.

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.

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

11.0 POTENTIAL HAZARDS AND HEALTH & SAFETY

The safety of operators, the general public and the wider environment is of foremost importance. As a result, all work will be undertaken in accordance with OPG's policies and procedures, as well as all regulatory requirements.

As per CSA N294:19 [R-4], during the detailed planning process, 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. This safety assessment will describe potential hazards and methods to reduce the risk associated with the hazards.

11.1 Hazard Assessment

The radiological, chemical and construction hazards that might be encountered during the decommissioning will be similar to those that may arise during some normal operational activities.

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 Occupational Health and Safety Act (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 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 the 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;

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 (potential) incidents.

To ensure that the hazard assessment is comprehensive, the methodology to be used will detail the resources and timeframes required for assessing the hazards, the proposed hazard 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 protection programs;
- Results of workplace inspections;
- Employee incident reports;
- Government or employer reports, studies and tests concerning the health and safety of employees;
- Records of holdings or 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 (e.g., engineered controls) and managerial (safe systems of work, operational procedures, etc.) 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 in the sections that follow.

11.1.1 Radiological Hazards to Workers and the Public

It is assumed that all stored waste will be removed before the decommissioning begins. The only remaining radioactive material on the sites will be low levels of contamination on the surface of equipment and structures. It is anticipated that 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. Due to this, occupational doses are expected to be low.

RWOS1, the CMLF and the CSF are physically remote from public use areas and are not expected to cause any radiological risk to the public over current levels.

11.1.2 Chemical Hazards

During decommissioning, the 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. Also, there may be trace amounts of chemicals left from pre-shutdown that were not removed.

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 common mode event (earthquake).

11.1.3 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.

11.2 Radiological Safety

All decommissioning activities will be carried out in accordance with the ALARA principle and OPG's approved radiation protection procedures. Where required, radioactive work planning will be implemented to ensure that safe working conditions are maintained.

11.3 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;
- The right of employees to refuse to perform work that is unsafe; and
- The fact that OPG will ensure that the DOC and any subcontractors maintain occupational health and safety programs that are consistent with OPG's programs.

11.4 Emergency Response Planning

During the preparation for decommissioning phase, 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:

- 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.

12.0 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 decommissioning; the DOC and its subcontractors will be required to comply with OPG procedures regarding physical security.

13.0 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 RWOS1, the CMLF and the CSF. 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 Suitably Qualified and Experienced Persons (SQEPs);
- 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, materials 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 performing quality assurance audits.

13.1 Applicable Legislation, Standards and Regulatory Guidance

All decommissioning activities from site preparation through to final restoration will be undertaken in accordance with the requirements of all relevant legislation and regulations in force at the time. This will ensure that the work meets the needs and expectations of the regulators, the site owners and other stakeholders.

The following list details some of the key 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 likely that a number of items may be updated, amended or replaced at a later time. As a result, the list will be 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;
- OHSA, R.S.O. 1990, C.0.1 (Ontario);
- National Pollutants Release Regulations; and

The CSA standards and regulatory documents and guidance that are anticipated to be applicable for decommissioning of the RWOS1, CMLF and CSF include but are not limited to:

- 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[5]: Financial Guarantees for the Decommissioning of Licensed Activities;

[5] 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.[R-5].

- Regulatory Guide G-219[6]: 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.

14.0 DOCUMENTATION (RECORDS)

It is recognized that there is a potential for information about the RWOS1, CMLF and CSF 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 and IAEA guidance related to record keeping (e.g., Technical Reports Series No. 411 [R-36]).

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

[6] 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].

- Records will be assembled and maintained in secure storage.

15.0 PUBLIC AND STAKEHOLDER ENGAGEMENT PROGRAM

Under the current planning assumptions, RWOS1, the CMLF and the CSF will be decommissioned concurrently with decommissioning of WWMF L&ILW Buildings. As such, it is foreseen that the public and stakeholder engagement program, as well as an indigenous engagement program that will be developed as part of the WWMF decommissioning, will also include these three facilities.

The public and stakeholder engagement program will comply with the applicable requirements of REGDOC-3.2.1 [R-37] and REGDOC-3.2.2 [R-38].

16.0 REFERENCES

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[R-2] Letter from A. Sweetnam to D. Howard, "Financial Guarantee for OPG's Radioactive Waste Site-1 and Central Maintenance Facility", N-CORR-00531-05697, June 21, 2012.

[R-3] CNSC, "Decommissioning Planning for Licensed Activities", Regulatory Guide G-219, June 2000.

[R-4] CSA, "Decommissioning of Facilities Containing Nuclear Substances", CSA N294:19, November 2019.

[R-5] OPG Letter, C. Carmichael & J. Van Wart (OPG) to E. Fortier (CNSC), "Implementation of Waste Management, Decommissioning and Financial Guarantee Regulatory Documents at the Pickering, Darlington and Western Waste Management Facilities and Radioactive Operations Site 1", W-CORR-00531-01771, October 15, 2021.

[R-6] OPG, "Preliminary Decommissioning Plan – Western Waste Management Facility", 0125-PLAN-00960-00001, Revision 04, December 2021.

[R-7] OPG, "Unconditional Clearance of Low-Level Radioactive Materials From OPG Regulated Facilities", N-STD-RA-0029 R004, May 2020.

[R-8] TLG, "Decommissioning Cost Estimate for the Radioactive Waste Operations Site (RWOS1), Central Maintenance Laundry Facility (CMLF) and the Contaminated Tool Storage Facility (CTSF)", W-REP-00962.2-00029-R001, December 2021.

[R-9] OPG, "Western Waste Management Facility Safety Report", W-SR-01320-00001-R003, October 2012.

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[R-11] OPG, "Radiation Protection Program", N-PROG-RA-0013, June 2019.

[R-12] CNSC, "Comprehensive Study Report, Bruce Heavy Water Plant Decommissioning Project", March 2003.

[R-13] U.S. NRC, "Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)", NUREG-1575 Revision 1, August 2000.

[R-14] OPG, "Final End State Report, Bruce Heavy Water Plant Decommissioning", 0124-REP-00960-00012, R000, June 2013.

[R-15] OPG, "Bruce Heavy Water Plant Environmental Assessment Follow-Up and Monitoring Closure Report", 0124-REP-00960-00013 R000, June 2013.

[R-16] CNSC, "License to Abandon a Heavy Water Plant Ontario Power Generation Bruce Heavy Water Plant", E-DOCs-#4237004, March 2014.

[R-17] OPG, "Licence Amendment Request for RWOS-1 Waste Nuclear Substance Licence WNSL-W1-320.04/ind", 0125-CORR-00531-18999, March 2019.

[R-18] CNSC, "Review of Final Status Survey Report WWMF Spent Solvent Treatment Facility Decontamination and Demolition Phase II", 0125-CORR-00531-19013, May 24, 2019.

[R-19] OPG, "OPG Response to CNSC Comments from the Review of Final Status Survey Report WWMF Spent Solvent Treatment Facility Decontamination and Demolition Phase II", 06116-CORR-00531-00082, August 8, 2019.

[R-20] CNSC, "Decision on the licence amendment for Ontario Power Generation-RWOS-1 Waste Nuclear Substance Licence WNSL-W1-320.04/ind", 0125-CORR-00531-19024, October 2019.

[R-21] NEA, "Decommissioning in Canada – Current Status", October 2004, www.nea.fr.

[R-22] Canatom NPM, "Final Report – Defense Research Establishment Suffield, Waste Removal", 1995.

[R-23] IAEA, "Decommissioning of Nuclear Fuel Cycle Facilities – Safety Guide", Safety Standards Series No. WS-G-2.4, July 2001.

[R-24] Ontario Hydro, "Conceptual Plan for Decommissioning Bruce Nuclear Power Development – Radioactive Waste Operations Site 1", 0125-REF-00960-{49779}, Revision 1, Nuclear Safety Department, Ontario Hydro, February 1992.

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[R-32] Hometown Demolition Contractors, "Concrete Demolition", http://www.hometowndemolitioncontractors.com/concrete-removal.html.

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[R-38] CNSC, "Indigenous Engagement", REGDOC-3.2.2, Version 1.1, August 2019.

Appendix A: Estimated Type and Location of Hazardous Materials Stored in the CMLF and CSF

In Table A-1, the type, estimated quantities and location of hazardous materials stored in the CMLF are provided.

Table A-1 – CMLF Hazardous Materials

Material	Type	Estimated Quantities	Location at CMLF
Compressed gas	P10 (90% argon, 10% methane) Oxygen, acetylene, argon, propane Calibration gas (CO, CO2, methane)	7 gas tanks, each 400 L	Main Weld Shop, Room 196, South Door M1948 outside bunker storage, Room M170
Flammable chemicals	Paint, solvents, oil	2500 L	West door M191A (main shop), Janitor's room on ground Floor, shop floor near Column A5
Corrosive chemicals	Cleaning supplies	250 L	Janitor's room on ground floor, M200 Column D7
Other	Waste (aqueous, oil, varsol, mineral oil)	1200 L	West door main shop M191A

In Table A-2, the type, estimated quantities and location of hazardous materials stored in the CSF are provided.

Table A-2 – CSF Hazardous Materials

Material	Type	Estimated Quantities	Location at CSF
Compressed Gas	P10 (90% argon, 10% Methane) Helium Propane Oxygen, acetylene, argon, propane P10	1400lbs 165lbs 160 lbs 200lbs 133lbs 100lbs 520lbs 100lbs	Inside Zone 3 and Unzoned area Mobile Equipment Outside Storage Area
Flammable Chemicals	E.g., Paint, solvents, oil	3085L	Flammable Storage Cabinets Main Floor Storage – Column 10 Unzoned area South Wall
Corrosive Material	E.g., Cleaning supplies	1028 L	Corrosive Storage Cabinets Main Floor Column 10 Unzoned area South Wall
Other	E.g., Aqueous,	170L	Main Floor Column 10 Unzoned area South Wall

Appendix B: Summary of Decommissioning Cost Estimate for RWOS1, CMLF and CSF

OPG has produced a cost estimate for decommissioning the RWOS1, CMLF and CSF facilities [R-8]. This estimate considered each facility's unique features and expected conditions after removal of all stored radioactive waste. The total estimated cost to decommission RWOS1, CMLF and CSF is approximately $61.7 million (2022 dollars). A breakdown of the proposed costs is provided in Table B-1 and Table B-2 below.

Table B-1 – Decommissioning Costs for RWOS1 and CMLF

Project Stage	Cost (2022 $)
Preparations for Decommissioning	8,249,456
Site Decommissioning	28,889,753
Site Restoration	1,363,005
OPG Oversight (all periods)	3,481,523
Risk Factor Adjustment (10%)	4,198,374
Total Estimated Cost	**46,182,111**

Table B-2 – Decommissioning Costs for CSF

Project Stage	Cost (2022 $)
Preparations for Decommissioning	1,449,819
Site Decommissioning	7,048,150
Site Restoration	5,326,844
OPG Oversight (all periods)	1,711,976
Risk Factor Adjustment (10%)	0
Total Estimated Cost	**15,536,789**

The required funds necessary to decommission the RWOS1, CMLF and CSF will be managed via the Ontario Nuclear Funds Agreement and will be provided from the Decommissioning Segregated Fund.

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 Container Nuclear Substances". The regulatory guidance document and standard provides guidance regarding the preparation of decommissioning plans, as well as the basis for calculating financial guarantees. Regulatory Guide G-219 provides recommended CNSC guidance 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[7] 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 these decommissioning estimates ensures confidence in the reliability of the resulting costs.

Allowance

Cost elements in the cost estimates are based on normal conditions plus difficulty factors; 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.

Radioactive Waste Management

A nominal volume of 1,122 m^3 of LLW will be generated from the decommissioning of RWOS1, the CMLF and the CSF facilities. This study uses unit costs adopted by other OPG cost studies to estimate waste packaging, transportation and disposal costs for this waste material.

[7] T.S. LaGuardia et al., "Guidelines for Producing Commercial Nuclear Power Plant Decommissioning Cost Estimates," AIF/NESP-036, May 1986.

Appendix C: Compliance Matrix with CSA N294:19

Table C-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. Responsibilities for decommissioning, preparing documents, and recordkeeping shall be clearly established throughout the life cycle of a facility. Responsibility for the funding of the decommissioning shall be identified and financial guarantee shall be established to ensure adequate funding for decommissioning	13.1 4.1, 5.7, 6.6, 7.6, 14.0 8.0
4.3	The owner shall consider the requirements of CSA N286 when executing decommissioning works, including the following: a) protecting the health and safety of workers and the public; b) protecting the environment; c) complying with requirements of the AHJ; d) keeping radiation exposures as low as reasonably achievable (ALARA); e) managing all radioactive and hazardous materials generated by the decommissioning; f) security; and g) safeguards	13.0 11 10.0 13.1 4.4.2; 11.2 4.4.4, 5.8.5, 6.7.5, 7.7.5 12 N/A – no safeguards material are stored in these facilities and as such this is not applicable.
4.4	Programs shall be developed and implemented to support decommissioning.	9, 10, 11, 12, 13, 14, 15
5.1.1.3	A financial guarantee for decommissioning shall be established to ensure that adequate funding is available at the time of decommissioning. The financial guarantee for decommissioning shall be maintained throughout the life cycle of the facility.	8.0
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.

Section in CSA N294:19	Requirement in CSA N294:19	Section in 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.
5.2.5	Decommissioning records shall include, as applicable, a) the DDP(s); b) public and Indigenous engagement/communication records (as per CNSC REGDOC-3.2.2); c) if required by the AHJ, an impact assessment or environmental review in accordance with applicable legislation; d) licences and permits required for the decommissioning work; e) the plans and procedures used in decommissioning; f) reports and other documents that describe i) the criteria used to define radioactive and hazardous materials and to distinguish contaminated from uncontaminated materials; ii) the criteria used to define the final contamination status of the facility; iii) the principles and models used in deriving the criteria in Items i) and ii); iv) the residual radionuclide inventory after decontamination; v) the amounts of radioactive and hazardous materials removed and the disposition method; vi) waste management and transfer records; 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; viii) the survey methods and the types of instruments used; ix) the equipment, nuclear and non-nuclear materials, and structures remaining at the end of decommissioning; and 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; g) reports, other documents, and photographs describing findings from inspections, modifications, and repairs to SSCs; h) reports and other documents that describe unplanned or unusual occurrences; i) results and interpretations of environmental monitoring programs; j) occupational dose records; k) deviations from plans and procedures; l) quality assurance records; m) storage-with-surveillance plans; n) facility inspection, maintenance, and equipment records; o) the final radiological and hazardous materials surveys; and p) interim and final end-state reports.	This pertains to records following the completion of decommissioning.
5.4.2	The facility shall be characterized. See Annex G for guidance.	4.4.1, 5.8.3, 6.7.3, 7.7.3
5.4.3	All radioactive waste generated shall be characterized as per the CSA N292 series of Standards.	4.4.4
5.5.1	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.	4.4.4

Section in CSA N294:19	Requirement in CSA N294:19	Section in This PDP
5.6	A hazard assessment commensurate with the tasks to be performed shall be completed prior to decommissioning.	11.1
5.8.1	A quality assurance program shall be implemented.	13.0
6.1.1	The owner shall demonstrate that, under the strategy selected, the facility will be maintained in a safe configuration at all times.	11.0, 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.	3.0
6.2.3	Cost estimates shall include all decommissioning activities from operations, during shutdown to the final release from regulatory control. The cost estimate for decommissioning shall address the cost of the following principal activities, if applicable: a) preparation for final shutdown; b) site characterization, site surveys; c) facility shutdown activities; d) additional activities for safe enclosure; e) decontamination and dismantling activities; f) processing, storage and disposal of all waste including used fuel; g) project management, engineering, and site support; h) site clean-up, landscaping, and restoration; i) long-term management of radioactive waste and used fuel; j) long-term monitoring and maintenance of the site and institutional control; k) licensing costs; and l) miscellaneous expenditures.	8 and Appendix B
7.1.1	Preparation for decommissioning shall include 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; b) an impact assessment or environmental review in accordance with applicable legislation, if required; c) a safety assessment for decommissioning; d) ensuring that there is a sufficient number of qualified staff to ensure safe operation during the approach to shutdown; e) further development of the PDP into the DDP; f) placing a facility in a permanent shutdown state; and g) any additional requirements specified by the AHJ.	4.3 describes the overall activities involved in the 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.

Section in CSA N294:19	Requirement in CSA N294:19	Section in This PDP
7.1.2	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.	4.3 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.
7.4.1.1	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.
7.4.3	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.
7.5.1	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.	4.3 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.
7.5.2.1	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.
7.5.2.2	Historical information shall be preserved that is relevant to the eventual decommissioning of the facility.	14
7.6.1	A DDP shall be developed for nuclear facilities, in accordance with Annex C and regulatory requirements, and submitted to the AHJ for acceptance.	4.3.4 describes the development of a DDP, however these requirements pertain to the actual DDP preparation for the Dismantling phase. Relevant for the DDP not the PDP.
7.6.2.1	The DDP shall meet the content provisions of Annex C.	Same as above

Section in CSA N294:19	Requirement in CSA N294:19	Section in This PDP
7.6.3	If deferred decommissioning is the preferred decommissioning strategy, in addition to a DDP, a SWS plan shall be developed. If a SWS plan is standalone, it shall be submitted to the AHJ.	Not Applicable
7.6.4	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. The assessment shall describe the relative importance of the potential hazards and identify the methods for mitigating the risks associated with such hazards. If fissile material is involved, a criticality safety assessment and the planned actions involving fissile material shall be included. The assessment shall also address the residual risks to the public, if any, after decommissioning is completed. 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.	11.0, however these requirements pertain to the preparation phase. N/A N/A
7.6.5.1	The strategy for managing all wastes from decommissioning shall include a management plan covering both the short term and, where possible, the long term.	4.4.4 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.

Section in CSA N294:19	Requirement in CSA N294:19	Section in This PDP
7.6.5.2	The waste management program shall cover the following processes, as applicable: a) characterization; b) classification; c) minimization; d) segregation; e) clearance; f) handling; g) volume reduction; h) treatment; i) packaging; j) storage; k) transportation; and l) final disposition. 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.	4.4.4 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.
8.1.2	The work to be performed during the decommissioning shall be described in a DDP.	This requirement pertains to the preparation phase.
8.1.3	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.	These requirements pertain to the execution phase and are, as such, not applicable for this PDP.
8.1.7.1	Where decontamination is being used as part of decommissioning, the following shall be identified: a) the areas, locations, and equipment to be decontaminated; 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); c) the decontamination methods to be employed; and d) the residual level of radioactivity that is to be achieved.	These requirements pertain to the execution phase.
8.1.8.1	A demolition plan shall be prepared. The equipment and structures to be dismantled or demolished shall be identified. The equipment and structures that are to remain at the completion of decommissioning shall also be identified. Procedures for dismantling and demolition shall take into account the associated hazards.	These requirements pertain to the execution phase.

Section in CSA N294:19	Requirement in CSA N294:19	Section in This PDP
8.1.8.2	The following factors shall be considered when selecting dismantling/demolition methods: a) availability of professional competence associated with the operations of the chosen equipment; b) the equipment should be simple to operate, decontaminate, and maintain; c) remaining structural elements shall be kept in a physically stable state; d) measures to prevent unintentional releases to the environment; e) planned discharges to the environment shall be controlled as per licence conditions and previous commitments; f) when underwater dismantling and cutting is used, provisions shall be made to process the water to promote and assist in effluent treatment; g) the effect of dismantling tasks on adjacent systems and structures and on other work in progress shall be evaluated; h) waste containers, handling systems, and routes shall be defined before the start of dismantling work; and i) federal, provincial/territorial and/or municipal requirements.	These requirements pertain to the execution phase.
8.1.9.1	Surveys during decommissioning shall be performed to comply with a) worker occupational safety and radiation protection limits; b) environmental monitoring criteria; and c) processes to release materials and equipment from the site.	4.4.1, 5.8.6, 6.7.6, 7.7.6 provides a high level plan for surveys to be performed during decommissioning. However, it should be noted that these requirements pertain to the execution phase.
8.1.9.2	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. The results of the survey shall be documented in a report that includes a) the criteria used to define the end-state; b) the methods and procedures used to ensure that the criteria were met; and c) the measurement data, including appropriate statistical analysis and systematic approaches.	4.4.1, 5.8.6, 6.7.6, 7.7.6 provides a high level plan for surveys to be performed after decontamination or dismantling. However, it should be noted that these requirements pertain to the execution phase.
8.2	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.	These requirements pertain to the execution phase.
8.3	A plan for surveillance, monitoring, physical protection, and maintenance of the facility during such periods shall be developed and implemented to a) maintain the facility in a safe state; b) control the release of materials to the environment; c) prevent access by unauthorized persons; and d) mitigate infestations of vermin and other organisms.	These requirements pertain to the execution phase.

Section in CSA N294:19	Requirement in CSA N294:19	Section in This PDP
8.4	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.	4.4.5, 5.8.7, 6.7.7, 7.7.7 provides a high level plan for land remediation, however, this requirement pertains to completion of decommissioning.
8.5	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. The results of the final survey shall be documented in a report that includes a) the criteria used to define the end-state; b) the methods and procedures used to ensure that the criteria were met; and c) the measurement data, including appropriate statistical analysis and systematic approaches.	This pertains to the completion of decommissioning.
9.1	Following the completion of decommissioning, a final end-state report shall be prepared and retained. Where a decommissioning program involves completing a number of separately approved decommissioning projects, interim end-state reports shall be submitted for each project.	4.5.1, 4.5.2, 5.9.2, 6.8.2, 7.8.2 provides a high level plan for the final end state report, however, this requirement pertains to completion of decommissioning.

Table C-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
A.2	A PDP may include the following, unless they are not applicable to the facility:	
A.2 a)	a description of the location of the facility, including i) a map of the facility and its specifications; ii) geographic information; iii) details regarding the surrounding environment; iv) land uses; and v) illustrations and maps of the facility in relation to the municipality;	1.0 1.0 2.0 2.0 1.0 Figure 1-1 and Figure 1-2
A.2 b)	purpose and description of the facility, including i) primary components and systems; ii) building type and construction, including location of any hazardous building materials (e.g., asbestos, PCBs); iii) building services (e.g., power, heating, ventilation, sewer, water, fire protection); iv) laboratories and other hazardous handling areas; v) type, quantity, and form of radioactive and hazardous materials stored, produced, or used during operation; and vi) design features used to reduce the spread of contamination and facilitate decontamination and dismantling;	1.0 5.0, 6.3, 7.3 5.0, 6.3, 6.4.1, 7.3, 7.4.1 3, 5.4, 6.4.1, 7.4.1 5.2, 5.4, 6, 7 N/A for RWOS1, the facility is not currently operating (see 5.5) 6, 7, Appendix A 5.4, 6.3.1, 6.4.2, 6.4.3, 7.3.1, 7.4.2, 7.4.3
A.2 c)	post-operational conditions, including i) a summary of the shutdown process, including planned removal of stored inventories of hazardous or radioactive materials; 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); iii) the predicted nature and extent of contamination on floors, walls, work surfaces, ventilation systems, etc.; iv) the identification of any separate planning envelopes; and v) an overview of the principal hazardous conditions anticipated to exist;	5, 6, 7

Section in CSA N294:19 Annex A	Requirement in CSA N294:19	Section in This PDP
A.2 d)	the decommissioning strategy, including	4.5.1
	i) the final end-state objective;	5.6, 6.5, 7.5
	ii) rationale for	
	1) the decommissioning strategy selected;	Not applicable.
	2) interim end-states;	Not applicable.
	3) periods of SWS; and	Not applicable.
	4) in-situ decommissioning concepts;	Not applicable.
	iii) the requirements for long-term institutional controls; and	5.6, 6.5, 7.5
	iv) the assessment of alternative strategies (or a rationale for why alternatives do not exist or do not warrant consideration);	
A.2 e)	a plan of the decommissioning work, including	4.1
	i) a work breakdown structure;	4.4
	ii) a summary of the main steps for decontamination/disassembly/removal of each of the systems (preferably grouped into work packages);	
	iii) for each work package, identification of those types of activities that could pose a significant hazard to workers, the public, or the environment;	4.4, 11.0
	iv) the role of existing operational standard procedures for radiation protection, hazardous materials handling, industrial safety, and environmental protection in managing hazards;	11.0
	v) specific activities for which additional protection/mitigation procedures will be required at the detailed planning stage;	10.4
	vi) a summary of the final dismantlement of the structures; and	
	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;	4.4
		Table 5-1, Table 6-1, Table 7-1
A.2 f)	radiological monitoring and survey commitments, including	
	i) a program for conducting periodic contamination surveys and the recording of contamination events during facility operation;	11.0, 14.0
	ii) a commitment to conduct detailed post-operation surveys in support of DDP development; and	4.3.4, 4.4.1, 4.4.3
	iii) a commitment to develop plans and protocols acceptable to the AHJ at the detailed planning stage for monitoring	
	1) work hazards during decommissioning;	4.3, 4.3.1, 4.5.2, 11.0
	2) personnel dosimetry;	
	3) environmental emissions and effluents; and	
	4) materials, sites, and structures to be cleared from regulatory control;	

Section in CSA N294:19 Annex A	Requirement in CSA N294:19	Section in This PDP
A.2 g)	a waste management strategy specifying 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); ii) the anticipated final disposition of radioactive and chemically hazardous materials; and iii) a commitment to segregate as much material as possible for reuse and recycling;	4.4.4, 5.8.5, 6.7.5, 7.7.5
A.2 h)	a commitment to prepare a DDP for regulatory approval prior to dismantling and demolition;	4.3.4
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
A.2 j)	the physical state of the facility at i) the end of operations; and ii) the start of decommissioning;	5.6, 5.7, 6.4.4, 6.6, 6.7, 7.4.4, 7.6, 7.7
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);	14.0
A.2 l)	a public engagement plan, including a public information program and avenues for public participation;	15.0
A.2 m)	an Indigenous engagement plan as per the requirements and guidance of CNSC REGDOC-3.2.2; and	15.0
A.2 n)	the cost and a financial guarantee, specifying i) an estimate of the total present-value cost of the decommissioning; ii) a reasonable basis for how cost estimates were derived; and iii) a description of how the required funds will be provided;	8 Appendix B