1675 Montgomery Park Road, Pickering, Ontario L1V 2R5

June 27, 2025

CD# P-CORR-00531-23980 P

MS. C. SALMON
Commission Registrar
Canadian Nuclear Safety Commission
P.O. Box 1046
280 Slater Street
Ottawa, Ontario, K1P 5S9

Dear Ms. C. Salmon:

Renewal Application for Pickering Nuclear Generating Station Power Reactor Operating Licence and Pickering Waste Facility Operating Licence

The purpose of this letter is to submit to the Canadian Nuclear Safety Commission (CNSC) Ontario Power Generation Inc.'s (OPG) application for renewal and consolidation of the Pickering Nuclear Generating Station (NGS) Power Reactor Operating Licence (PROL), PROL 48.03/2028, and the Pickering Waste Management Facility (PWMF) Waste Facility Operating Licence (WFOL), WFOL-W4-350.00/2028, as per the notification provided in Reference 1. The current licences for both facilities expire on August 31, 2028.

OPG is requesting a 10-year licence renewal from January 1, 2027 to December 31, 2036. OPG is requesting an early renewal of these licences to align with the projected Pickering NGS refurbishment and decommissioning schedules.

OPG is an Ontario-based electricity generation company with its head office currently located at 700 University Avenue, Toronto, Ontario, M5G 1X6. The head office will officially change to 1908 Colonel Sam Drive, Oshawa, Ontario, L1H 8W8 on September 1, 2025. The Pickering NGS and PWMF are located within the Pickering nuclear site boundary in Pickering, Ontario on the treaty and traditional territory of the Michi Saagiig and Chippewa Nations, collectively known as the Williams Treaties First Nations.

OPG is steadfast in its commitment to supporting ongoing meaningful engagement before, during and after the licencing renewal application process. OPG will continue to work with Indigenous Nations and communities to implement engagement approaches that are based on the nature of rights potentially impacted and considerate of the unique interests of each Indigenous Nation and community. OPG continues to prioritize and makes regular efforts to engage and collaborate with Indigenous Rightsholders on ongoing operations, as well as proposed initiatives at the Pickering NGS and PWMF. Implementation of a site-wide Indigenous Engagement Plan, informed by input from Indigenous Nations and communities, is ongoing and supports a holistic, comprehensive and coordinated approach to engagement across Pickering NGS, inclusive of this renewal application. OPG shared an early draft of the PROL and WFOL licence renewal application and a memo that provided a summary of the PROL and WFOL renewal application with Michi Saagiig Nations mid-May 2025, based on feedback received in April on the Nations' priorities.

The management and control of operation of the Pickering NGS and the nuclear substances, prescribed equipment, and associated prescribed information, are the overall responsibility of Mr. Paul Seguin, Senior Vice President of Pickering NGS.

The management and control of operation of the PWMF, including radioactive materials transportation, are the overall responsibility of Mr. Kapil Aggarwal, Vice President of Nuclear Sustainability Services.

The management and control of operation of the Pickering NGS refurbishment and safe storage are the overall responsibility of Mr. Luca Ceccato, Senior Vice President of Pickering Projects.

The Pickering NGS consists of eight reactor units designed, constructed and operated primarily to produce electrical power. Both Units 2 and 3 have been safely placed in Storage with Surveillance since 2010. Unit 1 was removed from service in October 2024 and Unit 4 was removed from service in December 2024. Units 5 to 8 will remain in operation until 2026. The Pickering NGS Units 5 to 8 currently generate a total of 2,100 megawatts of electricity and produce 10% of Ontario's electricity.

Electricity generated by nuclear power comes with the by-product of radioactive waste. OPG is committed to the responsible and comprehensive management of all its radioactive waste and has been safely processing and providing interim dry storage of used fuel generated from the Pickering NGS at the PWMF. The PWMF also provides interim storage for components previously removed during retubing of Pickering NGS reactors.

The licence renewal application has been prepared in accordance with the requirements of the *Nuclear Safety and Control Act* and its associated *Regulations*, and CNSC staff's expectations as provided in Reference 2. The information provided within this application demonstrates that OPG is qualified to carry on the licensed activities to operate a Class I and Class IB nuclear facility, decommission Pickering NGS Units 1 to 4, and refurbish Pickering NGS Units 5 to 8, while meeting the requirements in the *Act* and *Regulations* and continuing to protect the health, safety, and security of persons and the environment.

In Reference 3, CNSC staff also requested, for identified Canadian Standards Association (CSA) standards and CNSC regulatory documents (REGDOC), that OPG provide implementation plans or justification for the CSA standards or REGDOCs to be used in the Pickering Licence Conditions Handbook. OPG has provided this information in Reference 4.

For ease of use, Attachment 1 provides a "*Licence Renewal Application Matrix*", to assist CNSC staff in locating specific information within the application.

Attachment 2 provides the "*Pickering Nuclear Generating Station Power Reactor Operating Licence Renewal Application*" describing the 14 Safety and Control Areas, facility-specific information, additional matters of regulatory interest, OPG's programs, station performance during the current licence period, and planned activities for the PWMF, the refurbishment of Units 5 to 8 and the decommissioning of Units 1 to 4. OPG is proud of the strong performance, long standing safety record and the many significant achievements during the current licence term. Our track record reflects the exceptional high standards upheld by OPG and our dedicated staff to provide safe and reliable operation of the station and waste management facility.

OPG plans to submit supplemental information to this application to include updates on performance data and information that are pending at time of this submission including more information on the refurbishment scope development. OPG plans to submit a supplemental Commission Member Document as per the schedule provided by Registry.

OPG is committed to the safe and reliable operation of the Pickering NGS and PWMF, safeguarding the health, safety, and security of individuals and the environment and will continue to meet the requirements of the *Nuclear Safety and Control Act* and the associated *Regulations*. OPG is confident in our ability to reliably and safely execute the requested licensed activities through 2036.

Should you require any further information, please contact Soo Chae, Senior Manager, Regulatory Affairs Strategic Projects, at soo.chae@opg.com.

Sincerely,

Paul Seguin
Senior Vice President
Pickering Nuclear
Ontario Power Generation Inc.

Kapil Aggarwal
Vice President
Nuclear Sustainability Services
Ontario Power Generation Inc.

Luca Ceccato
Senior Vice President
Pickering Projects
Ontario Power Generation Inc.

Attach.

cc: A. Viktorov
R. Richardson
K. Campbell
CNSC Site Supervisor - Pickering
forms-formulaires@cnsc-ccsn.gc.ca

References:

1. OPG Letter, P. Seguin, L. Ceccato and K. Aggarwal to C. Salmon, “Pickering NGS - Notice of Intent to Renew Power Reactor Operating Licence PROL 48.02/2028”, October 31, 2024, e-Doc 7396766, CD# P-CORR-00531-23838.

2. CNSC Letter, R. Richardson and N. Greencorn to P. Seguin, L. Ceccato and K. Aggarwal, “Pickering NGS - Notice of Intent to Renew Power Reactor Operating Licence PROL 48.02/2028”, November 22, 2024, e-Doc 7397547, CD# P-CORR-00531-23859.

3. CNSC Letter, R. Richardson and N. Greencorn to P. Seguin and L. Ceccato, "Pickering NGS - Notice of Intent to Renew Power Reactor Operating Licence PROL 48.02/2028 – Implementation of CSA standards and CNSC REGDOCs, New Action Item 2025-48-34809”, January 29, 2025, e-Doc# 7406684, CD# P-CORR-00531-23908.

4. OPG Letter, L. Ceccato, P. Seguin and K. Aggarwal to R. Richardson and K. Campbell, “Pickering NGS and PWMF – Implementation of CSA Standards and CNSC REGDOCs, Action Item 2025-48-34809”, May 28, 2025, CD# P-CORR-00531-23928.

ATTACHMENT 1

OPG Letter, P. Seguin, K. Aggarwal, and L. Ceccato to C. Salmon "Pickering NGS – Renewal Application for Pickering Nuclear Generating Station Power Reactor Operating Licence and Pickering Waste Facility Operating Licence".

CD# P-CORR-00531- 23980 P

Licence Renewal Application Matrix

(6 pages)

Attachment 1
Licence Renewal Application Matrix

Table 1: Licence Application Matrix – Applicable Regulations
NOTE: Unless otherwise specified, all sections cross-referenced below refer to Attachment 2.

Section	Regulatory Requirement	Location in Submission
General Nuclear Safety and Control Regulations		
LICENCES - General Application Requirements		
3 (1)	An application for a licence shall contain the following information: (a) the applicant’s name and business address;	Cover letter
	(b) the activity to be licensed and its purpose;	Appendix C and Section 1.0
	(c) the name, maximum quantity and form of any nuclear substance to be encompassed by the licence;	Appendix C
	(d) a description of any nuclear facility, prescribed equipment or prescribed information to be encompassed by the licence;	Sections 1.1 and 2.12
	(e) the proposed measures to ensure compliance with the *Radiation Protection Regulations*, the *Nuclear Security Regulations* and the *Packaging and Transport of Nuclear Substances Regulations, 2015*	Sections 2.7, 2.12 and 2.14
	(f) any proposed action level for the purpose of section 6 of the *Radiation Protection Regulations*;	Sections 2.7 and 2.9
	(g) the proposed measures to control access to the site of the activity to be licensed and the nuclear substance, prescribed equipment or prescribed information;	Section 2.12
	(h) the proposed measures to prevent loss or illegal use, possession or removal of the nuclear substance, prescribed equipment or prescribed information;	Sections 2.12 and 2.13
	(i) a description and the results of any test, analysis or calculation performed to substantiate the information included in the application;	Sections 1.2 and 2.4
	(j) the name, quantity, form, origin and volume of any radioactive waste or hazardous waste that may result from the activity to be licensed, including waste that may be stored, managed, processed or disposed of at the site of the activity to be licensed, and the proposed method for managing and disposing of that waste;	Section 2.11, Appendix C and Appendix D
	(k) the applicant’s organizational management structure insofar as it may bear on the applicant’s compliance with the Act and the regulations made under the Act, including the internal allocation of functions, responsibilities and authority;	Section 2.1.2
	(l) a description of any proposed financial guarantee relating to the activity to be licensed; and	Section 4.1

Section	Regulatory Requirement	Location in Submission
	(m) any other information required by the Act or the regulations made under the Act for the activity to be licensed and the nuclear substance, nuclear facility, prescribed equipment or prescribed information to be encompassed by the licence.	Throughout
3 (1.1)	The Commission or a designated officer authorized under paragraph 37(2)(c) of the Act, may require any other information that is necessary to enable the Commission or the designated officer to determine whether the applicant (a) is qualified to carry on the activity to be licensed; or	See Table 2 in this Attachment 1.
	(b) will, in carrying on that activity, make adequate provision for the protection of the environment, the health and safety of persons and the maintenance of national security and measures required to implement international obligations to which Canada has agreed.	Sections 2.7, 2.8, 2.9, 2.10, 2.12 and 2.13
LICENCES – Application for Renewal of Licence		
5	An application for the renewal of a licence shall contain (a) the information required to be contained in an application for that licence by the applicable regulations made under the Act; and	Throughout
	(b) a statement identifying the changes in the information that was previously submitted.	Throughout
OBLIGATIONS – Representatives of Applicants and Licensees		
15	Every applicant for a licence and every licensee shall notify the Commission of (a) the persons who have authority to act for them in their dealings with the Commission;	OPG Letter "OPG – Persons Authorized to Act on Behalf of OPG in Dealings with the CNSC and Senior Leadership Positions with Responsibility for Safety", January 23, 2025, CD# N-CORR-00531-24362.
	(b) the names and position titles of the persons who are responsible for the management and control of the licensed activity and the nuclear substance, nuclear facility, prescribed equipment, or prescribed information encompassed by the licence; and	Cover letter; also OPG Letter "OPG – Persons Authorized to Act on Behalf of OPG in Dealings with the CNSC and Senior Leadership Positions with Responsibility for Safety", January 23, 2025, CD# N-CORR-00531-24362.
	(c) any change in the information referred to in paragraphs (a) and (b), within 15 days after the change occurs.	OPG will continue to provide the required information.
Class I Nuclear Facilities Regulations		
LICENCE APPLICATIONS – General Requirements		
3	An application for a licence in respect of a Class I nuclear facility, other than a licence to abandon, shall	Section 1.1

Section	Regulatory Requirement	Location in Submission
	contain the following information in addition to the information required by section 3 of the *General Nuclear Safety and Control Regulations*: (a) a description of the site of the activity to be licensed, including the location of any exclusion zone and any structures within that zone;	
	(b) plans showing the location, perimeter, areas, structures and systems of the nuclear facility;	Section 1.1
	(c) evidence that the applicant is the owner of the site or has authority from the owner of the site to carry on the activity to be licensed;	Section 1.1
	(d) the proposed management system for the activity to be licensed, including measures to promote and support safety culture;	Section 2.1
	(d.1) the proposed human performance program for the activity to be licensed, including measures to ensure workers' fitness for duty.	Section 2.2
	(e) The name, form, characteristics and quantity of any hazardous substances that may be on the site while the activity to be licensed is carried on;	Appendix D
	(f) the proposed worker health and safety policies and procedures;	Section 2.8
	(g) the proposed environmental protection policies and procedures;	Section 2.9
	(h) the proposed effluent and environmental monitoring programs;	Section 2.9
	(i) if the application is in respect of a nuclear facility referred to in a paragraph 2(b) of the *Nuclear Security Regulations*, the information required by section 3 of those Regulations;	Section 2.12
	(j) the proposed program to inform persons living in the vicinity of the site of the general nature and characteristics of the anticipated effects on the environment and the health and safety of persons that may result from the activity to be licensed; and	Section 1.7.1
	(k) the proposed plan for the decommissioning of the nuclear facility or of the site.	Sections 1.2.2 and 2.11
LICENCE APPLICATIONS – Licence to Operate		
6	An application for a licence to operate a Class I nuclear facility shall contain the following information in addition to the information required by section 3: (a) a description of the structures at the nuclear facility, including their design and their design operating conditions;	Sections 1.1 and 2.5
	(b) a description of the systems and equipment at the nuclear facility, including their design and their design operating conditions;	Section 2.5
	(c) a final safety analysis report demonstrating the adequacy of the design of the nuclear facility;	Section 2.4

Section	Regulatory Requirement	Location in Submission
	(d) the proposed measures, policies, methods and procedures for operating and maintaining the nuclear facility;	Sections 2.3 and 2.6
	(e) the proposed procedures for handling, storing, loading and transporting nuclear substances and hazardous substances;	Sections 2.3, 2.7, 2.11, 2.14 and 3.1
	(f) the proposed measures to facilitate Canada’s compliance with any applicable safeguards agreement;	Section 2.13
	(g) the proposed commissioning program for the systems and equipment that will be used at the nuclear facility;	Section 1.2.1
	(h) the effects on the environment and the health and safety of persons that may result from the operation and decommissioning of the nuclear facility, and the measures that will be taken to prevent or mitigate those effects;	Sections 1.2, 2.7, 2.8, 2.9 and 2.11
	(i) the proposed location of points of release, the proposed maximum quantities and concentrations, and the anticipated volume and flow rate of releases of nuclear substances and hazardous substances into the environment, including their physical, chemical and radiological characteristics;	Section 2.9
	(j) the proposed measures to control releases of nuclear substances and hazardous substances into the environment;	Section 2.9
	(k) the proposed measures to prevent or mitigate the effects of accidental releases of nuclear substances and hazardous substances on the environment, the health and safety of persons and the maintenance of national security, including measures to (i) assist off-site authorities in planning and preparing to limit the effects of an accidental release, (ii) notify off-site authorities of an accidental release or the imminence of an accidental release, (iii) report information to off-site authorities during and after an accidental release, (iv) assist off-site authorities in dealing with the effects of an accidental release, and (v) test the implementation of the measures to prevent or mitigate the effects of an accidental release;	Sections 2.10, 2.9 and 2.14
	(l) the proposed measures to prevent acts of sabotage or attempted sabotage at the nuclear facility, including measures to alert the licensee to such acts;	Section 2.12

Section	Regulatory Requirement	Location in Submission
	(m) the proposed responsibilities of and qualification requirements and training program for workers, including the procedures for the requalification of workers; and	Section 2.2
	(n) the results that have been achieved in implementing the program for recruiting, training and qualifying workers in respect of the operation and maintenance of the nuclear facility.	Sections 2.1 and 2.2
7	An application for a licence to decommission a Class I nuclear facility shall contain the following information in addition to the information required by section 3: (a) a description of and the proposed schedule for the decommissioning, including the proposed starting date and the expected completion date of the decommissioning and the rationale for the schedule;	Section 1.2.2
	(b) the nuclear substances, hazardous substances, land, buildings, structures, systems and equipment that will be affected by the decommissioning;	Sections 1.2.2 and 2.3.7 Section 5.0 - Reference 2
	(c) the proposed measures, methods and procedures for carrying on the decommissioning;	Throughout
	(d) the proposed measures to facilitate Canada's compliance with any applicable safeguards agreement;	Section 2.13
	(e) the nature and extent of any radioactive contamination at the nuclear facility;	Sections 2.7 and 2.9 Section 5.0 - Reference 2
	(f) the effects on the environment and the health and safety of persons that may result from the decommissioning, and the measures that will be taken to prevent or mitigate those effects;	Sections 1.2.2, 2.7, 2.8, 2.9 and 2.11 Section 5.0 - Reference 2
	(g) the proposed location of points of release, the proposed maximum quantities and concentrations, and the anticipated volume and flow rate of releases of nuclear substances and hazardous substances into the environment, including their physical, chemical and radiological characteristics;	Section 2.9
	(h) the proposed measures to control releases of nuclear substances and hazardous substances into the environment;	Section 2.9
	(i) the proposed measures to prevent or mitigate the effects of accidental releases of nuclear substances and hazardous substances on the environment, the health and safety of persons and the maintenance of national security, including an emergency response plan;	Sections 2.10, 2.9 and 2.14

Section	Regulatory Requirement	Location in Submission
	(j) the proposed qualification requirements and training program for workers; and	Section 2.2
	(k) a description of the planned state of the site on completion of the decommissioning.	Section 1.2.2
Nuclear Security Regulations		
LICENCE APPLICATION – Licence in Respect of Category I or II Nuclear Material or a Nuclear Facility		
3	An application for a licence in respect of Category I or II nuclear material, other than a licence to transport, and an application for a licence in respect of a nuclear facility referred to in paragraph 2(b) shall contain the following information in addition to the information required by section 3 of the *Nuclear Substances and Radiation Devices Regulations* or sections 3 to 8 of the *Class I Nuclear Facilities Regulations*, as applicable: (a) a copy of the arrangements referred to in section 35;	Section 2.12
	(b) the site plan referred to in section 16;	Sections 1.1, 2.5 and 2.12
	(c) a description of the proposed security equipment, systems and procedures;	Section 2.12
	(d) a description of the proposed on-site and off-site communications equipment, systems and procedures;	Section 2.12
	(e) a description of the proposed structure and organization of the nuclear security officer service, including the duties, responsibilities and training of nuclear security officers;	Section 2.12
	(f) the proposed plan and procedures to assess and respond to breaches of security; and	Section 2.12
	(g) the current threat and risk assessment.	Section 2.12

Table 2: Licence Application Matrix – Additional Matters of Regulatory Interested Identified by CNSC Staff

No.	Item	Location in Submission
1	Environmental assessment	Section 2.9
2	Indigenous engagement	Section 1.6
3	Cost recovery	Section 4.1
4	Financial guarantees	Section 4.1
5	Improvement plans and significant future activities	Sections 1.1, 1.2 and Appendix C
6	Licensee public information program	Section 1.7.1
7	Nuclear Liability insurance	Section 4.1

ATTACHMENT 2

OPG Letter, P. Seguin, K. Aggarwal, and L. Ceccato to C. Salmon “Renewal Application for Pickering Nuclear Generating Station Power Reactor Operating Licence and Pickering Waste Facility Operating Licence ”

CD# P-CORR-00531- 23980 P

Pickering Nuclear Generating Station Power Reactor Operating Licence Renewal Application

(341 pages)

Pickering

Nuclear Generating Station

Power Reactor Operating Licence Renewal Application

June 2025

ONTARIO POWER GENERATION

Land Acknowledgment

The lands and waters on which the Pickering Nuclear Generating Station (NGS) and Pickering Waste Management Facility (PWMF) are situated are the treaty and traditional territory of the Michi Saagiig and Chippewa Nations, collectively known as the Williams Treaties First Nations.

Pickering NGS and PWMF are within the territory of the Gunshot Treaty and the Williams Treaties of 1923. The Gunshot Treaty Rights were reaffirmed in 2018 in a settlement with Canada and the Province of Ontario.

Ontario Power Generation (OPG) respectfully acknowledges that the Williams Treaties First Nations are Rightsholders, stewards and caretakers of these lands and the waters that touch them, and that they continue to maintain responsibility to ensure their health and integrity for generations to come.

As a company, OPG remains committed to developing positive and mutually beneficial relationships with the Williams Treaties First Nations.

Executive Summary

OPG requests authorization from the Canadian Nuclear Safety Commission (CNSC) for a renewal of the Pickering NGS Power Reactor Operating Licence (PROL), PROL48.03/2028, which expires on August 31, 2028. OPG is requesting renewal of the PROL for a 10-year licence term from January 1, 2027 to December 31, 2036. During the requested licence term, OPG plans to refurbish Pickering NGS Units 5 to 8 for continued operation and to progress decommissioning of Pickering NGS Units 1 to 4. OPG is requesting an early renewal of the PROL to align with the planned refurbishment schedule.

OPG also requests the renewal of the licensed activities authorized under the Pickering Waste Management Facility (PWMF) Waste Facility Operating Licence (WFOL), WFOL-W4-350.00/2028, which expires on August 31, 2028, and consolidation of these licensed activities with the Pickering NGS PROL. This combined request is administrative in nature and OPG will uphold the safety standards and regulatory requirements of both facilities.

This application demonstrates that OPG will continue to safely operate Pickering NGS Units 5 to 8 and the PWMF, as well as progress decommissioning of Units 1 to 4, while meeting the requirements of the *Nuclear Safety and Control Act* (NSCA) and associated *Regulations*. OPG is qualified to carry out the requested licensed activities and will continue to protect the health, safety, and security of persons and the environment while maintaining national security and satisfying international obligations.

OPG is proud of the strong performance, long standing safety record and the many significant achievements at the Pickering NGS and PWMF during the current licence term. Our track record is a testament to the diligence and passion for excellence that all personnel are committed to on a daily basis in support of the safe and reliable operation of the station and waste management facility (WMF). Our people do more than just work here; they live here and across the Durham Region and the surrounding areas. Public and environmental safety is more than a top priority; it is part of who we are.

Year over year, Pickering NGS and the PWMF continue to meet the regulatory requirements of the CNSC as demonstrated through CNSC Compliance Verification activities. These robust evaluations of all the Safety and Control Areas (SCAs) demonstrate that the Pickering NGS and PWMF have taken the necessary actions for the protection of the health, safety and security of persons and the environment from the use of nuclear energy and the storage of nuclear waste.

Pickering NGS Units 5 to 8 Refurbishment

OPG was asked by the Province of Ontario to continue producing safe, reliable energy at the Pickering NGS for Ontario by delivering another world-class refurbishment project for the benefit of generations to come. Pickering NGS Units 5 to 8 are authorized under the current PROL to operate until the end of 2026 after which the units will be in a shut down state with activities planned to defuel and dewater. Pending the renewal of the PROL, all four refurbished reactors are planned to be returned to service by the mid-2030s.

To support refurbishment, extending the Pickering NGS Units 5 to 8 operating life for an additional 30-plus years, OPG is conducting a comprehensive Periodic Safety Review (PSR3). The PSR3 will be completed before any of the units are returned to service post refurbishment. OPG is committed to implementing the resulting Integrated Implementation Plan (IIP) for Pickering.

The Pickering Refurbishment Project will be a multi-year, multi-phase project which will include the replacements, upgrades, and improvement opportunities within each reactor, as well as replacements and upgrades of other systems, structures and components (SSCs). Since Q1 2024, OPG has engaged in procurement and pre-requisite activities to ensure readiness to proceed when planning is complete and regulatory approvals are secured. OPG has a proven track record of successfully completing refurbishment activities at the Darlington NGS. The Darlington NGS Refurbishment Project nearing completion of its 10-year execution phase, realizing strong safety, quality and schedule performance. Darlington NGS Units 2, 3 and 1, each successfully refurbished and returned to service in June 2020, July 2023 and November 2024 respectively, are operating at full capacity. Darlington NGS Unit 4 is on track to be returned to service in 2026.

The refurbishment of Pickering NGS will allow Units 5 to 8 to continue providing a significant portion (10%) of the provincial energy supply, thereby maintaining the grid system's stability, moderating the overall cost of electricity, sustaining the province's economic competitiveness, and maintaining Canada's energy sovereignty. The investment in refurbishment supports OPG's commitment to a net-zero economy by 2050. This improvement reduces reliance on fossil fuels and contributes to a significant decrease in overall carbon emissions. The refurbishment of Pickering NGS Units 5 to 8 will provide many benefits for customers, the economy, and the environment including:

- Securing more than 2,100 MW of clean, reliable nuclear power for Ontario for an additional 30-plus years.
- Powering one and a half million homes and businesses across Ontario, safely and reliably.
- Maintaining and securing thousands of highly skilled jobs for OPG, contract partners and the broader Canadian supply chain.
- Creating significant economic impact of more than $19 billion over the refurbishment period within Durham Region and across the province.

Pickering NGS Units 1 to 4 Decommissioning

In parallel with the refurbishment and continued operation of Pickering NGS Units 5 to 8, OPG will progress the decommissioning of Pickering NGS Units 1 to 4 during the proposed licence period. Units 1 and 4 will complete stabilization activities and progress to Storage with Surveillance (SWS) and dismantling. Units 2 and 3 have been in SWS since 2010. Once the SWS Plan and Detailed Decommissioning Plan (DDP) are accepted by CNSC staff, OPG will proceed with select dismantling and demolition activities as described in these plans.

Pickering Waste Management Facility

OPG will continue to safely process and store used fuel generated from the Pickering NGS in Dry Storage Containers (DSCs) into the next licence period. To support onsite interim storage of DSCs, a fifth used fuel dry storage building will complete construction and be operated. To support the storage of low and intermediate level waste generated from Pickering NGS refurbishment and decommissioning activities, a new onsite interim storage structure is required and is pending Commission approval; in May 2024, OPG requested an amendment of the PWMF WFOL for the construction and operation of the Pickering Component Storage Structure.

Safety and Control Areas

This licence renewal application provides the information required to demonstrate that OPG meets all applicable requirements of the NSCA and the associated *Regulations*.

The application is structured in accordance with the CNSC SCAs. To ensure that licensees in Canada meet all of their regulatory requirements and expectations, the CNSC assesses compliance with these requirements. The CNSC staff base their evaluations on 14 SCAs, broadly sorted into three functional areas: Management System, Facility and Equipment, and Core Controls and Processes.

This application highlights strengths and achievements in each SCA and includes updated information since OPG's last Pickering NGS licence application, including improvements made or planned, to support operation through the end of the requested licence term.

Safety and Reliability

During the current licence term, the Pickering NGS and PWMF continued to demonstrate strong safety performance. OPG has received the Electricity Canada President's Award of Excellence for Employee Safety – Generation, 9 times in the last 10 years. The award recognizes OPG's achievement of being the top large-scale generator for total recordable injury frequency performance (TRIF).

OPG is currently undertaking PSR3 in support of the refurbishment of Pickering NGS Units 5 to 8. Safety review processes were used for Darlington NGS refurbishment as well as other Nuclear Power Plant refurbishments worldwide. It is a well-defined approach to obtain an overall view of plant safety, the quality of the safety documentation and to determine reasonable and practical improvements to further enhance safety. The process being used for Pickering NGS is described in CNSC regulatory document REGDOC-2.3.3, *Periodic Safey Reviews*. For Pickering NGS Units 5 to 8 refurbishment, the PSR process will review the effectiveness of the programs and the SSCs in place to ensure plant safety and will be documented in a Global Assessment Report (GAR). Based on these results, OPG will commit to an IIP which defines the improvements to be implemented and timelines for their implementation. This IIP will be submitted in August 2027 as per the protocol with CNSC for the conduct of PSR3. This PSR will be the basis for CNSC acceptance of the enhancements associated with the continued operation of Pickering NGS Units 5 to 8. It is expected that the IIP will be accepted before any refurbished unit is returned to service. Transparency and open communication are values that OPG demonstrates by posting the Global Assessment Report and the IIP on www.opg.com. OPG has the experience of being very successful in undertaking previous IIPs for Pickering NGS (PSR2 and PSR2B), as well as for the Darlington NGS refurbishment, and is equally committed to implementing the IIP for Pickering NGS. CNSC staff will be kept up to date throughout this process and will be undertaking comprehensive technical reviews.

OPG is committed to the safe handling and management of waste and radioactive materials. During the current licence term, OPG continued to safely and reliably transfer, process, and store used fuel in Dry Storage Containers (DSCs) from the Pickering NGS to the PWMF. The PWMF has operated safely without a Lost Time Accident for all 30-plus years the facility has been in operation (since 1994). There have been more than 1300 on-site transfers of loaded DSCs without incident, with 421 DSCs processed and stored between 2018 and 2024 and with dose to the public from the operation less than 1% of the regulatory limit.

Commitment to Reconciliation and Indigenous Engagement

OPG is committed to taking concrete and measurable actions to advance reconciliation with Indigenous peoples and to regularly report on the company's activities and progress in achieving established goals. In July 2024, OPG released an updated version of its Reconciliation Action Plan (RAP), which was originally launched in the fall of 2021. Some key highlights and achievements include:

- Since 2022, OPG has reached $198 million in Indigenous contract awards and $39.4 million in equity distributions to our Indigenous partners.
- Developing and initiating roll out of an Indigenous Relations training program to build Indigenous relations awareness and cultural competence across the organization.
- Overall, in 2024, OPG invested a total of over $700,000 in Indigenous initiatives including a sponsorship of the Little Native Hockey League's 51st Annual Tournament, and two bursaries for youth pursuing energy related education.
- In September 2024, OPG was recertified with the Gold Designation from the Canadian Council for Indigenous Business through its Partnership Accreditation in Indigenous Relations Program.
- The Indigenous Opportunities Network (ION) program was launched in 2018 through a partnership with Kagita Mikam Aboriginal Employment and Training Agency, with the goal of placing Indigenous candidates into trades and non-trades roles within OPG, vendors, and unions in the energy sector. To date, ION has placed 209 Indigenous candidates. So far in 2025, 36 candidates have been hired with a goal of 70 this year.

OPG values the relationships it has built with Indigenous Nations and communities and is committed to continued collaboration and engagement regarding ongoing operations to meet the electricity needs of the province of Ontario while also reducing the impacts of climate change.

In the context of this specific application, OPG acknowledges and respects the Aboriginal and/or treaty rights of Indigenous Nations and communities as recognized in the *Constitution Act, 1982* and regularly undertakes engagement with Indigenous Nations and communities with established Aboriginal and/or treaty rights proximate to the site. OPG also engages with Indigenous Nations and communities that assert Aboriginal and/or treaty rights as well as Indigenous Nations and communities that express interest in OPG's sites and operations.

OPG recognizes that meaningful relationships thrive on consistent engagement where trust is maintained through respectful, open, and transparent dialogue. OPG has deepened engagement on nuclear operations over the current licence period and will continue to support meaningful engagement into the future. Based on feedback received from the Michi Saagiig Nations, OPG has built a site-wide engagement plan with Indigenous Nations and communities to increase collaboration on ongoing and proposed initiatives at Pickering NGS in PWMF.

Public Engagement and Communications

OPG values the relationships it has with local communities, the public and all its stakeholders. OPG fosters open and ongoing communications through a comprehensive public outreach program (Public Information and Disclosure Program).

The program ensures public communications are informative, timely and accurate; and information is disclosed in accordance with applicable legal and regulatory requirements.

Information is communicated in several ways based on audience identification, their interests, perception of risk, and their preferred means of communication. This ensures clear understanding of nuclear operations, activities and projects to allow the public to make informed objective decisions through readily accessible information, open dialogue and opportunities to have concerns addressed.

OPG's relationship with the local community remains strong as a result of ongoing engagement and partnerships with community stakeholders and organizations. Community stakeholders

include: government, media, business leaders, educational institutions, interest groups and community organizations.

Conclusion

In summary, this licence renewal application includes information to demonstrate that OPG meets all the requirements of the NSCA and associated *Regulations* and demonstrates that OPG:

- Is qualified to carry on the activities to be licensed; and,
- Will, in carrying on those activities, continue to ensure the health and safety of persons, protection of the environment and the maintenance of national security and measures required to implement international obligations to which Canada has agreed.

OPG has demonstrated strong safety and operational performance at the Pickering NGS and PWMF during the current licence term resulting in many operational achievements. OPG has also demonstrated from its refurbishment of Darlington NGS, that it can safely execute the refurbishment of a nuclear power plant. With the improvements and future activities planned as outlined in this application, OPG is confident in its ability to safely and reliably execute the requested licensed activities through 2036.

OPG therefore requests the CNSC to authorize the renewal of the Pickering NGS PROL, with the licensed activities from the PWMF WFOL consolidated within, for a 10-year term from January 1, 2027 to December 31, 2036, authorizing the licensed activities requested in this application.

Table of Contents

List of Figures

List of Tables

1.0

Pickering NGS Licence Renewal – Introduction

1.0 Pickering Licence Renewal – Introduction

Ontario Power Generation (OPG) generates approximately half of the electricity in the province of Ontario and operates two nuclear generating stations in the province. The Pickering Nuclear Generating Station (NGS) Units 5 to 8 currently generate a total of 2,100 megawatts (MW) of electricity, equivalent to powering one and a half million homes and producing 10% of Ontario's electricity. Nuclear power's major benefits include low operating costs and extremely low greenhouse gas emissions.

Since its start of commercial operation, the Pickering NGS has proven to be a safe, reliable, and important source of energy for the province of Ontario while meeting growing energy needs. The dedicated team of professionals who operate, maintain and support the station have consistently demonstrated their commitment to safety and excellent performance.

The Pickering NGS refurbishment and continued operation are essential to meeting the growing energy needs in the province while securing safe, reliable power that is virtually emissions-free, contributing significantly to our climate change goals. The Independent Electricity System Operator forecasts that electricity demand will rise by 75 per cent by 2050, requiring an additional 111 Terawatt-hours (TWh) of energy to meet this demand. Moreover, with other nuclear stations in Ontario undergoing their own refurbishments, there will be a need for additional electricity beyond 2026. Refurbishing Pickering NGS supports Ontario's energy sovereignty, helping the province manage its energy future with reliable, baseload electricity while protecting the environment.

Electricity generated by nuclear power comes with the by-product of radioactive waste. OPG is committed to the responsible and comprehensive management of all its radioactive waste and has decades of experience in safely providing interim storage of waste generated from the Pickering NGS at our waste management facilities including at the Pickering Waste Management Facility (PWMF). OPG is also committed to the safe management and permanent disposal of nuclear waste.

This application to the Canadian Nuclear Safety Commission (CNSC) is for the renewal of the Pickering NGS Power Reactor Operating Licence (PROL) PROL 48.03/2028, which expires on August 31, 2028. OPG requests renewal of the PROL for a 10-year licence term from January 1, 2027 to December 31, 2036. During this requested licence term, OPG plans to refurbish Pickering NGS Units 5 to 8 for continued operation. OPG also requests a licence activity to progress decommissioning of Pickering NGS Units 1 to 4. OPG is requesting licence renewal at this time to align with the projected refurbishment project schedule.

OPG also requests renewal of the licensed activities authorized under the PWMF Waste Facility Operating Licence (WFOL) WFOL-W4-350.00/2028 and consolidation of the WFOL with the Pickering NGS PROL. This request is administrative in nature and OPG will uphold the safety standards of both facilities. OPG requests that WFOL-W4-350.00/2028 be revoked upon Commission approval of the proposed consolidated PROL renewal.

This application has been prepared in accordance with the requirements of the *Nuclear Safety and Control Act* (NSCA) and its associated *Regulations*. OPG will continue to carry on the licensed activities and continue to protect the health, safety and security of persons and the environment, and maintain national security and measures required to implement international obligations. Activities requested to be licensed are listed in Appendix C. Also, Appendix D provides additional information on hazardous substances encompassed for the requested licence, and Appendix E provides other CNSC licences that control other nuclear substances at Pickering NGS and PWMF.

OPG's CANDU reactors do more than just generate electricity. Pickering NGS reactors are utilized to support the radioisotope industry in both the medical and food safety fields through the production of Cobalt-60 (Co-60). Approximately every two years, the cobalt adjuster rods are harvested (i.e., removed from reactor core) from the Pickering NGS Units 6, 7 and 8 and shipped to Nordion Inc.'s facility in Kanata, Ontario, where it is commercialized and sold to market. The refurbishment of these units would enable another 30-plus years of cobalt production, accounting for 20% of the world's supply, making it one of the world's leading sources of this important life-saving product. The predictable and reliable nature of our reactors enables dependable supply chains for isotope markets.

OPG is committed to working with Indigenous Nations and communities, proximate to its present and future operations, to foster positive and mutually beneficial relationships that will create social and economic benefits through partnership and collaboration. Our relationships are developed on a foundation of respect for the rights of Indigenous Nations and communities and our goal is to build and foster openness, transparency, and trust in our engagement efforts. OPG's relationship with Indigenous Nations and communities has evolved over the last 10 years. As a continuous learning and growing organization, OPG has been adaptive and flexible to be responsive to the Truth and Reconciliation Commissions Calls to Action and ongoing feedback from the Indigenous Nations and communities OPG works with. OPG remains committed to strengthening relationships with Indigenous Nations and communities and facilitating continued engagement at the Pickering NGS and PWMF through the licence renewal application process and going forward into the future.

OPG also believes in open and transparent communication in a timely manner to maintain positive and supportive relationships, and the confidence of Indigenous peoples, key stakeholders and the local community who have an interest in the operation and management of the Pickering NGS site.

1.1 Site Description and Ownership

The Pickering NGS site includes the Pickering NGS and PWMF. The site is located in the traditional territory of the Michi Saagiig and Chippewa Williams Treaties First Nations, on the north shore of Lake Ontario in the City of Pickering in the Regional Municipality of Durham, within the Province of Ontario. The site is approximately 32 km east-northeast of downtown Toronto and 21 km southwest of the City of Oshawa at latitude 43° 49´N and longitude 79° 04´W. The total frontage of the site along the Lake Ontario shoreline is approximately 2260 m. The transmission egress right-of-way which leads north from the site boundary is 155 m in width. There are a number of watercourses in the vicinity of Pickering NGS site. The two major ones closest to the site are Duffins Creek, 2.2 km to the east, and the Rouge River, 4 km to the west.

The Pickering NGS site, including the exclusion zone and structures within the zone, is shown in the OPG drawing, NK30-D0A-10200-0001, *Building Development Site Plan.*

The Pickering NGS site is owned by OPG and the Province of Ontario. The title/deed is available upon request.

CNSC staff will be notified, as required by the licence, about changes to site descriptions and the site plan resulting from refurbishment activities should any arise.

Pickering NGS

Pickering NGS has eight reactor units numbered 1 to 4, from east to west, and 5 to 8, from west to east from the centre of the station. Units 1 to 4 are also referred to as Pickering NGS-A while Units 5 to 8 are also referred to as Pickering NGS-B, as shown in Figure 1.

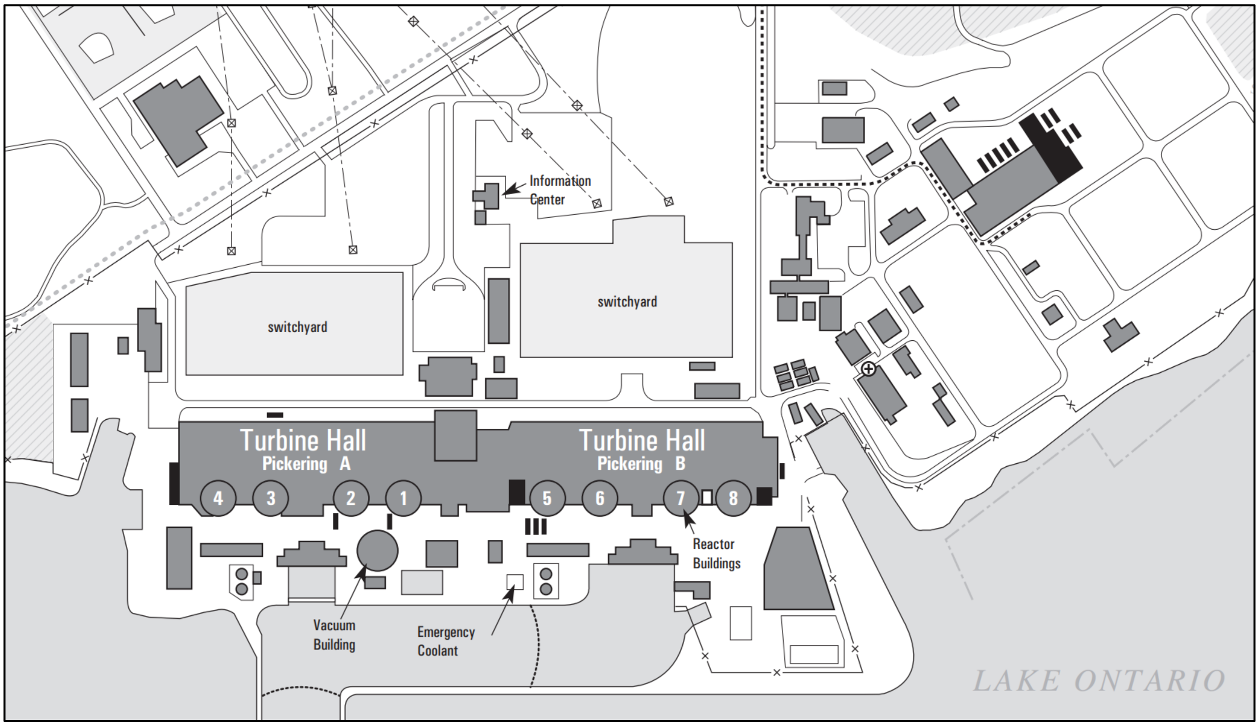

Figure 1. Pickering Site Map

Pickering NGS Units 5 to 8 are licensed to operate until December 31, 2026, up to a maximum of 305,000 equivalent full power hours on the lead unit (Unit 6). Unit 1 was removed from service in October 2024 and Unit 4 was removed from service in December 2024. Units 2 and 3 have been in Storage with Surveillance (SWS) since 2010.

The Pickering NGS-A and Pickering NGS-B safety reports provide detailed and extensive information on the facility and the systems, structures and component (SSC) design. Further information is provided below in Table 1 and Table 2.

Table 1. Summary Data for Pickering NGS

Summary Data - Pickering NGS	
Number of Units	8
Operational Units	4 (Units 5-8)
Units removed from service	4 (Units 1-4) Units 2 and 3 in SWS Units 1 and 4 undergoing stabilization
Net Power Output (Electrical)	4 x 516 MWe (Units 5-8)
Nuclear Steam Supply System	CANDU Pressurized Heavy Water Reactor

Table 2. Pickering In-service Dates

Unit	In-Service Dates (Operational Units)
Unit 5	May 10, 1983
Unit 6	February 1, 1984
Unit 7	January 1, 1985
Unit 8	February 26, 1986

Pickering Waste Management Facility

The PWMF is currently licensed under a separate operating licence, WFOL-W4-350.00/2028 which expires August 31, 2028. At the PWMF, OPG processes and stores used fuel Dry Storage Containers (DSCs) containing used nuclear fuel (high level radioactive waste) generated at the Pickering NGS that has been cooled typically for a minimum of 10 years in the irradiated fuel bays at Pickering NGS, with a maximum of 100 DSCs at a time containing used fuel that has been cooled for a minimum of 6 years from Pickering NGS Units 5 to 8.

The dry storage of used fuel at the PWMF spans over two physically separate areas - Phase I and Phase II - within the overall boundary of the Pickering NGS site, as shown in Figure 2. Phase I is located within the protected area of the Pickering NGS and consists of the DSC Processing Building and two DSC storage buildings (SB1 and SB2). Phase II of the PWMF is located northeast of Phase I and is contained within its own protected area within the boundary of the Pickering site. Phase II contains Storage Building #3 and #4 (SB3 and SB4). The transfer route of the loaded DSCs from the PWMF Phase I to the PWMF Phase II is solely on OPG property. WFOL-W4-350.00/2028 also authorizes OPG to construct two additional DSC storage buildings in Phase II and one DSC processing building to replace the current DSC Processing Building. Currently, a fifth storage building (SB5) is planned with an in-service date of approximately 2027. Consistent with industry best practice, OPG will construct new facilities on an as-needed basis.

The PWMF also provides interim storage for intermediate level waste components previously removed during retubing of Pickering NGS Units 1 to 4 reactors. The retube waste is stored in Dry Storage Modules within Phase I.

In May 2024, OPG submitted a request to the CNSC to amend the PWMF WFOL, to construct and operate the Pickering Component Storage Structure (PCSS) for storage of low and intermediate level waste that is generated by the Pickering NGS. This additional interim storage capacity, intended for radioactive component waste and material, will be required to support the refurbishment of Pickering NGS Units 5 to 8 and Units 1 to 4 decommissioning activities. In August 2024, OPG received notice from the CNSC that the amendment application will be considered by the Commission through a hearing in writing that is scheduled to take place in July 2025. Pending Commission approval, OPG targets to have the PCSS operational by Q2 2027.

Table 3 provides a summary of the developments at PWMF.

Figure 2. PWMF Layout

Table 3. Chronology of Development for used Fuel at PWMF

Building	Number	Capacity	In-Service Dates
DSC Processing Building			1996
DSC Storage Building	1	185 DSCs (nominal)	1996
	2	469 DSCs (nominal)	2001
	3	480 DSCs (nominal)	2009
	4	624 DSCs (nominal)	2021
	5	1200 DSCs (nominal) *(increasing to 1410 DSCs later)*	Planned for 2027

1.2 Future Operation of Pickering NGS

In January 2024, the province of Ontario formally requested OPG to proceed towards refurbishing Pickering NGS Units 5 to 8. Pending CNSC approval, OPG intends to refurbish Pickering NGS Units 5 to 8 after ceasing operation at the end of 2026.

The refurbishment of Pickering NGS will allow Units 5 to 8 to continue to provide a significant portion (10%) of the Provincial energy supply, thereby helping maintain system stability, moderate the overall cost of electricity, and sustain the province's economic competitiveness.

The refurbishment of Pickering NGS Units 5 to 8 will provide many benefits for customers, the economy, and the environment by ensuring over 2,100 MW of clean, reliable power for Ontario for at least another 30 years. This will provide safe and consistent electricity to power one and a half million homes and businesses across the province, while preserving skilled jobs and generating a significant economic impact of more than $19 billion throughout Durham Region and Ontario.

In parallel with the refurbishment and continued operation of Pickering NGS Units 5 to 8, OPG will progress decommissioning of Pickering NGS Units 1 to 4. During the requested licence period (2027-2036), Units 1 and 4 will enter SWS and dismantling will be progressed. Units 2 and 3 have been in SWS since 2010. OPG plans to complete selected dismantling and demolition activities of outbuildings and non-nuclear systems and components once the associated SWS Plan and the Detailed Decommissioning Plans (DDP) are accepted by the CNSC staff.

OPG is committed to engaging with Indigenous Nations and communities regarding nuclear operations, including proposed future initiatives at the Pickering NGS.

Separation of Pickering NGS Units 1 to 4 and Pickering NGS Units 5 to 8

With the planned decommissioning of the Pickering NGS Units 1 to 4 and the planned refurbishment and continued operation of Pickering NGS Units 5 to 8, a boundary between Units 1 to 4 and Units 5 to 8 will be defined. Common systems and infrastructure, e.g., electrical, service water, etc. may no longer be shared.

The separation of Units 1 to 4 (Pickering A) from Units 5 to 8 (Pickering B) is denoted by the concept of an "AB Gate" which is illustrated in Figure 3 and has been defined for planning purposes. Planned engineering and physical modifications to separate the units will take place throughout the licence period and will follow OPG's Engineering Change Control (ECC) process with any required change notifications being submitted to CNSC staff. (See Section 2.12.6 for additional information). Some reliance on Pickering NGS Units 1 to 4 systems will exist post refurbishment and this dependence will gradually be removed over time. Until such time, Pickering NGS Units 1 to 4 systems needed to support Pickering NGS Units 5 to 8, will be maintained to ensure their continued high reliability.

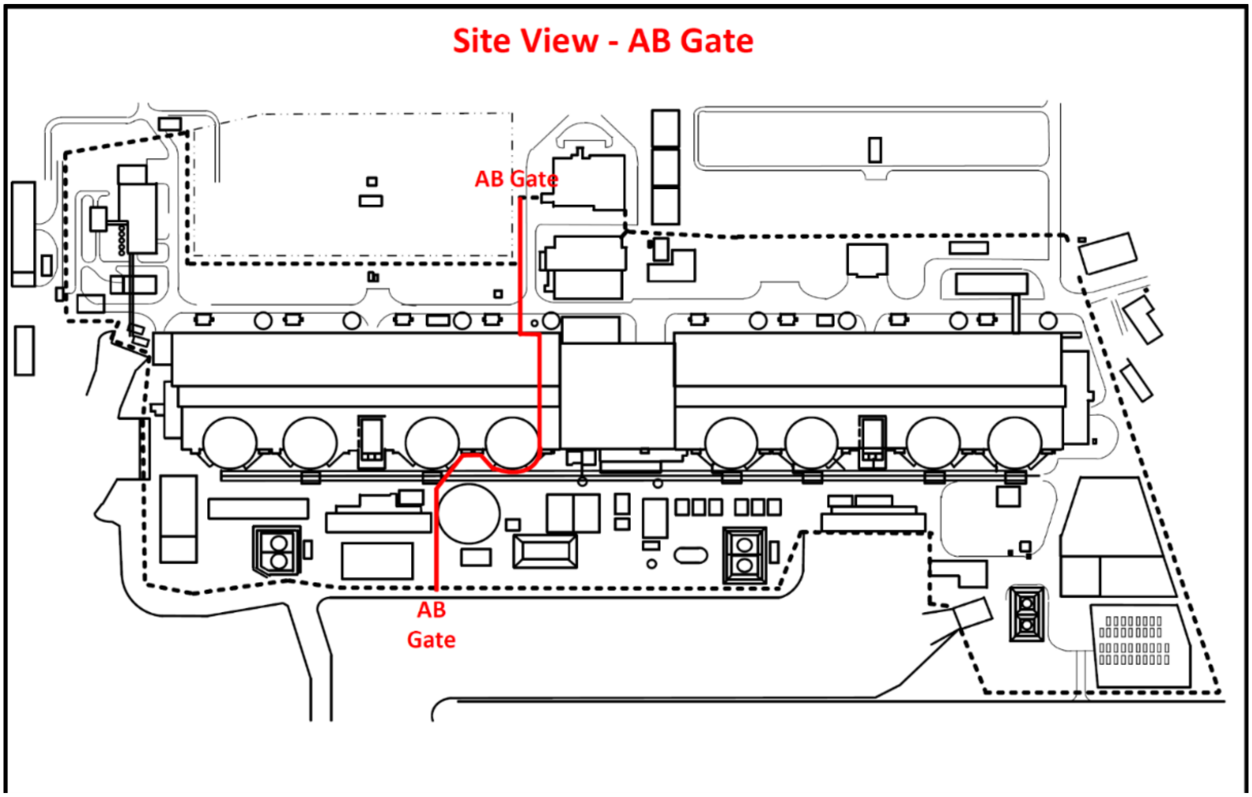

Figure 3. Conceptual AB Gate

1.2.1 Pickering NGS Units 5 to 8 Refurbishment

Refurbishment is a multi-year, multi-phase project for Pickering NGS to enable the removal and replacement of key components of each reactor and its associated equipment. OPG has engaged in procurement and pre-requisite activities to ensure readiness to proceed when planning is complete and regulatory approvals are secured. OPG has a proven track record of successfully conducting refurbishment activities at Darlington NGS.

Following shutdown planned in the autumn of 2026, Units 5 to 8 will be defueled and dewatered. Refurbishment activities will be conducted following this period. OPG currently plans for all four refurbished reactors to be back in service in the mid-2030s.

1.2.1.1 Refurbishment Planning Process

The refurbishment program addresses the planning, preparation and execution of activities required to complete the refurbishment of Pickering NGS Units 5 to 8 and bring the units back to service. The refurbishment program will leverage OPG's mature and effective Nuclear Management System. In addition, scope management requirements will be met as documented in OPG-MAN-00120-0011, *Project Scope Management*, to ensure that the individual projects included in the refurbishment program include the work required to complete the refurbishment successfully.

The Refurbishment Change Control Board (RCCB) has been established to provide a structured forum for control of changes to the scope and structure of the Pickering Refurbishment Program (PRP). The RCCB will manage new scope requests and requested scope changes for the individual projects, ensuring that scope changes are properly defined, validated, controlled, and align with the overall program objectives. The scope is bounded and limited to the replacement

of life limiting components, regulatory and safety improvement work, as well as approved Balance of Plant components.

To support refurbishment, OPG is conducting a comprehensive Periodic Safety Review (PSR3) of Pickering NGS Units 5 to 8, in accordance with Licence Condition 15.4 of PROL 48.03/2028, to extend its operating life for an additional 30-plus years. The PSR3 is being conducted in accordance with CNSC REGDOC-2.3.3 *Periodic Safety Reviews*, with guidance from International Atomic Energy Agency (IAEA) SSG-25 *Periodic Safety Review for Nuclear Power Plants* and Canadian Standards Association (CSA) N290.18-17 *Periodic safety review for nuclear power plants.*

Major components to be replaced during Pickering NGS refurbishment will include selected reactor components such as the pressure tubes, calandria tubes, annulus spacers, feeder pipes and steam generators. The PSR3 process will identify enhancements to safety by comparing the station against modern codes and standards. This assessment is discussed further below.

To support the refurbishment of Units 5 to 8, OPG has completed a Climate Change Resilience Assessment and a Predictive Environmental Risk Assessment (PERA). The results of these assessments are discussed below.

Periodic Safety Review

A Periodic Safety Review (PSR) is a systematic and comprehensive evaluation of the design, condition, and operation of the plant against modern codes and standards. It is a safety reassessment, performed periodically (typically at 10-year intervals), and used to assess the cumulative effects of plant aging and plant modifications, operating experience, technical developments, and siting aspects. A PSR includes an assessment of plant design and operation against applicable current safety standards and operating practices and has the objective of ensuring continued high level of safety throughout the plant's operating lifetime.

The flowchart in Figure 4 depicts the PSR process.

The PSR3 builds upon previous safety assessments: the Pickering Integrated Safety Review (ISR), the Pickering PSR2 and PSR2-B, the Darlington ISR, and the Darlington PSR (for programmatic components applicable to Pickering NGS). The most recent Pickering safety reassessment, PSR2-B, concluded that the current plant design, operation, processes and management system will ensure continued safe operation of Pickering NGS Units 5 to 8 to the end of December 2026. The PSR3 is being executed from the perspective of Units 5 to 8 being refurbished for an additional 30-plus years of operating life.

In accordance with CNSC REGDOC-2.3.3, the PSR3 is being conducted in four phases:

1. Preparation of the Basis Document;
2. Conduct of Safety Factor reviews and identification of Gaps and Strengths;
3. Analysis of the gaps and identification of potential safety enhancements for Pickering NGS in the Global Assessment Report; and
4. Preparation of a plan for the implementation of safety enhancements (Integrated Implementation Plan).

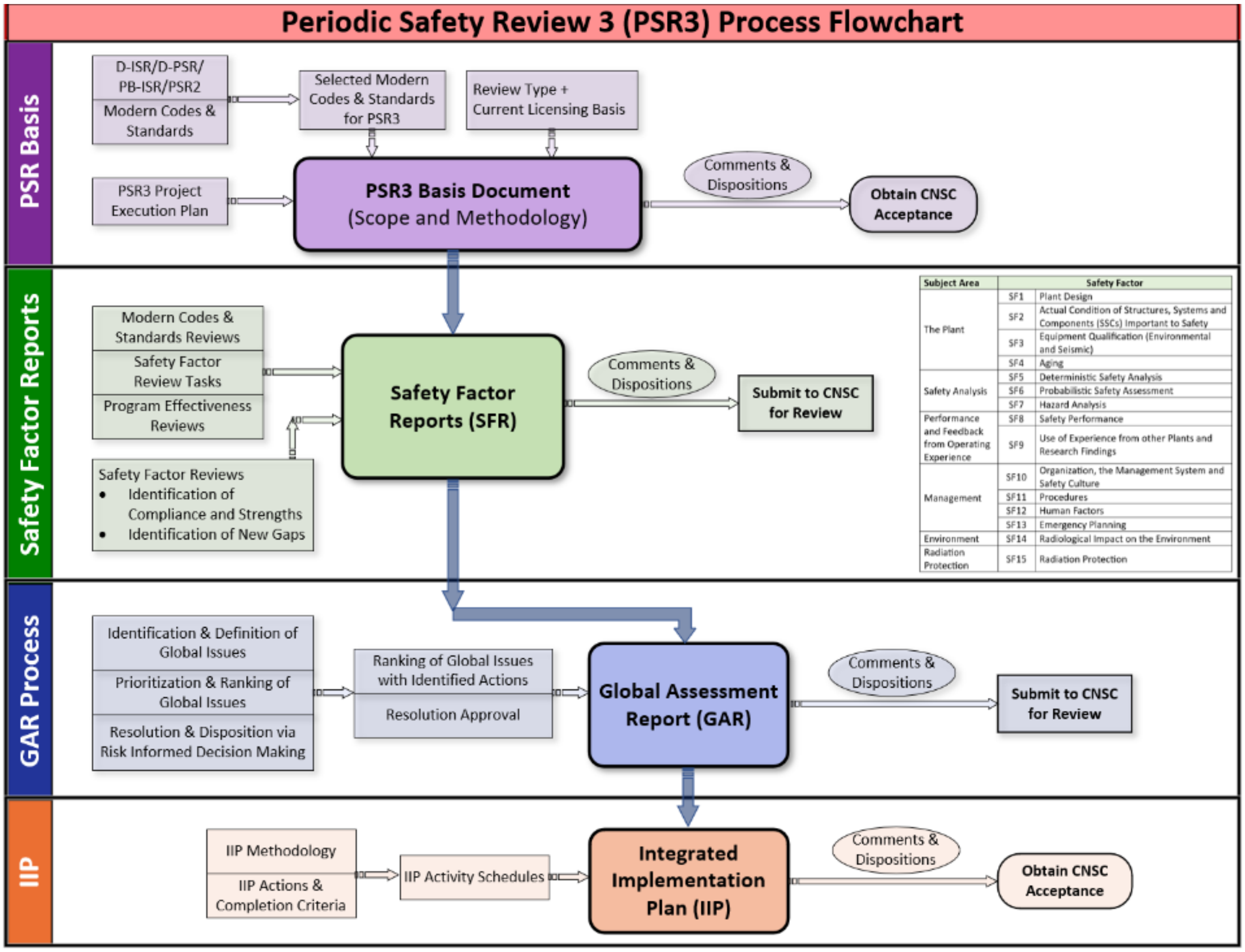

Figure 4. Periodic Safety Review 3 Process Flowchart

PSR3 Basis Document

The PSR3 Basis Document defines the scope and methodology for the conduct of the PSR3 and addresses:

- The current licensing basis for Pickering NGS
- The proposed operating strategy of the facility
- The scope of the PSR (i.e., Safety Factors to be reviewed; Laws, Regulations, Codes and Standards to be reviewed; and the SSC list)
- The methodology for conducting the PSR
- Major milestones
- The project management and quality management processes to be followed

OPG followed a systematic process to establish the safety significant SSCs for the PSR3 assessment basis with a focus on the Pickering Systems Important to Safety (SIS) and the Safe Operating Envelope (SOE) systems. The only SSCs from Units 1 and 4 included in the PSR3 scope are those supporting the continued safe operation of Units 5 to 8. The Pickering PSR3 Basis Document, P-REP-03680-00054 *Pickering NGS Periodic Safety Review 3 (PSR3) Basis Document,* was accepted by CNSC staff in May 2024.

In addition to the lessons-learned from previous OPG fleet PSRs, the PSR3 Basis Document also describes the Expert Panel which provides the mechanism for applicable external industry OPEX to be expertly applied in the Pickering PSR3. The Expert Panel is discussed further in Item (h) under the Global Assessment section below.

Safety Factor Reviews

Safety Factor reviews cover all aspects important to the safe operation of a nuclear power plant. The Safety Factors addressed in PSR3 are shown in Table 4 below.

Table 4. PSR3 Safety Factors Addressed

Subject Area	Safety Factor	
The Plant	1	Plant Design
	2	Actual Condition of Structures, Systems and Components Important to Safety
	3	Equipment Qualification (environmental and seismic)
	4	Aging
Safety Analysis	5	Deterministic Safety Analysis
	6	Probabilistic Safety Assessment
	7	Hazard Analysis
Performance and Feedback from Operating Experience	8	Safety Performance
	9	Use of Experience from other Plants and Research Findings
Management	10	Organization, the Management System and Safety Culture
	11	Procedures
	12	Human Factors
	13	Emergency Planning
Environment	14	Radiological Impact on the Environment
Radiation	15	Radiation Protection

The Safety Factors include the review of:

- OPG programs and procedures listed in the Licence Condition Handbook (LCH);
- Previous regulatory commitments, actions, etc.;
- Regulatory Action Items, Continued Operation Plan;
- Previously identified PSR2, Pickering ISR, Darlington ISR and Darlington PSR gaps;
- Assessments and reviews performed since the PSR2, Pickering ISR, Darlington ISR and Darlington PSR documents were completed;
- Audits and other self-assessments.

The results of the reviews are summarized in Safety Factor Reports and submitted to the CNSC.

Global Assessment

The objective of the Global Assessment is to provide an overall assessment of the safety of the plant, and to ensure the plant will continue to achieve present and future safety objectives.

This assessment takes into account:

- the safety enhancements identified in the Global Assessment (plant and process modifications),
- strengths and residual Global Issues/Acceptable Deviations that impact on aggregate effects of the results, and
- consideration of existing planned safety enhancements and recent overall station safety performance.

The Global Assessment process consists of the following elements:

a) *Identification and consolidation of Gaps and Strengths from the Safety Factor Reports:* The strengths and gaps from the 15 safety factor reports will be consolidated and grouped by topic area to support the Global Assessment.

b) *Development of Global Issues:* The consolidation of Gaps into Global Issues will provide a means to assemble Gaps of a common nature, facilitating the assessment of safety impact and identifying and assessing practical and effective resolutions. The Global Issues will be tabularized, tracking sources of the issues, to facilitate further review and assessment.

c) *Assessment of the interfaces between various Safety Factors and aggregate impact of Global Issues:* With the assembly of Global Issues and Strengths, the aggregate impact of the Global Issues will be assessed. Through this process, the interaction between issues will be identified. New Global Issues may be identified as part of this consolidation review. This will support the prioritization and ranking of Global Issues as described below.

d) *Prioritization of Global Issues and Gaps:* PSR3 Global Issues and associated gaps will be prioritized with respect to their importance to Nuclear Safety to determine the Safety Significance level associated with each Global Issue. This will support the resolution evaluation method and the outcome of the resolution process. This methodology is consistent with OPG's prioritization processes used in previous ISRs, PSRs, and industry practice. The Safety Significance level will consider deterministic and probabilistic safety analysis impact, as appropriate. Probability levels selected for delineation between categories are based on significance, as applied in previous ISRs and PSRs. These values account for overall safety impact and align, where appropriate, with requirements and limits in relevant safety standards.

e) *Development of Resolutions/Dispositions of Global Issues and Gaps:* Resolution options will be developed and assessed using risk-informed decision-making techniques. The development of the resolution will utilize the following strategy:
    - In assessing potential dispositions, defence-in-depth elements will be considered
    - In developing the resolutions, consideration of overall safety significance will guide the resolution process
    - For global issue resolution, the process will be:
        - Evaluate the Global Issue to understand safety basis and intent of the requirement.

- Consider possible options for resolution/mitigation. Consider safety significance and defence-in-depth elements.
- Evaluate options with respect to effectiveness, cost, schedule, and practicality. For potential plant modifications, this may require an evaluation of the safety impact, both deterministic and probabilistic. If it is not practicable to fully resolve a global issue, other mitigation options will be considered for enhancements.
- Evaluate the practicality of a proposed resolution in terms of cost, resources, schedule, and consideration in relation to the overall safety impact.
- Propose recommended resolution/mitigation.
- Document the decision-making process.

- Items of high or medium impact on nuclear safety will require a more in-depth analysis to fully understand the issue and potential impact, and to develop the proposed recommended resolution/mitigation.
- Items of very low impact on nuclear safety will generally be deemed as Acceptable Deviations within the context of PSR3 (with the rationale provided), and while these items will not be tracked beyond the Global Assessment, they will be shared with the accountable organizations for consideration as potential enhancement initiatives for their future work program planning purposes. This will allow the organizations to prioritize the initiatives as part of their integrated programs to ensure the focus is on the right overall priorities.
- A similar treatment will be applied for items of low impact on nuclear safety for which a practicable solution is not readily evident.
- Proposed resolutions will be categorized as i) Programmatic (changes to procedures and programs), ii) Engineering (plant modifications or maintenance), or iii) Analytical (e.g., safety or hazard analysis), to facilitate binning of potential work. In some cases, the proposed resolutions may entail work from more than one of these categories.
- In some cases, the development of resolutions/dispositions to the Global Issues will be part of an ongoing or planned OPG or industry initiative. Alternatively, the resolution and development of options may require more detailed analysis and assessment, extending beyond the timelines for submission of PSR3. In these instances, the status of the initiative and plans will be included in the disposition. The work will be included in the Global Assessment to facilitate continued tracking.
- Previous Global Assessment resolutions for the same Global Issue/Gap will be considered in the review
- If, in the assessment, it is determined that a Global Issue/Gap has been closed, due to work performed in the interim or for other reasons, the rationale will be documented, and the Global Issue / Gap will be resolved and closed.
- An alternate process / resolution may be utilized for a particular Global Issue/Gap.

f) *Assessment of Defence-in-Depth and aggregate impact of Acceptable Deviations:* An important element of the development of proposed recommendations will be to assess the overall defence-in-depth and aggregate impact of the residual Global Issues/Acceptable Deviations. After evaluating a range of resolutions for Global Issues, and determining a recommended resolution to be selected, the impact on defence-in-

depth, considering both deterministic and probabilistic elements, will be evaluated to assess the aggregate impact on overall safety. It may be necessary to refine the proposed resolutions based on the results of this review. This overall assessment will be an important element in supporting the enhancement plans and the planned operational strategy over the period of PSR3. For each of the five levels of defence listed below, the defence-in-depth assessment will consider the overall plant as well as the identified strengths, acceptable deviations, and the proposed resolutions to the global issues listed in the global assessment.

Level 1: Prevention of abnormal operation and failures;
Level 2: Control of abnormal operation and detection of failures;
Level 3: Control of accidents within the design basis;
Level 4: Control of severe plant conditions, including prevention of accident progression and mitigation of the consequences of severe accidents;
Level 5: Mitigation of radiological consequences of significant releases of radioactive materials.

g) *Ranking Global Issues:* All Global Issues whose resolution involves identified actions will be ranked. The ranking process will consider factors such as the priority previously determined, the contribution to defence-in-depth, the source of the issue and the degree of non-compliance with the PSR3 Assessment Basis. The ranking process will also account for the extent of impact on multiple safety factors or areas. The Global Issue resolution actions and ranking will be confirmed by OPG subject matter experts.

h) *Third Party/Expert Panel and OPG Senior Management review of proposed Resolution Statements:* The results of the Global Assessment will be reviewed by a panel of industry experts independent of the Global Assessment Team. The enhancements identified in the PSR3 Global Assessment, with their priority and safety basis, will then be presented to OPG senior management for approval. This review will ensure alignment with the resolutions proposed, their basis and context, and will be the means to obtain concurrence that the proposed enhancements are practicable and effective. This will also allow the senior leadership team to consider potential realignment of overall priorities based on the insights from PSR3.

i) *Assessment of overall acceptability of operation of the plant over the period considered in PSR3:* As a final step in the assessment process, the team will assess the overall acceptability of operation of the plant over the period considered in PSR3. This will entail a review of the results of the Safety Factor reviews, a consideration of enhancements planned (both newly identified in PSR3 and from other station plans), and a consideration of plant performance and initiatives underway.

j) *Preparation of the Global Assessment Report:* The Global Assessment Report (GAR) will present the results, assess the overall defence-in-depth of the plant, and document the conclusions, corrective actions, and enhancements to be considered. The GAR includes a ranked list of the global issues with identified actions, with rationale for the ranking using an established decision support methodology. Residual global issues and acceptable deviations are noted in the GAR, summarizing the assessed aggregate impact on safe operations. The Global Assessment Report will include a statement of OPG's assessment of the overall acceptability of operation of the plant.

Integrated Implementation Plan

The proposed enhancements resulting from the Global Assessment will be documented in the Integrated Implementation Plan (IIP). The GAR Resolution Statements will be turned into Resolution Actions with supporting IIP Actions.

The IIP will include a schedule that is established to manage the completion of the resolution actions, and the supporting IIP Actions, with baseline target completion dates, progress reporting requirements, and risk management plan for the period of the PSR3. The IIP will include a tabularized listing of the safety enhancement initiatives, their assigned owners, and their planned implementation date. The IIP will be developed based on the lessons learned from the completion and close out of previous IIP items in the OPG fleet, to ensure alignment with already established procedures, and to benefit from the process efficiency improvements. The IIP will be submitted to the CNSC staff for acceptance as per the requirements of CNSC REGDOC-2.3.3.

The target submission dates for the PSR3 major milestones are as follows:

Table 5. PSR3 Target Submission Dates to the CNSC

Activity	Target Submission Dates
PSR3 Basis Document	March 5, 2024 (COMPLETE)
Safety Factor Reports	May 19, 2025 (COMPLETE)
Global Assessment Report	August 8, 2026
Integrated Implementation Plan	August 31, 2027

Since the introduction of CNSC REGDOC-2.3.3, the PSR process has become well established. OPG has conducted ISRs and PSRs at both the Pickering and Darlington stations and builds upon this experience in each successive safety review. Through these previous ISR and PSR assessments, OPG has also demonstrated its commitment to the implementation of the resulting IIPs. CNSC staff provide regular updates to the Commission and public on the status of OPG's IIP activities through the CNSC staff annual Regulatory Oversight Report for Canadian Nuclear Power Generating Sites.

The PSR will be completed before any of the units begin return to service post refurbishment. The GAR and the IIP will be posted on www.opg.com. OPG has been successful in undertaking previous Pickering NGS IIPs, as well as, the IIP for the Darlington NGS refurbishment, and will be applying this experience to support implementation of the IIP for Pickering NGS.

The IIP scope and timeline will be determined as part of the IIP preparation process.

Climate Change Resilience Assessment

OPG is committed to adapting to climate change to ensure operations are resilient to the impacts of a changing climate. The Climate Change Resilience Assessment is a forward-looking climate resilience assessment to demonstrate the resilience of the plant to the impacts of climate change for the proposed extended plant life. OPG has completed the Pickering NGS Units 5 to 8 Climate Change Resilience Assessment. OPG has also shared the Climate Resilience Assessment Summary report with the Williams Treaties First Nations Rightsholders and welcomes input and further engagement with the Nations. Details of this assessment are provided in Section 2.4.2.1.

Predictive Environmental Risk Assessment (PERA)

A PERA identifies and assesses the potential environmental interactions of proposed activities that could alter the nature of a site's interaction with the environment from those captured in previous Environmental Risk Assessments (ERAs), and/or that are part of a transition to a new phase in the lifecycle where the application for the new licensing phase includes interactions with the environment that were not previously captured in the ERA(s).

The PERA for the Pickering NGS site was conducted in accordance with CSA N288.6-22 *Environmental risk assessments at nuclear facilities and uranium mines and mills*, and CNSC REGDOC-2.9.1 *Environmental Protection: Environmental Principles, Assessments and Protection Measures, Version 1.2*, for the refurbishment and continued operation of Pickering NGS Units 5 to 8 and the decommissioning of Pickering NGS Units 1 to 4. Project activities associated with the PWMF and its continued operation are also included in the PERA.

The objectives of the PERA are to:

- Identify whether any proposed activities are likely to result in environmental emissions or other stressors beyond those assessed for current operations or other recent assessments;
- Predict and assess the risk to representative human and ecological receptors resulting from exposure to radiological and non-radiological substances and physical stressors expected to be released during refurbishment, decommissioning, and continued operations of Pickering NGS; and
- Inform prioritization of monitoring and mitigation measures.

To support this PERA, additional field data were collected in 2024 and 2025 to characterize existing conditions. This data supplements existing data collected through the routine Environmental Monitoring Program (EMP), effluent and emissions monitoring programs, biodiversity monitoring programs, and previous supplemental environmental studies. Further aquatic field studies are planned for 2025.

In spring 2024, OPG engaged early with the Michi Saagiig Rightsholders to seek feedback and gauge interest in attending field work activities in support of the PERA. Through 2024 and 2025, OPG continued to share and facilitate field work activities with the Michi Saagiig Rightsholders. In April 2025, the PERA was shared with the Williams Treaties First Nations Rightsholders. OPG welcomes input and further engagement with the Nations on the PERA.

Additional details on the PERA are provided in Section 2.9.2.1.

1.2.1.2 Refurbishment Program

OPG has established a dedicated refurbishment management organization (Nuclear Refurbishment), separate from the station, to allow each entity to concentrate on its core responsibilities and areas of expertise. The scope of the Pickering NGS refurbishment program encompasses the planning, design, procurement, construction, and commissioning of the structures and components necessary for Units 5 to 8, to continue operating safely for an additional 30-plus years. A comprehensive review of the Systems Condition Assessments encompassing multiple data points from documents such as system and components health reports, Component Condition Assessments, maintenance history etc., determined that replacement of feeders, fuel channels, steam generators, and turbine and generator systems will be the major scope of the Refurbishment project. A re-designed water intake structure, upgrades to support facilities and modifications to various plant systems and equipment to further improve plant reliability and safety are also included to ensure continued emission-free reliable operations for another 30-plus years. OPEX from Darlington NGS and Bruce Power NGS refurbishment programs will be strategically used to enhance efficiency, support ongoing maintenance activities, and ensure alignment with project goals.

The Pickering Refurbishment Program covers the planning, preparation and execution of activities required to complete the Refurbishment of Pickering NGS Units 5 to 8 and bring the units back to service. It is defined in an overarching Program Management Plan NK30-PLAN-00120-00002 *Pickering Refurbishment Program Management Plan* which provides the framework and guidance on requirements for the supporting lower-level program management plans (PgMPs).

The Pickering Refurbishment PgMPs describe how the program is managed to meet the requirements of OPG's Nuclear Management Systems while ensuring business objectives, program-specific requirements (planning and controls, licensing, engineering, regulatory, etc.), and commitments are fulfilled. The PgMPs have been established to provide assurance that all aspects of the programs will be conducted in accordance with:

- CSA N286-12, *Management system requirements for nuclear facilities*,
- N-CHAR-AS-0002, *Nuclear Management System*, and
- OPG Corporate and Nuclear governance.

In addition to the PgMPs, Project Management Plans (PMPs) have been developed which further define the scope and execution of the refurbishment program. The PMPs outline the specific objectives that the projects will accomplish, such as project planning, execution, monitoring and control, and project closure. The PMPs reference the relevant sections from the applicable PgMPs and will follow the requirements of OPG-PROG-0039, *Project Management*, OPG-PROG-0046, *Construction Management*, OPG-STD-0148 *Project Management Standard*, and the associated governance.

To ensure alignment between the Nuclear Refurbishment and Pickering NGS organization, both have set common goals and objectives. A structured process is in place to maintain control and responsibility throughout, which includes:

- An interface agreement to ensure safety of the plant, public and environment is maximized through clearly defined roles and responsibilities. This ensures the Refurbishment Program's objectives are successfully achieved while maintaining safe and reliable plant operations.
- Departmental organizational transfer plans that outline the specific responsibilities and activities required to transition a unit from the station to the Nuclear Refurbishment organization, and vice versa.
- A Resource Management and Staffing PgMP that defines the staffing strategies to be implemented for Pickering Refurbishment. The staffing plan for Pickering NGS Refurbishment will be less complex than Darlington NGS Refurbishment as all units will be offline.

This structured process will ensure that all station and refurbishment staff are aligned and have a clear understanding of the deliverables necessary to support the seamless transition of units between the station and the Nuclear Refurbishment organization.

Pickering NGS Units 5 to 8 site staff in the Operations and Maintenance organization will transition to the Pickering Refurbishment Program. Support from other OPG business units will be implemented via a "matrix" model (e.g. functional staff working in project teams). This support is identified as part of OPG's annual business planning process. Partnering and interface agreements will document and formalize the working relationships amongst all groups. Prior to Unit 5 return to service, the Operations and Maintenance organization and staffing will be restructured as presented in Section 2.1.2.

1.2.1.3 Refurbishment Timeline

The projected timeline for Pickering NGS Units 5 to 8 refurbishment is provided in Figure 5. The current licence (PROL 48.03/2028) authorizes Pickering NGS to operate Units 5 to 8 until December 31, 2026, after which the units will be shut down and placed in a layup state (defueled and dewatered) until they undergo refurbishment. The dates in Figure 5 are based on current refurbishment planning assumptions and are subject to change.

During refurbishment, work will focus on ensuring the credited safety-related systems are ready for an additional 30-plus years of safe operation.

The refurbishment of Pickering NGS Units 5 to 8 will involve engineering, design, and procurement activities, including securing long-lead components. This process will require removing and replacing selected reactor components, including pressure tubes, calandria tubes, feeder pipes, and steam generators. Additionally, the intent is to construct a Deep Water Intake (DWI) structure, similar to Darlington NGS, at Pickering NGS.

Similar to the Darlington NGS refurbishment, station improvements, enhancements, and maintenance will continue beyond the refurbishment window during planned unit maintenance outages and during normal operation.

Completion of refurbishment activities will ensure that Pickering NGS continues to operate safely and reliably for an additional 30-plus years.

Pickering NGS Timeline Overview

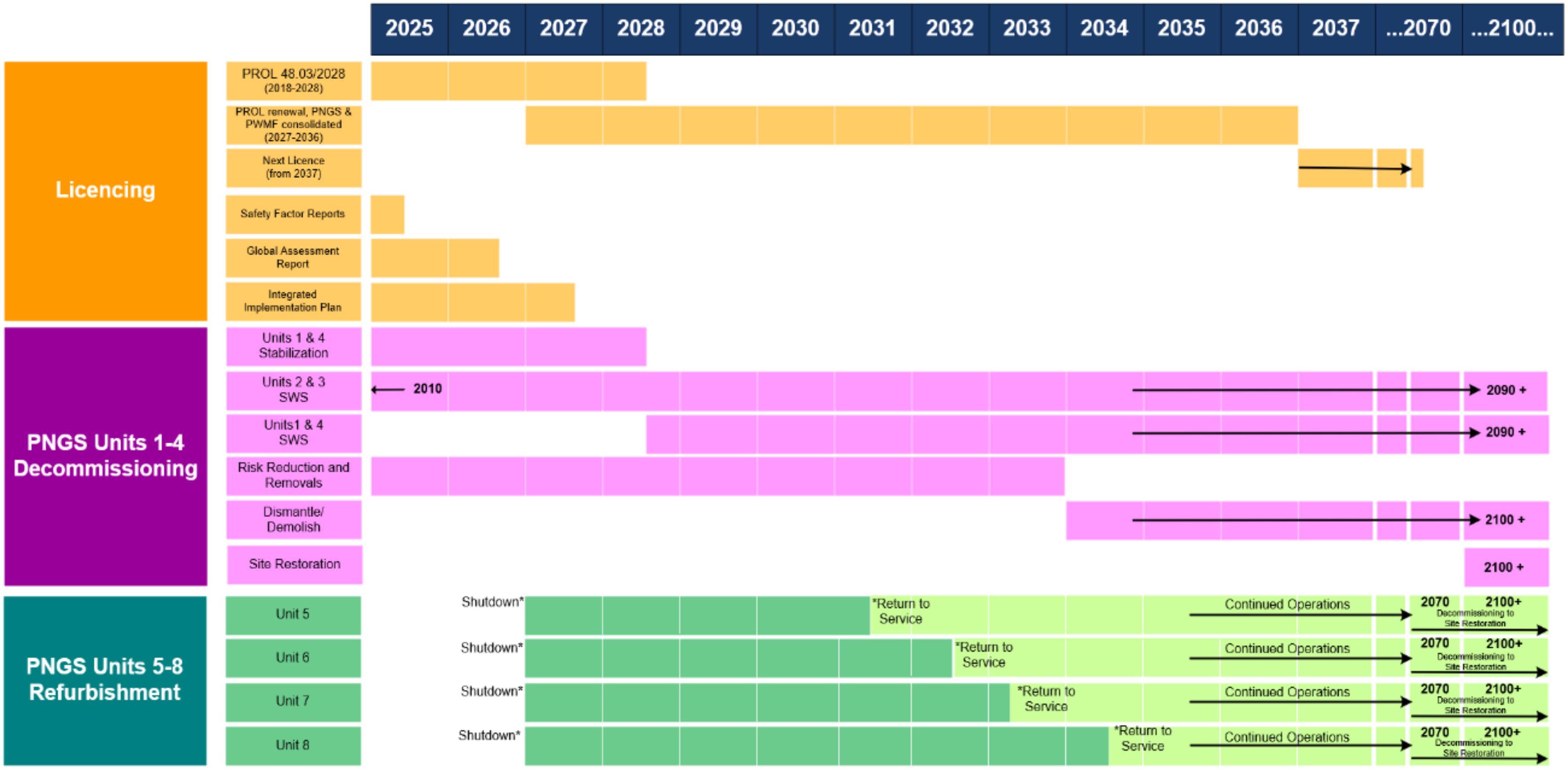

Figure 5. Pickering NGS Units 5 to 8 Planned Refurbishment Timeline

Other Facility Modifications and Enhancements

OPG is committed to safety improvements to the plant to ensure all safety goals continue to be met or exceeded. Studies conducted to identify areas for enhancement in nuclear safety have led to the identification of Safety Improvement Opportunities (SIOs). These SIOs represent planned modifications selected for their potential to enhance nuclear safety, based on deterministic safety analysis, probabilistic safety analysis, and/or hazard analyses. The SIOs are currently progressing through various design engineering phases to ensure that practical solutions can be implemented to achieve the expected benefits.

Some common services (e.g., service water, electrical systems, etc.), currently supplied by Pickering NGS Units 1 to 4 are essential to the operation of Pickering NGS Units 5 to 8. Due to the planned decommissioning of Units 1 to 4 and refurbishment of Units 5 to 8, to ensure operational independence between Units 1 to 4 and Units 5 to 8, these shared systems will be reconfigured. Modifications to systems are being considered to decrease the interdependencies between Units 1 to 4 and Units 5 to 8 following refurbishment. The scope of these modifications are planned to be carried throughout refurbishment and in the subsequent period to accommodate execution windows and critical refurbishment modifications.

1.2.1.4 Return to Service

Return-To-Service (RTS) involves returning the reactor and associated nuclear and non-nuclear systems to commercial operation. OPG must demonstrate that all regulatory requirements have been met and the associated work has been completed to the satisfaction of the CNSC. The *Pickering Refurbishment Program Management Plan – Return to Service*, NK30-PLAN-00120-00022, describes the processes, procedures and organization that will be used during the Pickering Refurbishment Project to manage the modification, commissioning and restart activities of Pickering NGS Units 5 to 8. This RTS plan and the RTS process documents are compliant with the CSA N286-12 *Management system requirements for nuclear facilities* and other applicable codes, standards, and laws.

The RTS activities will occur in 4 phases:

1. Phase A: restart activities prior to fuel load.
2. Phase B: fuel load and activities leading up to but not including Guaranteed Shutdown State (GSS) removal.
3. Phase C: Over-poisoned GSS removal, Approach to Critical and low power testing
4. Phase D: high power testing and power escalation to full power. During these phases, a test program will integrate:
    a. Normal start-up testing
    b. Outstanding modification commissioning tests
    c. Non-standard tests unique to a refurbishment outage. These may include the following:
        i. Fresh Core start-up activities
        ii. Fresh Core monitoring
        iii. Fresh Core testing
        iv. Testing of Reactivity Devices for commissioning and reactivity worth calculation.

Further details on the programs, procedures and other considerations for Pickering NGS Units 5 to 8 refurbishment activities are provided within each of the Safety and Control Area (SCA) discussions in Section 2 of this application.

1.2.2 Pickering NGS Units 1 to 4 Decommissioning

In December 2024, OPG submitted the DDP and SWS Plan for Pickering NGS Units 1 to 4. The DDP and SWS Plan were developed in accordance with PROL 48.03/2028 Licence Condition 11.2, CNSC REGDOC-2.11.2 *Decommissioning,* and CSA N294-19 *Decommissioning of Facilities Containing Nuclear Substances*. OPG provided opportunities for engagement on the DDP with the Williams Treaties First Nations Rightsholders. The Michi Saagiig Rightsholders have undertaken a technical review of the DDP. OPG welcomes any additional input and further engagement on the DDP with the Rightsholders. On June 26, 2025, CNSC staff accepted the SWS Plan and DDP for the removal of non-nuclear SSCs.

As described in the DDP, OPG has selected a deferred decommissioning strategy for Pickering NGS Units 1 to 4 based on an assessment of key factors outlined in CNSC REGDOC-2.11.2. Applying this strategy, Pickering NGS Units 1 to 4 will pass through four distinct phases:

1. Planning for Decommissioning – this phase occurred prior to the planned shutdown of Units 1 and 4 in 2024 and was captured in the Pickering Nuclear Site Preliminary Decommissioning Plan (PDP).
2. Preparation for Decommissioning – this phase includes activities for permanent shutdown and transition to SWS. Unit 1 and Unit 4 were permanently shut down in 2024 and have begun undergoing stabilization activities to transition from operation to SWS. This transition is currently planned to be completed in 2028.

   The period of stabilization is governed by the *Pickering NGS Stabilization Activity Plan (SAP)* (P-PLAN-00990-00007), which describes the arrangements and activities that ensure a safe and efficient transition from the end of commercial operation of Pickering NGS Units 1 and 4 to the SWS state. As per PROL 48.03/2028 Licence Condition 15.4, OPG provides SAP updates annually to CNSC staff.

   Stabilization activities include defueling the reactors and ensuring they cannot be refueled, draining the moderator and heat transport systems of heavy water, safe-stating and de-registering unit-specific nuclear and conventional SSCs as well as safe-stating and de-registering common station SSCs no longer required for the operation of the nuclear facility. SSCs will be removed from service once no longer required, placed in the end-state configuration and abandoned in place or removed. Inactive end-states are generally characterized as isolated from operational systems, drained and purged (if necessary) of gasses, fluids, transient combustible and hazardous material, de-energized and de-registered (as required). Systems will be drained and purged to reduce the fire loading as much as practical and to reduce the potential personnel or environmental hazards (present and future) associated with the system. Inactive systems will be isolated from operational systems to reduce the footprint of the system, as well as the need for supporting systems (e.g., heating, electrical).

   Other activities during stabilization include updating operational and maintenance procedures to reflect ongoing maintenance and monitoring requirements post-stabilization leading to SWS.
3. Execution of Decommissioning – this phase begins for each unit after it has been permanently shut down, stabilized and all necessary approvals have been obtained. OPG will perform the following activities during this phase:

a. Storage With Surveillance – The SWS timeframe will run until the last structures have been removed from the site. During SWS, the SWS Plan (NA44-PLAN-00960-00001) for Pickering NGS Units 1 to 4 will be implemented and updated to ensure the facility/site is maintained in a safe configuration and the SSCs needed to maintain safe storage are functioning as required.

   The SWS Plan is a subset of the DDP and describes the requirements for the care and maintenance of the facility equipment and substances until decontamination and dismantling actions are completed. The SWS Plan was prepared in accordance with the requirements of CNSC REGDOC-2.11.2 and CSA N294-19 and is based on the safety assessment completed as part of the DDP. Along with the DDP, OPG will review and update the SWS plan within five years of submission as required by REGDOC-2.11.2.

   The SWS plan details systems that are expected to remain active or partially active post-stabilization and are necessary for the SWS period, planned continued operation of Pickering NGS Units 5 to 8, or anticipated to be required for decontamination and dismantling activities at Pickering NGS. As hazards are removed and more systems reach their end states, maintenance requirements will decrease and the SWS program scope will gradually reduce.

   During SWS, the release of materials to the environment will be controlled, access by unauthorized persons will be prevented, and the infestations of vermin and other organisms will be mitigated so that decontamination, dismantling and/or cleanup can be carried out safely. Surveys of hazards will also be performed to support the safe performance of surveillance and maintenance activities during SWS. All facility modifications, including the process to place SSCs into inactive/abandoned status and managing active SSCs during SWS will follow OPG's existing Nuclear Management System.

   During this phase, OPG will also complete planned risk reduction activities per CNSC REGDOC-2.11.2 such as the removal of outbuildings and some non-nuclear components and systems.

b. Dismantling and Demolition – decontamination, dismantling and demolition of all Pickering NGS Units 1 to 4 SSCs, except the reactor buildings, is expected to take place over a nominal 20-year period starting in 2034. Removal of the reactor building structures will be deferred until Pickering NGS Units 5 to 8 are shut down after planned extended operation.

   OPG is applying a "lead-and-learn" approach to both risk reduction and dismantling activities. A "lead-and-learn" approach involves undertaking small-scale or initial tasks first, gathering insights from those experiences and continually refining methods and practices before scaling up. This approach will allow OPG to apply lessons learned and experience from early risk reduction work to the dismantling of non-nuclear components planned between 2034-2040, and then continue to build expertise for the dismantling of nuclear components and more extensive decommissioning beyond 2040.

   From 2034 to approximately 2040, dismantling operations are planned to complete the outbuilding and non-nuclear component removal work packages and pave the way for full-scale decommissioning. This schedule aligns with the anticipated completion of Pickering NGS Units 5 to 8 refurbishment, thereby allowing for shared resources and minimizing overlaps between the two major projects (decommissioning and refurbishment). Reactor removal is planned to start in the early 2050s.

c. Site Restoration – lands associated with the Pickering NGS Units 1 to 4 site that might have been impacted will be remediated to the degree required to meet the end-state criteria. OPG will engage with the WTFN regarding the end-state goals and criteria. At the completion of this phase, final surveys of residual radioactive and hazardous materials will be performed and documented to demonstrate the final end-state for remaining SSCs and the site has been achieved. By the end of the site restoration phase, the site will be free of industrial and radiological hazards. Currently, OPG is contemplating industrial reuse as the proposed end-state land use.

4. Completion of Decommissioning – this phase involves verifying that all decommissioning activities have been completed satisfactorily, the final end-state has been reached, and all documentation has been completed.

   Decommissioning ends with the release of the facility from CNSC regulatory control. If unrestricted release cannot be achieved, institutional controls will be required and OPG will submit post decommissioning plans to the CNSC for review. Note that OPG anticipates being able to achieve unrestricted release based on current decommissioning plans.

The full Pickering NGS Units 1 to 4 decommissioning scope is covered in eight DDP volumes to facilitate comprehensive planning and execution:

Table 6. Pickering NGS Units 1 to 4 Decommissioning Scope

Planning Envelope (PE)	Focus Area	Scope	DDP Volume
Program Overview	Pickering NGS Units 1 to 4	Decommissioning program description which covers all aspects of the decommissioning scope.	Volume 0
PE-A	Out Buildings Removal	Includes structures and systems within the protected area that are not part of the main Powerhouse	Volume 1*
PE-B	Non-Nuclear Component Removal	Removal of components and systems not considered a nuclear system.	Volume 2
PE-C	Nuclear Component Removal	Removal of components and systems that are considered part of a nuclear system (including Irradiated Fuel Bay-A and Auxiliary Irradiated Fuel Bay (AIFB))	Volume 3*
PE-D	Reactor Segmentation	Disassembly and removal of the reactor and internals	Volume 4*
PE-E	Powerhouse Structure	Removal of the Turbine Hall, Turbine Auxiliary and Reactor Auxiliary Bays structures, which make up part of the Powerhouse. This envelope also	Volume 5*

Planning Envelope (PE)	Focus Area	Scope	DDP Volume
		includes the Irradiated Fuel Bay-A and AIFB	
PE-F	Reactor Building Structural Demolition	Removal of the Reactor Building structure that make up part of the Powerhouse	Volume 6*
PE-G	Site Remediation	Remediation of the site within the protected area, including environmental clean-up and restoration.	Volume 7*

*Volumes 3-7 and PE-A3 from Volume 1 will be included in future submissions of the DDP.

Volume 0 (NA44-PLAN-00960-00004) provides the overall framework for Units 1 to 4 decommissioning and the SWS plan. It outlines the programmatic planning considerations and offers a broad perspective on the entire decommissioning process to be implemented for Units 1 to 4.

Volumes 1 through 7 cover Planning Envelopes (PE) A through G, respectively. The PEs encompass the entire decommissioning scope for Pickering NGS Units 1 to 4 and have been defined based on logical groupings of work based on physical location within the station and common characteristics. The PEs are further subdivided into PE groups and can be executed in parallel or sequentially as required.

Initial risk reduction and removal activities planned for the 2025-2033 timeframe are encompassed by DDP Volume 1 (PE-A) (NA44-PLAN-00960-00005) and Volume 2 (PE-B) (NA44-PLAN-00960-00006). PE-A focuses on the dismantling and removal of outbuildings, i.e., SSCs that are within the Pickering NGS Units 1 to 4 protected area but are not part of the main Powerhouse structure. PE-B focuses on the dismantling and removal of non-nuclear SSCs located within the Turbine Hall and Turbine Auxiliary Bay. Overall, OPG's plan per the current DDP is to focus on dismantling and removal of outbuildings and non-nuclear SSCs during the next requested licence period from 2027 to 2036.

Five years after the submission of the DDP, the DDP (Volume 0, Volume 1, Volume 2, and any active volume) will be reviewed and updated as per regulatory requirements. The DDP will be revised, as needed, to incorporate WTFN engagement feedback, newly active volumes, changes to regulatory requirements, internal and external operational experience and lessons learned, and technological advances in decommissioning technology.

Figure 6 provides an overview of the anticipated decommissioning activity timeline for Pickering NGS Units 1 to 4. This timeline may be further optimized as decommissioning activities progress.

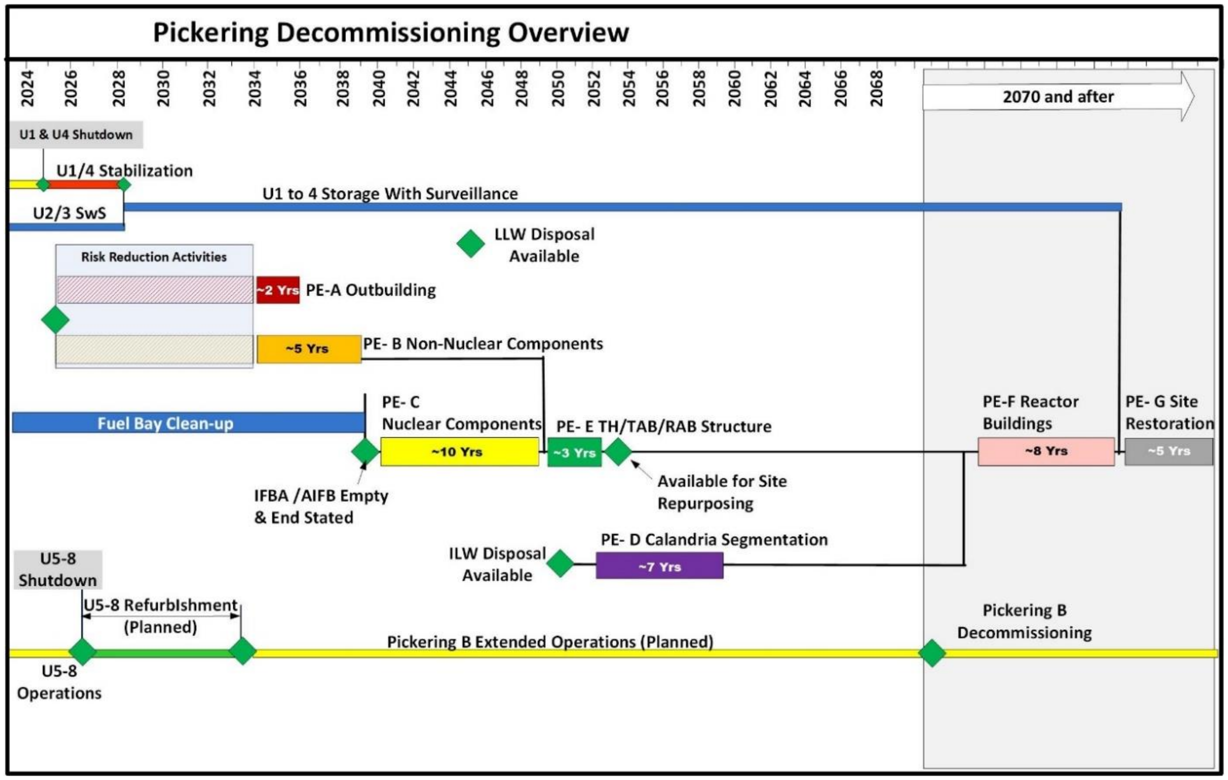

Figure 6. Pickering NGS Units 1 to 4 Decommissioning Timeline

1.2.2.1 Storage with Surveillance Period

In addition to ongoing maintenance and monitoring of operational SSCs within the station, the activities that are planned to continue during SWS include ongoing fuel transfers from the Irradiated Fuel Bays (IFBs) to dry storage.

Used fuel from Units 1 and 4 is stored in IFB ‘A’ and the Auxiliary IFB (AIFB) for an initial cooling period following defueling. Used fuel that has been stored in the IFBs for the required minimum cooling period will continue to be loaded into DSCs and transported to the PWMF for dry storage using the existing programs and procedures for the management of used fuel. The required fuel bay infrastructure and support systems will continue to be kept active and maintained as described in the SWS Plan. It is anticipated that by 2036 all the used fuel remaining in the IFBs will be transferred to dry storage.

The IFBs safely store a mix of intact, damaged and defective fuel along with non-fuel waste and used inspection equipment. A comprehensive clearance operation will be conducted which includes removing all fuel bundles, non-fuel waste and equipment as well as cleaning and draining the bays. Once emptied, the IFBs will transition to the decommissioning and dismantling phase, ensuring a safe and efficient progression in the overall decommissioning process. CNSC and IAEA safeguards arrangements for the bays will be maintained until all used fuel has been removed from the IFBs.

As described in the DDP, the decommissioning of the IFBs will follow a phased approach. Phase 1 addresses the ongoing loading of used intact fuel bundles into DSCs. This activity has been ongoing throughout the operating life of the station and will continue through stabilization and into SWS. As fuel is removed, empty baskets and associated frames will be removed from the IFBs and disposed of using existing waste routes. This work will be undertaken to create space for installing equipment necessary for inspecting the fuel.

Phase 2 addresses the handling of damaged and defective fuel in the IFBs. A small amount of damaged/defective fuel has been safely managed and stored in baskets and modules in the fuel bays since the beginning of Pickering NGS operation.

The process for inspecting and removing damaged and defective fuel will incorporate operational experience from Hydro Quebec's Gentilly-2 and leverage the canning process previously approved by CNSC for use at Gentilly-2. Canning is a specialized containment method for managing damaged or degraded nuclear fuel. In 2021, Hydro Quebec completed canning of damaged/defective fuel in Gentilly-2 by remotely canning the fuel underwater. This successful initiative was completed under a Conexus Nuclear Inc. (formerly CANDU Owners Group (COG)) joint project led by Nuclear Waste Management Organization (NWMO).

OPG plans to implement a similar system that is designed for a higher processing rate. The canning system will be installed underwater in the bay and encapsulate one bundle at a time. The underwater remote encapsulation process will include drying the fuel, filling the can with inert gas and welding the can. This will be followed by remote visual inspection of the weld.

Once the canning is complete, the canned fuel will be loaded into modified modules. After loading the modified module with the canned fuel, the modified module will be loaded into a DSC for storage at the PWMF. Analyses and evaluations will be conducted to determine the impact on DSC structural, thermal, and shielding performance. The DSC loaded with modified modules will be processed and stored following the existing DSC processing steps (vacuum drying, welding, helium leak testing, etc.). The DSC containing encapsulated damaged/defective fuel will have less canned fuel due to their size compared to the intact fuel DSC which contains 384 intact fuel bundles. See Section 2.13.6 for additional details regarding Safeguards provisions for canned fuel.

The canning system and module modification and any required modifications to the DSC will be conducted in accordance with OPG's ECC process. Currently this project is in the preliminary design phase, further details and safety analysis will be provided to CNSC staff as the project progresses for the storage of damaged and defective fuel in DSCs. OPG plans to begin the canning of damaged/defective fuel by approximately 2030, with transfer to dry storage by approximately 2034.

Phase 3 of the IFB decommissioning approach addresses the removal of remaining Low and Intermediate Level Waste from the IFBs. For the removal of operational non-fuel components and materials stored in the fuel bay, tooling and underwater containers are being developed to process and remove the waste from the bays between 2027 to 2039. OPG will follow its existing Nuclear Management System to implement any changes required for these activities.

Phase 4 focuses on the cleaning and draining of the IFBs. As documented in the current DDP, IFB-A is planned to be drained by 2034, followed by the AIFB by 2041. Further details on this activity will be addressed in future submissions of the DDP.

1.2.2.2 Decommissioning Waste Management

As outlined in the DDP (Volume 0), Waste Management Plans (WMPs) will be developed for all waste generated during decommissioning activities. Depending on the complexity of the activity, a WMP could be developed for a PE or a specific work package and the associated waste volume estimates will be provided in the respective PE DDP volume. The WMP will use the conventional and radiological characteristics determined during scoping/characterization activities to document the approach for handling waste throughout the decommissioning process.

WMPs for PE-A and PE-B activities are provided in DDP Volumes 1 and 2, respectively. Waste generated from these decommissioning activities is expected to be comprised largely of conventional solid waste. A small volume of Low-Level Waste (LLW) may be generated. All decommissioning waste will be managed in accordance with Pickering NGS's existing Waste Management programs (see Section 2.11 (SCA 11)).

Further details on the programs, procedures and considerations for Pickering NGS Units 1 to 4 decommissioning activities are provided within each of the SCA discussions in Sections 2 of this application.

1.3 Station Performance

Throughout the current licence period, Pickering NGS has continued to demonstrate strong safety performance. OPG has received the Electricity Canada President's Award of Excellence for Employee Safety – Generation for seven consecutive years (2018-2024). The award recognizes OPG's top quartile performance for both total recordable injury frequency and lost time injury severity rates, underscoring our long-standing dedication to health and safety in the workplace.

Station reliability continues to improve due to strategic investments and enhancements made during the current licence period. These efforts have resulted in significant improvements in Fuel Handling reliability, Work Protection, Outage Management and Equipment Reliability. In 2023, Pickering NGS was recognized by an international nuclear organization highlighting the station's ability to operate at the highest levels of performance.

In 2024, following a planned multi-decade contribution to Ontario's power grid, Pickering NGS Units 1 and 4 were safely removed from service and stabilization activities are underway to place the units in SWS. On its final day, Pickering NGS Unit 1 was one of the best performing operating plants in North America for equipment reliability based on unplanned shut downs, forced outages, and availability of key safety systems as measured by industry accepted indicators.

Through ongoing investments, innovations and the efforts of our employees, Pickering NGS exhibits a strong safety and operational performance. This track record reflects the diligence and passion for excellence that all personnel are committed to on a daily basis in support of the safe and reliable operation of the station.

In 2019 and 2024, Pickering NGS was awarded a Business Excellence Award by the Ajax Pickering Board of Trade, recognizing the station's continued commitment to innovation in governance and overall business excellence.

Integrating the use of new technology remains a key focus area. In 2024, Pickering Radiation Protection (RP) and X-Labs team members received the Canadian Nuclear Society (CNS) Innovation Achievement Award for developing and implementing a groundbreaking shielding process using Additive Manufacturing (AM) to custom print tungsten material. This approach not only addressed the challenges of shielding system components with difficult configurations or demanding environment scenarios, but it also minimizes radiological exposure to workers, setting new standards in RP and operational efficiency at the stations. AM or 3D printing solutions continue to be increasingly leveraged, including as a manufacturing solution for custom robotic tooling needed for emergent station requests such as repositioning a circuit breaker shutter.

OPG was also recognized by Electricity Canada with the Centre of Excellence Award in 2024 for its 3D laser scanning program. The use of remote tooling such as drones and robots continues to enhance safety, with a LiDAR mapping drone deployed to complete detailed laser scans in preparation for Pickering NGS Refurbishment, and a radiation mapping drone using LiDAR navigation to safely inspect the Unit 8 vault during operation.

OPG's in-house developed sensor platform also continues to be expanded to support station temperature, vibration, and battery monitoring requests, to assist Operations and Engineering staff with online sensor data for their equipment.

OPG is also committed to the safe handling and management of waste and radioactive materials. Throughout the current licence period, OPG continued to safely and reliably transfer, process, and store used fuel in DSCs from the Pickering NGS to the PWMF. The PWMF has operated safely without a Lost Time Accident for all 30 years the facility has been in operation (since 1994). There have been more than 1,300 on-site transfers of loaded DSCs without incident, with 421 DSCs processed and stored between 2018 and 2024 and with dose to the public from the operation less than 1% of the regulatory limit.

OPG's continual investment in innovative technologies continues to improve planning, increase safety, minimize radiological exposure, and reduced carbon emissions. The strong performance of the Pickering NGS and PWMF is also evident in the numerous community and industry recognitions and awards received over the years, reflecting the exceptional high standards upheld by OPG and our dedicated staff.

1.4 Our People

At OPG, we are growing stronger every day because of the talent, skill, and knowledge of our increasingly diverse team of employees. OPG values the importance of a diverse, engaged workforce and we are proud to be an equal opportunity employer that actively seeks applicants from a variety of backgrounds.

In 2021, OPG launched its first ever Equity, Diversity and Inclusion (ED&I) strategy; a 10-year strategy to become a global leader in ED&I best practices. This ambitious strategy identifies nearly 100 initiatives and 15 strategic priorities to be carried out across the enterprise by 2030, including:

- OPG's Indigenous Opportunities Network (ION) program is a collaboration between OPG, the Electrical Power Systems Construction Association and Kagita Mikam Aboriginal Employment and Training. The three partners actively work with unions and vendors to find employment for Indigenous people in the energy sector. Since launching the program in 2018, 209 ION participants have been placed.
- Partnering with the BlackNorth Initiative to launch a nationwide science, technology, engineering and mathematics recruitment platform to connect BlackNorth candidates with internship, mentorship and career opportunities across the sector.
- OPG's 2021 Reconciliation Action Plan (RAP), which includes three commitments, such as providing resources to all OPG employees to increase knowledge, understanding, and learning of Indigenous culture under its "People" pillar. The People pillar was established to create an engaged and inclusive workforce that reflects the broad diversity of Indigenous Nations, communities and peoples across the company.
- Establishing anti-racism training for all OPG employees (achieved in 2023).

Notably, in 2022 OPG made history with an all-women led crew of CNSC-licensed Control Room Shift Supervisors and Shift Managers at the Pickering NGS. OPG's employees are helping us drive our ED&I strategy forward and fostering a more inclusive workplace by getting involved and increasing awareness through numerous employee resource groups including the Abilities Alliance, Indigenous Circle, PRIDE Group, Racial Equality, and Women's Employee Resource Group. Employees have access to additional learning opportunities through various groups and partnerships including Women in Nuclear, North American Young Generation in Nuclear, the Canadian Centre for Diversity and Inclusion, and Pride at Work Canada.

These initiatives and more have led to OPG being named one of Canada's Best Diversity Employers in 2023, an award that recognizes employers across Canada for exceptional workplace ED&I programs.

1.5 Innovation at OPG

Pickering's advancements in innovation are driven by initiatives supported through OPG's Monitoring & Diagnostics (M&D) Centre, X-LAB, and innovations in training.

OPG's Monitoring and Diagnostics Centre

Established in 2017, the M&D Centre leverages data analytics and continuous remote monitoring to closely observe key components, utilizing over 2,400 Advanced Pattern Recognition models and analyzing approximately 20,000 data points across the OPG fleet. The M&D Centre plays a crucial role in early detection, supporting the condition-based maintenance strategy, ensuring maintenance is performed when needed. Additionally, the M&D Centre offers thermal performance monitoring for Pickering NGS, helping to reduce generation losses from the turbine cycle.

In 2022, the M&D Centre received the Canadian Nuclear Society Innovative Achievement Award in recognition of significant innovative achievements and the implementation of new concepts displaying clear qualities of creativity, ingenuity and elegance in the nuclear field in Canada. Additionally, the M&D Centre has also benchmarked against various utilities through organizations such as Electric Power Research Institute (EPRI) and has been recognized as one of the industry leaders, leveraging data analytics to enhance plant reliability and to minimize generation loss.

OPG's Innovation Department (X-Lab)

OPG's innovation department, coined the "X-Lab", was also established in 2017. The X-Lab is dedicated to transforming perspectives, fostering creativity, and implementing cutting-edge technologies and processes. These initiatives have brought value and efficiency to OPG's daily operations, while advancing the company towards its net-zero climate goals. The X-Lab Innovation team spearheads innovation in the utility sector with a mission to redefine standards. The team's vision is to drive enhancements in equipment reliability, safety, and employee efficiency while nurturing an innovation culture.

In 2023, the EPRI Global Innovation Effectiveness (GIE) Cohort reviewed OPG's innovation practices and processes and recognized the X-Lab Innovation Team for industry-leading practices. GIE aims to provide insights into the effectiveness of innovation by examining how utilities strategize, structure, and cultivate an innovative culture.

Through X-Lab, OPG also demonstrates industry leadership in robotic utilization through the adoption of the Spot Robotics Platform by Boston Dynamics. This platform drives efficiency while maintaining OPG's high level of executional excellence and safety. The Spot robot has

enabled OPG to perform tasks online, and in harsh environments that would otherwise require a unit outage to perform safely by a human. Extensive use of robotics for investigations of high dose rate areas result in accumulated dose savings. Additionally, the X-Lab supported the implementation of micro-drones for operation, enabling lightweight drones to be utilized by staff. This allows for visual inspections to be performed more efficiently.

The X-Lab also encourages employee engagement through an internal cloud-based idea management system, Launchpad, to capture innovative ideas from employees across OPG. Ideas are visible to all employees who can then vote, comment, and collaborate to develop ideas into actionable projects. The X-Lab team ensures every voice is heard, fostering an environment where ingenuity thrives.

By empowering employees and facilitating seamless collaboration, the X-Lab Innovation Team remains committed to shaping the future of energy delivery, setting new benchmarks for innovation in the process.

Innovative Strategies for Training

OPG's Training strategies have innovation embedded in its program through use of various simulators:

- The updated Fuel Handling Simulators provide Operators with the opportunity to enhance their proficiency in fuel handling activities within a low-risk environment. The Fuel Handling team has leveraged the simulator to expose Operators to improved procedures.
- Operations Training instructors improve Fuel Handling Major Panel Operator and Field Operator defueling performance by delivering Just-in-Time Training (JITT) utilizing full scope and glass top simulators. The updated glass top simulators allow Operators to become more proficient in fuel handling activities all while working in a zero-risk environment. A glass top simulator has also been placed in the Administration Building, allowing staff to train and practice scenarios without leaving the protected area to come to the training facility. As well, the Fuel Handling team has utilized the simulator to not only expose the Operators to enhanced procedures but to fine tune the flow of what are now first-of-a-kind procedures.
- The Virtual Reality Crane Simulators serve as an advanced tool for maintenance training instructors, significantly enhancing crane operator performance.

  Maintenance Training instructors improve crane operator performance by incorporating a virtual reality (VR) simulator into crane operator training. Training material improvements include the incorporation of simulated scenarios such as precision lifts, crane failures, and risk management decision points. The VR crane simulator offers a learning opportunity that is personalized, on-demand and realistic. By integrating virtual reality technology into crane operator training, the simulators offer a safe environment where operators can encounter conditions typically experienced only after many years in the field.
- The full scope Boeing 737-800NG Flight Simulator for human performance training immerses individuals in an unfamiliar environment, enabling them to fully appreciate the advantages of human performance tools and techniques while managing distractions and competing priorities. This approach allows individuals to practice safely, learn from mistakes, and enhance their proficiency in utilizing human performance tools.

The course introduces the trainees to the psychology behind the Human Performance tools. Following completion of the theoretical classroom portion, the trainees are provided an opportunity to practice the Human Performance tools/techniques using various interactive simulations in a flight simulator. This places the trainee in an unfamiliar environment, different from the station, where they are able to observe the full benefits of the Human Performance tools/techniques while being challenged with distractions and competing priorities.

- RP training has improved RP technician performance by incorporating a Simulated Radiological Source Generator into their continuing training. A radio frequency simulated source eliminates actual live radiological sources. Technicians are demonstrating greater radiological risk mitigation proficiency while eliminating any exposure to radiological sources. The simulation equipment includes portable wireless dosimeters, survey meters, gamma sources and scenarios that mimic conditions that were unachievable in previous training conditions.

1.6 Indigenous Engagement

1.6.1 Indigenous Engagement

OPG respects Aboriginal and treaty rights and is committed to developing positive relationships with Indigenous Nations and communities. OPG's Indigenous Relations Policy, OPG-POL-0027, provides a framework for engagement with Indigenous Nations and communities and provides support of community programs and initiatives. As part of its Indigenous Relations Policy, OPG maintains an Indigenous Relations program for its nuclear operations with the goals of:

- Keeping Indigenous Nations and communities with established and/or asserted treaty and/or Aboriginal rights and those that have expressed interest informed of nuclear station operations, emerging projects and station environmental performance;
- Seeking the input and worldviews of Indigenous Nations and community representatives about OPG's ongoing nuclear operations and projects, and;
- Addressing any identified concerns, as appropriate.

OPG is committed to engaging with Indigenous Nations and communities regarding nuclear operations as well as proposed future initiatives at Pickering NGS.

As recommended in CNSC REGDOC-3.2.2, *Indigenous Engagement*, this section contains:

- An initial review to consider whether the activities described in this licence application could result in potential impacts to the environment and/or an Indigenous groups' potential or established Aboriginal and/or treaty rights;
- An overview of OPG's efforts to identify and create an initial list of Indigenous groups whose potential or established Aboriginal and/or treaty rights may be adversely affected by the proposed activities in the licence application;
- A summary of Indigenous engagement activities conducted to date;
- A description of proposed and planned Indigenous engagement activities through the licencing process; and
- A proposed schedule for interim reporting to the CNSC on Indigenous Engagement through the licencing process.

1.6.1.1 Commitment to Reconciliation

OPG has a long history of developing respectful and collaborative relationships and is committed to taking concrete and measurable actions to advance reconciliation with Indigenous peoples and to report regularly on the company's activities and progress in achieving established goals.

OPG launched its RAP in the fall of 2021, which outlines OPG's commitment to advancing reconciliation with Indigenous peoples under the focus areas of leadership, relationships, people, economic empowerment, and environmental stewardship. The RAP is a public document that serves as a roadmap to reconciliation and the 2021 edition included 38 specific actions and commitments with clear deliverables and timelines spanning between 2022 and 2031. Some key highlights and achievements since the 2021 Reconciliation Action Plan was developed include:

- Since 2022, OPG has awarded $198 million in Indigenous contract awards and $39.4 million in equity distributions to Indigenous partners.
- Programs are offered to Indigenous employees to promote their career path development.
- Developing and initiating an Indigenous Relations training program to build Indigenous relations awareness and cultural competence across the organization.
- Overall, in 2023, OPG invested a total of nearly $600,000 in Indigenous initiatives, including a sponsorship for the annual Indspire Awards, which recognize Indigenous excellence.
- In September 2024, OPG was recertified with the Gold Designation from the Canadian Council for Indigenous Business through its Partnership Accreditation in Indigenous Relations Program.
- The ION program began in 2018 with the goal of placing Indigenous candidates into trades and non-trades roles within OPG and vendors and unions in the energy sector. To date, ION has placed 209 Indigenous candidates. So far in 2025, 36 candidates have been hired with a goal of 70 this year.

OPG is proud of how far it has come as a company, while also recognizing that there is still much more to do to advance reconciliation. In the spirit of driving change across the industry and holding firm on our commitment to advancing reconciliation, OPG refreshed the RAP in July 2024. The refreshed RAP includes a recap of OPG's progress on its goals through 2021-2023 and the addition of 20 new commitments that were developed through internal discussions and input from Indigenous Nations, communities and businesses.

1.6.1.2 Preliminary Assessment of Impacts

OPG has undertaken an initial assessment to determine whether the continued operations, refurbishment and decommissioning activities for which OPG is seeking authorization in this licence application may give rise to novel impacts on established or asserted Aboriginal and/or treaty rights. In undertaking this initial assessment, OPG considered potential impacts to Aboriginal and/or treaty rights that may result from:

- Radiation from ongoing safe storage operations (continued operations), restart and operations of Units 5 to 8 post-refurbishment (refurbishment and continued operations) and certain dismantling and demolition activities for Units 1 to 4 (decommissioning).

- Dust, noise and particulate emissions from site preparation and construction activities (continued operations, refurbishment and decommissioning).
- Impacts to aquatic habitat from construction and operation of a deep-water intake structure (refurbishment).
- Impacts to water quality from dismantling and demolition activities (decommissioning).

OPG also assessed the significance and likelihood of the potential impacts by considering the spatial extent of the proposed activities as well as assessing the nature, degree and duration of the potential impacts.

From OPG's perspective, there are specific activities, like the construction of the deep-water intake structure, that may result in certain novel impacts on established or asserted Aboriginal and/or treaty rights.

For the construction of the deep-water intake structure in support of refurbishment, OPG's assessment that there may be novel impacts on established or asserted Aboriginal and/or treaty rights is based on:

- The location of the proposed deep-water intake structure being outside of the Pickering NGS protected area, in an area of the lakebed that has not been disturbed previously and in an area accessible to Indigenous Rightsholders by boat.
- The potential for shoreline modifications in support of construction (e.g. dock dredging, infill, and material disposal), which could adversely impact quality and availability of fish habitat.
- The potential presence of marine archaeological and/or cultural heritage resources.
- There are air and noise emissions associated with deep-water intake construction (launch shaft and tunnel, infill, equipment).
- During tunneling activities, a large volume of spoils will be excavated. Spoils management options are being explored and a spoils management plan will be developed.

OPG anticipates that future benefits associated with the proposed deep-water intake structure would reduce impacts from present practices. OPG will ensure that Indigenous Nations and communities are provided information on the anticipated benefits of the deep-water intake structure.

With respect to continued operations, decommissioning and other refurbishment activities included in the application, OPG's assessment that these activities are anticipated to give rise only to minimal novel impacts to established or asserted Aboriginal and/or treaty rights is based on:

- The location of operations, decommissioning and refurbishment activities are within a previously developed area of the Pickering NGS site, a site that is already heavily disturbed and inaccessible.
- The predicted radiation dose to the Harvester receptor is 1.24 μSv/a, which is well below the regulatory public dose limit of 1,000 μSv/a (i.e., 0.12% of the limit).
- Although wildlife in the area are accustomed to noise levels associated with an urban environment, there may be an increase in noise associated with decommissioning and refurbishment activities.

- No radiological atmospheric emissions are expected during the proposed dismantling and demolition activities as most of the dismantled equipment will not be from radiological systems or from systems likely to be radiologically contaminated.
- Vehicle traffic associated with transporting dismantled material off-site will be similar to or slightly higher than traffic associated with current operations.
- Ambient air quality exceedances are expected to remain largely localized to the Pickering site where dust suppression measures will be implemented to minimize dust and particulate emissions.
- Potential impacts to surface water quality from dismantling activities will be minimized through OPG's spill management protocols and construction best practices.
- Potential impacts to fish and fish habitat due to the potential release of contaminants into surface water will be effectively mitigated through OPG's spill management protocols, by ensuring all dismantling activities occur in controlled areas with proper containment systems.
- Potential impacts to soil and groundwater from potential spills will be minimized through OPG's spill management protocols and by having spill recovery equipment and procedures in place prior to commencement of and during decommissioning activities.
- Following refurbishment, Units 5 to 8 will operate in a manner consistent with existing operations.

OPG emphasizes that this assessment is preliminary in nature and may evolve as OPG's site planning efforts advance, the engagement process unfolds, and/or based on the Crown's assessment of consultation obligations. OPG is committed to proactively engaging with Indigenous Nations and communities to inform OPG's understanding of how the activities in this application may impact established or asserted Aboriginal and/or treaty rights, and address those impacts through avoidance, mitigation and accommodation measures, as appropriate.

1.6.1.3 Identified Nations and Communities

Engagement on the Pickering Site PROL and WFOL renewal is focused on the WTFN Rightsholders in whose treaty and traditional territory Pickering NGS is located. In consideration of CNSC REGDOC-3.2.2*, Indigenous Engagement*, OPG also engages with Indigenous Nations and communities that assert treaty and/or Aboriginal rights, as well as other Indigenous Nations and communities who do not assert Aboriginal or treaty rights, but who have expressed an interest in our operations at Pickering.

In the tables below, OPG has identified Indigenous Nations and communities that have established Aboriginal and/or treaty rights, have asserted Aboriginal and/or treaty rights, or have expressed an interest in Pickering Site. The below lists were developed based on consulting the Government of Canada's Aboriginal and treaty Rights Information System, previous engagement and relationship building efforts with Indigenous Nations and communities, information shared by the CNSC on previous licence and renewal applications at Pickering NGS and engagement lists previously provided by provincial and/or federal agencies.

Aboriginal and treaty rights refer to those rights that are recognized and affirmed in section 35 of the *Constitution Act, 1982.* For the purposes of the Duty to Consult, both established and potential rights are considered. Indigenous Nations and communities identified in Table 7 have established treaty rights in the Pickering area that have been acknowledged by the Crown.

Table 7. Identified Indigenous Nations/Communities with Established Aboriginal and/or Treaty Rights

Indigenous Nation/ Community	Reason for Engagement
Mississaugas of Scugog Island First Nation	Rightsholder, and Pickering NGS is within their traditional and treaty territory.
Curve Lake First Nation	Rightsholder, and Pickering NGS is within their traditional and treaty territory.
Hiawatha First Nation	Rightsholder, and Pickering NGS is within their traditional and treaty territory.
Alderville First Nation	Rightsholder, and Pickering NGS is within their traditional and treaty territory.
Chippewas of Rama First Nation	Rightsholder, and Pickering NGS is within their traditional and treaty territory.
Chippewas of Beausoleil First Nation	Rightsholder, and Pickering NGS is within their traditional and treaty territory.
Chippewas of Georgina Island First Nation	Rightsholder, and Pickering NGS is within their traditional and treaty territory.

Aboriginal and treaty Rights refer to those rights that are legally recognized and affirmed in section 35 of the *Constitution Act, 1982.* For the purposes of the Duty to Consult, both established and potential rights are considered. Indigenous Nations and communities identified in Table 8 have claimed Aboriginal and/or treaty rights in the Pickering NGS area but have not had these potential rights established in court or acknowledged by the Crown.

Table 8. Identified Indigenous Nations/Communities with Asserted Aboriginal and/or Treaty Rights

Indigenous Nation/ Community	Reason for Engagement
Kawartha Nishnawbe	Asserted Aboriginal and/or treaty rights where Pickering NGS is located.

Indigenous Communities identified in Table 9 do not claim Aboriginal or treaty rights, but have expressed an interest in the project, will be provided with information as the project progresses.

Table 9. Identified Indigenous Nations and Communities Expressing an Interest

Indigenous Nation/ Community	Reason for Engagement
Six Nations of the Grand River	Has expressed interest in OPG nuclear operations and projects at Pickering NGS.
Métis Nation of Ontario Regions 8	Has expressed interest in OPG nuclear operations and projects at Pickering NGS.
Mohawks of the Bay of Quinte	Has expressed interest in OPG nuclear operations and projects at Pickering NGS

Indigenous Nation/ Community	Reason for Engagement
Huron-Wendat Nation, Quebec	Has expressed historical significance of traditional territory in Pickering area.
Saugeen Ojibway Nation comprised of Saugeen First Nation and Chippewas of Nawash Unceded First Nation (Nawash)	Has expressed interest in transportation and storage of waste from Pickering NGS within their traditional and treaty territory.
Mississaugas of the Credit First Nation	Has expressed interest in OPG nuclear operations and projects at Pickering NGS.

1.6.1.4 Engagement Framework and Approach

OPG has established Framework Agreements with Alderville First Nation, Curve Lake First Nation, Hiawatha First Nation, the Mississaugas of Scugog Island First Nation and the Six Nations of the Grand River. The Framework Agreements allow for dedicated time and capacity funding to support ongoing engagement on OPG's nuclear and renewable generation operations. OPG recognizes that meaningful engagement begins with relationship-building, the establishment of trust and is committed to respect, openness and transparency in building these relationships. In the context of this specific application, OPG built an engagement plan with Indigenous Nations and communities to increase collaboration and deepen engagement with respect to the Pickering NGS. In January and February 2024, OPG developed a draft Indigenous Engagement Plan (IEP) to guide engagement activities on ongoing and proposed programs and initiatives at Pickering NGS, including engagement on OPG's PROL and WFOL renewal application. This comprehensive IEP was informed by CNSC REGDOC-3.2.2, *Indigenous Engagement*, and was developed based on comments from Indigenous Nations and communities for a site wide engagement strategy that supports a holistic, comprehensive and coordinated approach to engagement across the Pickering NGS.

Indigenous Nations and communities identified in the draft IEP, at the time of drafting, received a copy for review and comment. In May 2024, OPG updated the IEP based on feedback received from Indigenous Nations and communities and issued a final working version of the IEP in late May and June 2024. For Indigenous Nations and communities that provided substantive comments on the IEP, OPG prepared comment disposition tables to demonstrate how comments did or did not influence the IEP update. The IEP is intended to be a dynamic document and, as such, can continue to be updated, as appropriate, to respond to new comments that come forward from Indigenous Nations and communities and/or any shifts in engagement priorities and needs. As an example, a revised working version of the IEP was issued in January 2025 to reflect additions made to the list of Indigenous Nations and communities that have expressed interest in the Pickering NGS.

To date, Pickering Site has provided PROL and WFOL information and invited the Indigenous Nations and communities identified in Table 7, Table 8, and Table 9 to engage on OPG's licence renewal application and any other engagement opportunities of interest.

1.6.1.5 Summary of Engagement Efforts and Activities to Date

In addition to the Pickering IEP, OPG has made efforts to share and engage on the Licence Renewal Application as well as ongoing and proposed activities at Pickering NGS. A high-level overview of OPG's engagement efforts and activities are further detailed below in Table 10, Table 11 and Table 12.

Table 10. Williams Treaties First Nations (WTFNs) Rightsholders

Community	Summary
Alderville First Nation	• OPG letter sent in March 2023 with context about nuclear power, the Pickering station, past technical feasibility assessments for refurbishment, a statement of planned feasibility assessment, key milestones, invitation to tour the Pickering facility, and commitment to ongoing engagement. • Multiple meetings in 2023 discussing Pickering NGS feasibility assessment and refurbishment activities including decommissioning. • Shared draft Pickering IEP for review and comment in January 2024. Final working version of IEP shared in May 2024. Update shared in January 2025. • OPG email sent in June 2024 providing opportunities to monitor during Predictive Environmental Risk Assessment at the Pickering NGS. • OPG and Michi Saagiig Waste Table (August and October 2024 and January, March, and May 2025). • The May 2025 Waste Table meeting was used as an opportunity to provide a workshop on the DDP. • OPG and Michi Saagiig Pickering Engagement Table (October & November 2024). • Executed Pickering Memorandum of Understanding (MoU) to provide capacity funding in November 2024. • Communicated a Detailed Decommissioning Plan briefing note in October 2024. • Draft Detailed Decommissioning Plan shared in November 2024 for review and feedback. Comments received in April 2025 following Michi Saagiig Nations request to hire a third-party reviewer to support their review. • Predictive Environmental Risk Assessment (PERA) for Pickering Component Storage Structure (PCSS) shared in November 2024. MSIFN comments received in April 2025 and OPG responses to MSIFN comments shared in May 2025 with all Michi Saagiig Nations. Revised PCSS PERA shared with all WTFN in June 2025. • Framework meetings throughout 2024 to discuss Pickering NGS PROL and WFOL activities. • OPG and Michi Saagiig Pickering Engagement Table (February, March, April, May, and June 2025). • Representatives attended tour of the Pickering NGS in March 2025.

Community	Summary
	• Predictive Environmental Risk Assessment and Climate Change Vulnerability and Assessment Summary Report for Pickering Nuclear shared in April 2025. • Briefing note to support key aspects of the DDP sent in April 2025. • Supporting an ongoing stage 1 terrestrial archaeology assessment at the Pickering NGS and site visit in April 2025 at request of the Michi Saagiig Nations. • OPG email sent in March 2025 suggesting meeting to further discuss engagement on the PROL and WFOL relicensing and related activities. • Engagement approach pathway for PROL and WFOL. OPG shared an early draft of the PROL and WFOL licence renewal application and memo that provided a summary of the PROL and WFOL renewal application with Michi Saagiig Nations mid-May 2025, based on feedback received in April on Nations' priorities. • Meetings in May 2025 with the Michi Saagiig Nations to discuss Deep Water Intake marine archaeology path forward and next steps.
Beausoleil First Nation	• OPG letter sent in March 2023 with context about nuclear power, the Pickering station, past technical feasibility assessments for refurbishment, a statement of planned feasibility assessment, key milestones, invitation to tour the Pickering facility, and commitment to ongoing engagement. • Shared draft Pickering IEP for review and comment in January 2024. Final working version of IEP shared in May 2024. Update shared in January 2025. • Attended Pickering Engagement meeting in March 2024. • Predictive Environmental Risk Assessment (PERA) for Pickering Component Storage Structure (PCSS) shared in December 2024. Revised PCSS PERA shared with all WTFN in June 2025. • Communicated a Detailed Decommissioning Plan briefing note and opportunity to review the Detailed Decommissioning Plan, in November 2024. • Continued follow-up via email and phone throughout 2024 attempting to provide opportunity to engage on Pickering NGS PROL and WFOL activities. • OPG email sent in November 2024 informing OPG's intent to apply for a consolidated Pickering PROL and WFOL and offer for further engagement. • OPG email sent in January 2025 informing OPG is working towards submitting the PROL and WFOL application in Q2 2025. • OPG email sent in March 2025 sharing Pickering updates.

Community	Summary
	• Predictive Environmental Risk Assessment and Climate Change Vulnerability and Assessment Summary Report for Pickering Nuclear shared in May 2025.OPG email sent in June 2025 sharing a memo that provided a summary of the PROL/WFOL renewal application.
Curve Lake First Nation	• OPG letter sent in March 2023 with context about nuclear power, the Pickering station, past technical feasibility assessments for refurbishment, a statement of planned feasibility assessment, key milestones, invitation to tour the Pickering facility, and commitment to ongoing engagement. • Multiple meetings in 2023 discussing Pickering NGS feasibility assessment and refurbishment activities. • Shared draft Pickering IEP for review and comment in January 2024. Final working version of IEP shared in May 2024. Comments received in October 2024. Update shared in January 2025. • Attended Pickering Engagement meeting in March 2024. • OPG and Michi Saagiig Waste Table (August and October 2024, January, March, and May 2025). • The May 2025 Waste Table meeting was used as an opportunity to provide a workshop on the DDP. • OPG and Michi Saagiig Pickering Engagement Table (October and November 2024). • Executed Pickering MoU to provide capacity funding in November 2024. • Communicated a Detailed Decommissioning Plan briefing note in October 2024. • Draft Detailed Decommissioning Plan shared in November 2024 for review and feedback. Comments received in April 2025 following Michi Saagiig Nations request to hire a third-party reviewer to support their review. • Predictive Environmental Risk Assessment (PERA) for Pickering Component Storage Structure (PCSS) shared in November 2024. CLFN comments received in January and MSIFN comments received in April 2025; OPG responses to MSIFN comments shared in May 2025 with all Michi Saagiig Nations. Revised PCSS PERA shared with all WTFN in June 2025. • Framework meetings throughout 2024 to discuss Pickering NGS PROL and WFOL activities. • OPG and Michi Saagiig Pickering Engagement Table (February, March, April, May, and June 2025). • Representatives attended tour of the Pickering NGS in March 2025.

Community	Summary
	• Predictive Environmental Risk Assessment and Climate Change Vulnerability and Assessment Summary Report for Pickering Nuclear shared in April 2025. • Briefing note to support key aspects of the DDP sent in April 2025. • Supporting an ongoing stage 1 terrestrial archaeology assessment at the Pickering NGS and site visit in April 2025 at request of the Michi Saagiig Nations. • OPG email sent in March 2025 suggesting meeting to further discuss engagement on the PROL and WFOL relicensing and related activities. • Engagement approach pathway for PROL and WFOL. OPG shared an early draft of the PROL and WFOL licence renewal application and memo that provided a summary of the PROL and WFOL renewal application with Michi Saagiig Nations mid-May 2025, based on feedback received in April on Nations' priorities. • Meetings in May 2025 with the Michi Saagiig Nations to discuss Deep Water Intake marine archaeology path forward and next steps.
Chippewas of Georgina Island First Nation	• OPG letter sent in March 2023 with context about nuclear power, the Pickering station, past technical feasibility assessments for refurbishment, a statement of planned feasibility assessment, key milestones, invitation to tour the Pickering facility, and commitment to ongoing engagement. • Shared draft Pickering IEP for review and comment in January 2024. Final working version of IEP shared in May 2024. Update shared in January 2025. • Predictive Environmental Risk Assessment (PERA) for Pickering Component Storage Structure (PCSS) shared in December 2024. Revised PCSS PERA shared with all WTFN in June 2025. • Communicated a Detailed Decommissioning Plan briefing note and opportunity to review Detailed Decommissioning Plan in November 2024. • Engagement via email and phone throughout 2024 attempting to provide opportunity to engage on Pickering NGS PROL and WFOL activities. • OPG email sent in November 2024 informing OPG's intent to apply for a consolidated Pickering PROL and WFOL and offer for further engagement. • OPG email sent in January 2025 informing OPG is working towards submitting the PROL and WFOL application in Q2 2025. • Predictive Environmental Risk Assessment and Climate Change Vulnerability and Assessment Summary Report for Pickering Nuclear shared in May 2025.

Community	Summary
	• OPG email sent in June 2025 sharing a memo that provided a summary of the PROL/WFOL renewal application.
Hiawatha First Nation	• OPG letter sent in March 2023 with context about nuclear power, the Pickering station, past technical feasibility assessments for refurbishment, a statement of planned feasibility assessment, key milestones, invitation to tour the Pickering facility, and commitment to ongoing engagement. • Multiple meetings in 2023 discussing the Pickering NGS feasibility assessment and refurbishment activities. • Shared draft Pickering IEP for review and comment in January 2024. Final working version of IEP shared in May 2024. Update shared in January 2025. • Attended Pickering Engagement meeting in March 2024. • OPG and Michi Saagiig Waste Table (August and October 2024, January, March, and May 2025). • The May 2025 Waste Table meeting was used as an opportunity to provide a workshop on the DDP. • OPG and Michi Saagiig Pickering Engagement Table (October and November 2024). • Executed Pickering MoU to provide capacity funding in 2025. • Communicated a Detailed Decommissioning Plan briefing note in October 2024. • Draft Detailed Decommissioning Plan shared in November 2024 for review and feedback. Comments received in April 2025 following Michi Saagiig Nations request to hire a third-party reviewer to support their review. • Predictive Environmental Risk Assessment (PERA) for Pickering Component Storage Structure (PCSS) shared in November 2024. MSIFN comments received in April 2025 and OPG responses to MSIFN comments shared in May 2025 with all Michi Saagiig Nations. Revised PCSS PERA shared with all WTFN in June 2025. • Framework meetings throughout 2024 to discuss Pickering NGS PROL and WFOL activities. • OPG and Michi Saagiig Pickering Engagement Table (February, March, April, May and June 2025). • Representatives attended tour of the Pickering NGS in March 2025. • Predictive Environmental Risk Assessment and Climate Change Vulnerability and Assessment Summary Report for Pickering Nuclear shared in April 2025. • Briefing note to support key aspects of the DDP sent in April 2025.

Community	Summary
	• Supporting an ongoing stage 1 terrestrial archaeology assessment at the Pickering NGS and site visit in April 2025 at request of Michi Saagiig Nations. • OPG email sent in March 2025 suggesting meeting to further discuss engagement on the PROL and WFOL relicensing and related activities. • Engagement approach pathway for PROL and WFOL. OPG shared an early draft of the PROL and WFOL licence renewal application and memo that provided a summary of the PROL and WFOL renewal application with Michi Saagiig Nations mid-May 2025, based on feedback received in April on Nations' priorities. • Meetings in May 2025 with the Michi Saagiig Nations to discuss Deep Water Intake marine archaeology path forward and next steps.
Mississaugas of Scugog Island First Nation	• OPG letter sent in March 2023 with context about nuclear power, the Pickering station, past technical feasibility assessments for refurbishment, a statement of planned feasibility assessment, key milestones, invitation to tour the Pickering facility, and commitment to ongoing engagement. • Multiple meetings in 2023 discussing the Pickering NGS feasibility assessment and refurbishment activities. • Shared draft Pickering IEP for review and comment in January 2024. Comments received in April 2024. Final working version of IEP shared in May 2024. Update shared in January 2025. • Attended Pickering Engagement meeting in March 2024. • OPG email sent in June 2024 providing opportunities to monitor during Predictive Environmental Risk Assessment at the Pickering NGS. • OPG and Michi Saagiig Waste Table (August and October 2024, January, March, and May 2025). • The May 2025 Waste Table meeting was used as an opportunity to provide a workshop on the DDP. • OPG and Michi Saagiig Pickering Engagement Table (October and November 2024). • Executed Pickering MoU to provide capacity funding in November 2024. • Communicated a Detailed Decommissioning Plan briefing note in October 2024. • Draft Detailed Decommissioning Plan shared in November 2024 for review and feedback. Comments received in April 2025 following Michi Saagiig Nations request to hire a third-party reviewer to support their review.

Community	Summary
	• Predictive Environmental Risk Assessment (PERA) for Pickering Component Storage Structure (PCSS) shared in November 2024. Comments received in April 2025. OPG responses to MSIFN comments shared in May 2025 with all Michi Saagiig Nations. Revised PCSS PERA shared with all WTFN in June 2025. • Framework meetings throughout 2024 to discuss Pickering NGS PROL and WFOL activities. • OPG and Michi Saagiig Pickering Engagement Table (February, March, April, May, and June 2025). • Representatives attended tour of the Pickering NGS in March 2025. • Predictive Environmental Risk Assessment and Climate Change Vulnerability and Assessment Summary Report for Pickering Nuclear shared in April 2025. • Briefing note to support key aspects of the DDP sent in April 2025. • Supporting an ongoing stage 1 terrestrial archaeology assessment at the Pickering NGS and site visit in April 2025 at request of Michi Saagiig Nations. • OPG email sent in March 2025 suggesting meeting to further discuss engagement on the PROL and WFOL relicensing and related activities. • Engagement approach pathway for PROL and WFOL. OPG shared an early draft of the PROL and WFOL licence renewal application and memo that provided a summary of the PROL and WFOL renewal application with Michi Saagiig Nations mid-May 2025, based on feedback received in April on Nations' priorities. • Meetings in May 2025 with the Michi Saagiig Nations to discuss Deep Water Intake marine archaeology path forward and next steps.
Chippewas of Rama First Nation	• OPG letter sent in March 2023 with context about nuclear power, the Pickering station, past technical feasibility assessments for refurbishment, a statement of planned feasibility assessment, key milestones, invitation to tour the Pickering facility, and commitment to ongoing engagement. • Shared draft Pickering IEP for review and comment in January 2024. Comments received in late May 2024. Final working version of IEP shared just prior to receiving comments. Update shared in January 2025. • Attended Pickering Engagement meeting in April 2024. • In-person meeting with Chief, Council and consultation staff to discuss ongoing and proposed activities at Pickering NGS in July 2024. • Shared Pickering MoU in July 2024. No response received.

Community	Summary
	• Predictive Environmental Risk Assessment (PERA) for Pickering Component Storage Structure (PCSS) shared in December 2024. Revised PCSS PERA shared with all WTFN in June 2025. • Communicated a Detailed Decommissioning Plan briefing note and opportunity to review the Detailed Decommissioning Plan in November 2024. • Engagement via email and phone throughout 2024 attempting to provide opportunity to engage on Pickering NGS PROL and WFOL activities. • OPG email sent in November 2024 informing OPG's intent to apply for a consolidated Pickering PROL and WFOL and offer for further engagement. • OPG email sent in January 2025 informing OPG is working towards submitting the PROL and WFOL application in Q2 2025. • OPG email sent in March 2025 sharing Pickering updates. • Predictive Environmental Risk Assessment (PERA) for Pickering Nuclear and Climate Change Vulnerability and Assessment Summary Report shared in May 2025. • OPG email sent in June 2025 sharing a memo that provided a summary of the PROL/WFOL renewal application.

Table 11. Identified Indigenous Communities with Asserted Aboriginal and/or Treaty Rights

Community	Summary
Kawartha Nishnawbe	• OPG letter sent in March 2023 with context about nuclear power, the Pickering station, past technical feasibility assessments for refurbishment, key milestones, invitation to tour the Pickering facility, and commitment to ongoing engagement. • OPG follow-up letter in July 2023 with context about Pickering NGS future, and meeting request to discuss engagement and involvement. • OPG shared email update in June 2025 to inform of OPG's intent to apply for a consolidated Pickering PROL and WFOL, shared the IEP, and offer for further engagement.

Table 12. Identified Indigenous Nations and Communities Expressing an Interest

Community	Summary
Huron-Wendat Nation, Quebec	• OPG letter sent in March 2023 with context about nuclear power, the Pickering station, past technical feasibility assessments for refurbishment, a statement of planned feasibility assessment, key milestones, invitation to tour the Pickering facility, and commitment to ongoing engagement.

Community	Summary
	• OPG follow-up letter in July 2023 with context about Pickering NGS future, meeting request to discuss engagement and involvement. • Shared draft Pickering IEP for review and comment in January 2024. Final working version of IEP shared in June 2024. Update shared in January 2025. • OPG email in January 2025 informing OPG's intent to apply for a consolidated Pickering PROL and WFOL and offer for further engagement.
Mohawks of the Bay of Quinte First Nation	• OPG letter with context about Pickering NGS future, meeting request to discuss engagement and involvement in July 2023. • Email regarding Pickering Emergency Management notification protocols sent in November 2023. • Shared draft Pickering IEP for review and comment in January 2024. Final working version of IEP shared in June 2024. Update shared in January 2025. • OPG email in January 2025 informing OPG's intent to apply for a consolidated Pickering PROL and WFOL and offer for further engagement.
Métis Nation of Ontario Region 8	• OPG letter with context about Pickering NGS future, meeting request to discuss engagement and involvement in July 2023. • Meeting to discuss Pickering NGS feasibility and refurbishment update in December 2023. • Shared draft Pickering IEP for review and comment in January 2024. Final working version of IEP shared in May 2024. Update shared in January 2025. • Meeting to discuss ongoing and proposed Pickering NGS refurbishment activities in June 2024. • OPG email in January 2025 informing OPG's intent to apply for a consolidated Pickering PROL and WFOL and offer for further engagement.
Saugeen Ojibway Nation	• Shared Pickering IEP for review and comment in September 2024. No comments received. • OPG email sent in February 2025 reaffirming OPG's desire to engage on operations and proposed activities at the Pickering site, including an updated IEP (February 2025).
Six Nations of the Grand River First Nation	• OPG letter sent in March 2023 with context about nuclear power, the Pickering station, past technical feasibility assessments for refurbishment, a statement of planned feasibility assessment, key milestones, invitation to tour the Pickering facility, and commitment to ongoing engagement.

Community	Summary
	• Meeting to discuss Pickering NGS overview and refurbishment feasibility assessment in September 2023. • Pickering NGS site tour and discussion in November 2023. • Shared draft Pickering IEP for review and comment in January 2024. Final working version of IEP shared in May 2024. Update shared in January 2025. • Framework meetings throughout 2024 to discuss Pickering NGS PROL and WFOL activities based on Six Nations of the Grand River interest. • OPG email in January 2025 informing OPG's intent to apply for a consolidated Pickering PROL and WFOL and offer for further engagement. • Framework meeting in January 2025 to discuss Pickering NGS PROL and WFOL activities.
Mississaugas of the Credit First Nation	• Shared draft Pickering IEP for review and comment in January 2024 for review and feedback. • OPG shared email update in June to inform of OPG's intent to apply for a consolidated Pickering PROL and WFOL and offer for further engagement.

1.6.1.6 Summary of Issues and Interests

Table 13 below outlines the comments and concerns OPG has heard to date through early engagement activities on the licence renewal application. Through OPG's ongoing engagement with the Michi Saagiig Nations, OPG shared early drafts of this application and relevant supporting documents (e.g. draft Detailed Decommissioning Plan, draft Pickering Site PERA and revised PCSS PERA). Reviews and further engagement on these materials are ongoing. OPG will continue to diligently capture issues and concerns over the course of engagement and seek to understand and address interests, as appropriate, through continued engagement.

Table 13. High Level Summary of Issues, Interests and/or Concerns Raised by Indigenous Nations and Communities

Theme/Topic Area	Summary of Interests and/or Concerns
Generation and Interim Storage of Waste	• Questions about the volume of waste that will be generated by Pickering NGS post refurbishment. • Comments regarding the absence of a long-term strategy for disposal of low, intermediate and high-level waste.
Incorporation of Indigenous perspectives in application materials and supporting documents	• Interest opportunities to include Indigenous perspectives in application materials and supporting documents, such as the PERA, DDP, Climate Change Resilience Assessment.

Theme/Topic Area	Summary of Interests and/or Concerns
	• OPG has shared the draft application and supporting documents with the Michi Saagiig Nations. Reviews are ongoing and OPG will continue to work with the Nations to address comments that come forward.
Past Grievances	• Comments regarding lack of consultation and that consent was never provided from the Michi Saagiig Nations from the original construction and ongoing operation of the Pickering site.
Dredging and Disposal of Materials	• Concerns regarding proposed in-water dredging and disposal options for dredged materials to support the construction of a new deep water in-take tunnel for refurbishment. • Interest in potential disposal of dredged materials that provide opportunities for shoreline restoration and habitat creation.
Historical Environmental Activities at the Pickering NGS	• Concerns regarding past environmental studies and assessments that do not align with an Indigenous perspective at the Pickering NGS.
Holistic vs. piecemeal approach to engagement at Pickering NGS	• Interest in a holistic, site-wide engagement approach at Pickering NGS that brings a comprehensive lens to potential impacts across decommissioning, refurbishment and operations.
Archaeological Studies and Assessments	• Interest regarding terrestrial and marine archaeology studies and assessments to understand, mitigate and address potential impacts to archaeological resources from proposed refurbishment activities.
Engagement on Station Operations	• Concerns regarding limited engagement with respect to OPG operations aside from licence amendments and extensions and there is an interest in deepening engagement on operations.

1.6.1.7 Planned Engagement

OPG is steadfast in its commitment to supporting meaningful engagement before, during and after the licencing renewal application process and will work in collaboration with Indigenous Nations and communities to identify approaches to engagement that are considerate of the engagement context and the interests of each Indigenous Nation and community.

For engagement on the Licence Renewal Application, OPG will continue to leverage the site-wide Pickering NGS IEP. Through engagement to date, OPG has heard preliminary concerns on the Licence Renewal Application and will continue to explore concerns through future engagement activities to address concerns, as appropriate.

OPG also will continue to provide capacity funding to the Michi Saagiig Nation Rightsholders (Mississaugas of Scugog Island, Hiawatha, Curve Lake and Alderville First Nations) to support their participation and engagement through the following forums described in Table 14.

Table 14. Planned OPG Forums with the Michi Saagiig Nation Rightsholders

Forum	Scope & Topics	Frequency
OPG-Michi Saagiig Pickering Table	• Operations of Units 5 to 8 to 2026 • Refurbishment of Pickering Units 5 to 8 • Safe Storage of Units 1 to 4 • Decommissioning • Nuclear Sustainability Services (NSS)	Monthly
OPG-Michi Saagiig Waste Table	• OPG heard from the Michi Saagiig Nations that there are key topics, like nuclear waste, that are not site or project specific and would benefit from a strategic engagement approach. • OPG and the Michi Saagiig Nations jointly established the Waste Table in August 2024.	Monthly (alternating between Waste Table and Environment Table)
OPG-Michi Saagiig Environment Table	• OPG heard from the Michi Saagiig Nations that there are key topics, like environment, that are not site or project specific and would benefit from a strategic engagement approach. • OPG and the Michi Saagiig Nations jointly established an Environmental Table in February 2025.	Monthly (alternating between Waste Table and Environment Table)
Framework Agreement Tables	• Bilateral forum between OPG and each individual Michi Saagiig Nation. • Agenda and topics are identified based on mutual interest between OPG and the individual Nation.	Monthly (Curve Lake, Hiawatha and Alderville First Nations). Bimonthly (Mississaugas of Scugog Island First Nation)

OPG will continue to share information, request input and provide opportunities for engagement with the Chippewa First Nation Rightsholders and be responsive to any questions, concerns or issues that may come forward. For those Indigenous Nations and communities that assert Aboriginal and/or treaty rights or express interest in the licence renewal, OPG will continue to reach out, share information and remain open to engaging upon request.

1.6.1.8 Schedule of Reporting

OPG will continue its practice of meeting with CNSC representatives monthly to discuss the status of Indigenous engagement on the Pickering Site PROL/WFOL renewal application. In addition, throughout the licence renewal process, an engagement log will be maintained and shared with the CNSC upon request. If further information or additional meetings are required, OPG will work with CNSC staff to establish additional reporting, as appropriate.

1.7 Community Support

1.7.1 Public Information and Disclosure Program

OPG believes in open and transparent communication in a timely manner to maintain positive and supportive relationships and the confidence of key stakeholders and the public. OPG's *Nuclear Public Information Disclosure and Transparency Protocol*, posted on OPG's website, describes our communication principles and information requirements and reporting. This protocol adheres to the regulatory requirements outlined in CNSC REGDOC-3.2.1 *Public Information and Disclosure*.

The following OPG document requires written notification of change per Pickering NGS Licence Conditions Handbook, LCH-PR-48.00/2028-R007 and PWMF Licence Conditions Handbook LCH-W4-350.00/2028 R003:

Table 15. Licensee Public Information Program

Document	Title
N-STD-AS-0013	Nuclear Public Information and Disclosure

OPG's Corporate Relations organization adheres to OPG' standard N-STD-AS-0013, *Nuclear Public Information and Disclosure,* as it describes consistent standards and procedures for all public disclosure of both material and non-material information. Public information and disclosure involves the provision to inform, in a timely and transparent manner, accurate information to stakeholders and the public in the vicinity of OPG's nuclear and waste facilities regarding events, activities and operations.

OPG's public information program has been recognized as a strength by national and international utility peers. To ensure continuous improvement, OPG annually evaluates the effectiveness of N-STD-AS-0013 and implements findings.

The public information program proactively provides information to the public and stakeholders on the Pickering NGS and PWMF operations.

The primary focus area for engagement activities, in addition to the public at large, includes local businesses and residents, municipalities proximate to the Pickering NGS site including the host community and adjacent communities within 10 km. The 10 km radius is consistent with the Pickering NGS Detailed Planning Zone for nuclear emergency planning purposes and meets the requirements of CNSC REGDOC-2.10.1 and the Provincial Nuclear Emergency Response Plan (PNERP). This area is where residents are most familiar with nuclear plant operations and regularly receive information on OPG's operations including station and project updates.

OPG ensures the public and stakeholders with a potential interest in Pickering NGS and PWMF operations and performance, are provided with relevant information and have the opportunity to

share their views and perspectives. Information is communicated in a number of ways based on their interests and preferred means of communication.

Stakeholders and audiences may include but are not limited to:

- Residents in the vicinity of the Pickering NGS site and the public.
- Established community committees such as the Pickering Community Advisory Council and the Durham Nuclear Health Committee.
- Local businesses and business organizations, such as boards of trade and chambers of commerce.
- Private/public community organizations and special interest groups.
- Non-Governmental Organizations.
- Nuclear industry associations/organizations and regulatory bodies.
- Media.
- Federal, provincial, regional, and municipal agencies and officials with a regulatory role or project interest.
- OPG employees and retirees.

1.7.1.1 Communication Methods

Communication methods are the approaches and activities used to distribute information, and to solicit feedback and input. The methods employed are specific to the issues and matters that arise and include:

- *Website:* OPG's website, www.opg.com is updated on a regular basis as new information becomes available. The website serves as a vehicle to provide access to information, as well as a mechanism to receive input from interested persons as an enhancement of the public outreach program; questions and inputs are tracked and responded to in a timely manner. OPG also maintains a comprehensive emergency preparedness website, preparetobesafe.ca, which is a joint program between Durham Region, City of Toronto, and OPG which contains detailed information on KI pills and emergency preparedness.
- *Social Media:* OPG maintains a presence on social media (Facebook, Twitter/X, Linked In and Instagram) and shares information through these media.
- *Public Information Centre:* OPG maintains a Public Information Centre at the Pickering NGS, with information available on station operations including OPG's Nuclear Sustainability Services Division, which includes the PWMF, as a leader in safe waste management practices. Information Centre staff manage the public phone line and messages are checked and responded to in a timely manner.
- *Community Events*: The OPG Corporate Relations team participates at a variety of community events and festivals each year, ensuring the public can ask questions about OPG's operations, including waste management and projects.
- *Media Relations:* Ongoing liaison with respect to operations and licensing activities is initiated and maintained by OPG with reporters and news editors for both electronic and print media.

- *Key Stakeholder Briefings:* Briefings are conducted to present information and provide an opportunity to have questions and comments addressed. Regular updates are presented to municipal representatives, established community committees including the Pickering and Darlington Community Advisory Committees, Durham Nuclear Health Committee, and other key stakeholders on a frequency commensurate with various activities and milestones. Feedback from these meetings is recorded for response and issues management.
- *Advertisements and Letters:* Public notifications are prepared and distributed to announce upcoming hearings and other licensing activities in a number of ways including: stakeholder letter(s), web communications, the OPG community newsletter (Neighbours), press release, and advertisements in local print or social media (as required).
- *Workshops:* Key stakeholders with a high level of interest in operations or other station activities may be invited to participate in workshops that involve meaningful discussions with the opportunity to provide input and have questions answered.
- *Public Information Sessions:* Information sessions (in person or virtual) advertised broadly and open to the public provide an opportunity to learn more about OPG's operations, projects and the Nuclear Sustainability Services division with the opportunity to provide comments and/or have questions answered by members of the OPG team.

1.7.1.2 Facility Reporting

OPG regularly and proactively provides information to the public on its operations through OPG's nuclear standard N-STD-AS-0013, *Nuclear Public Information and Disclosure*.

For operational status changes or unscheduled operations that may cause public concern or media interest, OPG follows the *Stakeholder Public Interest Notification Process* to notify key stakeholders in a timely manner as outlined in Appendix B of OPG's nuclear standard N-STD-AS-0013. The purpose of the process is to ensure those key stakeholders in emergency agencies (fire, police, and emergency management) and local government organizations are kept aware and are able to respond accurately if they receive questions from constituents. OPG maintains a duty on-call organization 24 hours a day, seven days a week.

On a quarterly basis, OPG publicly posts performance reports on station operations on OPG's website and shares these documents electronically. Additionally, since 2014, OPG issues a quarterly Environment Report in an easy to read and understandable format.

1.7.1.3 Welcoming Visitors

Pickering NGS maintains an Information Centre to host public, community groups and students. Visitors can find information on operations, technology, future plans including refurbishment and decommissioning, and staff are available to have conversations and answer questions. Students are offered curriculum-based educational presentations, introductions to CANadian Deuterium Uranium (CANDU) technology and Science, Technology, Engineering, and Mathematics-based (STEM) activities.

OPG encourages community groups to use the Information Centre for events unrelated to the industry. OPG's meeting room and event space provide another means to engage with the local community. By creating a meeting space, organizations otherwise unrelated to the industry gain a comfort and familiarity with OPG and our operations.

1.7.1.4 Community Outreach

During the current licence period, through OPG's robust public outreach program, outreach activities in support of Pickering NGS and PWMF operations have included:

- Regular briefings including presentations and/or facility tours with key stakeholders, elected officials and established community committees.
- Multiple times a year, OPG publishes a Neighbours Newsletter which is distributed to approximately 250,000 residents and businesses within 10 km of the Darlington and Pickering stations. The newsletter is posted on www.opg.com and distributed at community events.
- Annually, OPG hosts a Community Power Expo, which is widely advertised with a focus on the nearby community. Staff from OPG are present to answer questions and provide information to participants, including waste. Since 2023, the annual event has welcomed more than 3,000 people from across the Durham Region each year.
- Pickering NGS's Corporate Relations team continues to provide quality programs within our host communities. Our annual March Break and Tuesdays on the Trail programs reached thousands of community members throughout the winter and summer months.
- Through our website, www.opg.com, OPG provides up-to-date information that is easily accessible by the public and offers opportunities for further contact. Newsletters, reports, media releases, stories and links to other agencies and regulatory proceedings are updated frequently to ensure information is easily accessible. OPG maintains public communications that simply explain how we safely manage nuclear waste and by-products.
- OPG maintains an active social media presence and shares information on OPG's operations (X - 18,581 followers, Facebook - 12,827 followers, Linked In - 145,565 followers, and Instagram - 8,326 followers).

1.7.1.5 Community Committees

OPG works with established local community committees on matters of interest and concerns related to our operations and projects. Updates on the status of licensing activities are provided to the committees.

- The Pickering Nuclear Community Advisory Council meets regularly to exchange information with community leaders and local residents, who in turn provide advice to senior OPG staff on issues of environmental, economic and public concern.
- OPG has representatives on the Durham Nuclear Health Committee and OPG staff make regular presentations on a variety of environmental, community outreach and operational topics. This committee is chaired by the Durham Region Medical Officer of Health.

OPG meets often with stakeholder groups, elected officials, municipal representatives, not-for-profit organizations and associations that have an interest in nuclear, energy, climate change, and/or environmental issues. OPG also participates in a number of speaking engagements in our host communities on a variety of topics.

1.7.1.6 Environmental Partnerships and Programs

OPG is committed to biodiversity work on all OPG property and on public lands within the host communities. Pickering site's biodiversity program continues to provide tree and pollinator garden planting, and numerous other initiatives. Since 2000, OPG has planted more than 9 million native trees and shrubs throughout the province, and we continue to help create hundreds of acres of new grasslands and wetlands.

To further enhance local sustainability efforts, OPG is a long-standing partner of Environmental Stewardship Pickering (ESP) alongside the City of Pickering and the Toronto and Region Conservation Authority. The ESP committee works to organize education sessions/workshops, tree plantings, family nature walks and other programs that are available to community members. Since 2011, OPG has been a lead partner in the Bring Back the Salmon program with the Ontario Ministry of Natural Resources, and the Ontario Federation of Anglers and Hunters. OPG's support contributes to all four pillars of the Bring Back the Salmon program but is weighted towards fish production. Each year, the Pickering site Information Centre houses a hatchery and OPG partners with a local school for the program. OPG hosts students at the Information Centre and provides a presentation about Atlantic Salmon history in January, as well as organizes the release of the fish in June with the school.

OPG's Nuclear Operations hold a Gold Level Conservation Certification from Tandem Global (a combination of Wildlife Habitat Council and World Environment Center). This achievement recognizes the specific efforts of our biodiversity programs, which aim to protect and nurture species and their habitats wherever the company operates. Tandem Global certifies conservation programs on corporate lands around the world and promotes environmental management through various partnerships and education.

Community Recognition

- Greater Oshawa Chamber of Commerce, Business Excellence Award – 2021
- City of Pickering Environment Award - 2021
- Whitby Chamber of Commerce, Business Achievement Award - Excellence in Governance Strategy Award – 2021
- Whitby Chamber of Commerce, Business Achievement Award (50 + People) – 2021
- Progressive Aboriginal Relations Gold Designation from the Canadian Council for Aboriginal Business - 2021
- Women's Executive Network Ally of Excellence Award – 2022
- Greater Toronto Top Employee – 2022
- Canada's Best 50 Corporate Citizens by Corporate Knights – 2022
- Greater Oshawa Chamber of Commerce, Sustainability Award – 2022
- Gold Certification by Wildlife Habitat Council – 2020 - 2023
- City of Oshawa, Business Excellence Sustainability Award – 2023
- Canada's Best Diversity Employers - 2023
- Ajax Pickering Board of Trade Business Excellence Award – 2024
- Government of Canada Employment Equity Achievement Award (Innovation category) – 2024

2.0

Safety and Control Areas (SCAs)

2.0 Safety and Control Areas (SCAs)

This section documents CNSC's regulatory requirements for the safety performance of programs. The sections are organized according to the CNSC SCA framework. As per the framework, each of the 14 SCAs are further divided into specific areas that define the key components of each SCA. The SCAs cover the functional areas of:

Management:	**(SCAs 1, 2 and 3)**
Facility and Equipment:	**(SCAs 4, 5 and 6)**
Core Control Processes:	**(SCAs 7, 8, 9, 10, 11, 12, 13 and 14)**

Each SCA section provides a summary of the OPG programs and relevant supporting standards, processes and procedures implemented at Pickering NGS to meet regulatory requirements and the conditions of the PROL. Information is also provided regarding Pickering NGS performance over the current licence period as well as implemented and planned improvement initiatives.

Three additional subsections are added to the end of each SCA to provide additional information relevant and specific to Units 1 to 4 decommissioning, Units 5 to 8 refurbishment and the PWMF.

2.1 Management System

OPG maintains a nuclear management system in accordance with the operating licence and associated Licence Conditions Handbook. OPG's nuclear management system is applicable to all OPG nuclear facilities and is compliant with CSA N286-12, *Management system requirements for nuclear facilities*.

The fundamental objective of OPG's nuclear management system is to ensure OPG nuclear facilities are operated and maintained using sound nuclear safety and defense-in-depth practices to ensure radiological risks to workers, the public, and the environment are As Low As Reasonably Achievable (ALARA), and in keeping with the OPG *Nuclear Safety and Security Policy* and the best practices of the international nuclear community.

OPG's nuclear management system sets out the principles, required supporting actions and documentation to support safe and reliable nuclear facilities, and brings together in a planned and integrated manner, the processes necessary to satisfy requirements and to carry out licensed activities safely.

Management system requirements provide direction to develop and implement management practices and controls. Programs and processes are created such that all applicable regulatory requirements and codes and standards are embedded and integrated within the nuclear management system, including aspects of health, safety, environment, security, economics and quality.

The OPG documents in the table below require written notification of change per Pickering NGS Licence Conditions Handbook, LCH-PR-48.00/2028-R007:

Table 16. SCA 1 – PNGS Management System

Document Number	Document Title
N-POL-0001	Nuclear Safety and Security Policy
N-CHAR-AS-0002	Nuclear Management System
N-PROG-AS-0001	Nuclear Management System Administration
N-STD-AS-0020	Nuclear Management System Organizations
OPG-PROC-0166	Organization Design Change
N-PROG-RA-0010	Independent Assessment
N-PROC-RA-0097	Self-Assessment and Benchmarking
N-PROC-RA-0023	Fleetview Program Health and Performance Rating
N-PROG-RA-0003	Performance Improvement
N-PROC-RA-0035	Operating Experience Process
N-PROC-RA-0022	Processing Station Conditions Records
N-PROG-MP-0001	Engineering Change Control
N-PROC-MP-0090	Engineering Change Control Process
OPG-PROC-0178	Controlled Document Management
N-STD-AS-0023	Nuclear Safety Oversight
OPG-PROG-0005	Environment Health and Safety Managed Systems
N-PROC-AS-0077	Nuclear Safety and Security Culture Assessment
N-STD-MP-0027	Configuration Management
N-STD-OP-0024	Nuclear Safety Configuration Management
OPG-PROG-0001	Information Management
OPG-PROG-0009	Items and Services Management
N-PROC-MM-0021	Supply Inspection
OPG-PROG-0037	OPG Business Planning
N-PROC-AS-0080	Nuclear Business Planning
OPG-PROG-0033	Business Continuity Program
OPG-PROG-0039	Project Management

2.1.1 Management System

OPG's nuclear management system is documented in charter N-CHAR-AS-0002, *Nuclear Management System* (the Charter), and provides the framework for programs and processes that collectively ensure that Pickering NGS operates safely and reliably.

The Charter takes authority from N-POL-0001, *Nuclear Safety & Security Policy*, established by OPG's Board of Directors. In accordance with N-POL-0001, the Chief Nuclear Officer (CNO) is accountable to the Chief Executive Officer (CEO) and Board of Directors to establish a management system that fosters nuclear safety and security as the overriding priority.

The Charter, consistent with N-POL-0001, communicates the expectations of the CNO. Collectively, the Charter and its reference programs establish a quality program, and the nuclear management system, and fulfill the requirements of CSA N286-12.

Every employee in the organization is responsible for and held accountable for complying with the expectations of the Charter and referenced programs, and for ensuring their actions are deliberate and consistent with protecting worker health and safety, the health and safety of the public, and the environment.

The nuclear management system has evolved over the licence term, to support the OPG centre-led business model. Several programs have transitioned from being Nuclear-only to being owned by interfacing corporate business units (e.g., Items and Services Management, Information Management, and Environment and Health and Safety). For these programs, ownership and accountability for the program resides with the corporate program owner but the CNO remains accountable for the effectiveness of the implementation of these programs in Nuclear, and in meeting the requirements of CSA N286-12. Oversight and review of the health and effectiveness of these corporate programs continue to be part of the nuclear management system.

The *Nuclear Management System Administration* program, N-PROG-AS-0001, describes the framework and processes established by OPG Nuclear and interfacing corporate organizations to demonstrate effective implementation and compliance with the requirements set out in CSA N286-12.

2.1.2 Organization

N-STD-AS-0020, *Nuclear Management System Organizations*, describes the organization and responsibilities of OPG in support of the Charter, CNSC REGDOC-2.1.1 *Management System*, and CSA N286-12.

OPG-PROC-0166, *Organizational Design Change*, outlines the OPG process utilized when organizational changes are planned and implemented. This includes meeting regulatory requirements under CSA N286-12 related to organizational changes, identifying operational and business risks using a graded approach, and ensuring roles and accountabilities are accurately defined when changes are implemented.

N-STD-AS-0020 and OPG-PROC-0166 support N-PROG-AS-0001, *Nuclear Management System Administration* in the Nuclear Management System (N-CHAR-AS-0002).

Figure 7 provides an overview of how the different OPG organizations are currently integrated, in relation to the Pickering NGS organization.

Figure 8 provides the planned Pickering NGS organizational structure, starting in January 2027, illustrating the Pickering Refurbishment organizational structure pending Commission approval of the new licence. The Senior Vice President (SVP) of Pickering Projects continues to be responsible for the management and control of Pickering NGS refurbishment and safe storage project activities. The Vice President (VP) of Plant Operations (Director of Operations and Maintenance (DOM)) will have site authority and is responsible for operations associated with Pickering NGS licence and plant activities; this operationally focused authority is involved in decisions during the refurbishment to ensure safe and reliable operation post refurbishment. The SVP of Integrated Fleet Management (Chief Nuclear Officer Delegate) will also be an authorized person having management and oversight of licence and plant activities. The Integrated Fleet Management team as well as Nuclear Oversight, will provide oversight during the refurbishment period independent of the project team.

Figure 9 provides the Pickering NGS organizational structure as of the first refurbished unit's regulatory hold point removal. The SVP of Pickering Projects continues to be responsible for the management and control of the Pickering NGS Refurbishment Project. The SVP of Pickering will have site authority and is responsible for the management and control of the operating unit(s).

Once all four refurbished units are returned to service, it is expected that the Pickering NGS organizational structure will return to the operational organization structure similar to that prior to 2027 (Figure 10) and the refurbishment organization will be disbanded. The SVP of Pickering is responsible for the management and control of the Pickering NGS and has site authority.

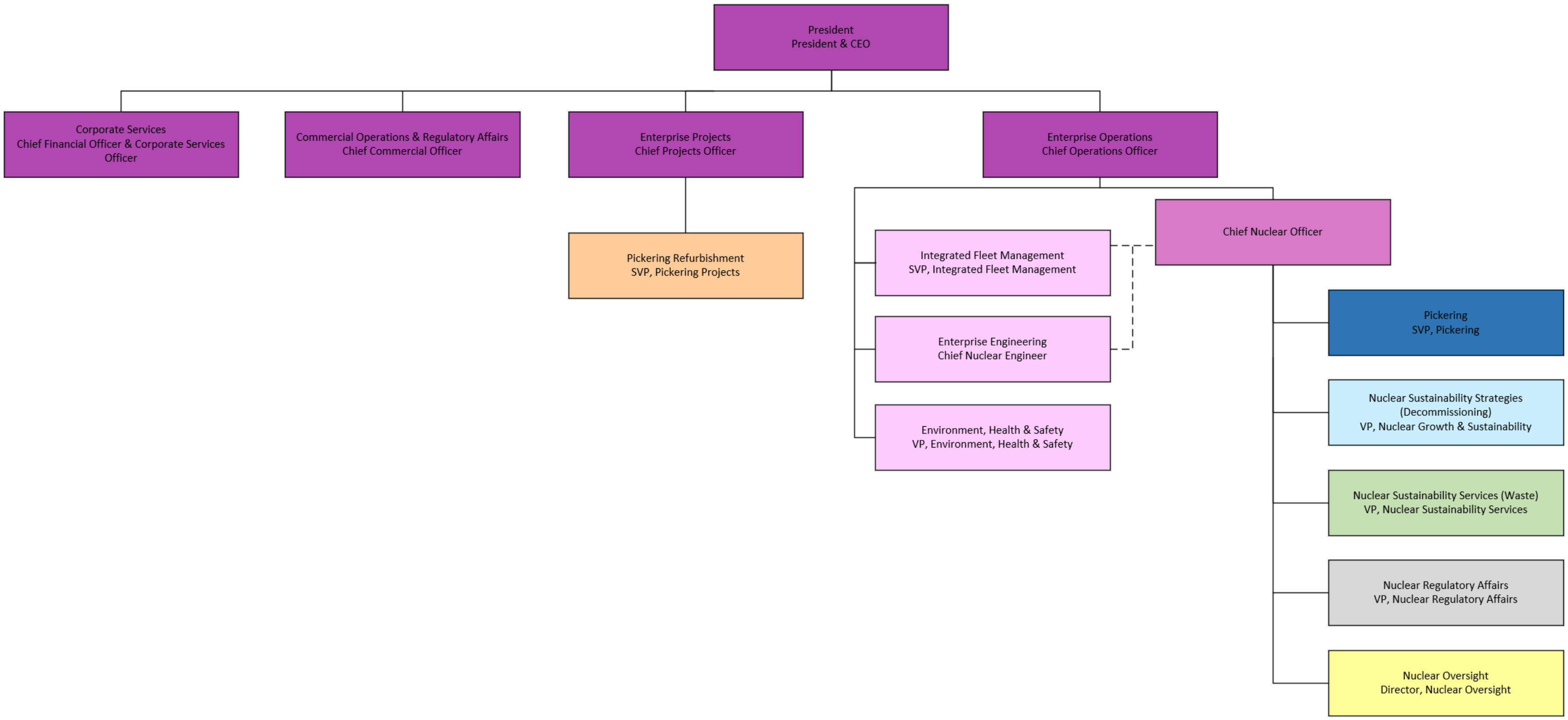

Figure 7. Current OPG Organizational Structure

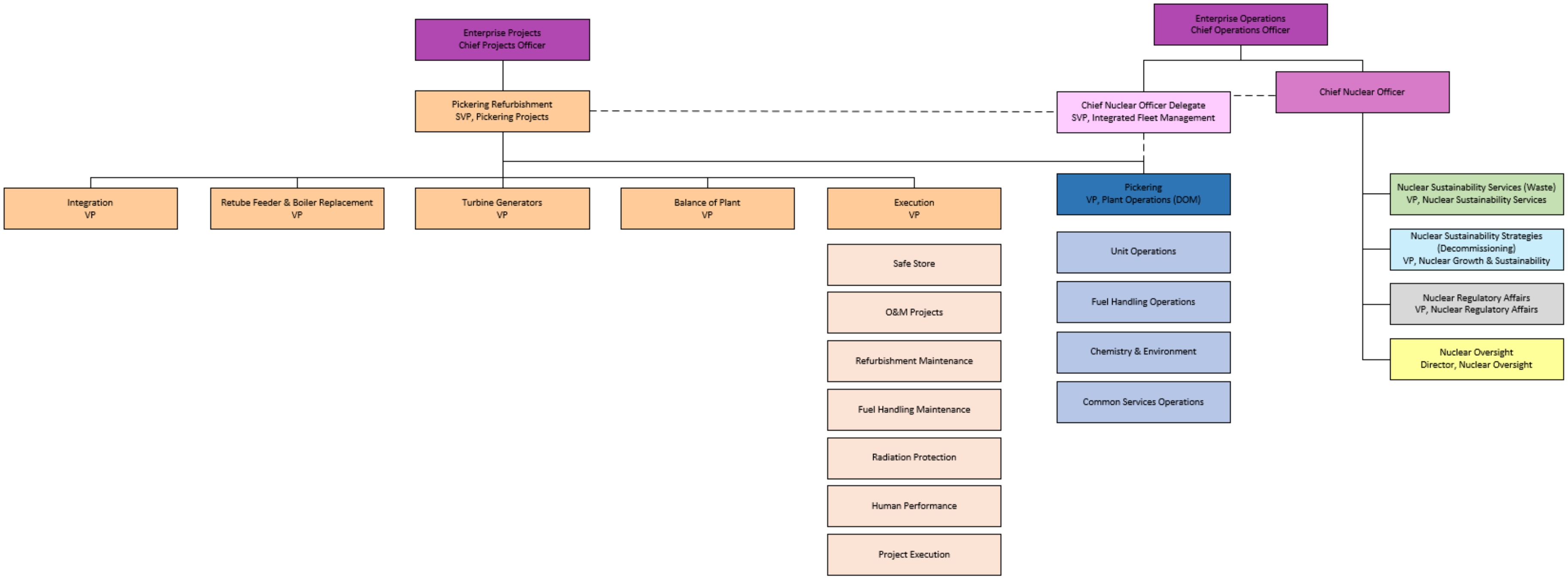

Figure 8. Planned Pickering NGS and Refurbishment Organization in 2027

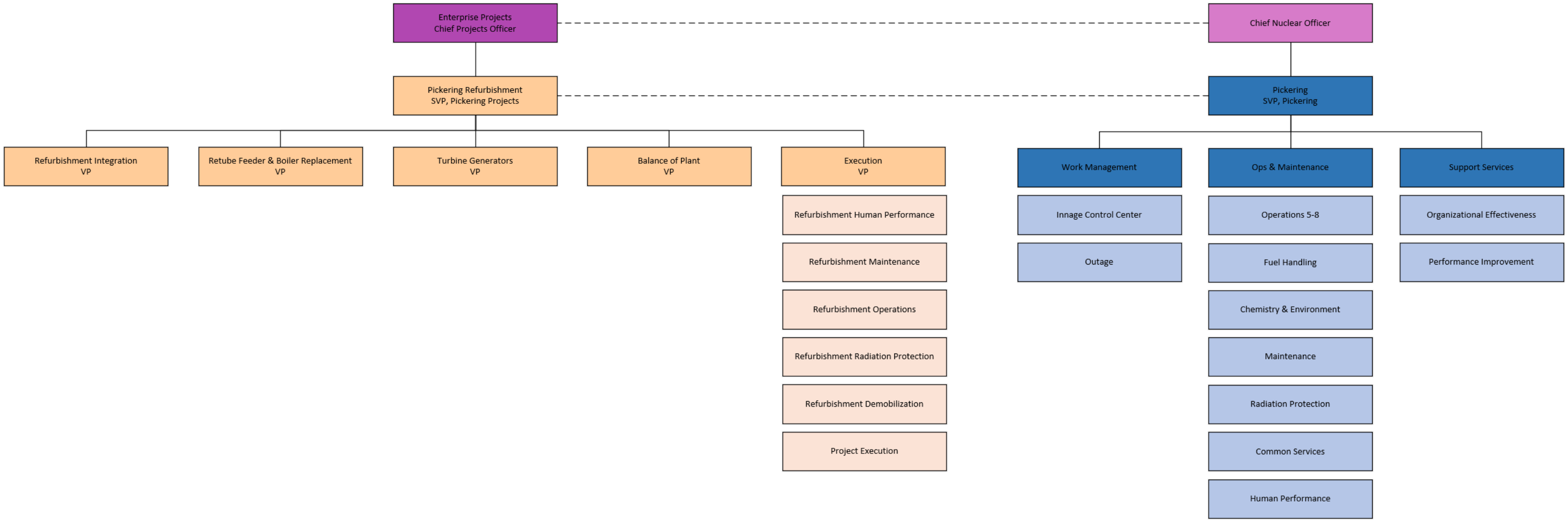

Figure 9. Planned Pickering NGS and Refurbishment Organization post First Hold Point Removal

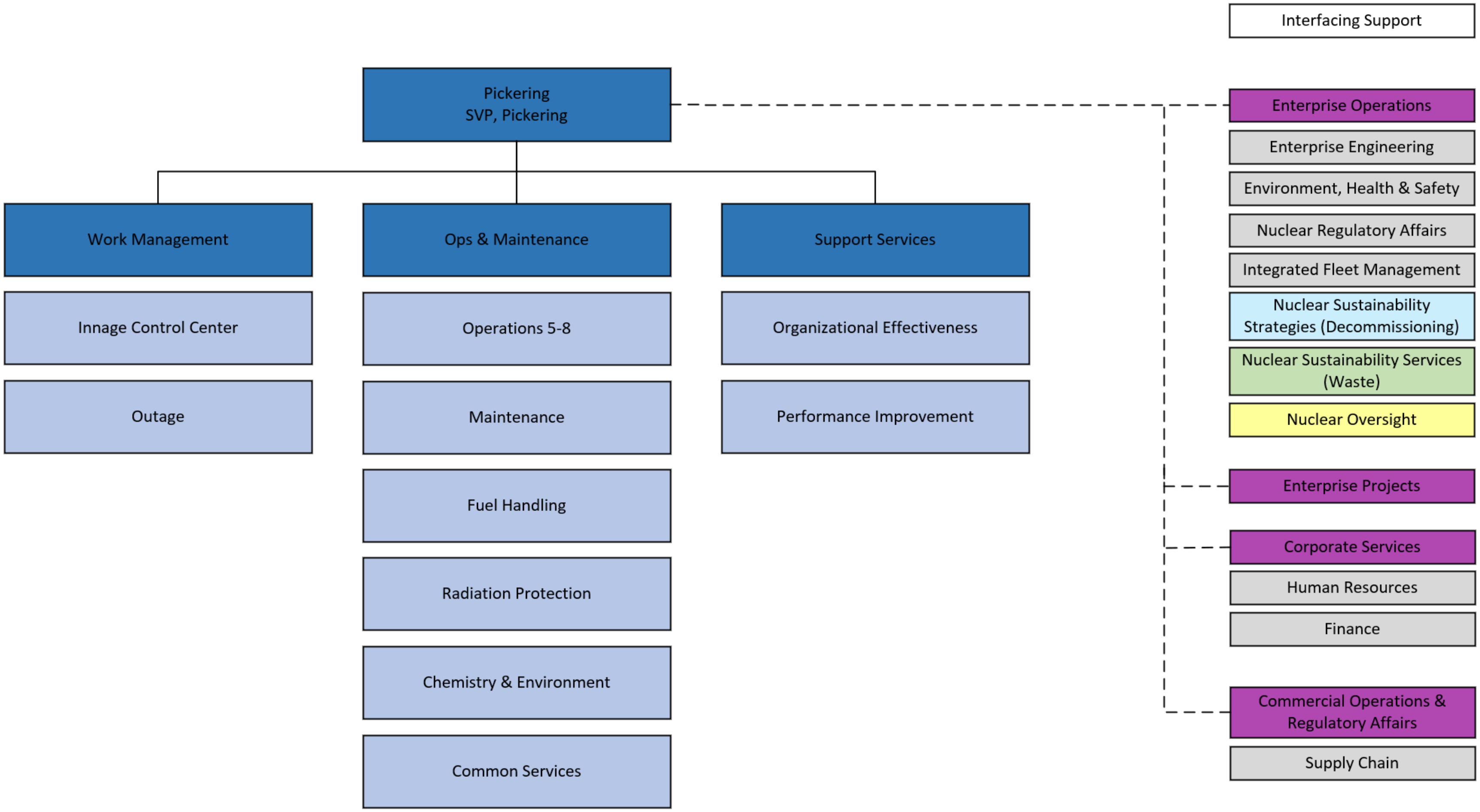

Figure 10. Pickering NGS Organizational Chart post Refurbishment

Figure 11 presents the decommissioning team organizational structure that supports Pickering NGS, and Figure 12 Figure 12outlines the Nuclear Sustainability Services organization supporting the operations of the PWMF. These organizations will continue to provide integrated support as they currently do in Figure 7 throughout the next licence period. The VP of Nuclear Growth & Sustainability is responsible for Pickering NGS decommissioning strategies, not including Pickering safe storage activities. The VP of Nuclear Sustainability Services is responsible for the management and control of operation of the PWMF, including radioactive materials transportation.

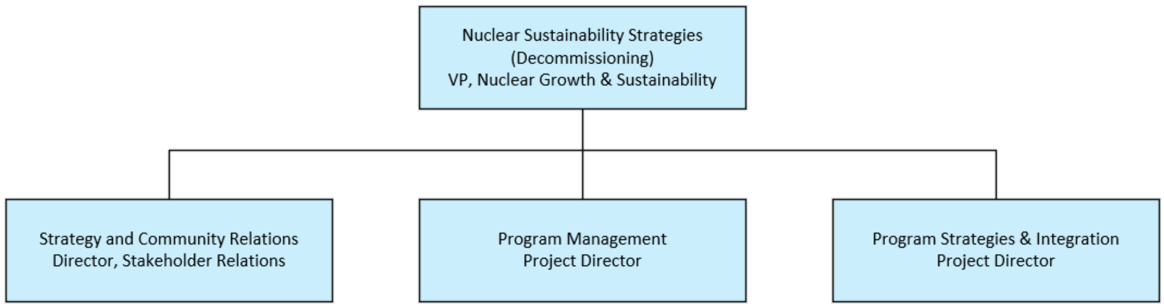

Figure 11. Pickering NGS Decommissioning Organizational Chart

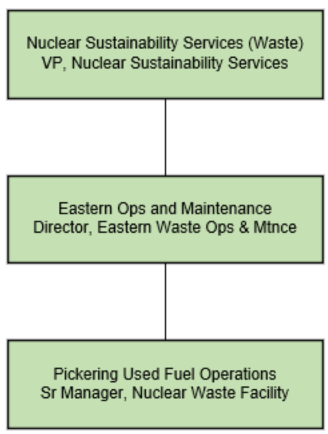

Figure 12. Pickering Waste Management Facility Organizational Chart

The above figures illustrate how the Pickering NGS interfaces with PWMF, Decommissioning project and Refurbishment project to ensure safe and reliable operations remain the priority and at the forefront of decisions. To ensure staffing levels are optimized with the required qualified and engaged people throughout the licence period, OPG will be developing an Organizational Change Management Plan in alignment with OPG-STD-0140, *Managing Change*, and OPG-PROC-0166. This Organizational Change Management Plan will support a systematic and holistic approach to ensure organizational changes achieve their intended results, maximize outcomes and minimize risks. As required by the *General Nuclear Safety and Control Regulations*, OPG will provide CNSC staff with updates to the list of persons that are authorized to represent OPG in dealings with the CNSC as the organization changes during the licence period.

To support interdivisional integration across the site, integration meetings are set up with the participation of teams and representatives from key site projects and programs, in areas such as refurbishment, safe storage, decommissioning, Nuclear Sustainability Services, and operations, who meet regularly to review progress, address issues, and ensure strategic alignment. This structured forum enables effective coordination of dependencies between areas like regulatory licensing, environmental studies, health and safety, and Indigenous engagement, helping all groups work together efficiently and in compliance with OPG's project management governance.

2.1.2.1 Staffing Management

Workforce planning is an integrated and continuous process that identifies and addresses critical gaps between the current workforce and future needs in the context of Pickering NGS's operating strategy. OPG is attracting, developing, and retaining our talent through existing programs and processes.

Staffing plans at OPG use workforce planning data (i.e. approved business plan demand, supply and attrition assumptions) to proactively identify potential resourcing gaps and risk areas requiring mitigation. The plans are prepared annually and are periodically reviewed throughout the year to ensure any changes to workforce profiles are regularly assessed for risks, mitigation plans are incorporated, and required qualified staffing levels are maintained for safe reliable operation of Pickering NGS.

Recruitment and Onboarding

OPG has a number of internal and external recruiting programs to source and attract a diverse and high-performing workforce. The sourcing strategies are multi-faceted and include partnerships with educational institutions, apprenticeship programs, use of hiring halls for trades, internal and external job posting and career sites, direct sourcing, retained/ contingent recruitment agencies and succession planning discussions.

OPG's ION is dedicated to the recruitment of Indigenous Peoples through a network of employers in the energy industry and recruitment agencies. Furthermore, OPG proactively seeks Indigenous post-secondary student participation in co-ops, internships and summer employment opportunities in an effort to build an Indigenous talent pipeline. OPG has partnerships with ED&I and Indigenous programs at Ontario Tech University, Durham College, Humber College, Queen's University, Lakehead University, and Trent University and continues to expand post-secondary partnerships. OPG is committed to advance hiring of qualified equity-deserving candidates in the four designated groups (Women, Indigenous Peoples, Racialized People, Persons with Disabilities) and increase representation at OPG.

OPG's onboarding program integrates qualified employees and contractors into the organization. It promotes exceptional performance aligned with company goals and values. The Onboarding Centre, a centralized hub, provides new hires with essential information and tools for productivity.

Knowledge Management

OPG has many well-established methods to ensure people have the qualifications, knowledge and skills required to perform competently. The knowledge management program complements

these foundational programs by providing tools and techniques to consider and share tacit knowledge.

OPG has invested in knowledge management for ongoing operations as well as the delivery of projects and initiatives to ensure that the critical knowledge and expertise of employees is sustained.

Talent and Succession Planning

The OPG talent review and succession planning program ensures that necessary talent and skills will be available when needed, and that essential knowledge and abilities will be maintained. Succession planning is one component of this strategy, with the objective to identify and develop future leadership and to integrate this with the staffing needs to ensure continuity in critical roles.

The Nuclear organization has an integrated succession planning process that includes identifying critical positions and determining the priority of each role. The level of management oversight of the succession planning of these critical positions is determined by the priority given to the role.

The OPG talent review and succession planning program is fully integrated into the broader human resources management programs within OPG that include performance measurement, individual development planning, skills and capability development, diversity and inclusion, and culture.

Leadership Development

The Human Resources (HR) organization partners with OPG business leaders at all levels to deliver an integrated leadership and talent development program to achieve business results supporting OPG’s strategy. HR designs, delivers and monitors the effectiveness of programs aligned with the strategy and OPG values, and other industry competency models that help to attract, orient, develop, engage and retain employees.

OPG participates in various external leadership development programs to advance internal leaders, support industry knowledge-sharing/learning and build a holistic approach to the learning and development portfolio. Programs and events are selected in partnership with line leaders and are managed by various program owners.

2.1.3 Performance Assessment, Improvement, and Management Review

OPG program N-PROG-RA-0010, *Independent Assessment* provides independent assessment (internal and external) processes to perform a comprehensive and critical evaluation of all activities affecting OPG nuclear facilities. This program ensures the management system under N-CHAR-AS-0002 is reviewed with sufficient frequency to confirm its continuing effectiveness. The program is comprised of the following processes:

- Internal independent assessments performed by Nuclear Oversight.
- External independent assessments performed by the Nuclear Safety Review Board (NSRB).

Programs in N-CHAR-AS-0002, *Nuclear Management System*, are assessed independently (internally) by Nuclear Oversight in accordance with N-PROC-RA-0048, *Conducting Audits and Performance Assessments*.

The NSRB performs an independent (external) assessment in accordance with N-STD-RA-0035, *Nuclear Safety Review Board*, to ensure the requirements of N-POL-0001, *Nuclear Safety and Security Policy,* and N-CHAR-AS-0002, *Nuclear Management System*, are being fulfilled.

OPG program N-PROG-RA-0003, *Performance Improvement*, establishes the processes that support the conduct of performance improvement and, by extension, employ the principles for preventing, identifying and understanding, and correcting problems. This program covers the key areas of performance improvement, namely; corrective action, self-assessment, benchmarking, operating experience, and nuclear safety culture.

Self-assessment and benchmarking activities for functional and line organizations of OPG are performed in accordance with N-PROC-RA-0097, *Self-Assessment and Benchmarking*. Self-assessments and benchmarking are utilized to evaluate actual performance against management expectations, industry standards of excellence and regulatory requirements. Identified adverse conditions are documented as per procedure N-PROC-RA-0022, *Processing Station Condition Records*, and corrective actions are assigned as required.

In addition to the above, OPG performs regular program health and performance reviews for all applicable programs within the nuclear management system in accordance with N-PROC-RA-0023, *Fleetview Program Health and Performance Reporting*. Fleetview Program Health and Performance is a fleet-wide functional review and reporting process to monitor and routinely report on overall program effectiveness. The inputs into the report support OPG to drive continuous improvement efforts and sustainable performance. The oversight provided by Nuclear Executive Committee ensures that early signs of decline are self-identified and self-corrected through sustainable actions in order to achieve and/or maintain industry top quartile performance. For programs that may require additional oversight, the Nuclear Executive Committee will conduct focused meetings to further drive improvement of program performance.

The effectiveness of the Performance Improvement (PI) program is routinely assessed through a set of Key Performance Indicators (KPI) in the monthly PI Health Report. Routine peer team meetings are effectively used to share site and industry best practices, discuss tactical and strategic actions to correct performance shortfalls and gaps to excellence.

This programmatic approach offers defense in depth, with multiple layers of oversight across the station to ensure that adverse conditions are quickly identified, understood, and corrected. Strong line ownership taking action when trends are identified proactively ensures that issues and problems are resolved with appropriate response to eliminating or reducing the frequency of events. The result of this is high quality work and safe, reliable operations through the Pickering NGS refurbishment project. This ensures safety for the public, station personnel, environment, and plant.

2.1.4 Operating Experience (OPEX), Problem Identification and Resolution

N-PROG-RA-0003, *Performance Improvement*, allows for the proactive identification and resolution of potential issues or opportunities for improvement as well as allowing for the prompt identification of adverse conditions. This includes non-conformances, deficiencies, or conditions that adversely impact – or may adversely impact – plant operations, personnel, nuclear safety, the environment or equipment and component reliability. These processes ensure that problems are corrected or dispositioned with a level of rigor and formality commensurate with their risk significance. For those problems deemed to be of a high level of significance or systemic in nature, these processes ensure appropriate levels of management are notified, causes identified, actions taken to minimize or prevent recurrence and lessons learned are communicated. Actions taken to address the identified causes of significant or systemic problems are verified to be complete and effective.

N-STD-RA-0008, *Incident Investigation*, provides a systematic and consistent approach for evaluating adverse conditions at OPG, including determining the cause of an adverse condition or event, and developing effective corrective actions to eliminate or reduce the probability of similar events occurring in the future. Incident investigation should determine if the adverse condition is an individual, programmatic, or organizational issue.

N-PROC-RA-0035, *OPEX,* establishes processes to prevent reoccurrence of significant internal and external events received from nuclear industry sources, by ensuring internal and external OPEX is evaluated, distributed to appropriate personnel, and applied to implement actions that improve plant safety and reliability.

In 2021, OPG developed a new OPEX database to facilitate the distribution of external OPEX from Conexus Nuclear Inc. to departmental OPEX Single Points of Contact, the management of OPEX reviews, and the documentation of initial assessments or dispositions from site departments. The OPEX database also provides a readily available repository of all previous external OPEX and site reviews/responses to new OPEX with searching capabilities.

As part of ongoing improvements for the OPEX process and use of OPEX at Pickering NGS, a number of initiatives have been completed or are in-progress:

- Implemented a web-based OPEX search engine that is able to extract information from various sources such as the Station Condition Record (SCR) database, OPEX Database, Work Reports etc. providing quick access to key OPEX events relevant to line organization tasks.
- OPEX Health Metrics were updated to challenge the status quo for indicators with consistent green scores over a long period and raising the target score for green, yellow, white and red ranges to further improve performance and challenge the fleet for maintaining excellence. A second part of this initiative is OPEX Health Metrics automation of KPIs to provide efficiency in completing monthly metrics and provide visibility to line organizations of where the data is specifically feeding from. This feature will help identify trends (declines or improvements) in specific KPIs and which line organizations are contributing to it. The benefit will provide line organizations the opportunity to check and adjust their behaviours towards implementing OPEX internally and from external sources.
- Improving use of internal and external OPEX during Pre-Job Brief and *electronic Safe Work Plan* (eSWP) as part of the current review of Institute of Nuclear Power Operators (INPO) IER L2-24-2, Leadership in Preventing Fatalities and Severe Injuries.
- Establishing a Plant Information Centre Impact Identifier program to support line organizations in understanding of how internal events that are Industry Reporting and Information System (IRIS) reports are impacting station performance. OPG's governance, oversight and internal reporting structure have been aligned with Plant Information Centre and IRIS to drive sustainable performance improvements in all business areas through comparison against top performances in the North American nuclear industry.

2.1.5 Configuration Management and Change Control

Changes at OPG are implemented to realize improved results in safety, quality, cost and operations. OPG-STD-0140, *Managing Change*, outlines the Change Management approach to change planning and implementation to ensure changes achieve their intended results, maximize outcomes through better change adoption, and minimize risk.

Configuration Management at OPG is governed by N-STD-MP-0027, *Configuration Management*, which takes its authority from N-PROG-AS-0001 *Nuclear Management System Administration.* N-STD-MP-0027 ensures the station physical configuration for all essential SSC matches the configuration documents for all plant states. In addition, the standard ensures configuration information is maintained accurately, consistently and is readily accessible along with defining clear scope, responsibilities, authorities and interfaces among organizations. This information is uniquely identified, maintained current and consistent.

The standard controls the changes which may affect configuration by:

- Requiring regulatory and licensing reviews, approvals and safety evaluations to ensure physical configuration or configuration information changes conform to the design and licensing basis.
- Reviewing impacts so that related configuration information is maintained consistent with the change.
- Ensuring changes to the design and licensing basis receive appropriate verification and approvals before the change is made.
- Ensuring change processes work in accordance and consistently with each other for design, procurement, construction, installation, commissioning, operation and maintenance, including surveillance, training, and testing.

Figure 13 shows the relationship between nuclear management system activities, programs and configuration management.

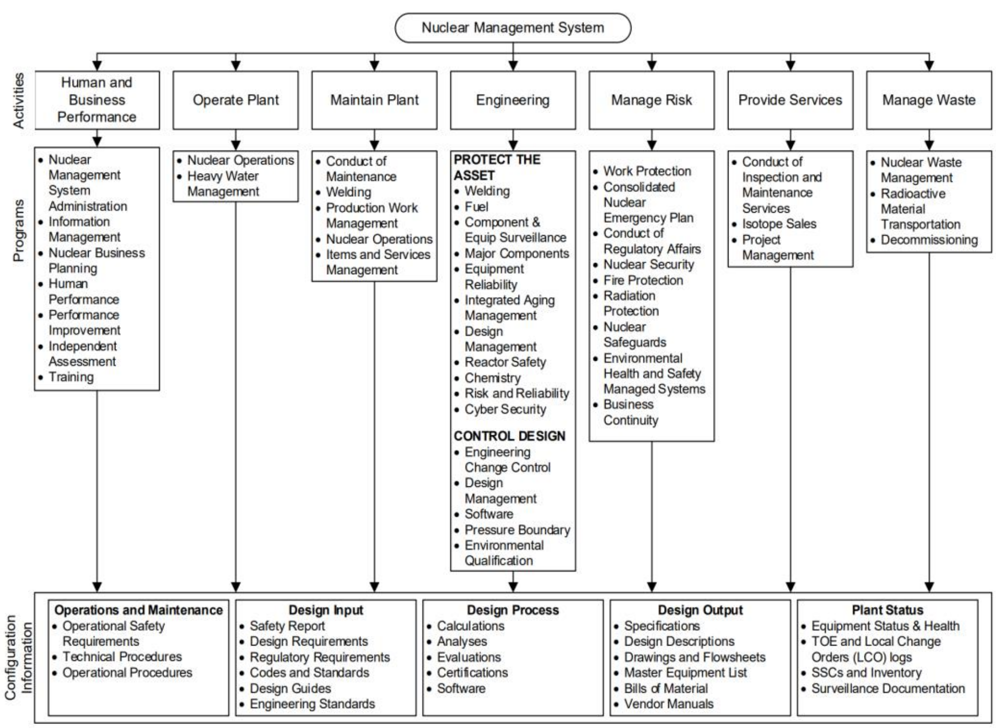

Figure 13. Configuration Management Relationships of engineering changes to support the safe and reliable operation of OPG facilities

Change Control programs such as ECC, support configuration management by ensuring design changes, document changes and physical configuration changes that impact design and the licensing basis are tracked to completion and are traceable throughout the life of the facility. Adverse configuration management issues are documented using SCRs.

Design changes are performed in accordance with OPG's program N-PROG-MP-0001, *Engineering Change Control*. The program and its implementing procedures have been written to be consistent with N-POL-0001, CSA N286-12, and all relevant legal, statutory and regulatory requirements, as well as Industry guidelines. The ECC program ensures design changes to each OPG facility (including SSC, software and engineered tooling) are controlled such that the facility configuration is managed in accordance with the design and licensing bases and remains within the SOE.

For pressure boundary SSC, OPG's program N-PROG-MP-0004, *Pressure Boundary* complies with the general configuration management requirements and additional requirements in N-STD-MP-0027. The ECC process detailed in N-PROC-MP-0090, *Engineering Change Control Process*, ensures that OPG's pressure boundary processes are described in the Pressure Boundary program.

Configuration management is an important aspect of maintaining and keeping Pickering NGS in an assessed state within the SOE and is reviewed both by internal and external organizations regularly. Actions are taken as appropriate to correct any identified adverse conditions.

OPG's Nuclear Oversight audits of the ECC program in 2020 and 2023 found that the managed system controls are effective and that overall, the program achieves its goal of executing and controlling engineering changes to support the safe and reliable operation of OPG facilities.

The ECC program documents undergo cyclic review and revision. Such revisions include improvements based on industry OPEX and as suggested by users. Ongoing process improvements are also generated through two monthly meetings intended to identify any problem areas and share OPEX. The Design Managers' Working Group consists of the OPG facility Design Authorities and other managers of various OPG and vendor design organizations, while the ECC Working Group consists of working-level staff from those organizations. Thus, the process is regularly examined from varying points of view to ensure that it meets requirements and is efficient.

OPG continues to make use of vendor companies to Engineer, Procure, and Construct (EPC) modifications that will improve the reliability of Pickering NGS and OPG facilities. To ensure the use of EPC is successful, OPG is continually working to better define the requirements and level of oversight required for contracted work. EPC is managed through a quality assurance program to ensure that OPG's expectations for vendor design and installation quality are met.

2.1.6 Nuclear Safety and Security Culture

N-POL-0001, *Nuclear Safety and Security Culture* establishes the fundamental principles for OPG employees. It emphasizes the vital importance of nuclear safety and security as the top priority in all activities performed in support of OPG facilities and underscores the value that OPG places on ensuring the highest level of protection for individuals, the environment, and surrounding communities. The policy highlights the organization's firm commitment to prioritizing nuclear safety over any other consideration, including cost, schedule, or production. By adhering to this policy, OPG employees can be confident that they are contributing to a culture of safety and responsibility that is paramount to the success of the organization.

In accordance with the policy, the Chief Nuclear Officer is accountable to the CEO and the Board of Directors to establish a management system that fosters nuclear safety and security as the overriding priority

OPG's Traits of a Healthy Nuclear Safety and Security Culture are detailed in Figure 14. These 11 traits are incorporated into OPG's organization and administrative procedures starting at the policy level and cascading throughout the nuclear management system, programs and procedures.

Figure 14. Nuclear Safety and Security Culture

N-STD-AS-0023, *Nuclear Safety Oversight,* summarizes the framework and accountabilities for nuclear safety oversight as well as the external and internal processes used for oversight and assessment of nuclear safety. This standard applies to all aspects of nuclear operations and to all work and other activities undertaken at or in support of the stations. Nuclear safety oversight is conducted in a manner consistent with the Traits of a Healthy Nuclear Safety and Security Culture.

OPG conducts comprehensive, systematic and rigorous safety culture assessments at least every 5 years in accordance with CNSC regulatory document REGDOC-2.1.2, *Safety Culture*.

In March 2022, Pickering NGS successfully conducted a station-wide Nuclear Safety and Security Culture Assessment to identify areas for improvement and areas of strength. The assessment included a staff survey of all Pickering NGS employees and contract partners on the site, as well as an on-site evaluation that included document reviews, staff interviews and observations. The assessment focused on perceptions, attitudes and behaviours of the organization, and concluded that Pickering NGS has a healthy nuclear safety culture, healthy respect for nuclear safety, and nuclear safety is not compromised by production priorities. In particular, station personnel feel they can challenge any decision if needed, without fear of reprisal.

This marked Pickering NGS's first evaluation since the implementation of CNSC REGDOC-2.1.2, of the Vigilance trait in Nuclear Security. The evaluation determined that Pickering NGS has a healthy nuclear security culture. However, OPG recognizes, with the rapid changes occurring in the technology sector, the need for heightened awareness and comprehension of nuclear security, including cyber security.

All results were documented in a self-assessment report in accordance with N-PROC-RA-0097, *Self-Assessment and Benchmarking* and N-PROC-AS-0077, *Nuclear Safety & Security Culture Assessments*. The results were communicated to staff by the Senior Leadership within a month following the assessment, and action plans were developed. Areas for improvement were documented and the actions taken to address the findings were tracked.

In 2022, Conexus Nuclear Inc. (formerly CANDU Owners Group or COG), in collaboration with Canadian Nuclear Utilities, developed a tool to assist in the assessment of Nuclear Safety and Security Culture. This tool was able to efficiently process and compare all the survey and interview data, significantly accelerate the report generation process, and provide a more precise depiction of the culture within OPG facilities.

OPG will continue to conduct station-wide assessments every 5-years as per CNSC REGDOC-2.1.2. OPG has tentatively scheduled the next assessment for Pickering NGS staff and contract partners on site for 2026.

In addition to the comprehensive station-wide assessment, OPG has a Pickering Nuclear Safety and Security Culture Monitoring Panel (NSSCMP) tasked with overseeing the key process indicators that reflect the state of the organization's nuclear safety and security culture. This panel, comprised of the senior plant leadership team, convenes twice a year to deliberate on the 11 nuclear safety and security culture traits. In doing so, strengths and potential concerns that merit additional attention by the organization are identified and acted upon.

One component contributing to these discussions is facilitated by the NSSCMP Power App. This online tool, developed in 2020, enables frontline station personnel to evaluate the 44 attributes constituting a robust Nuclear Safety and Security Culture and provide input directly to the NSSCMP. This approach allows OPG to capture insights from staff regularly working in and around the plant, helping to discern faint signals within the organization.

During the current licence term, OPG also implemented the Nuclear Safety and Security Culture Trait of the Week and accompanying App to remind staff about each of the attributes under the Traits on a rotating basis.

OPG has a comprehensive leadership development program that integrates the Nuclear Safety and Security Culture Traits at all levels. This includes the incorporation of Nuclear Safety Culture into employee orientation, leadership fundamentals training, and continuing leadership training.

2.1.6.1 Nuclear Safety and Security Culture and Organizational Effectiveness

Organizational effectiveness is monitored using the INPO Staying on Top (SOT) values. INPO's SOT values is a tool used by Industry for assessing organizational effectiveness and is based on the analysis of specific, common characteristics that exist in organizations that have achieved uninterrupted high performance for decades. SOT values include: Setting Long-Term Direction, Leadership and Talent Development, Excellence Standards, Continuous Learning, and Self-Awareness and Self-Correction. OPG performs an assessment of SOT at Pickering NGS every year to constantly monitor and course correct as required. Another tool used to monitor organizational effectiveness is the Employee Engagement survey. This pulses the organization on several key areas including commitment to the organization, the perspective of the leadership team, communication effectiveness, and alignment. This was recently done in 2022 and again at the end of 2023 OPG-wide. In 2025, OPG will assess employee sense of belonging across the Enterprise as the primary engagement focus area.

Information gathered from SOT meetings and the annual assessment as well as the Employee Engagement survey are included among the inputs managers use in the NSSCMP for each Nuclear Safety and Security Culture Trait assessment.

The interactive Organizational Roadmap metrics are reviewed by the NSSCMP as part of the package put together for the NSSCMP meetings. This roadmap, developed by INPO, shows the relationship between Leadership and Team Effectiveness, SOT, Nuclear Safety Culture and Organizational Effectiveness as well as key INPO documents such as Integrated Risk Management, Technical Conscience and Operations and Maintenance Fundamentals. OPG has tied its performance objective and criteria codes that are applied to SCRs to this roadmap to see if there are any trends arising that align with Nuclear Safety and Security Culture and ultimately, Organizational Effectiveness. The outcomes from the Organizational Effectiveness Reflection sessions and the SOT annual assessments are also used as indicators to the overall health of Nuclear Safety and Security culture.

2.1.7 Records Management

OPG-PROG-0001, *Information Management,* establishes a set of standards and procedures for the management of OPG's information throughout its life-cycle, regardless of media, to ensure consistent and appropriate use. The Information Management program is applicable to all OPG employees, temporary staff and contractors.

One of the objectives of the Information Management program is the advancement of electronic, digital, and mobility solutions that provide tools that effectively and efficiently capture, change, issue, and make content available electronically and with the highest quality. During the current licence term, a number of enhancements were made to Information Management tools used by OPG staff. For example:

- OPG's enterprise software, Asset Suite, was upgraded to incorporate new features and to maintain full vendor support. Cyber security has also evolved rapidly and is covered in Section 2.12.5.
- A new application allows workers to electronically submit and file their records and documents in Asset Suite/Curator, which has significantly reduced the turnaround time on availability.
- Electronic Work Packages are used by Pickering NGS Maintenance to allow the use of tablets for downloading work order tasks and associated documentation for use in the

field. This solution eliminates a paper-based process from Work Order binders to final records.

A new application is planned to be used to further automate OPG's client service processes. Once completed, the tool will embed key information management processes to improve control for the many OPG workers who handle confidential security information, and to automate external information exchange and Legal Hold processes.

In conjunction with the Cyber Security program data protection project, the security document access process is planned to be upgraded/modernized to take best advantage of evolving encryption protections and to automate the approvals and Asset Suite access.

Records projects are also underway to decrease the amount of legacy paper records in physical vaults and to scan quality assurance records for ease of access and secure fast retrievals.

2.1.8 Supply and Contractor Management

Supply and Contractor management are performed in accordance with OPG-PROG-0009, *Items and Service Management*, which interfaces with OPG-PROG-0038, *Contract Management* for managing contracts for services.

OPG-PROG-0009 establishes a governing document framework that meets regulatory requirements and ensures effective and efficient planning for and procurement of items and service. OPG-PROG-0038 establishes a governing document framework for managing contracts related to contractor services.

The supply chain organization is responsible for providing the necessary services and materials in a timely manner and of the appropriate quality to the Pickering NGS site. Supply Chain confirms all the quality aspects for receipted materials based on designated quality requirements. The contract owner confirms quality aspects for services. Vendor quality is maintained through audits, receiving inspections, and vendor oversight and surveillance.

OPG has extensive experience in the use of contractors to engineer, procure and construct new facilities or to implement design improvement to OPG's existing facilities. OPG will leverage OPEX from previous similar projects such as the Darlington NGS Refurbishment project to optimize how supply chain integrates with the contractors. This can include but is not limited to: improved terms and conditions that is more favourable to OPG, leveraging inventory tracking software to increase visibility on contractor inventory, and controlling costs through consolidating payment structures and applying new incentives and disincentive models. Contractors and suppliers are qualified by OPG Supply Chain Quality Services under a process that ensures each contractor has developed and implemented a management system that meets the applicable requirements outlined in CSA N286-12. OPG assesses a contractor's capability to work at OPG Nuclear facilities through an audit of the contractor's processes, to ensure they can perform the necessary work, with OPG oversight as the licensee at each stage. Once OPG is assured of a contractor's capabilities, they are placed on OPG's approved suppliers list, as approved contractors.

The contractors that OPG uses have experience with the nuclear industry and with OPG. OPG-PROG-0009 includes provisions for extending applicable quality requirements to sub-contractors. OPG requires that all sub-contractors work under the contractor's quality program, to ensure there is an assurance that the agreed upon quality standards and expectations will be met, regardless of who is performing the work in the field. Field surveillance and verification activities are performed by OPG personnel (Contract Monitoring Officers) to ensure that the quality program requirements are being achieved.

Where possible, OPG will temporarily turn the contractor work area over to the contractor, as a Construction Island (defined project area controlled by contractor/vendor) where the contractor assumes the role of "Constructor" as defined in the *Ontario Occupation Health and Safety Act*. As Constructor, the contractor assumes responsibility and liability for conventional safety and environmental safety associated with the contractor work. The contractor produces a site-specific Health and Safety Plan and Environmental Safety Plan, which is accepted by OPG prior to the contractor work start. RP remains the responsibility of OPG.

Where a construction island is not feasible, OPG maintains the role of Constructor and provides oversight to the contractor. In this case, all contractor work will be carried out in accordance with OPG processes and procedures. OPG maintains responsibility and liability for conventional safety, environmental safety, and RP of the contractor work.

OPG retains the responsibility that the facility remains compliant with the operating licence. As such, OPG is accountable to the CNSC to provide the required assurances that the health, safety, and security of the public, workers, and environment are protected. This accountability cannot be delegated through contractual arrangements.

OPG program, OPG-PROG-0046 *Construction Management*, applies to the management of individual projects as well as to the integrated management of a group or program of related construction projects, or the total project portfolio at a plant/plant group, or business unit. This program, for nuclear projects, includes compliance to construction specific requirements of CSA N286-12.

Counterfeit, Fraudulent and Suspect Items

OPG's Counterfeit, Fraudulent and Suspect Items (CFSI) program is implemented through N-PROC-MM-0021, *Supply Inspection*, N-GUID-08173-10010, *Receiving Inspection Guideline,* Supply Chain Quality Services Supplier Audit Checklist(s) N-TMP-10294 and N-GUID-01900-10005, *Guideline to Identify Counterfeit, Fraudulent and Suspect Items*, and is aligned to industry best practices. All suppliers to OPG are required to have an implemented CFSI program and this is verified by supplier audits carried out by OPG.

Enhanced purchasing clauses and receiving inspections have been in place for several years to prevent CFSI material from being supplied to or received by OPG. Standardized training on CFSI was developed and implemented to support this program. External reviews and benchmarking indicates that OPG's CFSI program is an industry-leading, well established and an effectively implemented program.

OPG has also improved the supply chain quality engineering and supplier performance management process (N-PROC-MM-0041, *Quality Engineering and Supplier Performance Management*), which involves identifying and managing supplier quality issues from SCRs, audits, receiving inspections, and vendor oversight and surveillance activities.

2.1.9 Business Continuity

The objective of OPG-PROG-0033, *Business Continuity Program*, is to establish a managed system for business continuity, and to provide direction related to business and operational continuity, and recovery planning.

The Business Continuity program is aligned with OPG's business goals and objectives. The Business Continuity Program requirements, as defined by governance, are met and effectively implemented to ensure safe and reliable operation of the Pickering NGS, in accordance with periodic document updates and annual exercise requirements.

The Business Continuity Program ensures that if a disruption occurs or if there is a threat of disruption, critical business and operational processes continue to be available, or resume to the defined minimum operability requirements within required time limits.

Business continuity plans are revised every three years, with the most recent revision occurring in 2024. Notable recent improvements focus on response strategies to address enterprise ransomware events. Additional focus on ransomware is being further implemented as an initiative through the Business Continuity program.

OPG has an enterprise-wide Infectious Disease Response procedure which replaces previous pandemic plans. This procedure and the associated Infectious Disease Incident Response Team were utilized effectively as a part of OPGs Emergency Response Organization in response to the COVID-19 pandemic to support safe operations during this period. Following the COVID-19 pandemic, OPG conducted a review of the response to *capture lessons learned,* such as the inclusion of a formalized contingency staffing plan and specific plan activation and deactivation criteria for identified risks.

To support continuous improvement of the Business Continuity program, OPG will be incorporating Resiliency principles outlined in industry guidance. This will further strengthen resiliency against external threats that challenge continuity of operations.

2.1.10 Pickering NGS Units 1 to 4 Decommissioning

This section provides additional information regarding the Management System SCA with respect to Units 1 to 4 decommissioning. It is intended to supplement the information provided in the general SCA discussion above and therefore only addresses those specific areas where additional decommissioning-related details are needed.

Management System

The execution of work during decommissioning will follow OPG-PROG-0046, *Construction Management*, which is a referenced program in OPG's Nuclear Management System. This program ensures nuclear projects meets CSA N286-12 construction requirements with adequate oversight.

Organization

The organization required to oversee the decommissioning program will be assembled from available OPG station staff and outside resources as needed. While the following information represents the current planning basis, detailed organizational structures and contractor arrangements will be further developed and included in the next DDP update.

Decommissioning contractor(s) will be retained to perform the dismantling, demolition, and site restoration work. OPG will provide the necessary oversight during planning and execution of the work. The decommissioning contractor(s) will be a company or consortium selected based on factors such as decommissioning experience, safety record, overall approach, and cost. OPG will remain the owner and licensee of the Pickering NGS throughout the course of Pickering NGS Units 1 to 4 decommissioning, but the decommissioning contractor(s) may be given charge and control of the decommissioning areas during risk reduction, dismantling, demolition and site restoration. Other contractors may also be given charge and control of designated portions of the site during certain phases of the decommissioning. During these periods, the contractor will become the 'Constructor' for the decommissioning work as defined by the construction safety regulations made pursuant to the *Occupational Health and Safety Act*. The decommissioning contractor(s) and sub-contractors will be required to comply with OPG procedures related to Nuclear Energy Workers and all federal and provincial regulations.

Configuration Management and Change Control

Configuration management for active systems during Decommissioning will follow existing governance currently used to maintain plant status control. Once systems have been end-stated, the configuration management of that system will fall under end-stating governance which requires the appropriate documentation and approvals to operate devices tagged as end-stated and work protection for any maintenance activities on the system.

2.1.11 Pickering NGS Units 5 to 8 Refurbishment

This section provides additional information regarding the Management System SCA with respect to Units 5 to 8 refurbishment. It is intended to supplement the information provided in the general SCA discussion above and therefore only addresses those specific areas where additional refurbishment-related details are needed.

Management System

The Nuclear Refurbishment organization will be subject to the OPG Nuclear Management System, N-CHAR-AS-0002 and all governance under that system.

In addition, the Nuclear Refurbishment organization has developed Pickering NGS Units 5 to 8 Refurbishment Program Management Plans to describe how refurbishment meets the Nuclear Management System and to identify any supplemental guidance/direction specific to undertaking the refurbishment of the units.

The Refurbishment Program complies with the Project and Construction Management Programs, OPG-PROG-0039 and OPG-PROG-0046 respectively. This program describes the key project management principles to support the safe, consistent, and effective execution of nuclear projects at OPG. OPG-PROG-0046 is implemented through standards on project management, contract management, project oversight and field engineering and supplemented with a procedure on the technical contractor management process.

Contractor Quality Management

EPC contractors will perform the majority of the refurbishment work.

Contractors and suppliers are qualified by OPG Supply Chain Quality Services under a process that ensures each contractor has developed and implemented a management system that meets the applicable requirements outlined in CSA N286-12. OPG assesses a contractor’s capability to work at OPG Nuclear facilities through an audit of the contractor’s processes, to ensure they can perform the necessary work, with OPG oversight as the licensee at each stage. Once OPG is assured of a contractor’s capabilities, they are placed on OPG’s approved suppliers list, as approved contractors. Combining this with the fact that many of the EPC contractors have a long history of working in the nuclear industry and with OPG in particular, provides confidence that the results of their work activities will satisfy all applicable standards.

Nuclear Refurbishment Program Oversight

OPG's Nuclear Standard on OPG-STD-0148, *Project Management* will be followed during refurbishment. Nuclear Oversight is accountable to ensure consistent oversight across the entire program and to coordinate all external reviews and evaluations.

The OPG Project Managers are accountable for planning and conducting oversight of their contractors and communicating and documenting the results. Project oversight of contractors is an assessment of the contractor's products and services to determine if they are delivering the contracted products and services safely, to the specified quality, on time and on budget.

Organization

The organizational structure is designed to ensure Operations remains in oversight of the plant operations and safe monitoring of irradiated fuel while Pickering NGS undergoes refurbishment. The reporting relationship of the Plant Operations Vice President (or Licence Holder) to the Chief Nuclear Officer (CNO) delegate ensures accountability of Operations performance and oversight of Refurbishment activities. This ensures an operational lens is applied to planning, decision making and execution of the project.

Following shutdown and defuel of the units, staff will be redeployed in the organization to support Pickering Refurbishment projects and be available to support minimum compliment and certification requirements prior to unit RTS. These staffing transition plans are currently being developed in detail.

The Maintenance Organization will form composite crews (control and mechanical trades) which will be responsible for executing specific scope in the Pickering Refurbishment Project. The Maintenance Transition Plan identifies the project scope that each composite crew will be executing and outlines the training plan that each crew will undergo in order to execute the work with safety and quality.

OPEX from the Darlington Refurbishment Project was considered to inform staffing strategies for each organization supporting Pickering Refurbishment. For example, Darlington used the concept of “swing staff” where organizations were created in the refurbishment organization structure under Operations and Maintenance and designated station staff would be reassigned to report into the appropriate department in refurbishment to support pre-requisite and execution work. This strategy was outlined in departmental transition plans to support Darlington Refurbishment for Unit 2.

The Pickering Refurbishment team in Operations and Maintenance have created transition plans that focus on staffing, building on the OPEX from the Darlington Refurbishment Project. The primary difference with Pickering Refurbishment is that the majority of station staff will be supporting refurbishment upon completion of defuel and dewater activities on Units 5 to 8 in 2027. In addition, each department is applying change management best-practices utilizing OPG-STD-0140, *Managing Change* and identifying people readiness risks related to staff reassignment collaboratively as “One Site, One Team”. This is being done collaboratively with Staffing Plan Owners to consider broader fleet impacts, and in partnership with the Pickering Nuclear organization.

Integration of transition planning has been incorporated into the Pickering Nuclear Station Excellence Meeting. Darlington Nuclear and Darlington Refurbishment took a similar “*OneTEAM*” approach to people and organizational readiness. Furthermore, Darlington Refurbishment OPEX points to the value of utilizing secondments to vendor partners of OPG staff as needed to help facilitate organizational integration. Pickering Refurbishment is taking a similar approach and secondments will be a strategy OPG will consider where necessary.

Performance Assessment, Improvement and Management Review

The Enterprise Projects and Conventional Health and Safety organizations will develop and conduct annual self-assessments, as per OPG processes, to confirm that the objectives of safety, scope, cost, and schedule are being maintained. The Pickering Refurbishment Program annual self-assessment plan are presented to and approved by Enterprise Projects Organization CARB (Corrective Action Review Board).

OPEX

The Pickering NGS refurbishment planning efforts included reviews of operating experience and lessons learned from Darlington NGS Refurbishment and OPG Hydro projects, as well as past CANDU and other nuclear refurbishments. To facilitate the sharing of information, skills, expertise, and insights across projects and teams, staff placements from the Darlington Refurbishment Project and Knowledge Transfer sessions have been introduced. These sessions are primarily designed to ensure that essential knowledge is effectively communicated and preserved within the organization.

Throughout the Darlington NGS refurbishment, comprehensive Lessons Learned Workshops were conducted at the end of each Window, which captured critical OPEX. The Lessons Learned team has been working with Project Teams, identifying scope areas related to the Darlington and Nuclear projects. Knowledge transfer sessions are near completion, where OPEX has been pulled from relevant projects and shared with the project teams to implement into planning. The Project Teams embraced a continuous learning mindset, actively participating in knowledge sharing. This approach enabled us to capture and transfer thousands of lessons, ensuring each unit benefited from previous experiences.

Additionally, the Bruce Power Collaboration Agreement has been amended to include the Pickering NGS refurbishment. This agreement allows for the exchange of lessons learned, engineering designs, resources, planning, reporting, tooling and equipment, resulting in more efficient and successful projects for both Bruce Power's Major Component Replacement and OPG's refurbishment projects. The exchange is limited to the approved vendors within the agreement and excludes any cost or budget information.

Nuclear Safety and Security Culture

The Nuclear Refurbishment organization is comprised of project teams and functional organizations supported by embedded staff from central OPG and OPG Nuclear organizations.

Ensuring a healthy safety culture exists within the construction environment during refurbishment will be achieved through active leadership from the responsible management teams from OPG and contractors starting with alignment around, "Safety is our core value".

Working under the Enterprise Projects Organization, the Construction Centre of Excellence (CCoE) will provide or oversee contract management, quality management and construction management in compliance with OPG-PROC-0231, *Construction Management and Oversight*.

Nuclear Refurbishment and contractor's management teams will:

- Set and maintain high standards and common expectations, through a focused management program that will be in place prior to commencement of refurbishment activities.
- Be aligned on common priorities and goals for quality, safety and efficiencies.
- Utilizing OPG-PROC-0231 and established procedures, conduct strong and agreed-upon oversight and assessment activities for quality, safety and efficiencies.

Established approaches to maintaining a healthy nuclear safety and security culture will be used based on industry experience and actual refurbishment performance. A key element is communication and reinforcement of the Safety and Security Culture message by the leadership of Nuclear Refurbishment and the contractors along with extensive field supervisory and worker training and reinforcement to engrain and uphold safety and security culture.

Similar to what was done for the Darlington NGS Refurbishment project, the Pickering NGS Refurbishment organization will conduct Nuclear Safety and Security Culture Assessments and monitoring panel discussions in conjunction with station operations at the beginning of the project, and then independent of station operations when further into the project, in order to maintain a healthy nuclear safety and security culture of the Pickering NGS.

2.1.12 Pickering Waste Management Facility

The OPG documents in the table below require written notification of change per PWMF Licence Conditions Handbook, LCH-W4-350.00/2028 R003:

Table 17. SCA 1 – PWMF Management System

Document Number	Document Title
OPG-PROG-0009	Items and Services Management
N-STD-AS-0020	Nuclear Management System Organizations
N-PROC-AS-0077	Nuclear Safety and Security Culture Assessment
N-STD-AS-0023	Nuclear Safety Oversight
N-POL-0001	Nuclear Safety and Security Policy
N-CHAR-AS-0002	Nuclear Management System
N-PROG-AS-0001	Nuclear Management System Administration
OPG-PROG-0046	Construction Management
N-PROG-RA-0010	Independent Assessment
OPG-PROG-0038	Contract Management

As discussed in the sections above, OPG's nuclear management system is documented in N-CHAR-AS-0002, and defines the organizational structure, roles and responsibilities, applicable programs and the interfaces amongst them. It applies to all OPG Nuclear facilities, including the PWMF, and is compliant with CSA N286-12, *Management system requirements for nuclear facilities*. OPG's nuclear management system establishes the required programs and processes to ensure that all OPG Nuclear facilities define the necessary safety objectives, continuously monitor performance against these objectives and foster a healthy Nuclear Safety Culture.

Descriptions of the applicable implementation programs and processes under the Management System SCA are provided in subsections 2.1.1 to 2.1.8 above.

2.2 Human Performance Management

Pickering NGS has an effective Human Performance Management Program that meets or exceeds all applicable regulatory requirements and related objectives to enable effective Human Performance through implementation of processes that ensure a sufficient number of licensed personnel are in relevant job areas, have the necessary knowledge, skills, procedures and tools in place to safely carry out their duties.

The OPG documents in the table below require written notification of change per Pickering NGS Licence Conditions Handbook, LCH-PR-48.00/2028-R007:

Table 18. SCA 2 – Pickering NGS Human Performance Management

Document Number	Document Title
N-PROG-AS-0002	Human Performance
P-PLAN-01900-00005[1]	Pickering Human Performance Strategic Plan
N-STD-OP-0002	Communications
N-STD-OP-0012	Conservative Decision Making
N-PROC-OP-0047	Hours of Work Limits and Managing Worker Fatigue
N-LIST-09110-10005	Listing of Broad Population and Safety Sensitive Job Codes
N-CMT-62808-00001	Continuous Behaviour Observations Program (CBOP) Participant Materials – Workbook Components
OPG-PROC-0028	Fitness for Duty: Policy on Managing Alcohol and Drug Use
P-INS-09100-00003	Pickering Minimum Shift Complement
P-INS-09260-00008	Duty Crew Minimum Complement Assurance
N-INS-03490-10003	Minimum Shift Complement Resources, Qualifications and Procedures Required for Responding to Resource Limiting Events
N-PROG-TR-0005	Training
N-PROC-TR-0008	Systematic Approach to Training
N-MAN-08131-10000-CNSC-031	Responsible Health Physicist
N-MAN-08131-10000-CNSC-007	Shift Manager, Pickering Nuclear
N-MAN-08131-10000-CNSC-010	Authorized Nuclear Operators
N-MAN-08131-10000-CNSC-028	Control Room Shift Supervisor, Pickering Nuclear
N-INS-08920-10004	Written and Oral Initial Certification Examination for Shift Personnel
N-INS-08920-10002	Simulator-Based Initial Certification Examinations for Shift Personnel
N-INS-08920-10001	Requalification Testing of Certified Shift Personnel

[1] P-PLAN-01900-00005 is being superseded by P-PLAN-01900-00006, *Pickering Human Performance Strategic Plan.*

2.2.1 Human Performance Program

The objective of OPG's Human Performance Program is to continually reduce the frequency and severity of events through the systematic reduction of human errors and management of defences in pursuit of zero events of consequence.

The Human Performance Program is defined in N-PROG-AS-0002, *Human Performance* and is executed through a series of standards and procedures that lay the groundwork for improving and sustaining performance. The program provides guidance to reduce the probability and consequences of human error associated with worker-machine interfaces required to operate, maintain, and support the nuclear power plant.

Pickering NGS leaders recognize that an understanding of the role of human performance in safety, supported by leadership and employee behaviours, helps prevent human error-related events. Human performance standards and expected behaviours are defined, established, and incorporated in processes, procedures and training

Through the following supporting standards, N-PROG-AS-0002 drives continuous improvement of human performance and establishes processes to monitor and correct any organizational deficiencies to minimize human error:

- N-STD-AS-0002, *Procedure Use and Adherence:* provides requirements for usage of, and adherence to approved procedures.
- N-STD-OP-0002, *Communications:* specifies requirements for both verbal and written communication practices when performing maintenance and operating activities including expectations for three-way communication and use of phonetic alphabet.
- N-STD-OP-0004, *Self-Check:* describes the features of the Nuclear Self-Check program.
- N-STD-OP-0012, *Conservative Decision-Making:* provides management expectations for a conservative decision-making culture and establishes responsibilities and accountabilities for affected managers to ensure conservative decisions are made.
- N-STD-RA-0014, *Second Party Verification:* establishes the scope and extent of verification and degree of independence required and, to prevent errors going undetected, specifies requirements for verification when a second person confirms a specific task or activity that satisfies established requirements.

OPG recognizes the importance of human performance and organizational effectiveness, and how they are interconnected. Performance is an important indicator of organizational effectiveness. Error precursors, flawed defences, and latent organizational weaknesses are proactively identified and addressed through self-assessments, internal and external reviews, job site condition reviews, pre-job briefs, observations, safe work plans, trend analysis, program reviews, and performance monitoring. When an event does occur, analysis is performed to identify and correct the contributing error precursors, flawed defences, and latent organizational weaknesses. Organizational factors that influence performance are demonstrated through oversight, observations, and paired Observations & Coaching to ensure alignment on standards.

The primary methods used to monitor performance and identify and mitigate risks include:

1. The Observation & Coaching (O&C) Program, N-INS-09030-10004, *Observation and Coaching*: Supervisors and managers are required to perform observations and document their findings in an O&C database where the data is rolled up into dashboard.

The observations include worker behaviours (including the use of human performance tools), number of and effectiveness of defences, worker proficiency and knowledge, and the execution of work. Observations are documented under specific categories and focus areas to enable trending and filtering by area of interest. Department managers review their observations regularly to monitor for decline in performance or significant gaps and take corrective actions as needed. Individual departments have Staying on Top meetings and forums to review trends and identify potential focus areas. They create action plans as needed to address the trends and gaps. The findings are also monitored by the Human Performance Department to identify station trends which may require action. The station aims for 30% of observations being opportunities for improvement to drive continuous improvement and prevent complacency and stagnation. The dashboard is designed to improve station insights and broaden the lens of observations to work environment and process rather than solely focus on people behaviours.

Over the past two years, there has been a higher focus on paired O&Cs to support supervisors' development and improvement in supervisors providing coaching and feedback to their crews and is used as one of the leading key performance indicators.

2. The process following human performance events includes the applicable department performing an accountability analysis, N-INS-09030-10001, *Human Performance Event Communication and Analysis*, to determine whether the error was the result of an intentional violation (very rare), a gap in process, or organizational and systemic weaknesses. The insights and actions taken are documented in a crew learning or learning brief and shared with the organization. Event communication and analysis is used to improve identification of systemic issues. This tool facilitates lessons learned from events to prevent event recurrence and foster an open reporting culture. The Human Performance department trends the information for indication of any adverse trends. If an adverse trend is identified, it is investigated further to identify its drivers and develop corrective actions. Crew Learnings are used as an event communication tool to share key learnings.
3. More significant human performance events (such as Department Event Free Day resets or Site Event Free Day Resets, N-INS-09030-10002, *Site and Department Level Event Free Day Resets*) follow the same process and will also have an evaluation and corrective action plan. Due to the higher significance of these events, the event evaluation and action plans go to the site Corrective Action Review Board for cross-functional challenge and quality review.
4. Facility Focus Plan: The Facility Focus is selected weekly to align the team on potential and real vulnerabilities identified from trending, historic data, and look ahead. These focuses are rolled out to the crews for the purpose of conducting focused observations by supervisors and line managers, as well as guiding discussions during start of shift briefs, and targeted station communications. This places focus on known elevated risks, such as plant status control events at the start of a unit outage and is flexible to address weaknesses identified through observations.
5. Stop When Unsure and Positive Stop Work initiatives are implemented to ensure that front line workers feel empowered to stop in the face of uncertainty and, as a last line of defense, see themselves as guardians of the standards. In addition to stopping when unsure, a matrix to restart work safely and promptly following a stop has been implemented. Leadership behaviours are aligned to positively recognize the stops using the Values in Acknowledgement (ViA) application, leverage these stops as a leading

indicator for event prevention, and provide a structured process to support workers to restart actions. To ensure sustainability and reinforce positive behaviours, Positive Stops are recognized in the weekly Director of Operations and Maintenance (DOM) employee communication.

The measures used to evaluate overall health, reliability and robustness of the Human Performance program are Site Event Free Day Resets (SEFDRs) and SEFDR rate. The SEFDR value is the number of human performance errors that result in events with significant consequences within a given period; it is an industry-wide measure of the effectiveness of organizational safety and other Human Performance programs.

Pickering NGS was challenged with 2 SEFDRs in 2022 which was above the target of 1. In 2023, Pickering NGS maintained zero events until December 28, 2023, when one SEFDR occurred. In 2024, Pickering NGS had 2 SEFDRs against a target of zero. In response to the events, Pickering NGS implemented a comprehensive human performance recovery strategy that focused on building a culture of high standards. The strategy aimed to cultivate a culture of behaviours where early drifts in standards are identified and corrected in a timely fashion to prevent significant incidents. The goal of the plan was to achieve sustained human performance improvement. The plan resulted in improved performance in areas of observation and coaching, and reinforcement of positive behaviours. This includes stopping when unsure and proactive human performance plans for outages and high-risk periods. In the last three quarters, Pickering NGS has showed improvement achieving zero SEFDRs.

Furthermore, in 2024, Site performance and Excellence Plans were aligned around five pillars of the Human Performance improvement to be Guardians of the Standard. To build awareness, understanding, and adoption to exceeding Guardian of the Standard expectations a comprehensive Guardians of the Standards tactical communication plan was developed and executed with following key messages:

- Pickering NGS is committed to fostering a culture of behaviours where early drifts in standard are identified and corrected before consequential events occur.
- To do this we must have a workforce committed to being Guardians of the Standards to support the future of Pickering and our ability to perform with excellence every day.
- “A key aspect of the Staying on Top value of Excellence Standards is for leaders and employees to individually and collectively act as guardians of the standards. Organizational breakthrough occurs when each individual internalizes and follows the standards because they recognize their inherent value." - Phil Russell, INPO Senior Vice President of Industry Self-Awareness and Continuous Improvement.

To reinforce positive behaviour change, team members continue to be observed and recognized for demonstration of Positive Stop and Guardians of the Standards behaviours, resulting in sustained improvement across all Human Performance metrics.

With the recovery and sustainment efforts, Pickering NGS has demonstrated significant improvement in performance in Human Performance (Hu) Events (18-month cycle) and Hu Causal Factor Events, an INPO reporting metric, meeting Industry Top Quartile (ITQ) in January 2025 with zero Hu Causal Factor events in Q1 2025.

Prior to December 2024, Figure 15 below shows data for reporting six operating units (Units 1,4 and 5 to 8). Reporting now reflects the current operating units of Units 5 to 8.

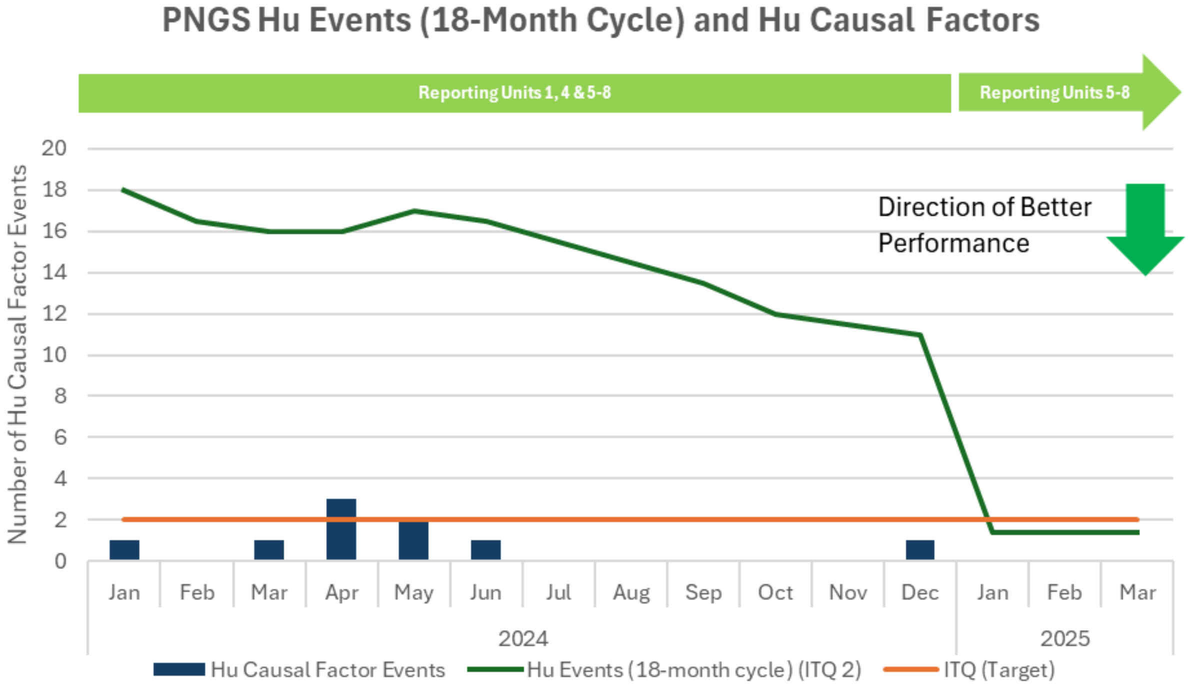

Figure 15. Pickering NGS Hu Events (18-Month Cycle) and Hu Causal Factors Events between 2024-Q1 2025

2.2.2 Personnel Training

The training program for regular staff, contractors, temporary personnel and other staff assigned work at OPG is defined by N-PROG-TR-0005, *Training*. This document, in combination with internal training procedures, defines the key activities involved in the training process and is compliant with CNSC REGDOC-2.2.2*, Personnel Training.*

The training program provides the structure, processes, and tools for defining, developing, implementing, documenting, assessing, and improving the training required to ensure staff have the appropriate knowledge, skill, and attitudes for safe and efficient plant operation. For tracking, OPG utilizes the Training Information Management System (TIMS) database to store and track training and qualification information for all staff, including contractors. The system also provides automatic notifications via email for upcoming scheduled training and identifying expiring qualifications to employees and their supervisors.

The health of training is carefully monitored with a defined program to ensure that there is a Systematic Approach to Training (SAT) foundation for OPG's nuclear training programs upon which it continues to build and improve. Operations, Maintenance and Engineering departments have a robust continuing training program, and continuing training plans are revised and reissued on a 5-year cycle.

The Health of Training reports continue to drive improvements to OPG's major training performance areas. Actions from the Health of Training reports successfully maintain a solid SAT foundation for OPG's Nuclear Training Programs upon which it continues to build and improve. Improvements to the training programs are driven by feedback from internal and external OPEX, Station Condition Records, Curriculum Review Committees, self-assessments, audit reports, CNSC inspections and in response to the training committee’s needs.

Innovation in Training

The objective of innovation in training is to incorporate innovative solutions and technology. Line and Training Managers effectively collaborate to create learning solutions and technologies that support exemplary workers and station performance.

Some examples of where innovative training techniques were developed include:

- *Fuel Handling Simulator:* Operations Training instructors improved Fuel Handling Panel Qualified Operator and Field Operator defueling performance by delivering Just-in-Time Training (JITT) utilizing the Fuel Handling simulator. The simulator allows Operators to become more proficient in fuel handling activities all while working in a zero-risk environment. The Fuel Handling team utilizes the simulator to expose the Operators to enhanced procedures and to fine tune the flow of first-of-a-kind procedures.
- *Virtual Reality Crane Simulator:* Maintenance Training instructors improved crane operator performance by incorporating a virtual reality (VR) simulator into crane operator training. Training material improvements include the incorporation of simulated scenarios such as precision lifts, crane failures, and risk management decision points. The VR crane simulator offers a learning opportunity that is personalized, on-demand and realistic.

Current Learning Culture and Use of Technology

Pickering NGS has established a learning culture where development is encouraged and learning resources are available to promote proficiency and encourage employee development. Improvement initiatives in support of continued operational excellence include:

- The creation of Proficiency Heat Maps and Individual Development.
- Extensive use of Dynamic Learning Activities, JITT, Job Familiarization Guides.
- Micro-learning through Video Learning-On-Demand library with 550 videos is available to refresh skills.
- Adaptive Learning was piloted in 2021 in the Nuclear General Employee Training program and is now used in more than 10 high demand courses. It provides the right training to the right people based on previous experience, training and education.
- All Leaders are trained on Facilitative Leadership Techniques to enable learning and development.

Operations Training

OPG develops knowledgeable, skilled, and highly competent Operations staff through comprehensive initial and continuing training programs for non-licensed Operators and for persons in Certified positions, including Authorized Nuclear Operators (ANOs), Control Room Shift Supervisors and Shift Managers. OPG training programs are SAT-based and incorporate elements of continuous learning and performance improvement.

The Operations Training program supports safe and reliable plant operation through comprehensive classroom and skills-based training on operations under normal, abnormal and emergency conditions. Operator Fundamentals are embedded and reinforced in all aspects of the training program and are utilized as a basis for evaluating operator performance. Human Performance error prevention tools are trained and reinforced. The inclusion of OPEX in training is a key element of continuous learning and performance improvement.

JITT is delivered to ensure critical evolutions are conducted safely and efficiently. Some examples of when JITT is conducted for Operations include unit shutdown, heat transport system warm-up and cooldown, approach to critical and turbine run-up and shutdown. JITT will be instrumental in the successful return to service of the refurbished Pickering NGS Units which will contain fresh fuel cores and where systems will have been extensively modified.

More recently, the use of Prepare-Execute-Learn as a methodology was introduced to minimize the probability and consequences of human performance events. This is accomplished by identifying human performance precursors up front, implementing well established human performance tools to prevent and mitigate errors, and strengthening feedback processes to promote continuous learning. Operations trainers assist line management by promoting self-awareness among staff and reinforcing the use of human performance error reduction tools and techniques during training activities in the classroom, the simulator and in the field.

Other initiatives include:

- Incorporation of a flight simulator in Human Performance training. The course introduces the trainees to the psychology behind the human performance tools. Following completion of the theoretical classroom portion, trainees are provided an opportunity to practice the human performance tools/techniques using various interactive simulations in a flight simulator. This places the trainee in an unfamiliar environment, different from the station, where they are able to observe the full benefits of the human performance tools/techniques while being challenged with distractions and competing priorities.
- Development and upgrades to control panel simulators for Fuel Handling.
- Use of Video Learning-On-Demand as a valuable tool available 24/7 to enhance work preparation and pre-job briefs.
- Development of Dynamic Learning Activities to promote effective use of Operator Fundamentals and Human Performance error prevention tools.
- Main Control Room simulator upgrades to improve versatility and maintainability.

Maintenance Training

Maintenance Training and Station Maintenance organizations continue to collaborate on Workshops and Dynamic Learning Activities to build proficiency and verify performance to standards and expectations.

OPG has implemented innovative solutions using virtual interfaces, including a Crane Virtual Reality Simulator. This training approach also improves accessibility to training resources when station equipment is in use. In addition, portable demonstration units have been implemented for gasket and leak mitigation training. These units focus on bolted joint proficiency building and are available for use in both the training environment and onsite to support work preparation and ongoing rehearsal.

Engineering Training

Engineering training focuses on core elements of nuclear professionalism and culture by concentrating on key elements of conduct and behaviours within the learning material. Training material has been organized to expand and make engineers aware of the library of proficiency enhancing learning material. A strong collaborative effort has been directed to collect and share learning to improve knowledge transfer and OPEX. Engineering training has built an extensive library of videos and other presentation material of individuals sharing lessons learned.

Engineering training has a robust continuing training program. An important component of this training program is the Conduct of Engineering Workshops. Every year senior engineering leaders select a new topic and the material is developed and delivered to OPG engineers. The chosen topic is a backdrop to the application expected behaviours within the engineering community and an opportunity to reinforce culture.

Many others outside of Enterprise Engineering take some components of this training to enhance knowledge of nuclear operations.

Emergency Response Organization Training

Alignment between Emergency Preparedness Training and Enterprise Emergency Management teams is maintained through formal reviews of potential training needs identified in field performance observations during training sessions, both through classroom and on-the-job training. OPG extensively uses drills and real events as means of continuous learning through post training critiques and feedback.

In September 2023, OPG participated in the Exercise Unified Command “full scale integrated” emergency exercise in which over 200 OPG staff participated (see Section 2.10.2 for additional details).

These exercises will continue to be scheduled as per regulatory requirements. Emergency exercises along with drills (smaller scale exercises, at least 5 per year at each site) provide an excellent opportunity for continuous learning, feedback on current training material, and to help identify any focused proficiency improvements opportunities. For example, over the last couple of years, there has been a focused effort to increase the proficiency of the Emergency Shift Assistant (ESA) and in 2025 the focus will be on increasing the proficiency of Off-Site Survey Teams (OSST).

2.2.3 Personnel Certification

As per the PROL, the initial and continuing training programs for the certified persons at Pickering NGS are designed in accordance with CNSC regulatory document, REGDOC-2.2.3 *Personnel Certification, Volume III: Certification of Reactor Facility Workers, Version 2*. This regulatory document specifies the requirements to be met by persons working, or seeking to work, in positions for which a certification by the CNSC is required. It also specifies the requirements regarding the programs and processes supporting worker certification that licensees must implement to train and examine persons seeking or holding a certification issued by the CNSC.

Pickering NGS’s PROL requires individuals who are appointed to the following positions have valid CNSC certification:

(i) Responsible Health Physicist (RHP)

(ii) Shift Manager (SM)

(iii) Control Room Shift Supervisor (CRSS)

(iv) ANO

Consequently, Pickering NGS is responsible for training and testing workers to ensure that they are fully qualified to perform the duties of their position, in accordance with the regulatory requirements.

The processes used to train and qualify persons for initial certification as SMs, CRSSs and ANOs are outlined in the following training qualification documents:

- N-TQD-101-00001, *Authorized Nuclear Operator Initial Training and Qualification Description*
- N-TQD-102-00001, *Nuclear Shift Manager/Control Room Shift Supervisor Initial Training and Qualification Description*

The process used to train and qualify persons for initial certification as RHPs is outlined in:

- N-TQD-443-00001, *Radiation Protection Training and Qualification.*

The processes used to ensure certified persons maintain their qualification are outlined in:

- N-TQD-103-00001, *Nuclear Certified Personnel Continuing Training and Qualification Description*
- N-TQD-443-00001, *Radiation Protection Training and Qualification*

Both initial and continuing training programs are based on N-PROC-TR-0008, *Systematic Approach to Training* as required by CNSC REGDOC-2.2.3 Volume III Version 2 and REGDOC-2.2.2.

Table 19 contains the number of certified staff at Pickering NGS as of December 2024. With the defueling of Pickering NGS Units 1 and 4 complete, changes to the Minimum Shift Complement (MSC) will occur. This will allow certified staff on Pickering NGS Units 1 to 4 to be redeployed to other areas of the business, including the Pickering NGS Refurbishment Project. OPG will no longer be seeking to renew certifications of Pickering NGS Units 1 to 4 staff beyond June 2025.

Table 19. Certified Staff at Pickering NGS (December 3, 2024)

	Pickering Units 1 and 4	Pickering Units 5 to 8
Certified Position	**Number of Certified Staff**	**Number of Certified Staff**
Shift Manager and Control Room Shift Supervisor	19	19
Authorized Nuclear Operator	33	51
Responsible Health Physicist	3	

The continuing training program for Certified Operating staff is at a mature stage. This training includes refresher training and update training for design or engineering changes, infrequently performed test and evolution exercises, JITT and formal evaluations (knowledge and performance) of certified staff. Certified Operating staff complete at least 200 hours per year of continuing training.

In line with our industry peers, Certified Operating staff have internalized the need to maintain a Line of Sight to the Reactor Core in all aspects of unit operations. This includes initiatives to improve leadership and team effectiveness; creating a culture of continuous learning, promotion of conservative decision-making; recognition and mitigation of proficiency shortfalls, improving operator training, promoting understanding of procedures important to the protecting the core and utilizing independent oversight. Integral to this is a Training to Improve Performance initiative whereby line-identified performance issues are addressed in a timely fashion through training. This initiative has been very effective at preparing crews to respond proficiently to unit upsets.

A MyPerformance application was developed to enable certified operating staff and supervisors monitor trends in performance in the simulator. The data is used in identifying opportunities for improvement in developing individual and crew improvement plans.

In October 2023, the Commission published CNSC regulatory document REGDOC-2.2.3 *Personnel Certification, Volume III: Certification of Reactor Facility Workers, Version 2*. Version 2 incorporates changes that provides more flexibility for those persons seeking initial certification as either an ANO or Control Room Shift Supervisor. The update streamlines the requirements for maintaining or reinstating existing certifications. OPG will comply with the licensing requirements for REGDOC-2.2.3 Volume III Version 2.

The long-range training plan outlines the schedule of initial certification classes necessary to meet certified operating staffing demand. The plan is updated annually to account for changes in business needs and staff attrition. The plan further identifies Authorization Trainer and Examiner resources required to meet the initial and continuing training demand. Authorization Trainers and Examiners are drawn from certified operating staff resources and included as part of the certified operating staff attrition.

In cooperation with our industry partners through Conexus Nuclear Inc., Pickering NGS is investigating opportunities to optimize and strengthen the initial training programs for Certified Operating staff. This includes improvements to the selection process, plant familiarization program and schedule optimization. The desired outcomes will be to improve the trainee learning experience, optimize program duration and improve candidate throughput.

2.2.4 Initial Certification Examination and Requalification Tests

The following CNSC documents contain the requirements for administering the certification examinations and requalification tests required by CNSC REGDOC-2.2.3 for persons in Certified Operating positions, e.g., SM, CRSS, ANO:

- CNSC-EG1, Rev.0: *Requirements and Guidelines for Written and Oral Certification Examinations for Shift Personnel at Nuclear Power Plants;*
- CNSC-EG2, Rev.0: *Requirements and Guidelines for Simulator-based Certification Examinations for Shift Personnel at Nuclear Power Plants;*
- CNSC document: *Requirements for the Requalification Testing of Certified Shift Personnel at Nuclear Power Plants, Revision 2.*

Initial certification examinations for persons who are seeking certification in one of the Certified Operating positions are conducted in accordance with the following instructions:

- N-INS-08920-10002, *Simulator-Based Initial Certification Examinations for Shift Personnel;*
- N-INS-08920-10004, *Written and Oral Initial Certification Examinations for Shift Personnel.*

Adherence to these OPG instructions ensures that initial certification examinations are administered in a consistent manner and in accordance with the requirements of CNSC-EG1 and CNSC-EG2.

OPG's Simulator Training program maintains Pickering NGS Units 5 to 8 full scope training simulator. The simulator is used for the training and examination of persons seeking or holding certification as SM, CRSS or ANO. The simulator replicates Pickering Unit 5 and is modelled to operate and respond as plant systems will do under normal and transient conditions. The design, modification, and upkeep of the simulators is governed by N-PROC-TR-0023, *Simulator Quality Assurance*, and N-PROC-TR-0024, *Simulator Change Control.*

With the refurbishment of Pickering NGS Units 5 to 8, construction of a second, full scope simulator to aid in meeting anticipated training demand is planned for completion in 2027. Going forward, the second Pickering NGS Units 5 to 8 simulator will provide greater flexibility in delivery of initial and continuing training for certified operating staff.

The initial certification examinations provide assurance that, at the time of their certification, candidates for certified positions have acquired the level of knowledge and skills required to work competently in their assigned positions.

Requalification Testing for persons in Certified Operating positions is conducted in accordance with the following instruction:

- N-INS-08920-10001, *Requalification Testing of Certified Shift Personnel.*

This includes Written Tests and simulator-based Comprehensive Simulator Tests and Diagnostic Simulator Tests for all Certified Operating staff.

Adherence to this instruction ensures requalification tests are administered in a consistent manner and in accordance with the requirements endorsed by CNSC in document titled, *Implementation of Requirements for the Requalification Testing of Certified Shift Personnel at Nuclear Power Plants, Revision 2, May 1, 2009.*

As per CNSC REGDOC-2.2.3, the initial certification examinations and requalification tests for the Responsible Health Physicist continue to be administered by the CNSC.

As required under CNSC REGDOC-3.1.1 version 2, *Reporting Requirements for Nuclear Power Plants*, Section 3.3, Item 6 (b), and subsequent implementation of REGDOC-3.1.1 Version 3, Section 3.3, Item 4(d), OPG submits a report detailing certification exam results and pass/fail rates. Results are also supplied to the CNSC in accordance with CNSC-EG1 and CNSC-EG2 *Examination Follow-up* sections during the Certification process.

Authorization Training staff are qualified as instructors and examiners according to the requirements outlined in the following documents:

- N-TQD-602-00001, *Nuclear Trainer Training and Qualification Description;*
- N-QG-602-00001, *Operator Training Instructor Qualification Guide.*

Authorization Training instructors and examination staff are normally persons who were previously or are currently certified at Pickering NGS. OPG training governance includes a provision for qualifying persons as training instructors and examiners in cases where the person was not previously certified at Pickering NGS. A Mentored Training Program serves to provide assurance that those examiners who were not previously certified at Pickering NGS are fully familiar with the knowledge and skill requirements of the persons being examined.

The Pickering NGS LCH currently permits, as a pilot project, the use of Multiple Choice Question (MCQ) format examinations for General Written Initial Certification Examinations. OPG and its industry partners will be seeking to formalize the use of the MCQ format not only for General Written Initial Certification Examinations but to extend use of this examination format to other initial certification written examinations. MCQ format examinations are widely used across the industry and are used for requalification testing at OPG currently. The MCQ format offers a more objective method of testing candidate knowledge than modified essay style examinations and allows for the sampling of a greater number of knowledge areas over a given examination time period.

OPG will continue to demonstrate to the CNSC its capability to self-administer the Certified Operator staff training and examinations and to ensure sufficient qualified staff are available to ensure safe and reliable operation of the Pickering NGS station. This includes the requirement that sufficient trained and qualified staff will be available to deliver these training programs throughout the continued operation and refurbishment timeframe.

2.2.5 Work Organization and Job Design

Minimum Shift Complement

Pickering NGS Minimum Shift Complement (MSC) is the minimum number of qualified workers who must be present at all times to ensure the safe operation and maintenance of the facility, to respond to all station emergencies that may arise, and to ensure adequate emergency response capability for the most resource intensive conditions. The processes that ensure an adequate number of qualified workers with the correct skills and competencies are within the facility at all times are captured in P-INS-09100-00003, *Pickering Minimum Shift Complement*, P-INS-09260-00008, *Duty Crew Minimum Complement Assurance,* and N-INS-03490-10003, *Minimum Shift Complement Resources, Qualifications and Procedures Required for Responding to Resource Limiting Events*.

Due to the shutdown of Units 1 and 4 in 2024, changes to the MSC are planned. All MSC will be made consistent with CNSC REGDOC-2.2.5 *Minimum Staff Complement* and will ensure the licensing basis defined in the LCH will be updated accordingly, supported by a sound technical basis documented for all minimum complement changes. The Pickering NGS Units 1 to 4 MSC changes will allow the Units 1 to 4 certified staff to be redeployed and strengthen Operations and Training staffing in support of Refurbishment.

Management of Minimum Shift Complement

Minimum Complement Compliance Program (MCCP) is the approved information management system software program to manage the MSC system. There are many capabilities of the system, including:

- Assignment of Emergency Response Organization (ERO) roles for each shift.
- Tracking ERO / shift complement staff as they arrive (badge in) and leave (badge out) the protected area.
- Forecasting of staff requirements.
- Various reporting including expiring qualifications, time exception and several accounting lists.

To ensure MCCP uses the most up to date information, it is live linked to the following software programs:

1. Training Information Management System – ensures the qualification of staff assuming MSC roles.

2. Time reporting software – tracks the schedules of staff, including shift assignment and time off (vacation etc.).

The software is updated regularly to add improvement, increase efficiency and make it more robust.

2.2.6 Fitness for Duty

Pickering NGS maintains robust procedures and policies to ensure that all staff members are fit for duty. OPG prioritizes the safety and well-being of the employees and recognizes the importance of their physical and mental readiness to perform their roles effectively. To achieve this, comprehensive measures to assess and monitor the fitness of the workflow are in place in order to comply with:

- CNSC REGDOC-2.2.4, *Fitness for Duty: Managing Worker Fatigue;*
- CNSC REGDOC-2.2.4, *Fitness for Duty, Volume II: Managing Alcohol and Drug Use, Version 3;*
- CNSC REGDOC-2.2.4, *Fitness for Duty, Volume III: Nuclear Security Officer Medical, Physical and Psychological Fitness.*

Regarding the implementation of CNSC REGDOC-2.2.4, *Fitness for Duty, Volume II: Managing Alcohol and Drug Use, Version 3,* OPG has implemented programmatic elements to comply with certain requirements as mandated by REGDOC-2.2.4. On June 6, 2023, the Federal Court of Canada endorsed the CNSC's move to require pre-placement and random alcohol and drug testing for workers in Safety-Critical positions at high-security nuclear facilities. This decision was appealed by the Unions, and while awaiting the outcome of the appeal which was heard in January 2024, all licensees, including OPG, were restricted from implementing the pre-placement and random testing requirements. On November 6, 2024, the Federal Court of Appeal issued their decision to uphold the Federal Court ruling on the validity of the pre-placement and random alcohol and drug testing requirements mandated by REGDOC-2.2.4. On June 17, 2025, CNSC staff requested OPG to fully implement sections 5.1 and 5.5 of REGDOC-2.2.4, *Fitness for Duty, Volume II: Managing Alcohol and Drug Use, Version 3* by January 1, 2026.

OPG-PROC-0208, *Fitness for Duty: Policy of Managing Alcohol and Drug Use* identifies the processes for addressing fitness for duty as it applies to alcohol and drug use. Initial and continuing training elements addressing fitness for duty focus on explaining company policies, expectations, and the various employee support programs available include:

- The Continuous Behaviour Observation Program (CBOP). CBOP is designed to develop a supervisors and managers ability to recognize and respond to behaviours that could impact worker performance and safety.
- Additional training is provided for SMs and CRSSs on monitoring fitness for duty for safety sensitive and safety critical personnel.
- Training is conducted for the Fitness for Duty: Policy of Managing Alcohol and Drug Use program through 3 computer-based training courses:
- Yearly Nuclear General Employee Training (for all site staff).
- Fitness For Duty – Managing Alcohol and Drug use for workers.
- Fitness For Duty – Managing Alcohol and Drug use for supervisors.

If an OPG Security Officer suspects a worker is unfit, they deny access to the facility and notify appropriate supervisory personnel. OPG also periodically uses canine drug monitoring at the security monitors as an additional barrier to alert Security Officers to review the fitness for duty of suspected staff entering the protected area.

Employee's Hours of Work (HoW) is also monitored. N-PROC-OP-0047, *Hours of Work Limits and Managing Worker Fatigue* prescribes the process for monitoring and controlling the HoW for Nuclear Broad Population and Safety Sensitive employees to meet the requirement set out by CNSC REGDOC-2.2.4, *Ontario Employment Standards Act* and Collective Agreement provisions. It includes guidance and instruction on the following:

- Hours of work (Including Regulatory limits, shift schedules and special exceptions).
- Monitoring requirements for workers.
- Reporting requirements.
- Management of worker fatigue.

The process requires that employees are aware of their time limitations, track work hours and promptly notify the first line manager in advance of a potential violation. Supervisors are also required to ensure that their employees are aware of their prescribed limit and are also responsible for monitoring their employees' HoW.

Additional HoW monitoring is completed by workgroup Single Point of Contacts. OPG has implemented a new time keeping and reporting system that allows for custom reports to be generated which has improved the discernment of HoW. Each workgroup SPOC monitors and reports on HoW for their departments. There has been a concerted effort by the SPOCs to educate those that approve time sheets on how to identify situations that can lead to HoW violations and how to disposition when they are identified. OPG's guide, N-GUID-08945.1-10000, *Limits of Hours of Work – Nuclear Monitoring and Reporting Process* ensures that reporting requirements are understood and complied.

Through education of time sheet approvers, and reinforcement of standards, OPG continues to improve in managing worker's hours of work. Pickering NGS Security was previously identified as not consistently adhering to hours of work limits, successfully reducing hours of work violations in Q4 2024 and Q1 2025 to zero.

2.2.7 Pickering NGS Units 1 to 4 Decommissioning

This section provides additional information regarding the Human Performance SCA with respect to Units 1 to 4 decommissioning. It is intended to supplement the information provided in the general SCA discussion above and therefore only addresses those specific areas where additional decommissioning-related details are needed.

Human Performance Program

The Human Performance program will continue to be implemented during decommissioning activities to help manage multiple priorities and proficiency and ensure activities are executed safely, effectively and efficiently with no impact to public and environmental safety.

Pickering NGS is focusing on the Proficiency Model and rolling it out to staff, distributing unit cards for crews to use and putting up posters at each unit to identify the unit number. In addition, Pickering NGS has developed a Human Performance proactive plan to support the shutdown of Pickering NGS Units and to mitigate potential human performance risks during this time. The Human Performance proactive plan is updated every 6 to 12 months with planned interventions in collaboration with Conventional Safety.

In addition, OPG has developed P-PLAN-01900-00006 *Pickering Human Performance Strategic Plan*, which is focused on strengthening the use of proactive, risk-based approaches to improve Human Performance during outages and decommissioning activities.

Personnel Training

N-PROG-TR-0005 *Training* provides the structure, processes, and tools that will be used for defining, developing, implementing, documenting, assessing, and improving the training required to ensure nuclear staff have the appropriate knowledge, skill, and qualifications for a safe and efficient Decommissioning program.

Work Organization and Job Design

Staff who are transitioned to new roles will be provided appropriate Training to ensure they are qualified in the new role as per N-PROC-TR-0008 *Systematic Approach to Training*.

Fitness for Duty

Through the safe storage and decommissioning of Pickering NGS Units 1 and 4, upon changes in MSC, surplus staff who support the operation of these units as Safety Sensitive, as described in N-PROC-OP-0047, and as Safety Sensitive or Safety Critical as described in OPG-PROC-0208, will transition to new roles.

Staff who are transitioned to new roles will be provided appropriate training to ensure they are qualified in the new role per N-PROC-TR-0008 *Systematic Approach to Training*. Safety Sensitive employees per OPG-PROC-0208 support the entire station. Employees who support the entire station, or assigned to Pickering NGS Units 5 to 8 are unaffected by the safe storage and decommissioning of Pickering NGS Units 1 and 4, with regard to Fitness for Duty.

Employees remaining at Pickering NGS Units 1 to 4 will be re-screened for Safety Sensitive or Broad Population per N-PROC-OP-0047, using screening criteria within N-LIST-09110-10005, Listing of Broad Population and Safety Sensitive Job Codes. Re-screening will take place at milestones which may impact classification. Any identified changes to Safety Sensitive or Broad Population job codes will be updated in N-PROC-OP-0047, with prior notification to the CNSC in accordance with the LCH.

Surplus staff who transition to Pickering NGS Units 5 to 8 or Darlington NGS will become trainees at their new location. As trainees, they are not considered Safety Sensitive per N-PROC-OP-0047, and they are not considered Safety Sensitive nor Safety Critical per OPG-PROC-0208. However, they will return to these classifications upon qualification or certification in their new role, as appropriate.

Limits of Hours of Work will continue to be implemented during decommissioning. Contractors will be required to have an equivalent program.

2.2.8 Pickering NGS Units 5 to 8 Refurbishment

This section provides additional information regarding the Human Performance SCA with respect to Units 5 to 8 refurbishment. It is intended to supplement the information provided in the general SCA discussion above and therefore only addresses those specific areas where additional refurbishment-related details are needed.

Human Performance Program

The Human Performance program will continue to be implemented during Units 5 to 8 Refurbishment with site and fleet strategies updated annually. NK30-PLAN-00120-00020, *Pickering Refurbishment Program Management Plan – Human Performance,* has been created to support Units 5 to 8 refurbishment.

Pickering NGS facilitates recurring Station Excellence Meetings, with the focus on prioritizing initiatives that support continued station excellence. Lessons Learned and Darlington NGS Refurbishment OPEX are integrated into the station excellence initiatives focused on Pickering NGS Future Organizational Transitions, expected to occur between 2025 – 2034. The incorporation of Darlington Refurbishment Lessons Learned and OPEX support future transitions to change management strategy, structure and process, vendor partner integration, training and development, communication and information flow, and management and leadership challenges.

Personnel Training and Certification

In NK30-PLAN-00120-00018, *Pickering B Refurbishment Training Program Management Plan*, Major Program Milestones have been established to ensure outage, execution, installation and Available-for-Service (AfS) readiness of all Refurbishment employees at each stage of the Project. A dedicated project training team will ensure end-to-end tracking and timely completion of all required training actions for each modification and scheduled verification point, including incorporation of any new training into the existing training programs. Vendor training oversight will be managed using corporate governance, and as required by the service level agreement. As the project progresses, training groups and line business units will address any performance gaps and promote continuous learning, focusing on task proficiency and learning innovations for project success.

A combination of new and existing buildings will house equipment for Engineered Tooling Transition Training. A replica of feeders and boilers will be installed to provide training to staff prior to performing work in the field. Specialized tooling required for refurbishment work will also be tested and commissioned on this replica reactor. Staff will have the opportunity to use these tools as part of training before field use to minimize the potential for human performance events during refurbishment.

A Pickering Refurbishment Operations Staffing and Training Plan, is currently under development and will be used as the framework for ensuring Certified operating staff are updated on system modifications and qualified to restart and operate the refurbished Pickering NGS Units 5 to 8. The plan will address the unique manner in which Pickering NGS is conducting Refurbishment with all units defueled for a period of time.

OPG will comply with the licensing requirements of CNSC REGDOC-2.2.3 *Personnel Certification, Volume III: Certification of Reactor Facility Workers, Version 2*. OPG is currently reviewing the certified staff work under supervision requirement over the Pickering NGS refurbishment period before the unit restart.

Knowledge and performance-based training will continue to be provided to Certified operating staff during the refurbishment period. Prior to the restart of Unit 5, the specific focus will be placed on updating training on the extensive number of modifications anticipated. Training on restart of units with fresh fuel core will also be provided. JITT will be an essential element of the restart of each refurbished unit.

Construction Island and interface Training

OPG refurbishment and contractor staff will receive construction islanding and interface training to ensure that expectations are clearly understood for accessing the construction island. Training will also be provided to station staff, either as an update to the Nuclear General Employee Training or by completing the same construction islanding and interface training as refurbishment and contractor staff.

Management of Training Change Control

To extend the life of Pickering NGS Units 5-8, the refurbishment scope modifications will be assessed on training impact for both OPG staff and supplemental employees contracted for the Project. Where required, training will adhere to OPG governance and vendor Quality Assurance (QA) programs, while also meeting closely monitored Project schedule milestones.

Contractor Training

Contractors will be required to train their personnel to be competent to perform the work they are assigned. They will also be accountable to provide QA training to their staff. Evidence of QA training activities will be supplied to OPG.

Training for contractor staff will follow agreed to project specific contracts and contractor training qualifications in accordance with the contractors QA program. OPG will remain accountable for OPG specific qualifications, e.g., radiation protection, work protection, and islanding and interface training.

Contractors will maintain documented evidence of all training provided to their staff including exams, training attendance, assessments, certificates, course correspondence and objectives.

OPG will exercise due diligence regarding training through observation and review of contractor training delivery and materials as part of oversight function accountabilities. OPG Project Managers or delegate will provide oversight of training that the contractor is conducting through routine or strategic observation and audits of materials.

Training Provided by Contractors

For some equipment the contractor/vendor/manufacturer will provide the training materials and deliver training to OPG staff. This is carried out in accordance with existing governance which provides the necessary information to facilitate the revision or development of training material for the operation and maintenance of that equipment. If information changes due to commissioning results, then just-in-time training will be provided prior to system available-for-service.

Work Organization and Job Design

Pickering NGS Units 5 to 8 minimum compliment changes are expected to be requested following defuel of units. This is currently being analyzed and will be submitted to CNSC staff. Following shutdown and defuel of the units, staff will be redeployed in the organization to support Pickering Refurbishment projects and be available to support minimum compliment and certification requirements prior to unit RTS. These staffing transition plans are currently being developed in detail.

OPG will leverage the lessons learned from Pickering NGS Units 1 to 4 Decommissioning MSC reductions and apply them to the Pickering NGS Units 5 to 8 Refurbishment project. MSC changes will be implemented upon key refurbishment project milestones.

These changes will be managed in a manner that does not impair OPG's ability to fulfill its overall emergency response capability for resource limiting accidents nor impact its ability to provide effective control over significant decommissioning and refurbishment evolutions on the defueled units.

2.2.9 Pickering Waste Management Facility

The OPG documents in the table below require written notification of change per PWMF Licence Conditions Handbook, LCH-W4-350.00/2028-R003:

Table 20. SCA 2 – PWMF Human Performance & Training

Document Number	Document Title
N-PROG-AS-0002	Human Performance
N-PROC-OP-0047	Hours Of Work Limits and Managing Worker Fatigue
N-PROC-TR-0008	Systematic Approach to Training
N-PROG-TR-0005	Training

2.2.9.1 Human Performance

The Human Performance Program at PWMF is defined by the OPG Nuclear Human Performance Program as described in Sections 2.2.1, 2.2.2 and 2.2.6.

An OPG fleetwide strategic plan is developed each year in response to human performance trends and events noted in the previous year. The strategic plan is also influenced by industry developments and emerging best practices in sustaining high levels of human performance. The strategic plan focuses on individual, supervisory, and organizational enhancements. By systematically identifying and addressing error- likely situations, reducing organizational vulnerability to errors and events and by questioning or enhancing the integrity of defenses, PWMF is positioned to continually improve organizational effectiveness through the use of best practices, enhanced behaviours and learning.

During the current licence period, there were no Site Event Free Day Resets and no Department Event Free Day Resets as a result of operations at the PWMF.

Supervisors and managers are required to perform and document monthly O&Cs. There is a specific focus area each month and weekly leaders in the field. The PWMF data is rolled up and presented at the monthly Staying on Top meeting, with a focus of identifying trends, areas for improvement with actions. Crew Learnings which is the sharing of lessons learned within the NSS organization and is shared fleetwide has improved in PWMF with 13 in 2024 compared to one in the previous two years. NSS has implemented Staying on Top monthly meetings to improve oversight and demonstrate effectiveness of the Human Performance Program.

2.2.9.2 Training Performance

PWMF staff are trained and qualified under OPG’s Nuclear Training Program as described in Section 2.2.2. The staff training and qualifications includes initial training, on-the-job training, and evaluation. This training is then maintained by periodic re-qualification and refresher training as appropriate. Training performance is tracked using a computer program to measure completion, scheduling and administration of qualification adherences and the capability of personnel to perform work duties through qualification status. A monthly computer report is generated that is reviewed during Monthly Curriculum Review Committee Meetings for each program area, Quarterly NSS Training Performance Review Committee meetings and quarterly Nuclear Waste Division Training council meetings ensure training adherence and performance. PWMF tracks training attendance, expired qualification, and qualified rate performance for all staff.

The Human Performance program will continue to ensure PWMF staff have the appropriate knowledge, skill, and attitudes for safe and efficient plant operation.

2.3 Operating Performance

Pickering NGS has an effective Operations Program that meets or exceeds all applicable regulatory requirements and related objectives. The program ensures that plant operation is safe and secure, with adequate regard for health, safety, security, radiation and environmental protection, and international obligations.

The OPG documents in the table below require written notification of change per the Pickering NGS Licence Conditions Handbook, LCH-PR-48.00/2028-R007:

Table 21. SCA 3 – Pickering NGS Operating Performance

Document Number	Document Title
N-PROG-OP-0001	Nuclear Operations
N-STD-OP-0036	Operational Decision Making
N-PROG-AS-0008	Heavy Water Management
N-PROG-MA-0019	Production Work Management
N-STD-OP-0011	Operations Performance Monitoring
N-STD-AS-0002	Procedure Use and Adherence
N-STD-AS-0014	Requirements for Technical Procedures
N-PROC-MA-0013	Planned Outage Management
N-PROC-MA-0049	Forced Outage Management
N-STD-OP-0025	Heat Sink Management
N-STD-OP-0009	Reactivity Management
N-STD-OP-0021	Control of Fuelling Operations
N-STD-MP-0016	Safe Operating Envelope
NA44-OPP-03600	Pickering NGS-A Operating Policies and Principles
NA44-OSR-08131.02-00001	Pickering A Operational Safety Requirements: Shutdown System
NA44-OSR-08131.02-00002	Pickering A Operational Safety Requirements: Negative Pressure Containment
NA44-OSR-08131.02-00003	Pickering A Operational Safety Requirements: Fuel and Reactor Physics
NA44-OSR-08131.02-00004	Pickering A Operational Safety Requirements: Emergency Coolant Injection System

Document Number	Document Title
NA44-OSR-08131.02-00005	Pickering A Operational Safety Requirements: Boiler Emergency Cooling System
NA44-OSR-08131.02-00006	Pickering A Operational Safety Requirements: Emergency Boiler Water Supply System
NA44-OSR-08131.02-00007	Pickering A Operational Safety Requirements: Feedwater System
NA44-OSR-08131.02-00008	Pickering A Operational Safety Requirements: Service Water Systems
NA44-OSR-08131.02-00009	Pickering A Operational Safety Requirements: Powerhouse Emergency Venting System
NA44-OSR-08131.02-00010	Pickering A Operational Safety Requirements: Main Steam Supply System
NA44-OSR-08131.02-00011	Pickering A Operational Safety Requirements: Shutdown Cooling System
NA44-OSR-08131.02-00012	Pickering A Operational Safety Requirements: Moderator System
NA44-OSR-08131.02-00013	Pickering A Operational Safety Requirements: Heat Transport System
NA44-OSR-08131.02-00014	Pickering A Operational Safety Requirements: Reactor Regulating System
NA44-OSR-08131.02-00015	Pickering A Operational Safety Requirements: Electrical Power System
NA44-OSR-08131.02-00016	Pickering NGS-A Annulus Gas System
NA44-OSR-08131.02-00017	Pickering NGS-A Operational Safety Requirements: Fuel Handling System & Irradiated Fuel Bays
NA44-OSR-08131.02-00018	Pickering NGS-A Operational Safety Requirements: Critical Safety Parameter Monitoring Instrumentation
NA44-OSR-08131.02-00019	Pickering NGS-A Operational Safety Requirements: Shield Cooling Systems
NA44-OSR-08131.02-00021	Pickering NGS-A Operational Safety Requirements: Interstation Transfer Bus (ISTB)
NA44-OSR-08131.02-00022	Pickering Nuclear 1-4 Operational Safety Requirements: Powerhouse Environmental Protection System
NK30-OPP-03600	Pickering NGS-B Operating Policies and Principles
NK30-OSR-08131.02-00001	Pickering B Operational Safety Requirements: Emergency Coolant Injection System
NK30-OSR-08131.02-00002	Pickering B Operational Safety Requirements: Fuel and Reactor Physics
NK30-OSR-08131.02-00003	Pickering B Operational Safety Requirements: Negative Pressure Containment

Document Number	Document Title
NK30-OSR-08131.02-00004	Pickering B Operational Safety Requirements: Shutdown Systems
NK30-OSR-08131.02-00005	Pickering B Operational Safety Requirements: Boiler Emergency Cooling System
NK30-OSR-08131.02-00006	Pickering B Operational Safety Requirements: Feedwater System
NK30-OSR-08131.02-00007	Pickering B Operational Safety Requirements: Emergency Water Supply System
NK30-OSR-08131.02-00008	Pickering B Operational Safety Requirements: Service Water Systems
NK30-OSR-08131.02-00009	Pickering B Operational Safety Requirements: Main Steam Supply System
NK30-OSR-08131.02-00010	Pickering B Operational Safety Requirements: Moderator System
NK30-OSR-08131.02-00011	Pickering B Operational Safety Requirements: Powerhouse Emergency Venting System
NK30-OSR-08131.02-00012	Pickering B Operational Safety Requirements: Shutdown Cooling System
NK30-OSR-08131.02-00013	Pickering B Operational Safety Requirements: Heat Transport System
NK30-OSR-08131.02-00014	Pickering B Operational Safety Requirements: Emergency Power Supply
NK30-OSR-08131.02-00015	Pickering B Operational Safety Requirements: Reactor Regulating System
NK30-OSR-08131.02-00017	Pickering B Operational Safety Requirements: Group 1 Electrical Power Supplies
NK30-OSR-08131.02-00018	Pickering B Operational Safety Requirements: Fuel Handling & Irradiated Fuel Bays
NK30-OSR-08131.02-00019	Pickering NGS Operational Safety Requirements: High-Pressure Emergency Coolant Injection (HPECI) Power Supplies
NK30-OSR-08131.02-00020	Pickering B Operational Safety Requirements: Annulus Gas System
NK30-OSR-08131.02-00021	Pickering B Operational Safety Requirements: Critical Safety Parameter Monitoring Instrumentation
NK30-OSR-08131.02-00022	Pickering B Operational Safety Requirements: Shield Cooling System
N-STD-OP-0017	Response to Transients
N-STD-MP-0019	Beyond Design Basis Accident Management
N-PROG-MP-0014	Reactor Safety Program
N-PROC-RA-0005	Written Reporting to Regulatory Agencies
N-PROC-RA-0020	Preliminary Event Notification

2.3.1 Conduct of Licensed Activity

N-PROG-OP-0001, *Nuclear Operations*, implements a series of standards and procedures to ensure that Pickering NGS is operated safely and reliably. The program establishes safe, uniform, and efficient operating practices and processes that provide nuclear professionals at Pickering NGS the ability to ensure the facility is operated in such a manner that the PROL, the *Operating Policies and Principles*, and other applicable regulations and standards are followed. It also supports the alignment and prioritization of equipment maintenance in a manner that protects the health and safety of workers, the public and the environment.

The following standards under the Nuclear Operations program provide instructions and requirements for consistent and safe operation of Pickering NGS.

- N-STD-OP-0036, *Operational Decision Making,* provides instructions on the systematic approach to decision making. It describes the principles and attributes, roles and responsibilities, and various levels of authority when making operational decisions.
- N-STD-OP-0011, *Operations Performance Monitoring*, provides a consistent manner of identifying and reporting common and site-specific performance. It is a tool used by station management to ensure standards for performance are being maintained or improved, and opportunities for continuous improvement are identified.
- N-STD-OP-0021, *Control of Fuelling Operations*, establishes the standard requirements such that fuelling operations and conduct of activities do not adversely affect reactivity control, containment of the fuel, and cooling of the fuel.

Furthermore, N-STD-OP-0012, *Conservative Decision-Making* (under N-PROG-AS-0002, *Human Performance*) describes management's expectations on conservative decision making with regards to the safe operation of the plant, such that decisions are made with full regard to the potential safety consequences and conservative actions are taken in the face of uncertainty.

The following subsections describe critical aspects of the Nuclear Operations program.

Heat Sink Management

N-STD-OP-0025, *Heat Sink Management*, specifies the requirements for management of reactor heat removal in all planned reactor states and planned configurations when the reactor is operating in low power conditions.

Response to Transients

N-STD-OP-0017, *Response to Transients*, defines the roles and responsibilities of operating crews when responding to transients to ensure the unit is placed in the appropriate safe state. Following any transient event and once the unit is in a safe operating state, a post-transient response meeting is held to confirm the cause of the event, verify that all systems and components of the unit operated as expected, ensure responses were per procedures, and initiate the appropriate corrective actions where required. Furthermore, a control room performance critique of the event will be conducted after the unit is in a stable steady state to evaluate the team's behaviours and use of operator fundamentals. Utilizing lessons learned allows for the operations team at Pickering NGS to continually improve their performance and ensure the continued safe operation of the station.

Reactivity Management

N-STD-OP-0009, *Reactivity Management*, applies systematic processes for monitoring and controlling reactivity in the core and stored nuclear fuel to ensure that reactivity is consistent with fuel design and operating limits.

Reactivity management performance of the station is measured using the Reactivity Management Index (RMI) (refer to Figure 16). It is a standard calculation used in the industry to gauge performance and facilitate benchmarking comparisons between individual plants and utilities. RMI Improvements have been shown over the licence period as a result of facility focus and effort on Fuel Handling Reliability.

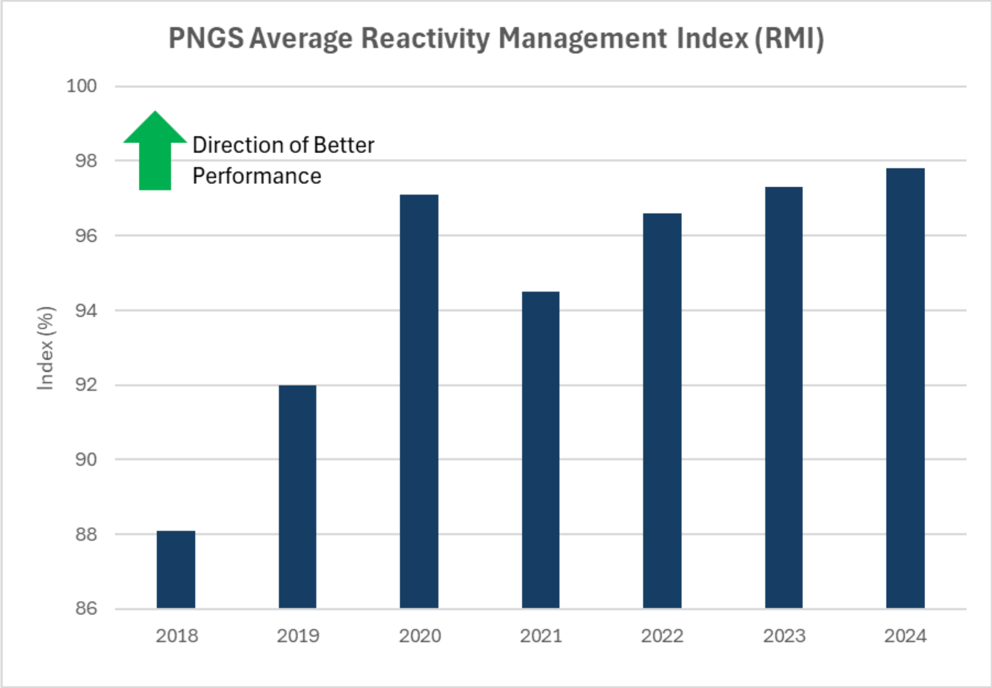

Figure 16. Pickering NGS Average RMI

Plant Status Control

The Plant Status Control program consists of different elements such as N-STD-OP-0024, *Nuclear Safety Configuration Management*, and N-STD-OP-0003, *Operations Narrative Logging*, to ensure that configuration of the station systems and components are monitored and controlled. It involves tracking the various operating conditions, parameters, and activities of the plant in real-time to ensure safe and efficient operation. Plant status control serves several important purposes including ensuring safety, improving operational efficiency, and fault detection.

Pickering NGS tracks significant mispositioning events using Mispositioning Index Value (MIV) (refer to Figure 17). Prior to 2021, Pickering NGS had a target of 97% which has been increased in recent years to drive continual improvement, along with the implementation of several initiatives and corrective actions for improved performance.

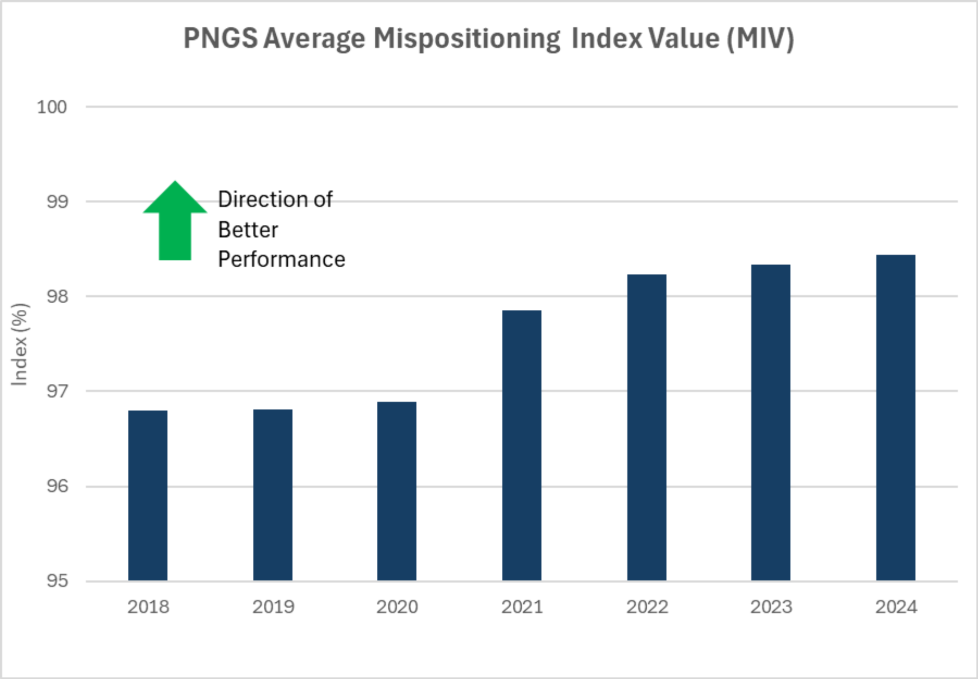

Figure 17. Pickering NGS Average Mispositioning Index Value

The Plant Status Control program at Pickering NGS strives for continuous improvement through new initiatives, innovation, and automation. The following software applications are utilized by Pickering NGS to support plant status control, and improvements have been made to the applications as discussed below.

- Equipment Status Monitoring (ESM) is used for tracking the position of system devices and components, work protection administration, temporary change requests for documenting system modifications and reactor outage alignments, flowsheet management, and creating equipment tags and status control tags. The current version of the program is fully electronic, which has improved efficiency and eliminates the potential for human errors found in older processes that were a combination of electronic and paper-based.
- Operator Shift Log (OSL) is a computer program for administrating Operational narrative logging requirements. It documents the chronological summary of shift activities and is used as part of shift turnovers to acquaint operators with unit conditions. It allows for quality operations logs to be maintained and include pertinent information such as enhanced monitoring requirements, equipment condition summaries, and abnormal station conditions. A version of the OSL program has been implemented, which has benefits such as remote accessibility and being linked in real-time to other key applications such as ESM and Equipment Status Log (ESL).
- ESL is used at Pickering NGS by Fuel Handling and Chemistry for control and monitoring of ion exchange columns, in addition to monitoring, controlling, and tracking of changes to plant systems, structures, and components. The ESL program was updated during the current licence term to improve speed and user experience.

Improvements have also been made to signage at the station including signage updating and simplification to ensure proper access and operation of overhead doors, and signage installation for emergency mitigating equipment to ensure clearance is maintained for emergency access.

Current ongoing initiatives for the Plant Status Control program include:

- New harsh environment tags being made available to improve readability and assist in identification of components in areas that are more difficult to assess.
- Main Control Room (MCR) key storage equipment and labelling has been updated. Key lists and tracking logs are in the process of being updated. Close control of keys ensure only authorized staff have access to sensitive equipment.

Work Protection

N-PROG-MA-0015, *Work Protection* describes requirements that are in place within OPG Nuclear to isolate and de-energize equipment to ensure worker safety.

Worker safety is achieved through the effective application of a work protection standard and procedures to ensure physical and administrative barriers are established between the energy source and the worker.

The objective of the physical and administrative barriers is to prevent breakthrough events that can expose staff to hazardous energy. As such, the key measure is the number of Level 1 events (events where there were no barriers for potential exposure to hazardous energy). The results of this measure will determine the corrective action requirements to improve performance. Operations Managers own the Work Protection program at the site and provide oversight through the:

- Nuclear Work Protection Review Board: review and provide oversight of the work protection performance in Nuclear.
- Local Work Protection Review Board (LWPRB): provide oversight of the Work Protection performance at the Site.
- Site Work Protection Working Committee: monthly meetings held to allow workers the opportunity to raise any work protection issues at site.

The Work Protection Performance Index (WPPI) is a measure of work protection performance. The number and significance of work protection events that occur on site each year affects the index. The annual trend in the WPPI metric is shown in Figure 18. In the current licence term, WPPI has improved as a result of the initiatives above.

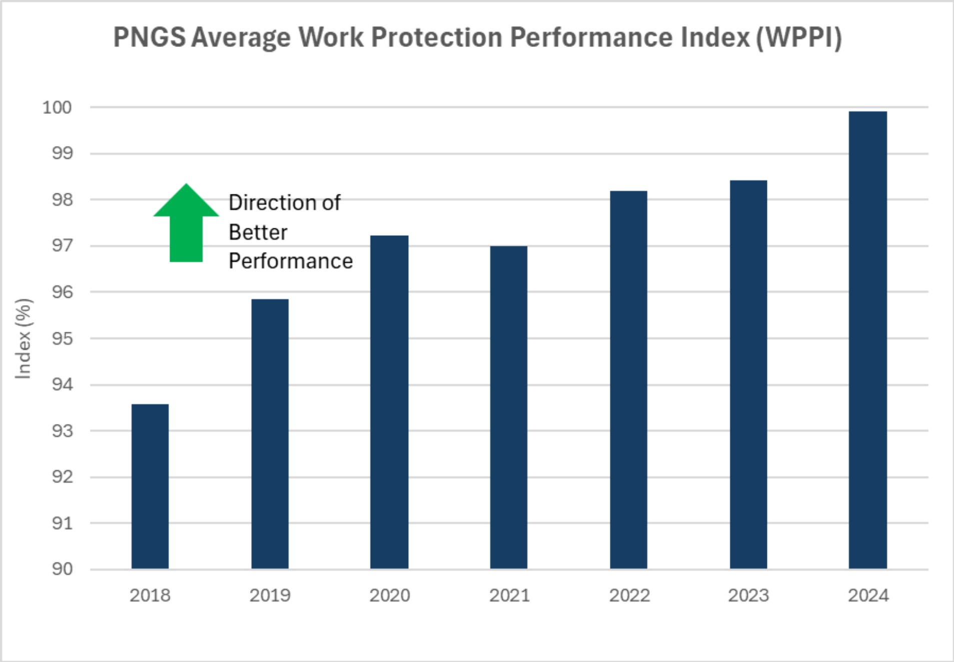

Figure 18. Pickering NGS Yearly Average WPPI

Production Work Management

N-PROG-MA-0019, *Production Work Management*, details the requirements for identifying, prioritizing, planning, scheduling and executing work in support of the operation, maintenance and modification of the plant, and described in more details in Section 2.6.2.

Heavy Water Management

The purpose of the heavy water Management program, N-PROG-AS-0008 is to establish overall requirements for effective heavy water management to ensure safety to workers, public and the environment, and to ensure there is a coordinated effort to achieve effective and efficient heavy water lifecycle management.

2.3.2 Procedures

Clear, concise, and accurate procedures are essential for the safe operation of the plant and for efficient and adequate response to transient situations. N-STD-AS-0002, *Procedure Use and Adherence* provides the requirements on how to use and adhere to administrative and technical procedures. Pickering NGS's operating procedures are developed and revised using defined processes to ensure compliance with operational limits and regulatory requirements, incorporating human performance and error-prevention tools such as second-party verification and place-keeping. N-PROC-AS-0028, *Development, Review and Approval of Technical Procedures* is in place for the development, review, and approval of technical procedures.

Validation when required is completed on both new procedures and procedures with extensive revisions. For procedures normally executed by MCR staff, the validation is completed before issuance by certified staff using the full-scope simulator, with additional input sought from trainers. Field validations are normally completed after issuance. Procedures requiring field validation are issued with a validation watermark and contain instructions on how to complete the validation.

Pickering NGS has multiple departmental procedures groups (e.g. Maintenance, Operations, Refurbishment, Fuel Handling, Operations Support, Nuclear Sustainability Services) that are dedicated to updating the technical procedures that their department has ownership of. Due to interfaces between different systems, the different procedures groups collaborate as required to revise various procedures.

Numerous procedure updates have either been completed during the current licence term or are ongoing due to the large amount of station projects and modifications. OPG has initiated several measures to improve the prioritization of implementing procedure updates. This includes development of training materials for new procedure authors, increasing staffing in procedures groups, streamlining the processes for reviews, verifications and approvals, and consolidation of databases into a single software application.

2.3.3 Reporting and Trending

As described in Section 2.1.3, N-PROG-RA-0003, *Performance Improvement*, establishes the processes that support the conduct of performance improvement and, by extension, employs the principles of problem prevention, detection, and correction at OPG Nuclear.

The implementing processes under this program allow for the prompt identification of adverse conditions, proactive identification and resolution of potential issues, or opportunities for improvement. Non-conformances, deficiencies, and adverse conditions must be promptly identified to prevent impact on plant operations, personnel, nuclear safety, the environment, or equipment and component reliability. These processes ensure that problems are corrected or dispositioned with a level of rigour commensurate with their risk significance. For those problems deemed to be of higher significance or systemic in nature, these processes ensure appropriate levels of management are notified, causes identified, actions taken to minimize or prevent recurrence, action completion and effectiveness verified, and lessons learned communicated.

N-PROC-RA-0022, *Processing Station Condition Records*, provides instruction on how adverse conditions are reported and outlines the process for effective evaluation, resolution, and trending of the adverse conditions. Each SCR is reviewed and dispositioned by an SCR co-ordinator before going through a screening committee, and a management review committee to ensure the disposition was accurate and complete. Most of the SCRs generated are determined to be not significant on their own and are dispositioned for trending (Category D), closed out to another SCR (Category CO) or determined to be non-events (entered in error, a duplicate or does not represent an adverse condition at Pickering NGS). The remainder of the SCRs require an evaluation of known facts or an investigation to determine the cause and related corrective action(s) that will prevent or reduce the frequency of recurrence of the adverse condition(s). Refer to Figure 19 for distribution of SCR categories in 2025 to date. This distribution of the SCR population is closely aligned with industry best practices based on benchmarking with nuclear utilities.

Additionally, N-PROC-RA-0035, *Operating Experience Process*, is in place for conducting OPEX evaluations for applicable SCRs. Refer to Section 2.1.4 for further details on the OPEX process.

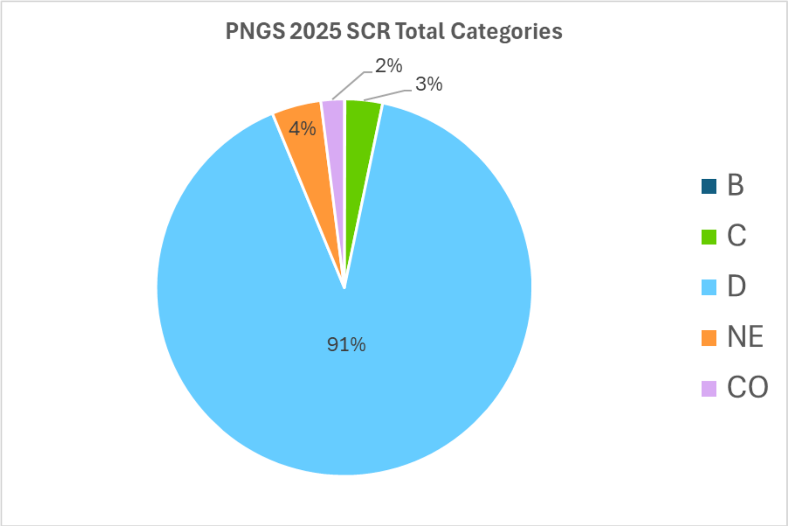

Figure 19. Distribution of SCR Categories for 2025 Year to Date

Root cause and apparent cause investigations are conducted for higher significance events to improve plant reliability and human performance at Pickering NGS. Quarterly reporting and trending analysis is conducted to identify trends in performance at a lower level before they become a more significant issue. Identified adverse trends are addressed by initiating an SCR and corrected as required through the corrective action program.

Pickering NGS maintains a Trend Watch List where potential trends are identified. Oversight is provided by the Management Review Meeting (MRM) where the Trend Watch List (TWL) is reviewed weekly. If a trend is suspected, a Validation of Trend (VoT) is performed to confirm if an adverse trend exists. The VoT process acts as a safeguard, proactively scrutinizing and challenging the potential impact of identified trends to prevent the development of consequential organizational issues. The implementation of a TWL and the utilization of trend performance indicators enhance the team's ability to meticulously observe, assess, and predict evolving patterns, ensuring that strategic actions are rooted in robust analytical foundations. For example, the MRM team identified a potential increase in Ignition Source Permits (ISPs) not being properly terminated after work completion and added this to the TWL. A VoT was requested, and it confirmed an adverse trend caused by unclear application and misalignment with current ISP form revisions. The resulting adverse trend SCR was evaluated, actions taken to arrest the trend ultimately resulted in a 50% reduction of late terminations over the observed period.

Regulatory Reporting

OPG provides both scheduled and unscheduled reports to the CNSC in accordance with CNSC REGDOC-3.1.1, *Reporting Requirements for Nuclear Power Plants version 3.*

OPG meets reporting requirements by adhering to the following governance, which are part of the management system per CSA N286-12, *Management system requirements for nuclear facilities*:

- N-PROC-RA-0020, *Preliminary Event Notification*, identifies the process by which preliminary notification requirements to facility and off-site organizations, management, and external officials and agencies are made after an event has occurred.
- N-PROC-RA-0022, *Processing Station Condition Records,* (described above) includes instruction on how adverse conditions are documented and reported. Adverse conditions

typically have some level of risk-significance associated with them taking into consideration any actual or potential impacts on operability or whether it is reportable.

- N-PROC-RA-0005, *Written Reporting to Regulatory Agencies*, defines roles, accountabilities, and processes for complying with regulatory requirements for Written Event Reports to regulatory agencies and for scheduled reports to CNSC.

Throughout the current licence term, OPG submitted all required scheduled and unscheduled reports in accordance with CNSC REGDOC-3.1.1. There were no significant events that affected the conduct of licensed activities at Pickering NGS.

2.3.4 Outage Management Performance

The objective of the Outage Management program is to ensure that inspections, testing, maintenance, and modifications activities are correctly identified, planned and safely completed while the unit is in the shutdown state, such that plant safety and reliability are maintained at the desired levels during normal operation. Outage management is performed in accordance with OPG procedures N-PROC-MA-0013 *Planned Outage Management*, and N-PROC-MA-0049 *Forced Outage Management,* which receive authority from N-PROG-MA-0019, *Production Work Management*. These procedures include a standard set of milestones that provides the methodical approach for guiding an outage through its life cycle. The milestones provide direction to plan, execute, monitor, and control outage activities to bring about the successful completion of outage goals and objectives while maintaining safety as the overriding priority. During the current license term, Pickering NGS outages have been managed in a safe and effective manner.

Planned outages are performed at Pickering NGS to perform inspections and undertake preventative and corrective maintenance of station components and equipment that require a unit shutdown state. Outage plans are focused on nuclear, radiological, and conventional safety and follow a detailed schedule. Outage preparation and execution involve organizations across the station and close coordination amongst work groups. As per CNSC REGDOC-3.1.1 requirements, Pickering NGS follows a process for submitting outage plans and schedules to the CNSC to ensure details of regulatory undertakings and commitments are clearly defined and communicated. The outage management program includes provisions to ensure that following the restart of the reactor, an outage completion assurance is submitted to the CNSC to confirm that all regulatory undertakings and major work on safety related systems have been completed successfully.

The primary objective of forced outage management is to correct the unit issue which caused the unit to shutdown and safely return the unit to service. In addition, the forced outage provides a potential opportunity to complete other critical outage related work within the regulated market rules. Pickering NGS maintains ready-to-execute forced outage plans to be completed in the event a forced outage occurs.

Pickering has an outage excellence plan which includes an optimized overall outage duration for the remaining outages prior to 2026, and planned outages post Refurbishment. This plan includes dose reduction, improved training windows, improved resource balancing because of reduced outage overlap, improved human performance, leveraging technology and innovation, more outage preparation time and fewer outage days. The outage excellence plan also includes an initiative for knowledge retention that leverages a fleet approach to outage management into the 2030's.

Additionally, outage work management will utilize work management fundamentals to continue to focus on risk mitigation and contingency planning to support execution of planned outage work. Accurately identifying and assessing risk ensures that business planning accounts for required contingencies, and key work required for plant reliability is completed within the outage window.

2.3.5 Safe Operating Envelope

The SOE at Pickering NGS is defined, implemented, and maintained per N-STD-MP-0016, *Safe Operating Envelope*, which is compliant with the requirements of CSA N290.15-10, *Requirements for the safe operating envelope for nuclear power plants*. The standard defines the processes, organizational responsibilities, and key program elements to ensure the SOE is defined and documented in a manner which is consistent with the station operating documentation. Furthermore, the standard for SOE is critical to the implementation of N-PROG-MP-0014, *Reactor Safety Program*.

The objective of the SOE is to define the set of limits and conditions within which the plant shall be operated to ensure conformance with the Safety Analysis upon which reactor operation is licensed. This set of limits and conditions are monitored and controlled by operators, as applicable per operating requirements. Limits and conditions that are part of the SOE include safety limits, safe operating limits, conditions of operability, actions and action times, and surveillances.

As SOE documents are considered living documents, they are revised and updated as required to reflect new safety analyses and modifications. OPG's ECC program has controls in place to ensure the need to revise SOE documentation is appropriately flagged as well as ensure these revisions are conducted and implemented correctly.

The SOE program at Pickering NGS has undergone continuous improvements driven by internal and external inspections and audits. Any enhancements identified through reviews of the Operational Safety Requirements (OSRs) and operational documents (e.g. Abnormal Incident Manuals (AIM)) are processed through OPG's document change management process with notifications made to CNSC staff, where applicable, as per regulatory requirements. The Pickering NGS SOE Improvement Project was initiated in 2023 to iteratively improve SOE documentation over time. As part of this initiative, OPG self-identified an opportunity to provide further clarity to the technical basis of some existing OSR safety limits and availability requirements. A review of the OSR documents and operational documents (e.g. AIMs) was completed. Any enhancements identified in the review of SOE documentation are being processed through OPG's document change management process and notifications will be made to the CNSC staff, where applicable, as per regulatory requirements.

2.3.6 Accident and Severe Accident Management and Recovery

OPG maintains an Accident Management program for Pickering NGS, which meets the requirements of CNSC regulatory document REGDOC-2.3.2, *Accident Management, Version 2,* in conjunction with the elements of safety analysis.

For Anticipated Operational Occurrences (AOOs) and Design Basis Accidents for Pickering NGS, OPG maintains AIMs. AIMs consist of the procedures for responding to events which have an immediate effect on a reactor unit, requiring the response of several major systems, and involving failure or impairment of one or more of the following: reactor power control; fuel cooling; breach of one or more barriers to containment of radioactivity. These are event-based procedures, based on the design-basis accident set.

An Emergency Operating Procedure is required for all single failure process upsets which directly and adversely affect reactor power control, and/or fuel cooling functions which are not satisfactorily terminated by automatic action of the process or mitigating systems.

For Beyond Design Basis Accidents (BDBAs) at Pickering NGS, OPG maintains Emergency Mitigating Equipment Guidelines and Severe Accident Management Guidelines (SAMGs). OPG's BDBA management program is implemented through N-STD-MP-0019, *Beyond Design Basis Accident Management*. Severe Accident (SA) management provides an additional layer of defence in depth to mitigate the consequences of accidents that fall beyond the scope of events considered in the plant design basis. Instead of the rule-based approach, SAMG uses a symptom-based/knowledge-based approach that includes steps for plant status diagnosis and equipment evaluation, making it well suited for responding to events involving failures affecting multiple components, systems, or lines of defense. The transition of the different strategies to prevent an event from progressing are shown below in Figure 20.

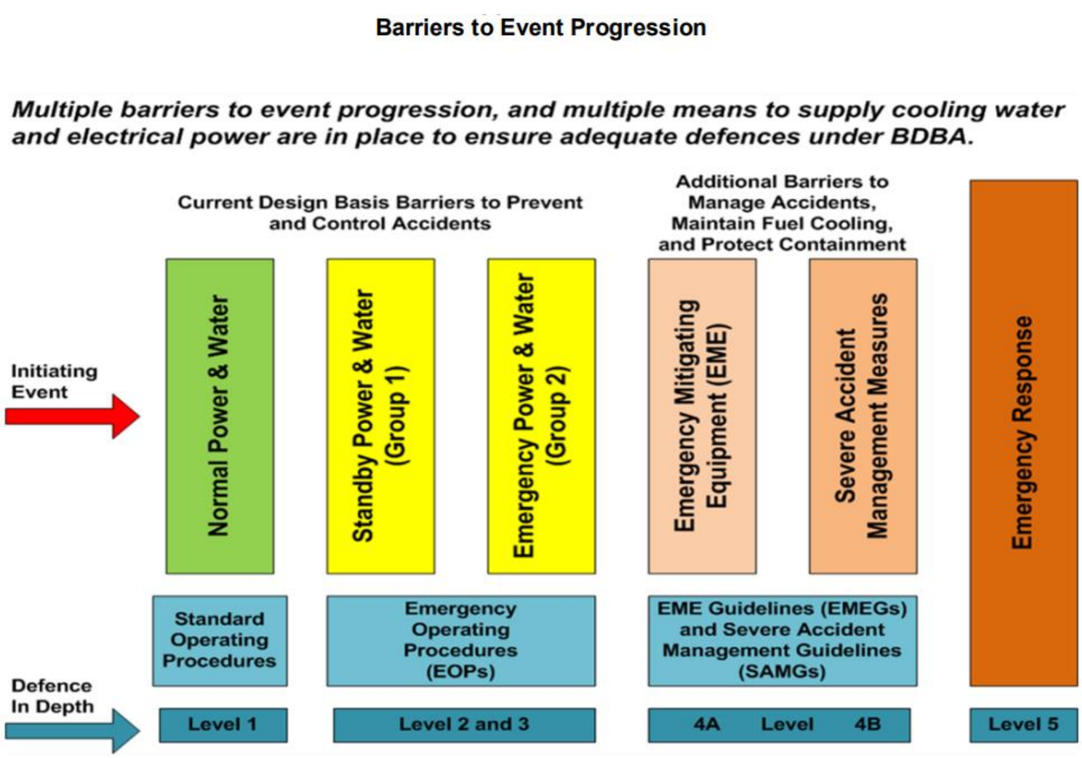

Figure 20. Barriers to Event Progression

In response to a plant transient, control room staff will diagnose the initiating event and to select the appropriate event-specific response procedure. It is critical to achieve acceptable fuel cooling in accident scenarios, through correctly diagnosing the initiating event, correctly implementing the response procedure(s), and ensuring functionality of mitigating equipment. In parallel with this event-based response, independent control room staff employ a symptom-based approach to assess the effectiveness of the procedure and its implementation by monitoring Critical Safety Parameters (CSPs). If any of the criteria for achieving acceptable fuel cooling are not met, one or more of these CSPs may exceed its specified setpoint, control room staff will take specified actions to restore the CSP value(s) within an acceptable range. These CSPs, their setpoints, and the related restoration procedures are specified in the AIMs.

For SA response and recovery, there are several key positions, roles and responsibilities established to support SAMG implementation at Pickering NGS, such as the Site Management Centre decision making authority (i.e., Emergency Response Manager/Authorized Duty Manager), the SAMG Technical Support Group, the Shift Manager, and the operations crew. Critical actions in the SAMG are listed below, and each action has different steps of responsibility (i.e. evaluate, recommend, authorize, implement), with specific personnel assigned to each step.

- Transition from Emergency Operating Procedures (EOPs) to SAMG;
- Implement SA mitigation actions;
- SA recovery strategies;
- End SAMG use and initiate long term recovery.

Details on the roles and responsibilities of OPG staff during a nuclear emergency, including communication strategies and interface with the public and with regulatory or other agencies can be found in N-PROG-RA-0001, *Consolidated Nuclear Emergency Plan*.

As per the requirements of the Reactor Safety program, OPG regularly performs self-assessments of the SAMG and BDBA management framework. The scope of these self-assessments is to review relevant engineering changes and confirm their implementation in the BDBA framework documents, address pending corrective actions, and verify completion of the actions initiated as a part of the previous self-assessments and/or audits. The self assessment results concluded that the implementation of the program meets the requirements of N-STD-MP-0019. The self assessment did not identify any gaps that required corrective actions.

2.3.7 Pickering NGS Units 1 to 4 Decommissioning

This section provides additional information regarding the Operating Performance SCA with respect to Units 1 to 4 decommissioning. It is intended to supplement the information provided in the general SCA discussion above and therefore only addresses those specific areas where additional decommissioning-related details are needed.

2.3.7.1 Conduct of Licensed Activities

OPG's Operating Performance programs will remain in place during all phases of decommissioning to ensure that the public, environment, and employees continue to be protected.

Plant Status Control (PSC)

During Decommissioning, Plant Status Control will be managed to ensure:

1. Status of SSC are known and controlled within bounds of analyzed conditions for safe operation and all phases of Decommissioning.
2. Changes to status of plant SSC are approved, documented, performed and verified by qualified personnel.
3. Changes in plant status that affect plant operation during Decommissioning are incorporated into procedures, flowsheets, and other operating documentation.

All changes to plant status will be captured using the electronic Equipment Status Monitoring Program. A new version of the Temporary Change Record (TCR) and Order to Operate (OTO) has been created specifically to document final configuration of each end-stated system.

Heavy Water Management

OPG plans to transfer an estimated 1,500 Mg of heavy water from Pickering NGS Units 1 and 4 to the Darlington NGS as per OPG's heavy water management program. This transferred heavy water will become Darlington NGS's heavy water inventory.

2.3.7.2 Safe Operating Envelope

Decommissioning unit configurations and activities will continue to meet the Safe Operating Envelope.

Pickering NGS Units 1 and 4 OSRs have been revised to reflect applicability once the unit is defueled and/or dewatered. The basis for OSR applicability as Pickering NGS Units 1 and 4 move through different states of stabilization is provided in P-REP-00990-1353834, *Safety Case Basis for P14 Safe Store Transition to SWS*. Prior written notification of the revised OSRs was submitted to the CNSC in September 2024. CNSC staff responded with no concerns in December 2024.

2.3.8 Pickering NGS Units 5 to 8 Refurbishment

This section provides additional information regarding the Operating Performance SCA with respect to Units 5 to 8 refurbishment. It is intended to supplement the information provided in the general SCA discussion above and therefore only addresses those specific areas where additional refurbishment-related details are needed.

Lessons Learned from Darlington NGS Refurbishment OPEX are actively incorporated into Pickering NGS Refurbishment planning. Some Operations staff who previously worked on Darlington NGS Refurbishment have been assigned to Pickering NGS to facilitate planning for refurbishment pre-requisite activities. In cases where it is not possible to transfer staff, Pickering Operations staff has performed extensive benchmarking and reviews of OPEX and Lessons Learned reports. Focused lessons learned sessions have been held with Darlington and Pickering Operations staff, covering various ranges of technical topics relevant to Pickering NGS Refurbishment.

Operations oversight has been present in preparation for refurbishment to ensure that all safety aspects have been considered for design changes, such as planning for the removal of systems and components from service for modifications.

2.3.8.1 Conduct of Licensed Activities

Plant Status Control (PSC)

During refurbishment PSC will be managed to ensure:

1. Status of SSC are known and controlled within bounds of analyzed conditions for safe operation and all phases of refurbishment.
2. Changes to status of plant SSC are approved, documented, performed and verified by qualified personnel (unless the SSC is isolated and de-energized).
3. Changes in plant status that affect plant operation, during or following refurbishment, are incorporated into procedures, flowsheets, and other operating documentation.

All changes to plant status will be captured using ESM. Each entry will be documented by unit, unit pair or common designation to ensure status is maintained.

Nuclear Refurbishment and Pickering NGS staff will establish a plan to transfer responsibility for the plant status control of a refurbishment unit. This will be documented in the Operations transfer plan. The exact status of the unit plant status control will be captured prior to a unit entering or exiting refurbishment. Continuous plant status control oversight will be performed by the Nuclear Refurbishment Operations and Maintenance Plant Status Control group.

To support the islanding of the refurbishment unit there will be boundary points and physical barriers in place to capture the partition between the operating station systems and the refurbishment systems. There will also be physical barriers to limit access to the refurbishment unit to appropriate personnel.

When an SSC is returned to service after maintenance or modification, a rigorous process will be used, with alignment checks and an approval process prior to declaring it available for service.

2.3.8.2 Heavy Water Management

Shipping of Pickering NGS Units 5 to 8 heavy water to Darlington NGS is also planned in order to temporarily store the units' heavy water from Pickering site during Units 5 to 8 refurbishment.

2.3.8.3 Procedures

Revisions to procedures related to the Refurbishment project will adhere to the strict safety standards of Pickering NGS operations to ensure refurbishment work is executed safely and with high quality. A specific procedures group will be created to manage and author these procedure updates. With the expected large volume of new procedures and revisions during Pickering Refurbishment, the procedures group staffing will increase to support the demand. Procedures will be developed with clear distinction between applicability during normal operation or during refurbishment states.

2.3.8.4 Safe Operating Envelope

OPG will ensure that the refurbishment unit configurations and activities continue to meet the SOE.

The primary change to the SOE arising during the Refurbishment Program will involve revisions to the Operating Policies and Principles (OP&Ps) as contained in NK30-OPP-03600, *Pickering NGS-B Operating Policies and Principles*. The Refurbishment outage will take place in several distinct stages. Each stage will require changes to the OP&Ps reflecting the unit and station configuration. For example, changes will be needed to reflect, i) a defueled core, and ii) isolated containment. OPG is currently undertaking a detailed assessment of the required changes to the OP&Ps. In all cases, the changes to the OP&Ps will be supported by the appropriate safety assessment and analysis, documented, and subject to CNSC staff notification prior implementation in accordance with the LCH.

Operational Safety Requirements

For any temporary changes being implemented specifically to facilitate the refurbishment outage, it is anticipated that the changes to the OP&Ps described above will be sufficient and no changes to the OSR documentation will be required in the majority of cases. This assumption will be verified during the outage planning process as assessments and analyses progress.

Permanent modifications to the plant will continue to be controlled by the ECC process as appropriate throughout the refurbishment period. This process includes a screening step to evaluate the impact of the modification on SOE margins.

The addition of any new SSCs or modifications implemented as part of Refurbishment activities which affect existing safety analysis will be incorporated as appropriate to the OSR documentation in order to properly capture safety limits and surveillance requirements. CNSC staff will be notified of any such impact to OSR documentation as per the LCH requirements.

2.3.9 Pickering Waste Management Facility

The OPG documents in the table below require written notification of change per PWMF Licence Conditions Handbook, LCH-W4-350.00/2028 R003:

Table 22. SCA 3 - PWMF Operating Performance & Reporting

Document Number	Document Title
W-PROG-WM-0001	Nuclear Waste Management
92896-OPP-01911.1-00001	Operating Policies and Principles, Pickering Waste Management Facility
N-PROG-RA-0002	Conduct of Regulatory Affairs
N-PROG-RA-0003	Performance Improvement
N-PROC-RA-0020	Preliminary Event Notification

2.3.9.1 Operating Performance

OPG's NSS is responsible for the life cycle management of radioactive waste for OPG-owned facilities and has direct responsibility for transportation, processing, and interim storage until final disposition of radioactive waste. The radioactive waste long term disposal strategy is described in Section 2.11.7.

The *Nuclear Waste Management Program*, W-PROG-WM-0001, establishes the overall program for PWMF operations and is described in more detail in Section 2.11. The operating limits and conditions for the PWMF are identified in 92896-SR-01320-10002, *Pickering Waste Management Facility – Safety Report,* and 92896-OPP-01911.1-0001, *Operating Policies and Principles, Pickering Waste Management Facility.*

In order to ensure there is adequate space available in the IFB for operation of the Pickering NGS, OPG safely and reliably transfers, processes, and stores DSCs from the Pickering NGS to the PWMF until disposal solutions for used fuel is available. During the current licence period, the safety performance of the PWMF used fuel processing and storage facilities has been excellent while meeting all targets. PWMF has operated safely without a Lost Time Accident for all 30 years the facility has been in operation (since 1994). There have been more than 1,300 on-site transfers of loaded DSCs without incident, with 421 DSCs processed and stored between 2018 and 2024 and with dose to the public from the operation less than 1% of the regulatory limit.

During the current licence period, DSC SB4 was placed in service and a transfer campaign was completed to support continued storage at PWMF. In addition, an alternate approved DSC transfer route was established on the south side of the Pickering NGS, providing full transport access around the Pickering NGS site.

DSC Reverse Loading

In the current licence period, OPG has demonstrated that all of the required DSC reverse loading steps to safely return fuel to an IFB can be performed should it be required. This is a precautionary step, to ensure flexibility and safety in reverse operations and removing fuel, if necessary.

Six-Year-Old Fuel

In August 2024, the CNSC Commission amended the PWMF operating licence to allow OPG to process and store up to 100 DSCs at a time containing used fuel that has been cooled in wet storage at Pickering NGS for a minimum of 6 years, after acceptance of the commissioning results by CNSC staff. In December 2024, OPG completed the commissioning phase of this initiative with 6-year cooled fuel successfully loaded into two DSCs, processed and stored in SB3 at the PWMF, and commissioning results were provided to CNSC staff. The dose rates and temperatures measurements for the weld surface and seal tube collected during commissioning were comparable to predicted values. The commissioning demonstrated that OPG is capable of safely processing DSCs containing minimum 6-year cooled fuel. In April 2025, CNSC staff accepted the commissioning results allowing OPG to proceed with processing and storing a maximum of 100 DSCs at a time containing a minimum of 6-year cooled used fuel.

Retube Component Storage Area

The purpose of the Retube Component Storage (RCS) area at the PWMF is to provide interim storage for components removed during retubing of the Pickering NGS Units 1 to 4 reactors from 1984 to 1992. The retube waste is stored and treated as nuclear waste using Dry Storage Modules (DSMs). During this current licence period, radioisotope inventories inside the DSMs have been steadily decreasing due to radioactive decay. Operational activities at the RCS area have been limited to periodic inspection, monitoring, maintenance, and refurbishment of the DSMs since 1993. There are 36 DSMs located in the Retube Component Storage area; two of these are empty and are stored for contingency and DSM aging management and monitoring purposes. The remaining 34 DSMs contain irradiated reactor components for interim storage.

Planned Activities

The following activities are planned for the PWMF:

- Construction of DSC SB5, with a planned operational capacity of 1410 DSCs and an anticipated in-service date in 2027, to support continued operations at Pickering NGS;
- Pending Commission approval, construction of PCSS, with an anticipated in-service date in 2027, to support Pickering NGS refurbishment and decommissioning activities;
- Change in DSC lid to base welding process to gain efficiencies (the DSC design change is described in more detail in Section 2.5.7); and
- Relocation of Dry Storage Modules located in the Retube Component Storage area at Phase I to PWMF Phase II west of DSC SB4.

2.3.9.2 Reporting and Trending

PWMF adheres to the same OPG programs and implementing procedures for reporting and trending as described in Section 2.3.3.

OPG provides scheduled and unscheduled reports for the PWMF to CNSC in accordance with CNSC REGDOC-3.1.2, *Reporting Requirements, Volume 1: Non-Power Reactor Class I*

Facilities and Uranium Mines and Mills., and Licence Condition 3.2 of the WFOL. Throughout the current licence term, OPG submitted all required scheduled and unscheduled reports, and there were no significant events that affected the conduct of licensed activities at PWMF.

2.4 Safety Analysis

Pickering NGS has an effective Safety Analysis program which meets or exceeds all applicable regulatory requirements and related objectives. The program ensures the maintenance of the safety analysis that supports the overall safety case for the facility. It also ensures there is demonstrated acceptability of the frequency and consequences of design-basis and beyond design basis events, with the ability of protective systems and emergency mitigating equipment to adequately control power, cool the fuel, and contain or limit any radioactivity that could be released from the plant.

The safety analysis program is governed by N-PROG-MP-0014, *Reactor Safety Program*, which establishes organizational responsibilities and key program elements for the management of issues related to Nuclear Safety Analysis (NSA) and the following major aspects of safe operation:

- Safety Analysis Basis and Safety Report Updates
- SOE
- BDBA Management

In addition, the Reactor Safety program governs generic CANDU Safety Issues (CSI) management, the Discovery Issue Resolution Process (DIRP), the Technical Operability Evaluation (TOE), and OSRs and Instrument Uncertainty Calculations (IUCs) preparation and revision processes.

The Safety Analysis Basis includes the NSA and assessments performed to demonstrate regulatory and design requirements are met and to determine safe operating limits.

The existing safety analysis at the Pickering NGS is a comprehensive and systematic evaluation of the hazards that can potentially result from operation of the plant and considers the effectiveness of preventive and mitigative measures and strategies in reducing the effects of the hazards. The existing safety analysis supports the overall safety case for Pickering NGS. Improvements to the safety case are continuously made including through Conexus Nuclear Inc. programs, and implementation of CNSC regulatory documents REGDOC-2.4.1, *Deterministic Safety Analysis* and REGDOC-2.4.2, *Probabilistic Safety Assessment (PSA) for Nuclear Power Plants*.

All software used by OPG for Deterministic Safety Analysis and Probabilistic Safety Analysis are governed by N-PROG-MP-0006, *Software* which is compliant with CSA N286-12, *Management system requirements for nuclear facilities* and CSA N286.7, *Quality assurance of analytical, scientific, and design computer programs for nuclear power plants*.

The OPG documents in the table below require written notification of change per Pickering NGS Licence Conditions Handbook, LCH-PR-48.00/2028-R007:

Table 23. SCA 4 – Pickering NGS Safety Analysis

Document Number	Document Title
N-PROG-MP-0014	Reactor Safety Program
N-PROC-MP-0086	Safety Analysis Basis and Safety Report Updates
N-PROG-MP-0006	Software
N-PROC-MP-0096	Use of Scientific, Engineering and Safety Analysis Software
N-PROG-RA-0016	Risk and Reliability Program
N-STD-RA-0034	Preparation, Maintenance and Application of Probabilistic Safety Assessment
N-STD-MP-0019	Beyond Design Basis Accident Management
N-REP-03491-0650826	Updated Emergency Planning Technical Basis for Provincial Nuclear Emergency Response Plan
N-STD-MP-0023	Technology and Research
N-PROC-MP-0092	Management of Research and Development

2.4.1 Deterministic Safety Analysis

The primary objectives of performing Deterministic Safety Analysis (DSA) are to confirm that the design of the Nuclear Power Plant (NPP) meets design and safety requirements, and to derive or confirm operational limits and conditions that are consistent with the design and safety requirements. Furthermore, DSA must confirm that the structures, systems, and components, in combination with plant procedures and operator actions, are effective in fulfilling their safety functions and keeping the releases of radioactive material from the plant below acceptable limits. DSA is a systematic process of calculating the public dose consequences for specific Postulated Initiating Events (PIEs) (refer to Section 2.4.1.2) and upset conditions at the plant.

DSA and the credited systems and equipment in the analysis is used to determine the limits that define the SOE of the plant (see Section 2.3.5 for discussion of the SOE). The SOE is implemented through the OSRs, IUCs, and other safety related limits and system credits that ensure operation within the safety analysis basis.

Performing and documenting DSA is governed by CNSC REGDOC-2.4.1, *Deterministic Safety Analysis*, which was issued in 2014. In response, OPG developed the REGDOC-2.4.1 Implementation Plan in 2014 for the OPG nuclear fleet, which outlined the framework for performing new DSA and identified the scope of the new analysis. Execution of the work defined in this plan is progressing and OPG continues to report on the safety analysis upgrades to meet REGDOG-2.4.1 requirements on an annual basis to the CNSC. The most recent analysis completed for Pickering NGS Units 5 to 8, in compliance with REGDOC-2.4.1, addresses safety analysis margins for the PIEs that are most impacted by Heat Transport System (HTS) aging were submitted to the CNSC in November 2024. The latest update on the status of REGDOC-2.4.1 implementation was issued in December 2024.

N-PROG-MP-0014, *Reactor Safety Program*, and its subsidiary governing documents define the key program elements for the planning, execution, and management of DSA. N-PROC-MP-0086, *Safety Analysis Basis and Safety Report Updates*, governs the updating of Safety

Reports and describes documentation of safety analysis. NK30-SR-01320-00001 and NK30-SR-01320-00002, *Pickering B NGS Safety Report - Part 1 and Part 2*, provide a general description of the site and the plant in sufficient detail for understanding the interaction of plant systems to facilitate DSA. The results of the DSA are documented in NK30-SR-01320-00003, *Pickering Nuclear 5-8 Safety Report: Part 3 – Accident Analysis* and NK30-REP-00531.7-00001, *Pickering B NGS Analysis of Record*. The documented DSA demonstrates compliance with licensing limits and derived acceptance criteria, identifies limits on process parameters and safety system requirements, and thereby establishes the SOE for the station to satisfy OPG's N-POL-0001, *Nuclear Safety and Security Policy*, requirement to control reactor power, cool the fuel, and contain radioactivity (3 C's).

As required by CNSC REGDOC-2.4.1, DSA for Design Basis Accidents (DBAs) takes into account the appropriate level of conservatism for the class of event analyzed, the acceptance criteria and trip coverage for each event analyzed and demonstrates applicable dose limits are met for the events. Analysis of AOOs demonstrates effectiveness of Level 2 defences (i.e., setback and stepback) for meeting fuel and fuel channel return-to-service criteria.

OPG maintains DSA current with ongoing analyses and assessments. In addition, DSA is also performed as required for operational support. Primary Heat Transport (PHT) system Aging Management (refer to Section 2.4.1.1) and CNSC REGDOC-2.4.1 implementation/compliance are two of the major programs contributing to maintaining DSA. Since these programs were created, several safety analysis submissions demonstrating sufficient margin for the plant have been made. Updating the current analysis in the Safety Report to be compliant with REGDOC-2.4.1 is progressing according to the REGDOC-2.4.1 implementation plan. Additionally, the scope of REGDOC-2.4.1 implementation will be updated depending on the significance of new technical insights in DSA methodology and changes in refurbishment.

2.4.1.1 Primary Heat Transport System Aging Management Strategy

OPG's PHT system aging management activities were initiated in 2000 to evaluate the impact of component aging on safety margins. OPG developed an overall Heat Transport System Aging Management Strategy (HTS-AMS) beginning in 2010 to manage safety analysis margin issues related to aging. HTS-AMS also interfaces with the broader N-PROG-MP-0008, *Integrated Aging Management*, in program execution.

The objective was to provide an integrated assessment on the cumulative effects of the identified aging mechanisms, and to develop effective safety margin management strategies based on the results of these assessments. The identification of known PHT system aging mechanisms and effects was completed in 2009 as part of the Technical Basis Document for PHT system safety margin management. Key parameters and phenomena for all important systems and sub-systems with direct interfaces with the PHT system main circuit have been identified and based on these, the critical accident scenarios from the perspective of PHT system aging impacts were determined.

OPG reports to the CNSC on the status of HTS-AMS, which was last updated for 2021 to 2025, and submitted to the CNSC in March 2021. OPG also reports to the CNSC on the progress of safety analysis related to PHT system aging, and the latest progress report was submitted in 2024. The most recent updates to safety analysis demonstrated the continued safe operation of the station until the end of 2026 and are also compliant with CNSC REGDOC-2.4.1.

During the Pickering NGS refurbishment outage, all pressure tubes will be replaced. Hence, the nuclear safety issues that would arise from pressure tube aging will not be present in the newly refurbished reactor units. As the units gradually age following refurbishment, OPG's existing aging management program will monitor and manage the aging process to ensure nuclear safety is maintained at all times.

2.4.1.2 Units Postulated Initiating Events

Formal identification of Postulated Initiating Events (PIEs) is a requirement of CNSC REGDOC-2.4.1 for performing DSA. These events could lead to a situation which can potentially challenge the safety functions of the nuclear facility and pose radiological hazards to plant, personnel, and public. These PIEs are identified through a systematic process which takes into account factors such as failure modes and effects analysis, regulatory requirements, past licensing experience, engineering judgement, operating experience, design of the plant, and previous DSAs and PSAs.

The identified PIEs include common hazards that can cause upset conditions in one or more units, leading to potentially unsafe conditions in more than one unit simultaneously. For example, common cause events or steam line breaks are part of the licensing basis and are documented in the Pickering NGS Units 5 to 8 Safety Report.

In compliance with CNSC REGDOC-2.4.1, all new safety analysis will have PIEs identified through a systematic process and classified into accident categories of AOOs, DBAs and BDBAs. The delineation between various accident categories is based on initiating event frequencies. The requirements and guidance for analysis of different accident categories are per REGDOC-2.4.1 and Conexus Nuclear Inc. Principles & Guidelines for DSA.

All safety analyses will be performed to satisfy the CNSC REGDOC-2.4.1 requirements, and as such, the events will be classified as AOOs, DBAs or BDBAs, while continuing to comply with the radiological dose limits specified in the LCH.

2.4.2 Hazard Analysis

Hazard Analysis for Pickering NGS is performed in compliance with CNSC REGDOC-2.4.2, *Probabilistic Safety Assessment (PSA) for Nuclear Power Plants*. Hazard Analysis has two main components: the initial Hazard Screening Analysis and the subsequent PSAs of the screen-in hazards. The Hazard Screening Analysis first involves the identification of a list of the internal and external hazards which could affect the safety of the reactor or the non-reactor sources of radiation (i.e., IFBs and used fuel DSCs). The list is subsequently screened using both qualitative and quantitative methods to identify the hazards for which a PSA must be conducted.

The Hazard Screening Analysis for Pickering NGS is updated every 5-years as per CNSC REGDOC-3.1.1, *Reporting Requirements for Nuclear Power Plants*. The methodology used to prepare the Hazard Screening Analysis is provided in the OPG PSA Guides for External and Internal Hazards, which are submitted to CNSC.

The Hazards Screening Analysis for Pickering B was last updated in December 2021 as part of the 5-year PSA update cycle for the Pickering B NGS, submitted to the CNSC in 2022. The report documents the hazard identification and screening of both internal and external hazards which are applicable to Pickering NGS. The scope of this screening analysis addresses hazards on both the reactors and the non-reactor sources. The hazard screening analysis was conducted as per OPG's External and Internal PSA Guides and was compliant with CNSC REGDOC-2.4.2.

External hazards are hazards which originate outside of the site boundary or are outside of OPG's direct control. External hazards are divided into two major categories: human induced external hazards (e.g. hazards such as airplane crashes and railway accidents) and natural external hazards (e.g. hazards such as earthquakes and severe weather). Internal hazards are those which originate within the site boundary and consist of hazards such as onsite transportation accidents and turbine missiles.

Once a list of the hazards has been generated, a screening assessment is performed to identify hazards and combinations of external hazards which do not need to be assessed (i.e. screening them out of the PSA). First, hazards and combinations of external hazards (e.g. combinations of human induced hazards with other human induced hazards, human induced hazards with natural hazards, and natural hazards with other natural hazards) are screened using the qualitative criteria presented in Table 24. If a hazard or combination of external hazards cannot be screened out using the qualitative screening criteria, they are then screened quantitatively, using the criteria provided in Table 25.

Table 24. Qualitative Hazard Screening Criteria

Criterion	Description	Applicable to Reactor and/or Non-Reactor Sources
QL-1	The event is of equal or lesser damage potential than similar events for which the plant has been designed.	QL-1 through QL-5 apply to both the reactor and the non-reactor sources
QL-2	The event has a significantly lower likelihood than another event that has been screened out, and yet the event could not result in worse consequences than the other event.	
QL-3	The event cannot occur at the site or close enough to the site to affect the plant.	
QL-4	The event is included in the definition of another event.	
QL-5	The event is slow in developing such that it can be demonstrated that there is sufficient time to eliminate the source of the threat or provide an adequate response.	
QL-6	The event does not cause an initiating event (including the need for a controlled shutdown) as well as safety system function losses needed for the event.	QL-6 and QL-7 apply only to reactor sources and not to the non-reactor sources.
QL-7	The consequences to the plant do not require the actuation of front-line systems.	

Table 25. Quantitative Hazard Screening Criteria

Criterion	Description	Direct Containment Bypass or Failure	Applicable to Reactor and/or Non-Reactor Sources
QN-1	Severe Core Damage Frequency < 10^{-6} / yr	No	QN-1 and QN-2 apply only to the reactor sources and not to the non-reactor sources
QN-2	Design Basis Hazard Frequency < 10^{-5} / yr and Conditional Core Damage Probability (CCDP) < 0.1	No	
QN-3	Severe Core Damage Frequency < 10^{-7} / yr	Yes	This QN applies to the reactor sources only. An equivalent QN for non-reactor sources of Large Release Frequency (LRF) < 10^{-7}/yr is proposed.
QN-4	Design Basis Hazard Frequency < 10^{-6} / yr and CCDP < 0.1	Yes	This QN applies to the reactor sources only. An equivalent QN for non-reactor sources will be considered as follows: Design Basis Hazard Frequency, < 10^{-6}/yr and conditional large release probability (CLRP) < 0.1
QN-5	Initiating Event or Hazard Frequency may be screened out if it can be shown that their frequency is < 10^{-7} / yr	Not Applicable	QN-5 applies to both the reactor and the non-reactor sources

At the conclusion of the 2021 Hazard Screening Analysis, the required downstream assessments were identified. Specifically, Hazard PSAs were subsequently performed (e.g., seismic events, internal fires, high winds, and internal floods) in conjunction with activities under Section 2.4.3. Certain meteorological hazards such as extreme temperatures and ice-storms were not further addressed as their impacts were already considered in the baseline PSA models to cater to events such as loss of switchyard and loss of bulk electricity supply.

The next scheduled update in 2027 for the Pickering Hazard Screening Analysis will be performed as required by CNSC REGDOC 2.4.2 and will be conducted according to the CNSC-accepted OPG PSA guides.

2.4.2.1 Climate Change

OPG completed a comprehensive climate change resilience assessment of Pickering NGS Units 5 to 8. The assessment's purpose was to demonstrate the safe and efficient operation of the units for at least another 30 years by addressing the potential impacts of climate change and Extreme Weather Events (EWEs).

OPG developed a first-of-a-kind industry methodology that broadly aligns with the nuclear sector's accepted EPRI "*Climate Vulnerability Assessment Guidance for Nuclear Power Plants*" Technical Report. The approach involved a sequence of evaluations, including:

1. *Climate Hazard Identification and Projections:* Climate hazards identification and characterization constitute a critical step in performing a site climate change resilience assessment. OPG collaborated with multiple climate scientists to identify various climate-related hazards, including Gradual Climate Change (GCC), EWEs, and Other Natural External Events (ONEEs). OPG completed a customized assessment of physical climate hazards at Pickering NGS to better understand historical and projected climate-related risks.
2. *Exposure Assessment:* A screening assessment was performed to evaluate a list of SSC and determined if they met criteria for being high value or critical components and determined if they are exposed to climate hazards.
3. *Vulnerability Assessment:* The identified SSCs were further evaluated to determine their susceptibility to climate change and if there were potential impacts on the performance of SSCs from changing climate related hazards.

Analysis of recent industry operating experience data from 2010 through 2020 shows that extreme events have an essentially negligible impact on nuclear generation capacity factors (the percentage of the time the nuclear power plant is running at full power and providing electricity to the grid), which are by far the highest of any carbon - free source of generation.

As a crucial part of the adaptation strategy, OPG has implemented the severe weather emergency preparedness procedure. This procedure is a key strategy for ensuring the safe operation of the plant during EWEs and includes actions like monitoring plant areas for water ingress, reviewing equipment affected by high heat, and clearing snow and ice from critical areas. This procedure has been successfully implemented at Pickering NGS Units 5 to 8, mitigating climate hazards with no negative impacts during severe weather events.

The nuclear industry has recognized the importance of resiliency; following industry guidance, OPG is working with its industry partners in implementing a more comprehensive resiliency program. While recognizing OPG's strong track record in demonstrating resilience to extreme conditions that may become more frequent due to climate change, additional adaptation options were presented using a graded approach – prioritizing improvements to existing programs and procedures first, followed by potential site-specific adaptations to further improve Pickering NGS resilience to climate change.

The climate change resilience assessment identified the importance of existing routine preventative maintenance programs and measures to monitor the daily operation of the plant, which are sufficient to discover climate change impacts to operation of Pickering NGS.

2.4.3 Probabilistic Safety Analysis

The purpose of a PSA is to establish whether the design and operation of the plant poses an acceptable level of risk to the public and to identify the primary sources of risk. PSA is a systematic process of radiological hazard identification and risk estimation using quantitative methods. The Pickering NGS PSA identifies the various event sequences that may lead to radioactive releases, assigns them to different categories of consequences, and calculates their frequencies of occurrence. The level 1 PSA estimates the frequency of accidents which may cause severe damage to the reactor core, and this is referred to as the Severe Core Damage Frequency (SCDF). The level 2 PSA estimates the frequency of accidents which may result in a

release of radionuclides outside of the boundary of the station, and this is referred to as the Large Release Frequency (LRF).

The entire suite of PSAs for Pickering NGS, performed in compliance with CNSC REGDOC-2.4.2, includes:

- Level 1 Internal Events At-Power PSA;
- Level 2 Internal Events At-Power PSA;
- Outage Internal Events PSA;
- Internal Fire PSA;
- Internal Flood PSA;
- High Wind PSA;
- Seismic PSA;
- Non-Reactor Sources PSA.

These PSAs are updated every 5-years, as required by CNSC REGDOC-3.1.1, to ensure that the PSA models accurately reflect the current design and operation of the station. OPG has established Safety Goals for the LRF and SCDF which the station PSAs are required to meet, and these Safety Goals are governed by N-PROG-RA-0016, *Risk and Reliability Program*. The PSAs are completed by following the OPG PSA Guides and N-STD-RA-0034, *Preparation, Maintenance and Application of Probabilistic Safety Assessment*. As required by CNSC REGDOC-2.4.2, the OPG PSA guides were provided to the CNSC, and the CNSC accepted the methodology documented in the guides.

In 2022 and 2023, OPG performed a full update of the Pickering NGS PSAs and demonstrated that the current design and operation of Pickering NGS poses an acceptable level of risk to the public.

OPG acknowledges the importance of continuous enhancement in PSA practices and methodologies. OPG plans to review and assess the impacts of various pending changes related to the Pickering NGS Units 1 to 4 transition to decommissioning and Pickering NGS Units 5 to 8 refurbishment activities on the existing Pickering NGS Units 5 to 8 PSAs. This assessment will identify and recommend improvements to methodologies, new assessments/analyses, procedural enhancements, refinements of assumptions, and other opportunities for improvement. These efforts will contribute to a more refined post-refurbishment risk profile. The update will be compliant with CNSC REGDOC-2.4.2 and will be conducted in accordance with the CNSC accepted OPG PSA guides.

OPG performs Importance Analysis as a part of the periodic PSA updates to identify the components and equipment of high importance. PSAs are also used to identify any Single Point Vulnerabilities (SPVs) and eliminate these SPVs with appropriate modifications or procedural changes. This process of identifying and eliminating the vulnerabilities feeds back into the PSA models to reduce the risk by lowering the probabilities of event sequences that could lead to SAs.

The PSA process also interfaces with the SA management program (i.e. procedures and modifications). This linkage facilitates the verification of the adequacy of the SA management program, by utilizing the specific PSA models to identify areas for improvement in the SA mitigating measures.

2.4.4 Severe Accident Analysis

An SA is a subset of BDBA that has the potential to release radioactive material. Severe Accident Analysis (SAA) is the means by which OPG assesses SAs, to ensure that the risk from the operation of nuclear reactors remains low. Response to a SA applies a symptom based/knowledge-based approach that includes steps for plant status diagnosis and equipment evaluation, making it well suited for responding to events involving failures affecting multiple components, systems, or lines of defense.

OPG performs SAA as a part of its periodic PSA updates as per regulatory requirements. OPG last performed SAA as a part of the Level 2 Internal Events PSA update for Pickering NGS Units 5 to 8 in 2022.

Extensive analysis has been carried out to identify BDBAs with the potential to transition to SAs. Included in this work are habitability studies to evaluate the impact of such events on the ability of station personnel to carry out actions as part of the emergency response.

SAA is an integral part of the comprehensive Level 2 PSA methodology. SAA follows a systematic approach which starts with defining the Plant Damage States (PDS) using the Level 1 PSA Fuel Damage Category 2 cutsets that could lead to core damage end states. Once binned into the representative PDS, the sequences are analyzed using the MAAP-CANDU SAA program. The current version of the MAAP code used by OPG is MAAP5-CANDU 5.00a which is the most recent code release version. Each accident sequence analyzed in the SAA is categorized into individual Release Category (RC) bins ranging from RC1 to RC6 based on the Cs-137 and I-131 release source terms. Details on SAA methodology are provided in the revised and CNSC accepted Level 2 PSA guide.

SAA using MAAP-CANDU also produces accident progression results which provide relevant phenomenological information such as timing for core collapse, calandria vessel failure, hydrogen source terms, hydrogen fires/explosions, core-concrete interaction, and containment failure to facilitate understanding of accident progression for various event scenarios.

The SAA performed as a part of the Level 2 PSA provides further insights in terms of the effectiveness of various BDBA modifications, SAMG strategies, and human interventions by performing sensitivity analysis to assess the importance of key actions and equipment. The results of the SAAs are also evaluated and used as input to the OPG BDBA and SA management program. The insights from the SAA are used in accordance with CNSC REGDOC-2.3.2, *Accident Management: Severe Accident Management Programs for Nuclear Reactors*, and REGDOC-2.4.1, *Deterministic Safety Analysis* to identify areas for improvement. This includes plant modifications and/or updates to the guidelines and procedures such as Emergency Operating Procedures, EMEGs, and SAMGs. OPG assesses BDBAs at Pickering NGS Units 5 to 8 as per REGDOC-2.4.1 requirements to ensure the as-built design meets the requirements for release limits established, and that the procedures and equipment put in place to handle the accident management needs are effective, taking into account the availability of cooling water, material, and power supplies.

OPG plans to update the Pickering NGS Units 5 to 8 SAA in support of the Pickering NGS Units 5 to 8 refurbishment PSA update. The SAA will be performed to implement and assess the impact of planned refurbishment activities on the existing Pickering NGS 5 to 8 PSA. In addition, OPG plans to perform SAA activities to reflect the decommissioning of Pickering NGS Units 1 to 4 and changes to the containment configuration resulting from Pickering NGS Units 1 to 4 decommissioning.

The Level 2 PSA Guide was updated in 2024 to reflect the updated requirements of CNSC REGDOC-2.4.2 Version 2. The next periodic Level 2 PSA and SAA update will be performed in compliance with REGDOC-2.4.2 and conducted in accordance with the OPG PSA guide.

2.4.5 Criticality Safety

The objective of criticality safety focuses on the prevention of fuel criticality both inside and outside the core, for either fresh or irradiated fuel.

Pickering NGS reactors use only natural uranium (0.7% U-235) or depleted uranium (0.4% U-235) fuel, which is incapable of achieving criticality in the absence of an unpoisoned heavy water moderator and precise geometric arrangement found only in the reactor core. Fresh fuel is safely stored and secured in an approved location within the facility and in such a manner that segregates it from heavy water and heavy water systems. Thus, ex-core fresh fuel cannot be made critical. Ex-core irradiated fuel is stored in the IFBs submerged within light water (H_2O) where the fuel's low fissile content cannot be made critical in any configuration; therefore, no criticality risk exists.

In-core criticality safety control is achieved by procedures specified in the GSS Manual. The four types of GSS at Pickering include: Over-poisoned GSS (RSG1), Rod Based GSS with Drained Moderator (RSG2), Moderator Drained GSS (RSG3), and Rod Based GSS (RSG4). Application of GSS is prescribed by the Operating Policies and Principles.

All criticality configurations are addressed as discussed above to ensure continued criticality safety.

2.4.6 Management of Safety Issues

The Safety and Licensing (S&L) Research and Development (R&D) program addresses issues related to the safety design basis and SOE of existing nuclear plants, in collaboration with Conexus Nuclear Inc. There is a strong focus on supporting the resolution of outstanding generic S&L issues and safety margin improvement initiatives. The program takes into consideration both Canadian and international operating experiences in identifying and selecting R&D work to be performed. In part, this work also supports safety assessments for new plant designs and refurbishments and assists in maintaining the core capabilities, scientific expertise, and the infrastructure necessary for an ongoing nuclear safety R&D program.

The Conexus Nuclear Inc. Industry Standard Toolset Program is a consolidation of the maintenance and support, development and qualification activities of the computer codes used for the design, safety analysis and operational support of CANDU reactors.

The Conexus Nuclear Inc. R&D program overview report and operational plans are submitted to the CNSC as part of annual reporting requirements in accordance with CNSC REGDOC-3.1.1. This submission provides a summary of the work completed in the previous year and the on-going R&D activities that are being performed under the Conexus Nuclear Inc. R&D and Industry Standard Toolkit program. Also, Conexus Nuclear Inc.-CNSC R&D seminars are held bi-annually.

2.4.6.1 Management of CANDU Safety Issues (CSIs)

A safety issue is defined as an issue related to the design or analysis of a NPP that has the potential to challenge safety functions, safety barriers or both.

In 2007, the CNSC assessed the status of CSIs and, while the safety case was not in question, the CNSC identified control measures to address residual concerns on nuclear safety. The initial list of issues was developed using the IAEA TECDOC-1554, *Generic Safety Issues for*

Nuclear Power Plants with Pressurized Heavy Water Reactors and Measures for their Resolution, and each issue was classified into one of the following three categories:

- Category 1: Not an issue in Canada
- Category 2: The issue is a concern in Canada. However, the licensees have appropriate control measures in place to address the issue and to maintain safety margins
- Category 3: The issue is a concern in Canada. Measures are in place to maintain safety margins, but further experiments and/or analysis are required to improve knowledge and understanding of the issue, and to confirm the adequacy of the measures

In 2009, the CNSC identified sixteen Category 3 CSIs of which four were related to Large Break Loss of Coolant Accident (LBLOCA) and twelve were non-LBLOCA. For the Pickering NGS station, all 12 non-LBLOCA Category 3 CSIs were previously recategorized to a lower category. One of the LBLOCA related Category 3 CSI was recategorized to a lower category in 2013. The remaining three LBLOCA related Category 3 CSIs were requested to be recategorized to a lower category in 2023 for Pickering NGS Units 1 to 4 and in 2024 for Pickering NGS Units 5 to 8.

OPG has demonstrated that appropriate control measures have been implemented and currently are in place to address all sixteen CSIs and maintain safety margins.

2.4.7 Pickering NGS Units 1 to 4 Decommissioning

This section provides additional information regarding the Safety Analysis SCA with respect to Units 1 to 4 decommissioning. It is intended to supplement the information provided in the general SCA discussion above and therefore only addresses those specific areas where additional decommissioning-related details are needed.

2.4.7.1 Safety Analysis and Safety Assessments

The end of commercial operation (ECO) for a reactor unit is defined as the final reactor shutdown, establishment of a GSS, and permanent cessation of the electricity production from the units. Unit 1 and 4 were permanently shut down in 2024 and are currently undergoing stabilization.

A Safety Case Basis documenting how Pickering NGS Units 1 and Unit 4 will transition from full power operations to SWS in a manner that is analyzed to be safe and consistent with the licensing basis, was completed and submitted to CNSC staff in 2024.

The Safety Case concluded that the existing Safety Analysis provides adequate coverage throughout the Safe Store period and into the SWS period. Containment will remain fully available until Pickering NGS Units 5 to 8 are shut down and defueled prior to the commencement of their refurbishment outages. Existing procedures for Fuel Bay cooling are adequate and will remain unchanged until the bays are empty of fuel. As the units progress through dewatering, heavy water will be stored in approved facilities analyzed to be safe under existing safety analysis as long as needed by the Station heavy water plan. OPG plans to revise the licensing basis for Pickering NGS Units 1 to 4 once the units have been defueled and dewatered such as update the OSRs, the AIMs, SAMG, Emergency Mitigating Equipment (EME) and the OP&Ps to reflect SWS state. In the SWS state, the residual accidents of concern for Pickering NGS Units 1 to 4 are Pickering NGS Units 5 to 8 Loss of Coolant Accident (LOCA), Seismic event support for Pickering NGS Units 5 to 8, IFB cooling and heavy water break outside of containment. All will be covered by existing procedures or changes that are already in progress.

Additionally, a Decommissioning Safety Assessment has been performed for decommissioning activities, including the SWS phase and an evaluation of potential risk reduction activities planned for units in SWS. This assessment, provided to CNSC staff with the DDP, systematically analyzed potential hazards and risks to workers, the public, and the environment associated with decommissioning activities. The assessment confirms that with the implementation of identified OPG processes for risk mitigation measures, all activities can be conducted safely and in compliance with regulatory requirements.

2.4.8 Pickering NGS Units 5 to 8 Refurbishment

This section provides additional information regarding the Safety Analysis SCA with respect to Units 5 to 8 refurbishment. It is intended to supplement the information provided in the general SCA discussion above and therefore only addresses those specific areas where additional refurbishment-related details are needed.

2.4.8.1 Safety Analysis

The Refurbishment Project will carry out the reactor safety assessments and safety analysis in accordance with N-PROG-MP-0014, *Reactor Safety Program* and N-PROG-RA-0016, *Risk and Reliability Program* and their implementing procedures.

The scope and extent of the refurbishment outage represents a significant change to the configuration of the plant including defueling, and containment isolation. Each plant configuration will be assessed to ensure the continuing safety of the operating and the refurbishment units during all outage states. Insights from the assessments above will be incorporated, as required, into the OP&Ps.

All modifications to the plant are carried out in accordance with the OPG ECC process which includes several steps requiring assessment against reactor safety criteria, including explicit consideration of impact on safety analysis.

Modifications during refurbishment have the objective to further enhance safety performance or reliability of the station. Should this analysis, or other analysis performed in support of the Refurbishment Project require an update of Part 3 of the Safety Report or the Analysis of Record, then the update will proceed in accordance with established OPG processes and procedures. Safety analyses will be performed according to CNSC REGDOC-2.4.1, *Deterministic Safety Analysis*.

New or modified systems or components which have been incorporated into the safety analysis will also result in updates of the Operational Safety Requirements documentation and, possibly, the OP&Ps.

2.4.8.2 Nuclear Safety Improvements

OPG conducted a number of studies to identify areas in nuclear safety where enhancements to safety could be achieved with the unique opportunities the Refurbishment Project presents. A multi-year, multi-unit outage when safety related system requirements will be greatly reduced or eliminated entirely allows for more intrusive modifications (while systems are defueled, dewatered and safe stated).

OPG will continue to ensure safe, reliable operation of Pickering NGS as it undergoes refurbishment activities. Processes and practices will also remain in place in Pickering's post-refurbishment life to ensure it continues to be operated and maintained with nuclear safety and Defence-in-Depth front of mind. Defence-in-Depth principles ensure redundant, diverse, independent measures (which include equipment, procedures, people) are in place to prevent and mitigate events. Building upon the concepts of Defence-in-Depth, significant safety improvements are being undertaken as physical plant modifications to improve long term plant reliability and to increase safety and operational margins of the Units 5-8. Scope during the next licence period includes, but is not limited to:

- Replacement of all Pressure Tubes, Calandria Tubes and Feeders
- Replacement of all 48 Boilers
- Replacement of all 6 Standby Generators
- Replacement of Digital Control Computers
- Fuel Handling Equipment improvements
- Fire Protection Equipment improvements

In addition, OPG is leveraging its Risk and Reliability program and industry operating experience to identify and incorporate targeted nuclear SIOs in the following areas:

1. Core Cooling
    a. Emergency Water Supply System: Additional flow paths and increased system reliability to increase core cooling capabilities in accident scenarios.
    b. Heat sink diversity: New sources of water to the core through dedicated pumps and/or firewater connections.
2. Containment Enhancement
    a. Containment Filtered Venting System: A new system dedicated to providing a filtered relief pathway to enhance containment integrity in SA scenarios.
    b. Calandria Vault Overpressure Protection: Increased safety margin for SAs.
3. External Hazard Protection
    a. High Wind Protection: Providing additional resistance to safety related equipment failures from hazards such as windborne missiles.

These SIO modifications are informed by Probabilistic Safety Analysis which will be used to further optimize the solutions as the detailed design work progresses.

Taken together, these sets of modifications demonstrate a strong commitment to Nuclear Safety and continued safe operation over the next operating life cycle for the Pickering NGS Units 5-8.

2.4.8.3 Hazard Analysis

The OPG ECC process includes several steps requiring assessment against reactor safety criteria, including consideration of impact on hazard analysis.

Modifications must be shown to either have no impact on the current assumptions contained in the Safety Report or the PERA or to incorporate mitigating measures, as appropriate within the SOE and in accordance with the Pickering LCH.

Hazards arising from space allocation and transient materials concerns including combustible material, tornado generated missiles, and impacts on the seismic route are addressed and controlled via application of established OPG programs and procedures. In addition to the consideration of hazards via the ECC process, Nuclear/Reactor Safety assessments of temporary work areas and refurbishment specific lay-down areas will be performed. These assessments will aid in identifying whether current governance is sufficient to control these types of hazards or if refurbishment-specific governance is required.

2.4.9 Pickering Waste Management Facility

The OPG documents in the table below require written notification of change per PWMF Licence Conditions Handbook, LCH-W4-350.00/2028 R003:

Table 26. SCA 4 – PWMF Safety Analysis

Document Number	Document Title
N-PROG-MP-0014	Reactor Safety Program
92896-SR-01320-10002	Pickering Waste Management Facility Safety Report
92896-SR-01320-10002 – ADD01	Pickering Waste Management Facility - Safety Report Addendum for Minimum Six-Year Cooled Fuel

Nuclear Waste safety analysis is performed under the OPG Nuclear Reactor Safety Program as described in Section 2.4.1. Specifically, as it relates to nuclear waste management, the program provides a basis for the performance of nuclear safety analysis and outlines the governing documents that define the processes associated with maintaining the safety analysis and safety reports supporting the operation of Nuclear Waste Facilities.

OPG has implemented and maintains a nuclear waste facility safety analysis program that complies with CNSC REGDOC-2.4.4, *Safety Analysis for Class 1B Nuclear Facilities*. Results of the PWMF safety analysis are presented in 92896-SR-01320-10002, *Pickering Waste Management Facility Safety Report*, which also provides an overview of the PWMF design and operations.

To assess the overall safety of the operation of PWMF SBs and structures, deterministic safety analyses are used. Computational tools are used for the dose consequence calculations when required. Bounding (worst-case) accident scenarios are conservatively identified, and the results of off-site dose consequence calculations are then compared against the regulatory dose limits. The PWMF safety report is reviewed every five years and updated as required to reflect changes in site layout, operational experience and information supporting the assumptions made in the assessments. The safety report update process encompasses the systematic identification of safety issues, their prioritization, their resolution, and the physical updates.

The PWMF safety report was submitted to the CNSC in 2023 and an addendum covering transfer, processing and storage of minimum six-year cooled fuel was submitted in 2024.

The safety report demonstrates that dose rates and emissions from the PWMF under normal and abnormal operating conditions as well as postulated accident conditions are acceptable, and operation of the facility continues to pose an acceptably low risk to the public, the workers, and the environment. The next safety report update will be in 2028 and it will combine the safety report and addendum into one document.

The following subsections describe aspects of the PWMF safety analysis.

Used Fuel Dry Storage Safety Analysis - Normal Operating Conditions

Shielding analysis is performed to determine dose rates from DSCs, both inside and outside the storage buildings and structures. Dose rates external to the buildings are determined for workers on-site and for members of the public off-site. In all cases, predicted dose rates inside the PWMF facility, at the site boundary and for the nearest public populations are estimated to result in doses well below the CNSC regulatory dose limit for Nuclear Energy Workers (NEWs) and well below the regulatory public dose limit of 1 mSv/year.

Used Fuel Dry Storage – Credible Abnormal Events

The assessment of malfunctions and accidents considered the following main stages of the out-of-station used fuel dry storage operations:

- On-site transfer operations.
- Operations inside the DSC Processing Building; and
- DSC Storage.

Each potential event was screened to determine if it could result in any radiological impact to the public and/or workers. Common-mode incidents such as seismic events, tornados, etc. have been considered. Design provisions and procedural measures that could prevent the event or mitigate its consequences were also evaluated.

Although considered unlikely, for on-site transfer and processing of DSCs (e.g. welding, inspecting, testing, sealing and moving to storage), the bounding accident was identified to be a drop of the DSC, with subsequent 100% fuel sheath failures and associated release of volatile nuclides to the environment. The total doses to the public at the PN site boundary and the occupational doses due to this event were assessed to be below the regulatory dose limits.

Criticality

Criticality assessments have been completed for the used fuel stored in DSCs for the PWMF. Consistent with expectations for irradiated natural uranium fuel, the analyses and assessments have demonstrated significant sub-criticality margin with no likelihood for criticality of used CANDU fuel.

Used fuel stored in DSCs cannot achieve criticality under normal conditions or under any postulated accident scenario at the PWMF.

Retube Component Storage – Normal Operating Conditions

The PWMF will have two areas that store refurbishment waste, the Retube Component Storage area where DSMs are stored and the PCSS where Pickering NGS refurbishment and decommissioning waste will be stored. These areas have been or will be designed and constructed such that OPG's dose rate targets at the facility fence and at site boundaries are achieved. Dose rates will continue to be routinely monitored and has shown to be within facility targets and resulting worker and public doses are well below CNSC regulatory limits.

Retube Component Storage – Credible Abnormal Events

Potential exposures from refurbishment waste under abnormal operating conditions have been assessed and no credible events have been identified that would lead to a failure of containers and release of irradiated components. Conservative estimates of worst-case doses from extreme conditions, such as seismic events or tornados are well below regulatory limits.

Pickering Component Storage Structure

A safety analysis was completed for the proposed Pickering Component Storage Structure and was submitted to the CNSC with the PWMF licence amendment application in May 2024. This structure will be designed and constructed such that OPG's dose rate targets, which are below the CNSC regulatory limits, are achieved. In May 2025, an updated safety assessment was submitted to the CNSC which continued to demonstrate that the proposed operation of the PCSS and storage of L&ILW components will have negligible effect on safe operation and public and worker safety.

Planned Activities

The methodology for performing safety assessments is routinely assessed and updated for the methodology to be as up-to-date and accurate as possible. Any facility improvements that are completed will be reflected in the safety report updates, after the facility improvements are implemented.

The following activities are planned for the PWMF:

- *Support for Additional Structures:* In the current PWMF operating licence, there is provision and authorization for DSC SB5 to be built at the PWMF Phase II site to store a maximum of 1,200 DSCs. OPG is planning to increase the maximum number of DSCs that can be stored in SB5 from 1,200 to 1,410 DSCs. Before more than 1,200 DSCs are stored in SB5, safety analysis will be completed to demonstrate that storing 1,410 DSCs is acceptable. All radiological safety requirements in the *Nuclear Safety and Control Act* and associated *Regulations* will be met.
- *Support for Defective Fuel Storage:* As a part of the project to store defective fuel, a safety analysis will be completed for the transfer, processing and storage of DSCs containing canned defective fuel at the PWMF. More information about defective fuel is provided in Section 1.2.2.
- *Support for MKIII (V-Groove) DSCs:* It will be confirmed, prior to storage, that storing used fuel in MKIII DSCs in the storage buildings is an acceptable practice. The MKIII DSC design will follow the OPG ECC process and is described in more detail in Section 2.5.7.
- *Safety Analysis Update:* Safety analyses are reviewed and updated as necessary including prior to safety report updates, to confirm that facility operations will not result in any unacceptable radiological consequences to the health and safety of the workers and the public, under normal and abnormal operating conditions as well as postulated accident conditions.

2.5 Physical Design

Pickering NGS has an effective program to maintain its design basis which meets or exceeds all applicable regulatory requirements and related objectives. The program ensures that SSCs and Software meet and maintain their design basis given new information arising over time and taking changes in the external environment into account.

Pickering NGS Units 1 to 4 are now fully shutdown and ceased operation at the end of 2024. For this reason, additional details for Pickering NGS Units 1 to 4 are discussed in Section 2.5.5 of this SCA.

The OPG documents in the table below require written notification of change per Pickering NGS Licence Conditions Handbook, LCH-PR-48.00.2028-R007:

Table 27. SCA 5 – Pickering NGS Physical Design

Document Number	Document Title
N-STD-MP-0028	Conduct of Engineering
N-PROG-MP-0009	Design Management
N-PROG-MP-0006	Software
N-PROG-MA-0016	Fuel
N-PROG-MP-0004	Pressure Boundary
N-PROC-MP-0040	System and Item Classification
N-PROC-MP-0082	Design Registration
N-MAN-01913.11-10000	Pressure Boundary Program Manual
N-CORR-00531-22359	Authorized Inspection Agency (AIA) Service Agreement
N-CORR-00531-22931	Amendment – AIA for Pressure Boundary Inspection and Registration Services
N-LIST-00531-10003	Index to OPG Pressure Boundary Program Elements
N-PROG-RA-0006	Environmental Qualification
N-STD-MP-0025	General Requirements for Seismic Qualification of OPG Nuclear Facilities
N-PROC-RA-0051	Environmental Qualification Lists
N-PROC-RA-0044	Environmental Qualification Assessment

2.5.1 Design Governance

OPG's design program satisfies the requirements of CSA N286-12, *Management system requirements for nuclear facilities* as defined in N-CHAR-AS-0002, *Nuclear Management System*. The program ensures that SSCs of facilities operate safely, reliably, and effectively, and are consistent with the design basis, safety analysis and quality control measures. The program also provides assurance that all design activities and their resulting documentation are controlled in a manner consistent with the plant's licensing basis.

N-PROG-MP-0009, *Design Management*, which receives its authority from N-CHAR-AS-0002, sets the overall requirement for execution and control of activities that provide design support and documentation for the nuclear facility. This program complies with CSA N286-12 and CSA N285.0-08 (and update no. 2), *General requirements for pressure-retaining systems and components in CANDU nuclear power plants/Material Standards for reactor components for CANDU nuclear power plants*. The program defines the minimum set of documentation that identifies and describes the design basis, design outputs, design processes, and the procurement engineering process ensuring implementation and maintenance of the physical nuclear facilities to meet the design basis requirements. The following governance documents receive their authority from N-PROG-MP-0009:

- N-PROC-MP-0040, *System and Item Classification*, defines the requirement and process to be followed for code classification of pressure retaining systems in OPG Nuclear.
- N-PROC-MP-0082, *Design Registration*, defines the requirement and process to be followed for design registration of pressure boundary and legacy pressure boundary systems.
- N-STD-MP-0028, *Conduct of Engineering*, provides a framework for performing engineering activities in a consistent manner across OPG Nuclear.

N-PROG-MP-0001, *ECC*, which receives its authority from N-CHAR-AS-0002, sets the overall requirement for modifications to the nuclear facility. The ECC program ensures design changes to each OPG Nuclear facility (including SSCs; software; and engineered tooling) are planned, designed, installed, commissioned, and placed into or removed from service such that the facility configuration is managed and remains within the SOE or safety and design envelope, design basis, and licensing conditions. This program complies with CSA standards N285.0 and N286-12. This program ensures all steps of modification are properly assessed, analyzed, and evaluated including identifying the problem statement, determining requirements and risk level, design, review by stakeholders, installation, commissioning and close-out. The following governance documents receive their authority from N-PROG-MP-0001:

- N-PROC-MP-0090, *Engineering Change Control Process*, defines the process to be followed for all changes to the OPG Nuclear design basis, including modifications to, removal of, or abandonment of any SSC, software, or engineered tooling designs;
- N-INS-06700-10000, *Human Factors Engineering Process,* provides instruction in the preparation of Human Factors Engineering (HFE) Worksheet. HFE is considered in every modification having a Human System Interface. OPG uses a systematic graded approach to determine the appropriate level of HFE effort and rigor required for a modification. CSA N290.12-14, *Human factors in design for nuclear power plants,* compliance is generally achieved through the ECC and Design Management programs.

N-STD-MP-0027, *Configuration Management*, which receives its authority from N-PROG-AS-0001, *Nuclear Management System Administration*, ensures that OPG nuclear facilities are operated, maintained, and modified in conformance with their design basis and licensing basis. During all life-cycle phases of the ECC process, it is ensured that constructability, operability, maintainability, and safety issues are identified and incorporated into the design requirements of nuclear design projects and modifications.

N-PROG-MP-0006, *Software,* which receives its authority from N-CHAR-AS-0002, identifies the process and overall requirements for an effective software program. Modifications and design changes involving software complies with CSA N286.7-16, *Quality assurance of analytical, scientific, and design computer programs for nuclear power plants*, and N290.14-15, *Qualification of digital hardware and software for use in instrumentation and control applications for nuclear power plants,* and ensures software changes support safe and efficient plant operation. The software program identifies the processes and overall requirements for classification of software and identifies governing standards for each software classification defining requirements for software development, maintenance, procurement, qualification, use and retirement.

Any modification which may affect the IAEA monitoring systems or equipment, is reviewed to ensure the changes do not impact compliance with the safeguards agreements. This includes, but is not limited to, potential obstruction of fields of view for the IAEA equipment or impact to the power supplies for IAEA equipment.

The health of the design and ECC programs is monitored using the ECC site index. The index incorporates metrics associated with quality of design ECC packages, ECC process compliance, and the timely updating of records and closeout of modifications.

The Plant Design department at Pickering NGS oversees the physical design SCA requirements and maintains the station design basis to ensure that systems remain in compliance with applicable standards, codes and licence conditions. As the Design Authority for Pickering NGS, this department specifies design requirements and authorizes design modifications to SSCs to ensure that all changes are within the SOE, design basis, and licensing conditions as per the station's PROL.

The Pickering Refurbishment organization at Pickering NGS oversees the physical design SCA requirements and maintains the station design basis through compliance with applicable standards, codes and license conditions for design changes planned as part of the facility and component refurbishment. Details outlining the governance and organizational structure applicable to refurbishment activities are outlined in Sections 2.5.6.

2.5.2 Site Characterization and Facility Design

Pickering NGS site is described in Section 1.1.

The description of the systems and equipment at Pickering NGS Units 5 to 8, including the system objectives, functional and performance requirements, interfacing systems, and design and operating conditions are provided in the following documents:

- Pickering NGS Units 5 to 8 safety reports Part 1 and 2 (updated every 5-years as required by CNSC REGDOC-3.1.1, *Reporting Requirements for Nuclear Power Plants*). The latest update of the Safety Report Part 1 and 2 was completed in October 7, 2022;
- Design Manuals.
- System design drawings.
- Design Guides identifying requirements and standards, which must be met in the design of various systems of a NPP.

N-LIST-01300-10000, *Bounded Document Set*, lists the sets of documents that shall be maintained when modifying the plant or when modifying other bounded document set documents. The bounded document set provides for a consistent set of configuration managed documentation across OPG Nuclear.

2.5.3 Structure Design

Pickering NGS Units 1 to 4 are now fully shutdown after ceasing operation at the end of 2024. Therefore, this section focuses on Pickering NGS Units 5 to 8. Refer to Section 2.5.5 for information concerning Pickering NGS Units 1 to 4.

The main group of buildings forming Pickering NGS Units 5 to 8 comprises the four reactor buildings, a powerhouse, a reactor auxiliary bay, and an extension to the service wing. The vacuum building serves Pickering NGS Units 5 to 8. The buildings, structures, and systems described in this section provide housing and containment for the four units.

The service wing, which is attached to the powerhouse and the reactor auxiliary bay, contains stores, laboratories, and workshops both for active and non-active operations. It is located close to Unit 5. The main passageways of the reactor auxiliary bay provide access on the two lower floors between the service wing and the reactor buildings.

The Pickering NGS Units 5 to 8 site contains the following buildings and structures:

1. Four reactor building structures.
2. A Powerhouse with a turbine hall and a turbine auxiliary bay.
3. A vacuum structure.
4. High Pressure Emergency Coolant Injection System Pumphouse.
5. Emergency Power and Water Supply Building.
6. Unit Emergency Control Centre per unit.
7. Filtered Air Discharge Monitoring building.
8. Pressure Relief Duct, including equipment running along the top.
9. Irradiated Fuel Bay and Auxiliary Spent Fuel Bay.
10. A single intake channel and common forebay.
11. A service wing attached to the powerhouse and reactor auxiliary bay.
12. Two Annex buildings for offices, tool and equipment laydown areas, and control maintenance shops.
13. A Main Security Building and an Auxiliary Security Building.
14. Administration Building.
15. Oil and Chemical Storage and Dispensing Building.
16. Pickering Waste Management Facility (PWMF).

The reactor building is part of the containment system, which prevents the escape of activity following postulated accidents in the reactor or other systems and provides shielding between active areas and staff outside the building. The reactor building encloses the reactor and its directly associated equipment, shields staff from radiation, and together with the vacuum building and pressure relief duct, acts as containment following postulated accidents. The reactor auxiliary bay houses auxiliary systems, which do not contain highly radioactive fluids.

The vacuum building forms part of the containment system. It is connected to each reactor building by a large pressure relief duct located at boiler room level on the south side of each reactor building.

The powerhouse consists of a turbine hall and a turbine auxiliary bay. The turbine/generators are arranged in a line down the turbine hall, which runs the length of the station. The auxiliary bay houses the condenser circulating water and service water pumps, switchgear, deaerator, some feedwater heaters, and other auxiliary equipment.

All major structures of the station, except for the main area of the powerhouse and the cooling water intake duct, are built on piles driven to bedrock or locally just above bedrock on very dense glacial till.

The design criteria and description of station structures is provided in Part 2, Section 2 and 3 of the Pickering Safety Report. Further information regarding design and physical characteristics of plant structures is provided in the Design Manuals for each respective structure.

CSA N291-08, *Requirements for safety related structures for CANDU nuclear power plants*, compliance is achieved through the ECC and Design Management programs. Inspection requirements of Clause 9 and Clause 10 of CSA N291-19 are achieved through N-PLAN-01060-10004, *Aging Management Plan for Concrete Containment Structures and Safety Related Structures.* The requirements of CSA N287.8-15, *Aging management for concrete containment structures for nuclear power plants* is integrated in the aging management program for concrete containment structures.

CSA N287.1-14, *General requirements for concrete containment structures for nuclear power plants* compliance is achieved through the ECC and Design Management programs. Compliance with CSA N287.2-08 *Material requirements for concrete containment structures for CANDU Nuclear Power Plants*, CSA N287.3-14, *Design requirements for concrete containment structures for nuclear power plants*, and CSA N287.4-08 *Construction, fabrication, and installation requirements for concrete containment structures for CANDU nuclear power plants* is accomplished through the ECC and Design Management programs. Compliance with CSA N287.5-11 *Examination and testing requirements for concrete containment structures for nuclear power plants* is achieved through the commissioning for containment structures.

Pickering NGS containment structures are routinely inspected at regular intervals in accordance with CSA N285.5-18, *Periodic inspection of CANDU nuclear power plant containment components* and CSA N287.7-17, *In-service examination and testing requirements for concrete containment structures for nuclear power plants*.

2.5.4 System and Component Design

The following subsections describe details on the physical design of the station, design and performance requirements of systems and components, key results from the current licence period, and ongoing and future activities over the next licence period.

Appendix B provides additional details on specific systems such as the functional and performance requirements, nuclear safety requirements, and projects and modifications on each system or various components within the system.

2.5.4.1 Pressure-Retaining Structures, Systems and Components

N-PROG-MP-0004, *Pressure Boundary,* manages the processes that control the quality of PB activities at OPG Nuclear with a goal of no failure of pressure retaining parts. The program establishes the infrastructure and defines the activities necessary to maintain a sustainable managed process that allows OPG to perform activities associated with repairs, replacements, modifications and alterations to pressure retaining items, components and systems, including installation of new systems.

The OPG Pressure Boundary (PB) Program ensures PB activities at Pickering NGS are in accordance with the codes and standards required by the Pickering NGS PROL. The PB program is a mature program that is compliant with the mandated codes and standards.

N-MAN-01913.11-10000, *Pressure Boundary Program Manual*, describes the program used to control the quality of PB activities at OPG Nuclear facilities and stations including Pickering NGS. It complies with CSA N285.0-08 and update no. 2, and CSA B51-09, *Boiler, pressure vessel and piping* standards.

Based on the agreement reached with the CNSC, all PB activities at Pickering NGS are compliant with CSA N285.0-08 and update no. 2. until the end of the Pickering NGS Refurbishment Project. In addition, as per the current LCH and N-LIST-00531-10003, *Index to OPG Pressure Boundary Program Elements*, OPG maintains a PB Program Document roadmap that is in compliance with Annex N of CSA N285.0-12 and update no. 1. The index is a document that correlates OPG's processes and procedures to the PB program elements identified in CSA N285.0-12 and update no. 1, Annex N, Table N.1.

Pickering NGS has been using the Technical Standards and Safety Authority (TSSA) as the AIA, under a contract between OPG and TSSA, to comply with CNSC requirements for inspection of pressure boundaries. Pickering NGS reports all PB degradations to CNSC (immediate and quarterly) as per CNSC REGDOC-3.1.1.

Since the last licence renewal application, Pickering NGS has had three successful PB Certificate of Authorization (CofA) renewal audits conducted by the TSSA demonstrating PB processes to be compliant with the OPG Nuclear Pressure Boundary Program Manual. The last three audits were conducted in 2017, 2020 and 2023 respectively. OPG's PB CofA were renewed and new certificates issued by the TSSA. These certificates will expire on April 15, 2026, before which the 3-year rolling renewal process will continue.

OPG is accountable for all communications with the CNSC related to code class approvals and notifications regarding registration and changes to PB documentation.

2.5.4.2 Environmental Qualification of Equipment

N-PROG-RA-0006, *Environmental Qualification,* establishes an integrated and comprehensive set of requirements that provides assurance that essential equipment can perform as required if exposed to harsh DBA conditions and this capability is preserved over the life of the plant. Implementation of these program requirements provides consistent methodology, programmatic controls, and interfaces for establishing and maintaining Environmental Qualification (EQ) of equipment and components at Pickering NGS. The EQ program is in accordance with CSA N290.13-05, *Environmental qualification of equipment for CANDU nuclear power plants* and update no. 1, 2009.

Effectiveness of the EQ program at Pickering NGS is evaluated and results indicate that the program meets requirements and is sustainable. EQ program controls are integrated into the engineering change governance to ensure engineering changes conform to EQ requirements.

Ongoing improvements continue from the combination of the OPG fleet EQ groups. Learnings are shared and incorporated into the daily processes at each site to increase the effectiveness of benchmarking between sites and improve implementation of the program.

2.5.4.3 Electromagnetic Interference

OPG has guidelines in place for Electromagnetic Compatibility (EMC) testing in conjunction with the ECC process. The guidelines provide design engineering teams with International Electrotechnical Commission (IEC) standards and test levels to consider in their design and testing requirements for instrumentation and electrical equipment. This allows for the mitigation of potential Electromagnetic Interference issues (EMI) and appropriately considers the criticality and safety classification of the SSCs.

Both susceptibility and emission aspects are considered to ensure SSCs are protected from EMI-induced faults without introducing significant electromagnetic disturbances to other equipment within the plant. Considerations for grounding and shielding are covered through the

ECC process, which includes references to design guides that provide strategies and best practices.

2.5.4.4 Seismic Qualification

Pickering NGS Units 5 to 8 is designed and constructed to ensure that the effects of an earthquake do not lead to unacceptable radiological releases as specified in the *Nuclear Safety and Control Act*, as a minimum requirement. Seismic qualification is demonstrated in accordance with the requirements of CSA N289.1-08, *General requirements for seismic, design and qualification of CANDU nuclear power plants*, for those SSCs which ensure that, as a minimum, the following safety functions for responding to a Design Basis Earthquake (DBE) are provided:

a) the capability to shutdown the reactor be maintained,

b) the capability to ensure the reactor remains shutdown be maintained,

c) the capability to remove decay heat be maintained,

d) the capability to limit release of radioactivity from containment be maintained

e) the capability to monitor the status of the nuclear steam supply be maintained,

f) systems other than the reactor proper containing significant amounts of radioactivity must not be damaged to such an extent as to lead to radioactive releases above allowable limits,

g) a seismically induced loss-of-coolant accident be prevented. (required primarily for a site design earthquake (SDE) following a loss-of-coolant accident)

In the event of a LOCA necessary portions of the emergency coolant injection system, the shutdown systems, containment system, monitoring equipment, and supporting systems shall remain functional following the earthquake (SDE) during the recovery period 24 hour after the LOCA.

To ensure that the system can perform its basic requirements, it is necessary that:

a) Qualified systems must be located in structures that are likewise qualified.
b) Safe operation of a qualified system must not be impaired because of a failure or dislocation of an associated (or adjacent) unqualified system.

At Pickering NGS Units 5 to 8, all the Group 2 safety related systems are seismically qualified DBE.

The ECC program ensures that modifications to seismically qualified SSCs are subjected to the applicable stakeholder review process and that the seismic qualification is not degraded by a proposed design change. It also reviews and ensures that the qualified systems are located in (or in the vicinity of) structures that are likewise qualified, and seismic interaction by unqualified SSCs is prevented. Furthermore, plant modifications are controlled to not compromise the function of the seismic routes. Seismic routes are marked on floors or ground to provide assured operator access to safety-related SSCs for which short term actions are credited following an earthquake. Procedures are in place at Pickering NGS Units 5 to 8 to ensure plant operations do not interfere or degrade the function of the seismic routes.

In addition to the seismic qualification of the safety-related SSCs to the DBE and SDE, the SSCs are also assessed for Beyond Design Basis Earthquakes (BDBE) for seismic robustness, which is to assure redundancy of the SSCs and defense-in-depth through common cause failures and to meet the seismic requirements stated in CSA N289.1. These assessments provide an estimate of the overall frequency of predetermined plant-level damage states, such as severe core damage frequency and frequency of release of radioactive materials to the environment through seismically-induced containment failure. As a means to evaluate the seismic robustness of the SSCs for redundancy and defense-in-depth beyond the DBE, the PSA based Seismic Margin Assessment (SMA) is performed for Pickering NGS Units 5 to 8 to assess the risks of severe core damage and seismically-induced containment failure. Two risk metrices were estimated including the SCDF and seismically-induced containment failure frequency (SCFF) to comply with OPG safety goals specified in N-PROG-RA-0016, *Risk and Reliability Program.* In the scenario where the PSA results indicate that design modifications are required to meet the OPG safety goals, the modifications would be executed in a timely manner.

For Pickering NGS Units 5 to 8, concurrent compliance with the seismic design basis and the PSA constitute the seismic licensing basis.

The last Pickering NGS Units 5 to 8 PSA based SMA was submitted to CNSC staff in 2022, and the next submission will be in 2025 per the 5-year submission requirement of CNSC REGDOC-3.1.1. The PSA based SMA demonstrated that the seismic SCDF and SCFF meet the OPG safety goals.

Pickering NGS maintains a list of seismically qualified systems (USI) that are credited to fulfill the safety requirements mentioned above. It compiles all the seismic qualification requirements including seismic categorization for the systems which have been documented within the bounded document set.

Depending on required safety functions during and following the DBE, the seismically qualified SSCs are classified into the following categories, which meet the requirements of CSA N289.1:

- Category A: systems must retain their pressure boundary integrity during and following an earthquake, in order to ensure and maintain the safety related system operation.
- Category B: systems must retain their pressure boundary integrity and/or must function mechanically and/or electrically during and/or following an earthquake, in order to ensure and maintain the safety related system operation.

Structures, systems, and components not seismically qualified for nuclear safety reasons are seismically designed to meet the requirements of the National Building Code of Canada.

Pickering NGS Units 5 to 8 has a seismic design guide which is utilized in determining seismic qualification requirements for SSCs. The Seismic qualifications at Pickering NGS Units 5 to 8 are primarily done by analysis, testing, or a combination of analysis and testing in accordance with the requirements of CSA N289.1, N289.3 *Design procedures for seismic qualification of nuclear power plants*, and N289.4, *Testing procedures for seismic qualification of nuclear power plant structures, systems and components*. The code-over-code reviews of the seismic qualification standards CSA N289 series are performed to identify significant technical changes due to evolutions of new standard editions. The Pickering NGS Units 5 to 8 Seismic Design Guide is being updated to support Pickering NGS Units 5 to 8 refurbishment. Changes to the plant are not expected; however should any be identified, the ECC process will be utilized.

In-plant seismic instrumentation is installed in the plant to monitor and record in-plant seismic motions in compliance with the requirements of CSA N289.5, *Seismic instrumentation requirements for nuclear power plants and nuclear facilities*. The Seismic Monitoring System provides measurement and recording of absolute accelerations caused by seismic events as a function of time. The seismic data obtained by the system may be used in conjunction with plant parameters and inspection reports to set the basis for assessing the effect of an earthquake on the Pickering NGS structures and equipment. Within the Pickering NGS facilities, seismic motions are recorded if the vibrations exceed a triggering threshold level. Outside the Pickering NGS facilities, the seismic motions are recorded by the Southern Ontario Seismic Network (SOSN) that records detailed free-field seismic activities covering Southern Ontario.

The in-plant seismic monitoring network includes eleven triaxial accelerometers spreading over critical nuclear structures. All these recorders communicate with a Central Recorder unit located in Unit 6 Unit Emergency Control Centre (UECC). Recorded seismic motions at the sensor locations are assessed against the component DBE seismic design basis.

In addition to the in-plant seismic monitoring network, a seismometer is located on the free field near the Pickering NGS property boundary, which is part of the SOSN. The SOSN accelerometer (PKRO) near Pickering is at Claremont, providing the free field ground seismic motion record. Recorded seismic motions are assessed against the DBE and other seismic design bases. The records of the SOSN are also used to support the probabilistic seismic hazard assessment.

The combination of the original seismic designs and the current seismic practices provide high confidence that Pickering NGS can withstand applicable design and review-level earthquakes.

N-PROC-TR-0008, *Systematic Approach to Training*, ensures that engineering, operations, and maintenance staff are aware of station requirements including seismic qualification while performing their respective duties, and that they receive the appropriate training on seismic qualification. N-PROG-MA-0004, *Conduct of Maintenance,* outlines precautionary measures to counter incidents that could impact the operation of seismically qualified equipment and seismic routes. N-PROG-MP-0008, *Integrated Aging Management,* requires seismic qualification requirement be considered during condition assessment of critical SSCs as the plant ages.

2.5.4.5 Fire Safety and Fire Protection System

The OPG Fire Protection Program (FPP), N-PROG-RA-0012, establishes provisions to prevent, mitigate and respond to fires such that fire risk to OPG Nuclear workers, public, environment, nuclear physical assets, and power generation is acceptably low and controlled.

The overall approach to the FPP is based on the defense in depth provisions of fire prevention, fire detection and suppression, and limiting or mitigating the effects of fires.

CSA N293-12, *Fire protection for CANDU nuclear power plants*, provides the fire protection requirements for design, construction, commissioning, operating, and decommissioning of NPPs, including SSCs that directly support the plant and protected area.

Fire Protection Assessments (FPAs) are engineering evaluations that assess the plants or facilities against the requirements of CSA N293 to ensure safety in the event of a fire in any plant or facility location. The evaluations are documented for each station in three assessments which are updated every 5-years:

1. Fire Protection Code Compliance Report (CCR) including Third Party Inspection, Testing, and Maintenance Reports.
2. Fire Safe Shut Down Analysis (FSSA) report.
3. Fire Hazard Assessment (FHA) report.

See Section 2.10.3 for information regarding the latest results of these assessments.

During the current licence period, improvements were made to the Pickering NGS Units 5 to 8 Fire Detection and Alarm System (FDAS).

2.5.4.6 Fuel

N-PROG-MA-0016, *Fuel*, establishes a formal and systematic process for integrating and reviewing information related to fuel, and reporting its performance, condition, and compliance with fuel design basis documents.

OPG provides an annual report on fuel monitoring and inspection to the CNSC as required by CNSC REGDOC-3.1.1, *Reporting Requirements for Nuclear Power Plants*. In-core fuel operating conditions from 2018 to present have been well controlled within the reporting and licence operating limits. Results from in-bay fuel inspection have verified that the overall core operating conditions did not result in fuel exceeding the fuel design basis wear and deformation guidelines, nor adversely affect in-core fuel performance.

2.5.5 Pickering NGS Units 1 to 4 Decommissioning

This section provides additional information regarding the Physical Design SCA with respect to Units 1 to 4 decommissioning. It is intended to supplement the information provided in the general SCA discussion above and therefore only addresses those specific areas where additional decommissioning-related details are needed.

As outlined in Section 1.2.2, during stabilization SSCs no longer required for the operation of the nuclear facility will be safe-stated. End state determination reports (ESDRs) have been prepared that document the preferred or planned end-state (Safe Storage End-State) of the system to which it is to be transitioned.

Systems that are required to support Decommissioning project activities will remain active (either available for service, or partially in service). These systems will be modified as required, following the ECC process, to perform their new or revised function and portions may be removed from service to reduce their footprint and support requirements, as determined by the ESDRs. SSCs not required to support SWS demands will be removed from service once no longer required, placed in the end-state configuration by multi-disciplinary end-stating teams and abandoned in place or removed. See discussion under “Preparation for Decommissioning” in Section 1.2.2 for additional details regarding inactive end-states.

The systems required for Pickering NGS Units 1 to 4 SWS and supporting refurbishment and continued operation of Pickering NGS Units 5 to 8 can be found in the associated SWS Plan and the Detailed Decommissioning Plans (see Section 2.11.4 for further details). These systems may change in the future to meet the requirements of refurbishment of Pickering NGS Units 5 to 8.

As discussed in Section 1.2, there are several common systems that will be separated and limited to Pickering NGS Units 5 to 8 to allow independent decommissioning activities to continue at Pickering NGS Units 1 to 4 following the planned refurbishment of Pickering NGS Units 5 to 8.

2.5.6 Pickering NGS Units 5 to 8 Refurbishment

This section provides additional information regarding the Physical Design SCA with respect to Units 5 to 8 refurbishment. It is intended to supplement the information provided in the general SCA discussion above and therefore only addresses those specific areas where additional refurbishment-related details are needed.

Lessons learned from Darlington NGS, Bruce Power as well as external OPEX have been actively incorporated into the Pickering Refurbishment planning and design process. Relevant lessons learned have been extracted from previous project experiences in the areas of welding challenges, crane and crane pad design, usage, layout, storage and inspection, work protection supplemental training and procedural roll out, resource management, and integrated schedule development. Additional strategies to incorporate OPEX for major scope bundles are in place for the steam generator replacement and the retube feeder replacement activities. OPEX has also been captured in relation to other refurbishment project scopes that highlight various strategies to incorporate previous lessons learned from various sources that are relevant in the areas of design, planning, execution and close-out.

2.5.6.1 Design Management Program

Consistent with N-PROG-MP-0009, *Design Management* and N-PROG-MP-0001, *ECC* all modifications implemented during refurbishment will be defined, planned, designed, installed, commissioned and placed in service within the SOE, design basis and licence conditions.

Plant modifications will comply with OPG's ECC process (N-PROC-MP-0090) and Design Management procedures. Modifications will be implemented with adherence to the Code Effective Dates established by OPG and accepted by CNSC staff.

OPG will monitor and assess design activities and ensure that appropriate interfaces and oversight are maintained throughout the modification process consistent with N-GUID-01920-10000, *Guideline for Engineering Oversight* and N-GUID-00700-10015, *Vendor Oversight Guide for Nuclear Engineering*. When a Design Agency is engaged, the responsibilities of OPG and the Design Agencies during each phase of the modification process as well as the mandatory interface points and oversight requirements are outlined below:

- OPG will be responsible for the requirements for the modifications, which includes elements such as Modification Design Requirements (MDRs), Conceptual Design Reports (CDRs), and Modification Outlines, as part of the Modification Planning phase. The Design Agency working under OPG QA, with approving Section Managers seconded to 'OPG' will prepare the aforementioned documentation under a Managed Task agreement and established Scope of Work (SOW). OPG will provide authorization/approval of the aforementioned documents with exception of any CDRs.
- The Design Agency will prepare the detailed design deliverables with OPG oversight, which includes new drawings, change-papers, calculations, studies/reports, and any other documents required in accordance with governance established within N-GUID-00700-10015, *Vendor Oversight Guide for Nuclear Engineering*.
- OPG has established mandatory interface hold points during the detailed design process. In-Process Engineering Hold Points occur at various stages of the design process to ensure the Contractor is progressing the product in accordance with OPG's expectations and contractual requirements, per N-GUID-01920-10000.
- All Oversight activities will be documented, managed and tracked to completion by the Project Manager in accordance with the Project Oversight Plan. In-Process Engineering Hold Points that require OPG "Approval" or "Authorization" will be included in the Design Plan.
- The OPG Design Authority authorizes design plans, engineering mobilization, constructability, operability, maintainability and safety declaration, design completion assurance verification review and engineering change release. All design modifications

are authorized by appropriate authorities as per OPG's managed process for ECC, before their implementation in the field. OPG will maintain oversight of the Design Agencies through activities such as routine communications, product monitoring, and review of required documents confirming the quality of the deliverables. Level of intrusiveness will be commensurate with the overall risk.

2.5.6.2 Pressure Boundary

During refurbishment, EPC contractors will perform PB activities under their own CofA. OPG will issue a Letter of Authorization to the EPC contractor to prepare registration and reconciliation packages and to submit them to the AIA for registration on OPG's behalf on a project-to-project basis.

The EPC contractor will also prepare Code Classification and Exemption evaluation packages. Should a variance or deviation from code be required, the EPC contractor will prepare and submit the proposed resolution for evaluation on OPG's behalf to the AIA.

OPG will be accountable for all communications with the CNSC related to Code Class Approvals and notifications regarding registrations and changes to any pressure boundary documentation.

2.5.6.3 Environmental Qualification

EPC modifications will comply with established OPG's ECC and EQ programs. The ECC program and supporting procedures will ensure proper reviews and approvals are achieved before modifications are implemented. The scope of these reviews includes EQ in accordance N-PROG-RA-0006, *Environmental Qualification.*

2.5.7 Pickering Waste Management Facility

The OPG documents in the table below require written notification of change per PWMF Licence Conditions Handbook, LCH-W4-350.00/2028 R003:

Table 28. SCA 5 – PWMF Physical Design & Pressure Boundary

Document Number	Document Title
N-STD-MP-0028	Conduct of Engineering
N-STD-MP-0027	Configuration Management
N-PROG-MP-0009	Design Management
N-PROG-MP-0001	Engineering Change Control
N-PROG-MP-0004	Pressure Boundary
N-PROC-MP-0082	Design Registration
N-PROC-MP-0040	System and Item Classification
N-LIST-00531-10003	Index to OPG Pressure Boundary Program Elements
N-MAN-01913.11-10000	Pressure Boundary Program Manual
N-CORR-00531-20012	AIA for Pressure Boundary Inspection and Registration Services

2.5.7.1 Design Program

OPG has robust processes to ensure that the physical design of the PWMF complies with the current safety basis and that all changes are authorized and performed in a controlled manner,

and in accordance with the PWMF licence. Management of the design basis at the PWMF is governed by the OPG Nuclear Design Program as described in Section 2.5.1.

The PWMF design will comply with the following codes and standards:

- NRC NBCC (2020), *National Building Code of Canada*;
- NRC NFCC (2020), *National Fire Code of Canada*;
- American Society of Mechanical Engineers (ASME) *B31.1 (2022) Power Piping*;
- CSA B51 (2019) *Boiler, pressure vessel and pressure piping code*, and
- CSA N285.0 (2022) *General requirements for pressure-retaining systems and components for CANDU nuclear power plants/Material Standards for reactor components for CANDU nuclear power plants*.

As communicated to CNSC staff, PWMF will be compliant with NBCC 2020 and NFCC 2020 by December 19, 2025.

PWMF has executed various modifications with no impact on the PWMF's ability to operate within its safety envelope. These modifications have been undertaken to improve the overall performance of the PWMF and to improve safety in design and operations. Some of the significant modifications in the current licence period are:

- To facilitate interim storage of used fuel on site, DSC SB4 was constructed and placed in-service.
- A modification was undertaken to allow loading, processing, and storing a maximum of 100 DSCs at a time containing minimum 6-year old used fuel in support of the Safe Storage Project.
- Modifications were executed to upgrade the DSC welding machine camera system for improved image quality.
- The Weld Cover Gas system design was upgraded to address the lack of overpressure protection for code compliance, as well as several design and equipment issues for improved operation and maintenance activities.
- Broadband Wireless Network (Wi-Fi) was installed at PWMF. This Wi-Fi installation is aligned with the digital transformation initiative taking place across the company which has the goal of delivering digital enhancements, providing employees with seamless and reliable access to OPG's information and fostering company-wide collaboration.

OPG NSS has adopted the standard OPG Nuclear fleet metrics for physical design. The current suite of metrics includes measures of the health of the ECC process within NSS. The quality of design products is monitored using recorded verification results and cold-body design review boards within NSS. A monthly report card is used to record and track performance and to ensure that corrective actions are being taken to address any weaknesses or deficiencies that are observed.

2.5.7.2 Pressure Boundary

PWMF follows the OPG Nuclear governance for pressure boundary as described in Sections 2.5.1 and 2.5.4, ensuring all pressure boundary activities including the Fire Protection system as a legacy pressure boundary are performed in alignment with the OPG pressure boundary program.

OPG Nuclear currently has an agreement with the CNSC that freezes the code effective dates of applicable pressure boundary codes and standards throughout the duration of the Darlington NGS Refurbishment project. These frozen code effective dates are in place for PWMF as well. Once the Darlington NGS refurbishment project is completed, new code effective dates for applicable pressure boundary codes accepted by CNSC staff will be incorporated into OPG Nuclear governance.

During the current licence period, OPG has implemented various modifications at PWMF to improve the overall performance of its pressure boundary systems and related activities, as well as safety in design and operations.

Pressure boundary self-assessments for NSS were performed regularly, the latest one being completed in 2024, which concluded that NSS meets the requirements as specified in the pressure boundary program manual and program compliance is adequate with areas for improvement.

Overall, work on PWMF pressure boundary systems meets the requirements of CSA N285.0-08 - including Update 1 and Update 2 - and additional requirements per the PWMF operating licence. OPG also maintains a pressure boundary program document roadmap in compliance with Annex N of CSA N285.0-12 and Update 1.

Planned Activities

The following activities are planned for the PWMF:

- DSC SB5 is currently in design stage, with an anticipated in-service date in 2027. It will be constructed in compliance with the licence and will follow OPG procedures and processes, including those in the Design Management Program, ECC Program, and Pressure Boundary Program.
- The PCSS is currently in design stage and will be constructed in compliance with the licence. An amendment of the PWMF licence is under review for the construction and operation of the PCSS. Pending Commission approval, the PCSS is anticipated to be in-service in 2027.
- Dry Storage Modules relocation from Phase I to Phase II is currently in design stage following the OPG ECC process.
- OPG is planning to encapsulate the damaged/defective fuel residing in IFB-A and AIFB as part of Pickering NGS Units 1 to 4 decommissioning activities. OPG will utilize the OPEX from Hydro Quebec which completed canning of damaged/defective fuel in Gentilly-2 and follow OPG ECC process.
- *DSC Design Change – MKIII:* The current DSC MKII design has been in use for about 25 years. OPG is planning to improve upon the existing design to increase DSC production at NSS, which currently takes approximately 1.5 days to carry out the entire Lid-to-Base (LTB) welding process. A modification is planned for the DSC with the following objectives:
    - Modify the DSC LTB weld configuration to 30-degree double bevel, which will allow easy access to the root and improves weld quality (i.e., reduce lack of fusion and weld defects).
    - Reduce the DSC top/base flanges thickness to allow for the reduction in the number of weld passes required to fill the weld groove.

The new DSC design will be referred to as MKIII. A preliminary dose rate assessment has been completed for MKIII DSC, which indicated an insignificant change to the dose rates and within the available margin at the site boundaries. MKIII is planned to be implemented across OPG's three nuclear waste facilities following the OPG ECC process and written notification to the CNSC will be provided for licensing basis document changes prior to implementation as per the LCH. At the PWMF, the MKIII DSC will also be used to load minimum six (6) years old cooled fuel (if required).

2.6 Fitness for Service

The Pickering NGS fitness for service program ensures all equipment is available to perform its intended design function when called upon to do so. The physical condition of SSC at Pickering NGS remain available, reliable, effective and consistent with design, analysis and quality control measures.

The reliability, maintenance and aging management programs at Pickering NGS meet the requirements of CNSC regulatory documents REGDOC-2.6.1, *Reliability Programs for Nuclear Power Plants*, REGDOC-2.6.2, *Maintenance Programs for Nuclear Power Plants*, and REGDOC-2.6.3, *Aging Management*, respectively.

The OPG documents in the table below require written notification of change per Pickering NGS Licence Conditions Handbook, LCH-PR-48.00/2028-R007:

Table 29. SCA 6 – Pickering NGS Fitness for Service

Document Number	Document Title
N-PROG-MA-0026	Equipment Reliability
N-PROG-RA-0016	Risk and Reliability Program
N-STD-RA-0033	Reliability and Monitoring of Systems Important to Safety
P-REP-03611-00012	PNGS Systems and Components Important to Safety
P-LIST-06937-00001	Pickering A and B List of Safety Related Systems
I-PROG-AS-0001	Conduct of Inspection and Maintenance Services
N-PROG-MA-0004	Conduct of Maintenance
N-PROG-MA-0017	Component and Equipment Surveillance
N-PROG-MA-0025	Major Components
N-PROC-MA-0024	System Performance Monitoring
N-PROG-MP-0008	Integrated Aging Management
N-PROC-MP-0060	Aging Management Process
N-STD-MA-0024	Obsolescence Management
N-PLAN-01060-10003	Reactor Components and Structures Life Cycle Management Plan
N-PLAN-01060-10008	Reactor Components and Structures Life Cycle Management Plan: Technical Basis Document
N-PROC-MA-0044	Fuel Channel Life Cycle Management

Document Number	Document Title
N-PLAN-01060-10002	Fuel Channels Life Cycle Management Plan
N-PLAN-01060-10001	Feeders Life Cycle Management Plan
N-PLAN-01060-10007	Feeders Life Cycle Management Plan: Technical Basis Document
N-PLAN-33110-10009	Steam Generators Life Cycle Management Plan
NA44-PLAN-33110-10003	Pickering Units 1 and 4 Steam Generator Life Cycle Management Technical Basis (excluding Sheet Sections 001, 002, 004, 005)
NK30-PLAN-33110-10008	Pickering Units 5-8 Steam Generator Life Cycle Management Plan (excluding Sheet Sections 001 to 005 and 007)
N-PLAN-01060-10004	Aging Management Plan for Concrete Containment Structures
NA44-PLAN-34220-00002	Life Cycle and Aging Management Program Plan for Fiberglass-Reinforced Plastic Components in the Pickering NGS Vacuum Building
N-PROG-OP-0004	Chemistry
I-STD-AS-0003	Non-Destructive Examination
N-PROC-MA-0052	Flaw Dispositioning
NA44-PIP-03641.2-00001	Pickering Nuclear Generating Station A Periodic Inspection Plan For Unit 1
NA44-PIP-03641.2-00007	Pickering Nuclear Generating Station A Periodic Inspection Plan For Unit 4
NK30-PIP-03641.2-00001	Pickering B Periodic Inspection Program Unit 5
NK30-PIP-03641.2-00002	Pickering B Periodic Inspection Program Unit 6
NK30-PIP-03641.2-00003	Pickering B Periodic Inspection Program Unit 7
NK30-PIP-03641.2-00004	Pickering B Periodic Inspection Program Unit 8
N-REP-31100-10041	Acceptance Criteria and Evaluation Procedures for Material Surveillance Pressure Tube
NA44-PIP-31100-00005	Pickering Nuclear 1,4 Fuel Channel Pressure Tubes Periodic Inspection Program Plan
NK30-PIP-31100-00005	Pickering Nuclear 5-8 Fuel Channel Pressure Tubes Periodic Inspection Program Plan
N-REP-31100-10061	Compliance Plan for Long-Term Use of CSA N285.8 For In-Service Evaluation of Zirconium Alloy Pressure Tubes
NA44-PIP-33126-00001	Pickering Nuclear Units 1& 4 Fuel Channel Feeder Pipes Periodic Inspection Program Plan
NK30-PIP-33126-00001	Pickering Nuclear Units 5-8 Fuel Channel Feeder Pipes Periodic Inspection Program Plan

COG-JP-4107-V06	Fitness-for-Service Guidelines for Feeders in CANDU Reactors
NA44-PLAN-33110-10003 Sheet Section 003	Pickering Units 1 and 4 Steam Generator Life Cycle Management Plan Technical Basis—In Service Inspection Plan
NK30-PLAN-33110-10008 Sheet Section 006	Pickering Units 5-8 In-Service Inspection Plan
COG Report 07-4089	Fitness-For-Service Guidelines for Steam Generator and Preheater Tubes
NA44-PIP-03642.2-00001	Pickering Nuclear Generating Station A Periodic Inspection Program For Containment Components
NK30-PIP-03642.2-00001	Pickering Nuclear Generating Station “B” Periodic Inspection Program For Containment Components
P-PIP-03642.2-00001	Pickering Nuclear Generating Station A Periodic Inspection Program For Unit 0 Containment Components
N-PROC-MA-0066	Administrative Requirements for In-Service Examination and Testing for Concrete Containment Structures
NA44-PIP-03643.2-00001	Pickering Nuclear GSA – Reactor Building Periodic Inspection Program
NK30-PIP-03643.2-00001	Pickering Nuclear GSB – Reactor Building Periodic Inspection Program
NA44-PIP-03643.2-00002	Pickering Nuclear GS – PRD & Vacuum Building (VB) Periodic Inspection Program
NA44-PIP-03643.2-00003	Pickering Nuclear GS – Vacuum Building Post Tensioning Rods Periodic Inspection Program
NA44-REP-34200-00017	Pickering NGS “A” Reactor Building and Pressure Relief Duct In-service Integrated Leakage Rate Test Requirements in accordance with CSA N287.7-17
NK30-REP-34200-00014	Pickering NGS B Reactor Building In-service Leakage Rate Test Requirements In Accordance With CSA N287.7-17
NA44-REP-25100-00009	Pickering NGS Vacuum Building In-service Integrated Leakage Rate Test Requirements in Accordance with CSA N287.7-17

2.6.1 Equipment Fitness for Service/Equipment Performance

The objective of the Equipment Reliability (ER) program, N-PROG-MA-0026, *Equipment Reliability*, is to ensure high levels of equipment reliability and reduce forced loss rate by ensuring reliable performance of critical components important to nuclear safety and production.

The ER program leverages various activities to ensure ongoing high levels of reliable performance of critical components. This includes identification of critical components and maintenance strategies, executing Predictive Maintenance (PdM) and Preventative Maintenance (PM) programs, monitoring system and component condition, identifying and predicting aging and obsolescence issues on important components and embedding mitigating strategies and actions into the business plan.

The Plant Health Committee (PHC), provides oversight, direction, and leadership for resolving ER issues and implementing actions from System and Component Health Plans. The PHC consists of managers and directors from the key functional organizations at Pickering NGS involved in implementing ER actions. The key activities for the PHC are conducted in accordance with N-PROC-MA-0097, *Equipment Reliability Implementation*.

Reliability of Systems Important to Safety

The Risk and Reliability Program, N-PROG-RA-0016, ensures Systems Important to Safety (SIS) and Components Important to Safety (CIS) are identified and their performance measures and targets are established with PSA insights being used in the process. SIS and CIS are station systems and components which contribute significantly to the initiation, prevention, detection, or mitigation of any failure sequence which could lead to damage of fuel or associated release of radionuclide or both.

The program requires operational performance of SIS be monitored, assessed and reported and component reliability data be compiled, analyzed and applied to maintain unavailability models. Nuclear standard N-STD-RA-0033, *Reliability Monitoring and Reporting of Systems*, provides requirements for reliability monitoring and reporting of SIS and CIS, and is consistent with CNSC regulatory documents REGDOC-2.6.1 and REGDOC-3.1.1, *Reporting Requirements for Nuclear Power Plants*.

The SIS/CIS list is developed using all available plant PSA studies. Expert panel reviews are completed to ensure that deterministic insights, historical licensing practices and industry reviews are considered while finalizing this list. The SIS and CIS at Pickering NGS are listed in P-REP-03611-00012, *PNGS Systems and Components Important to Safety*. Systems classified as safety-related are documented in P-LIST-06937-00001, *Pickering A and B List of Safety Related Systems.*

Pickering NGS has identified 13 SIS for Pickering NGS Units 1 and 4 and 12 SIS for Pickering NGS Units 5 to 8 as listed below. There are currently 247 CIS at Pickering NGS.

All Pickering NGS A SIS will be applicable until the defueling of Units 1 and 4 are complete. As such, the unavailability targets will also be applicable. The exception is the Pickering NGS A Negative Pressure Containment system, which will be applicable to support extended operation until the end of Pickering NGS Units 5 to 8 defuel.

Table 30. Pickering NGS Units 1 and 4 and 5 to 8 Systems Important to Safety

	Pickering Units 1, 4	
	System Important to Safety	**Unavailability Target [yrs/yr]**
A-01	Reactor Protective System (SDSA)	1.0E-03
A-02	Shutdown System Enhancement (SDSE)	1.0E-03
A-03	Emergency Coolant Injection (ECI)	2.0E-03
A-04	Negative Pressure Containment (NPC)	1.0E-03
A-05	Standby Class III Power	2.4E-02
A-06	Auxiliary Boiler Feedwater (ABF)	4.7E-02
A-07	Standby Class III Service Water:	
	• Emergency Low Pressure Service Water (ELPSW)	1.4E-02
	• Emergency High Pressure Service Water (EHPSW)	8.0E-03
A-08	Heat Transport Shutdown Cooling (SDC)	
	(With HTS hot & pressurized)	2.8E-04
	(With Unit Low Power Critical, HTS depressurized)	5.1E-02
A-09	Powerhouse Emergency Venting System (PEVS):	
	• Pressure Trip	8.5E-04
	• Temperature Trip	4.0E-03
A-10	Emergency Boiler Water Supply (EBWS)	5.2E-04
A-11	Heat Transport D_2O Recovery	2.3E-02
A-12	Class III 600 V Inter-Station Transfer Bus (ISTB)	9.1E-03
A-13	Class III 600 V Motor Control Centres 54130-MCC18 and MCC19	3.3E-05

	Pickering Units 5-8	
	System Important to Safety	**Unavailability Target [yrs/yr]**
B-01	Shutdown System 1 (SDS1)	1.0E-03
B-02	Shutdown System 2 (SDS2)	1.0E-03
B-03	Emergency Coolant Injection (ECI)	1.0E-03
B-04	Negative Pressure Containment (NPC)	1.0E-03
B-05	Standby Class III Power	8.0E-02
B-06	Auxiliary Boiler Feedwater (ABF)	4.8E-02
B-07	Standby Class III Service Water (includes ELPSW and EHPSW)	9.3E-03
B-08	Heat Transport Shutdown Cooling (SDC):	
	(With HTS hot & pressurized)	1.4E-03
	(With Unit Low Power Critical)	1.1E-01
B-09	Powerhouse Emergency Venting System (PEVS):	
	• Pressure Trip	3.6E-04
	• Temperature Trip	1.3E-03
B-10	Emergency Water System (EWS):	
	• to Boilers (Loss of Feedwater Event)	1.3E-02
	• to Boilers (No Loss of Feedwater)	4.4E-03
	• to Heat Transport System	2.0E-02
	• to Moderator	1.2E-02
B-11	Emergency Power System (EPS)	5.2E-04
B-12	Class II (includes Uninterruptible Power Supply Room Ventilation)	1.4E-05

As per CNSC REGDOC-3.1.1, the reliability and performance of SIS/CIS is documented and reported through the Annual Risk and Reliability Report (ARRR). The ARRR discusses changes to the SIS/CIS list and their reliability targets, SIS/CIS performance, updates to unavailability models, reviews of surveillance activities, the number of initiating events, and major changes in failure modes/failure rates. System Important to Safety (SIS) performance is measured using unavailability models, which incorporate internal and external component failure data to reflect current design, operation, and maintenance practices to calculate the Predicted Future Unavailability (PFU) of each system. Furthermore, SIS operational performance is evaluated through routine testing per the requirements described in N-STD-OP-0018, *Operability Testing of Safety-Related-Systems*. The field reliability data collected from operability testing and other sources is then incorporated into system unavailability models to improve the accuracy of PFU calculations.

ARRRs have been submitted to the CNSC each year of the current licence term, where annual SIS performance is documented and directly compared to respective reliability targets. As per the 2023 Pickering NGS ARRR, all 25 SIS were operating within their defined reliability targets.

The ER key performance indicator through 2023 was the Equipment Reliability Index (ERI). Conexus (formerly COG) established the ERI, which the industry used to assess health of a plant's reliability program and equipment performance and enabled benchmarking against other plants. The ERI provided a measure of long-term trends of ER improvements and sustainability, utilizing a composite of key sub-indicators that have a weighed value to add up to 100 as the highest score.

Figure 21 below depicts the ERI score trends from 2018 to 2023 for Pickering NGS in comparison to the target. Pickering NGS's ERI greatly improved over the current licence term. The 2023-year-end ERI score for Pickering NGS was 91, which is an improvement from the 2022 Q4 score. Pickering NGS has maintained an average ERI score of 85 points since 2018. Pickering NGS has focused on several initiatives to sustain an improved ER. Key actions include backlog reduction, PM program sustainability, establishing System Health Teams (SHTs), improvements to scheduling of critical PM work orders to ensure equipment reliability.

In 2024, the ER key performance indicator transitioned from ERI to the INPO Equipment Performance Index (EQP) as shown in Figure 22. This standardized metric for ER performance is utilized for INPO reporting stations from Canada, USA, Mexico, Romania, UAE, and South Africa, allowing for broader comparison and industry benchmarking. Five weighted sub-indicators measuring equipment reliability performance balanced across both a 12-month (EQP12M) and 18-month (EQP18M) rolling period add to a score of 100, with performance measured at the unit level and station level.

Pickering NGS is dedicated to achieving industry top quartile for performance resulting from station initiatives focused on equipment reliability vulnerability assessments, single-point vulnerability elimination and mitigation, fuel handling reliability, cross-functional engagement and action in equipment failure reviews and system health teams, and enhanced system performance monitoring.

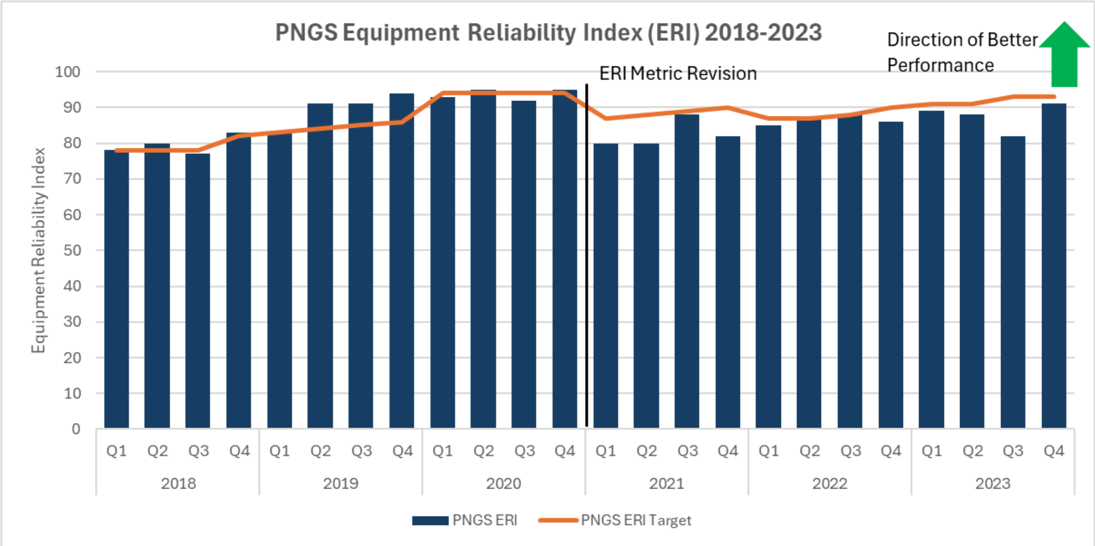

Figure 21. Pickering NGS Equipment Reliability Index Results

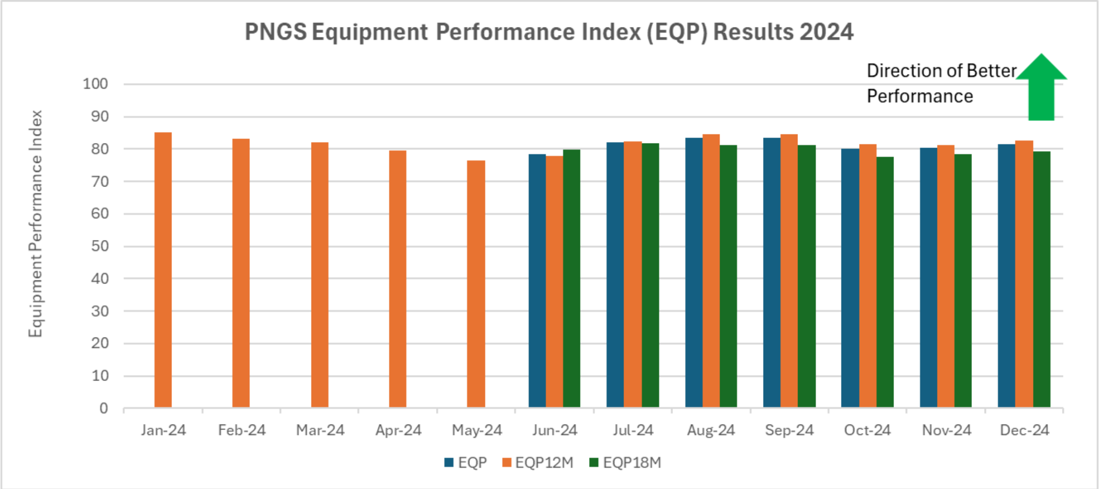

Figure 22. Pickering NGS Equipment Performance Index Results

Pickering NGS is actively advancing multiple initiatives to enhance ER, for Units 5 to 8, for the future. These initiatives aim to reinforce a robust safety and human performance culture, ensure high plant reliability of station systems and equipment, and enhance work planning and execution. They also support sustainability and the future development of the station. Throughout 2025, Pickering NGS is committed to driving continuous improvement in ER by focusing on enhanced oversight and monitoring of plant reliability risks and cross-functional ER behaviours. Efforts include implementing actions to prevent consequential events such as stronger cross-functional support, stronger mitigating strategies, and stronger bias to risk elimination. Additional strategies involve cross-functional engagement for identifying and mitigating system vulnerabilities through the completion of Equipment Reliability Vulnerability Reviews with oversight from the Plant Health Committee. The preventative maintenance program is continually optimized through PM feedback and changes driven by operating experience with oversight provided by the Preventative Maintenance Review Board (PMRB).

Pickering NGS has intensified its focus on Fuel Handling Equipment Reliability (FHER) by implementing a process to review trends and take action to adjust maintenance programs as necessary. The results of this initiative are expected to be realized going into 2026. This will also be balanced with an increased focus on FH Equipment Reliability for defuel.

Additionally, Pickering NGS has dedicated SHTs for critical systems that have historically contributed to significant equipment-related events. These systems include main power output, fuel handling, turbine, generator, and primary heat transport. The SHTs facilitate cross-functional analysis and collaboration, enhancing equipment reliability through improved self-awareness and proactive self-correction.

2.6.2 Maintenance

Pickering NGS meets the requirements of CNSC REGDOC-2.6.2, which states that effective maintenance is essential for the safe operation of a nuclear power plant. Specifically, the Pickering NGS facility is monitored, inspected, tested, assessed and maintained to ensure that SSCs function as per design. N-PROC-MA-0024, *System Performance Monitoring*, establishes a consistent and comprehensive process for the effective monitoring, maintenance, and enhancement of system performance and reliability.

The majority of maintenance activities are divided into preventive or corrective maintenance. Where the performance or condition of an SSC does not allow it to function as per design, corrective action is taken. The results of all maintenance activities are fed back through an optimization process which enables the continuous improvement of the program.

The Programs, Procedures and Standards documentation described below are used to implement the maintenance strategy.

The Pickering NGS Maintenance program, N-PROG-MA-0004, *Conduct of Maintenance*, is designed to ensure personnel and public safety, protection of the environment and reliable operation. The program includes work planning, work execution, tool calibration and control, personnel and training as well as performance indicators and assessment. This document also provides authority for N-PROC-MA-0015, *Tool Control*, which outlines the processes/requirements for anyone who uses, handles or manages/administers tooling tracked in the Tool Control System. Managed tools encompass those deemed high value, those with issuance/return tracking and those that require inspection and/or calibration as defined by this procedure.

The Pickering NGS Maintenance program interfaces with N-PROG-MA-0019, *Production Work Management* to support the process by which maintenance, modifications, surveillances, testing, engineering support and any work activities that require plant coordination or schedule integration are implemented.

The Component and Equipment Surveillance program, N-PROG-MA-0017 is a set of activities to assure the health of a select group of nuclear facility components. Pickering NGS Maintenance implements standards and procedures in support of component and equipment performance which further supports the overall safe, reliable and economic operation of OPG Nuclear.

The outage management processes for preparation and execution of planned and forced nuclear unit outages within OPG Nuclear receive authority from N-PROG-MA-0019, *Production Work Management*. Governance associated with planned outages is in accordance with N-PROC-MA-0013, *Planned Outage Management* and governance associated with forced outages is in accordance with N-PROC-MA-0049, *Forced Outage Management*. Refer to Section 2.3.4 for additional information on outage management.

The maintenance program is organized to align closely with the Engineering, Work Management, Operations and Supply Chain organizations to support equipment fitness for service requirements. The intent of the program is to ensure that safety systems remain available and that equipment failures are minimized. This is accomplished through corrective and preventative maintenance activities as well as routine inspections of system components to ensure they continue to operate as expected. N-PROG-MA-0019, *Production Work Management*, details the requirements for identifying, prioritizing, planning, scheduling, and executing work in support of the operation, maintenance and modification of the plant.

Maintenance is key to equipment reliability. Maintenance at Pickering NGS largely consists of preventative maintenance with a focus on condition-based maintenance, wherein systems with the ability to measure or monitor parameters that determine when the maintenance is required are used. This allows for efficient work scheduling and the completion of maintenance on condition-based approach.

The Maintenance organization works closely with the work group responsible for planning and scheduling of work – known as Work Control. Through N-PROC-MA-0002, *Work Planning*, Work Control establishes the process of planning work to ensure common base requirements are uniformly supported across nuclear. Through a collaborative and cross functional series of meetings, required tasks are prioritized and scheduled to preserve, repair and/or test equipment that supports safe operation of the Station. In addition, this process is benchmarked against the industry standard to ensure alignment with top performing nuclear stations.

Through N-PROC-MA-0006, *Work Performance*, Maintenance establishes the process of performance of maintenance activities within OPG to repair or replace malfunctioning SSCs to re-establish conformance with program requirements. This allows Maintenance and Work Control to optimize the planning and execution of work that directly and indirectly supports continued operation and/or maintaining the safe operation envelope within licence limits.

Upon completion of maintenance activities, Post-Maintenance Tests (PMTs) are conducted as per N-STD-MA-0008, *Station Material Condition and Housekeeping* which establishes the PMT process and specifies the requirements.

OPG's Maintenance organization has implemented two key oversight forums to strengthen our culture of self-awareness, self-criticality and self-correction:

- Staying on Top Meetings: Cross-functional Maintenance Leadership, including Contract Partners, Common Services, Fuel Handling, Centre-led Functional Area Management and Training, meet weekly to provide intrusive oversight and discuss strengths and opportunities for improvement for each crew based on leading (e.g., field observations) and lagging (e.g., rework events) indicators. Interventions are initiated to correct shortfalls in performance, as they are detected. This forum has enabled the Maintenance Leadership team, including First Line Managers and our contract partners, to collaborate on corrective action plans, as well as challenge the criticality in observations to ensure the highest possible standards of performance are maintained across all disciplines.

- Continuous Improvement Meetings: Cross-functional maintenance leadership, including contract partners, Centre-led Functional Area Management and Training meet weekly to present their excellence plans and current gaps, drivers, actions, and results by providing an update on actions in progress and completed, and associated key performance indicators. The intent of this forum is to ensure leaders are aligned around current actions, provide the opportunity to challenge actions and plans, and request or offer support as needed. As well, learnings from the other sections can be applied if necessary. Continuous improvement and other maintenance oversight forums (e.g., Confined Space, Foreign Material Exclusion, Hoisting and Rigging) fall under the Pickering NGS governance oversight framework to ensure clear ownership for station programs are in place.

Maintenance Backlog

Pickering NGS ensures that work is prioritized, planned and executed in a manner that focuses on maintaining personnel and nuclear safety, increases plant equipment reliability and reduces the station Forced Loss Rate.

Part of the prioritization of this work is in identifying components important to safety and reliability and to ensure that where those components can no longer reliably perform their function, that the repair is executed with priority. These components receive coding as either Corrective Critical (CC), Corrective Non-Critical (CN), Deficient Critical (DC), or Deficient Non-Critical (DN), depending on component criticality as it relates to nuclear safety.

It is a priority to ensure that CC, CN, DC and DN backlog is maintained low, which in turn allows important preventive maintenance programs to be executed to maintain system designed redundancy.

The volume of corrective and deficient maintenance backlog work orders continues to steadily decrease since 2019. As of 2024 Quarter 4, the backlog of Corrective Critical and Corrective non-critical (CC/CN) Work Orders (WOs) was reduced by 93% since 2017. Over the same period, the Deficient Critical and Deficient Non-Critical (DC/DN) WO backlog was reduced by 97%.

The Pickering NGS work order backlog performance has significantly improved over the past few years. As shown in Figure 23 and Figure 24 below, the updated data shows continued improvement to the end of 2024 through the sustained decrease of the CC/CN and DC/DN maintenance work order backlog. This is largely due to a number of station initiatives and dedicated resources to ensure that Pickering NGS achieves industry best performance in this area. The station team has also undertaken a Plant Reliability Station Excellence Initiative to systematically review the PM program. Under this initiative the team will review and update the frequencies of PM WOs based on available operating experience.

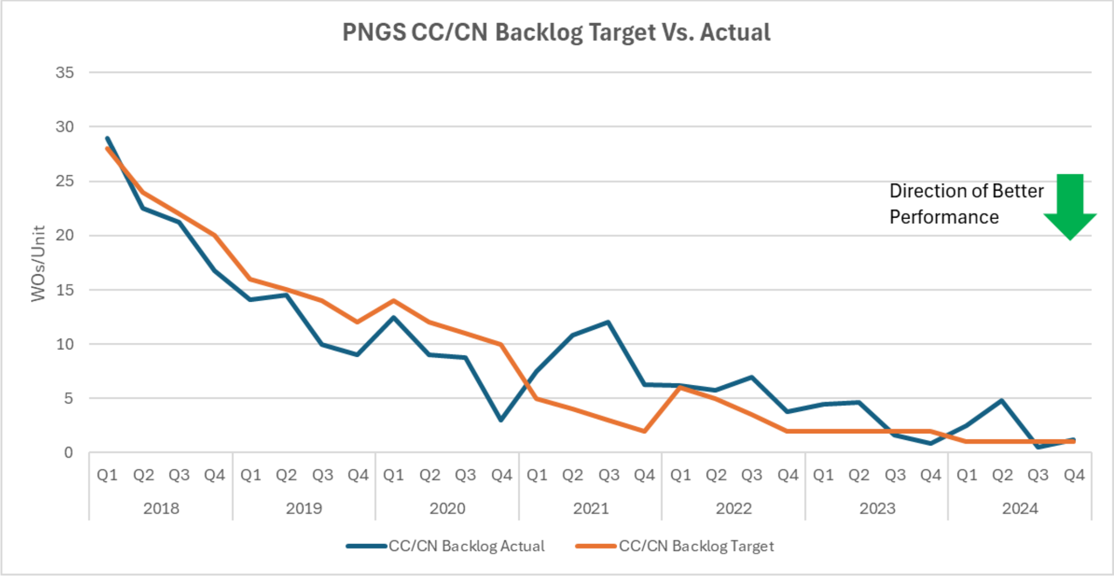

Figure 23. Pickering NGS CC/CN Backlog

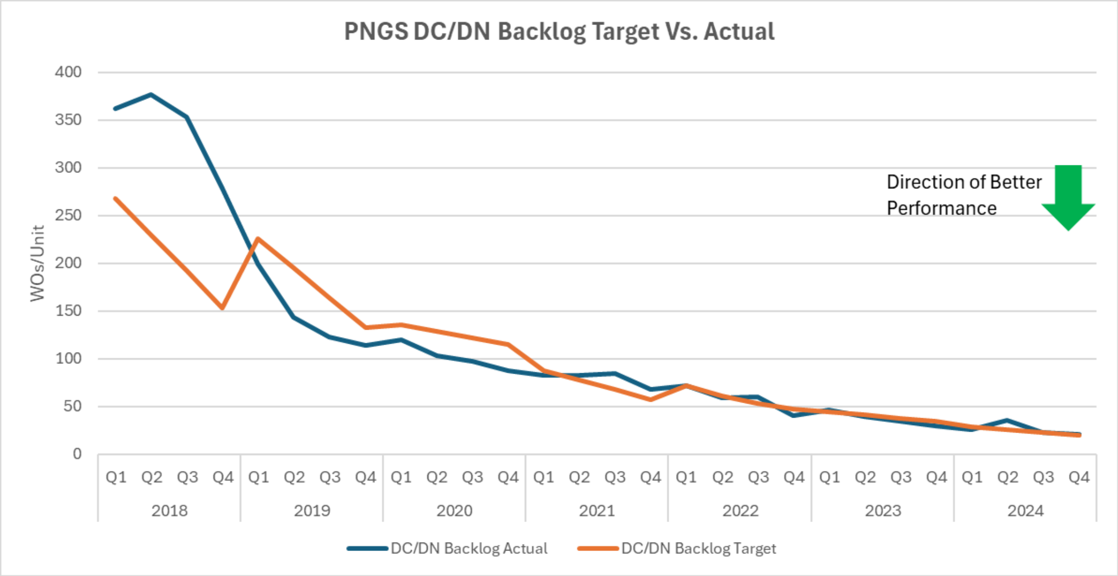

Figure 24. Pickering NGS DC/DN Backlog

The Pickering NGS Maintenance Department continues to drive improvements in areas such as, Hoisting and Rigging and Foreign Material Exclusion (FME) practices through the use of the PI program, and using insights gained in leading processes like the Observation and Coaching program. Through the continuous monitoring of programs, small declines in behaviour are observed and corrected, using a Staying on Top philosophy. The Staying on Top philosophy of Self Identification and Self Correction will be key to maintain an exemplary Maintenance Index while the department transitions from an Operational department to a Refurbishment department.

Indices in DN backlog work orders, although at Station target, will continue to improve to Industry Best Quartile by leveraging a strong focus on Equipment Reliability and availability.

Preventative Maintenance Activities

The Predefined Process, N-PROC-MA-0020 (or PM process) provides a formal means to facilitate planning, scheduling, and execution of work of a recurrent nature. The management and scheduling of preventive maintenance activities are completed using OPG's enterprise software system 'Asset Suite' which also retains records of all maintenance tasks completed.

PM program improvements have focused on changing behaviours and reinforcing expectations around performance metrics that promote a healthy, and sustainable living program. Key performance indicators have been established and are reviewed weekly at the oversight forum, Senior Work Management and PMRB, to monitor progress and take actions as required.

Key cross-functional initiatives driven through Engineering, Work Management and Maintenance include:

1. Maintenance consistently achieving greater than 95% as found condition compliance, which prompts engineering to evaluate and refine PM strategies. This ensures maintenance is performed at the correct frequency.
2. Reduced PM Modification Requests (PMMRs) Backlog: minimize the backlog of PMMRs, maintaining a "live zero". This translates into PM strategy changes to the program on an on-going basis.

3. The PMRB focuses on operating experience and critically evaluates PMMRs modification requests, challenging their necessity, enabling factors, and required resources. This ensures that each modification is justified and aligned with the overall goals of the PM Program.

Maintenance Program Assessment

The Pickering NGS Maintenance program demonstrates a commitment to continuous improvement through the self assessment process. Pickering NGS Maintenance conducts annual department self assessments on maintenance fundamentals and technical skills to identify improvement opportunities where focused actions will sustain performance. In addition, specific programmatic elements (e.g. FME, Hoisting and Rigging, Work Protection, and Pressure Boundary) are periodically reviewed to ensure that documentation, performance and behaviours are aligned with the expectations of those processes.

By participating in divisional self assessments, Pickering NGS Maintenance ensures contribution to cross-functional teams that work to achieve and sustain high levels of plant reliability. In 2023 a comprehensive self assessment addressed actions to improve cross-functional risk recognition, mitigation, and elimination at Pickering NGS, lowering the number of equipment-related consequential events. Pickering NGS applied a multi-pronged approach to close gaps to excellence including an awareness campaign for all stakeholders as to how they can contribute to high-level plant reliability, identification and prioritization of highest risk equipment to ensure mitigating and/or bridging strategies are in place, including an examination of potential parts issues related to procurement lead times and obsolescence. These proactive efforts align with the overall maintenance strategy of balancing preventative and corrective maintenance in the desired proportions.

Proactive initiatives, corrective actions and development of leading and lagging indicators inform our continuous improvement plan and provide a path to consistent improvement.

2.6.3 Aging Management

The Integrated Aging Management (IAM) program is an overarching and comprehensive program, that ensures the continued safe and reliable operation of the station's systems, components and structures. IAM provides the framework for managing aging at Pickering NGS and demonstrates how the current processes and programs meet the requirements for effective aging management in accordance with CNSC REGDOC-2.6.3. Program document N-PROG-MP-0008, *Integrated Aging Management* is the governing program for aging management at OPG.

The objective of the IAM program is to ensure that the condition of critical nuclear facility equipment is understood and that required activities are in place to ensure the health of these components and systems while the plant ages. This is accomplished by establishing an integrated set of programs and activities to ensure that the performance requirements of all critical station equipment are met on an ongoing basis. The IAM program covers all SSCs defined as critical based on a nuclear safety, production, environment and cost significance perspective. The IAM process is summarized in Figure 25.

To ensure effective implementation and management of the IAM program at Pickering NGS, roles and responsibilities are defined in Section 2.0 of N-PROG-MP-0008. The responsibilities for the IAM program are split between corporate groups and the station.

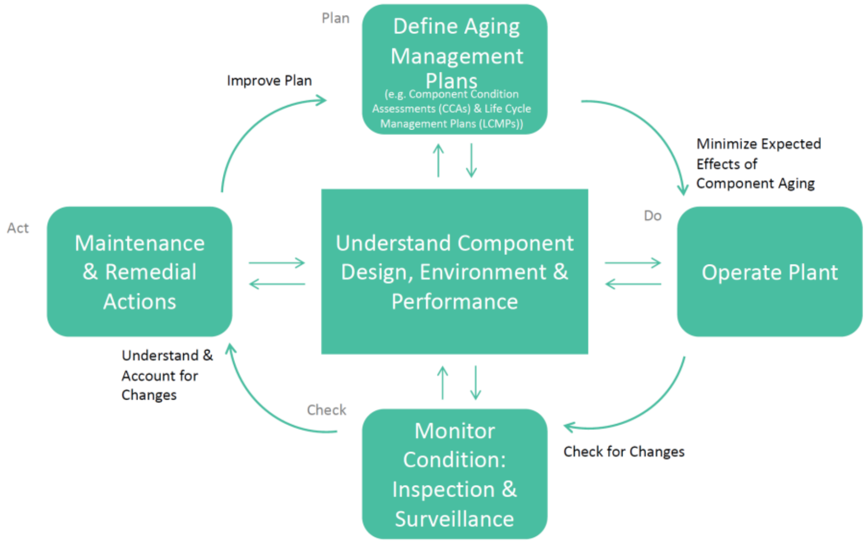

Figure 25. Integrated Aging Management Process.

Implementing procedure N-PROC-MP-0060 *Aging Management Process* describes the process for performing the following aging management activities:

- Effective aging management planning for SSC;
- Scoping to identify and group SSCs based on aging related characteristics;
- Screening to determine the method of Condition Assessment (CA) (whether an SSC within aging management scope requires a CA report to be developed); and
- CA to identify actions required to ensure the health of SSCs as the plant ages and to maintain the overall effectiveness of the aging management plans (CAs are prepared as per N-GUID-01060-00001, *Component Condition Assessment Preparation Guide*).

The aging management process uses a systematic and comprehensive approach to assess the effectiveness of an SSC's aging management plan and address any aging related issues.

An SSC's CA report provides a "road map" of its respective aging management plan through the application of the nine attributes in CNSC REGDOC-2.6.3, which are embedded within the CA process. The method of CA is determined and defined in N-PROC-MP-0060 and is accomplished through the following:

- Component and system surveillance for components important for safe and reliable operation.
- Fitness for service assessments and Life Cycle Management Plans (LCMPs) for major components such as fuel channels, steam generators, reactor components, turbine generators, and other strategic and long-lead SSCs.
- CA records for the balance of IAM critical plant equipment.

N-PROC-MP-0060 set the requirements for data collection and record-keeping in support of the IAM program. Data and records relevant to aging management are divided into the following categories:

- Baseline information consisting of data on the design and condition of the SSC at the beginning of its service life.
- Operating history regarding test and service data on the availability and failure of the SSC.
- SSC maintenance history.
- Records of SSC screening, Condition Assessment (CA) reports, and LCMPs.

The aging management process requires SSC screening and CAs to be appropriately documented, per N-PROC-MP-0060. Data is recorded and stored in such a way that it is secure and retrievable in accordance with regulatory requirements and OPG processes.

Aging Management Interfacing Programs

The following aging management interfacing programs are in place to support reliability and availability of required safety functions of SSCs throughout the service life of Pickering NGS. This includes programs that ensure all equipment is available to perform its intended design function.

N-PROG-MA-0025, *Major Components*: this interfacing program establishes an integrated set of processes and activities to demonstrate fitness for service for the four major component areas: fuel channels, feeders, steam generators, and reactor components and structures. Developing a long-term LCMP is one of the primary objectives of this program. It provides a framework for integrating and reporting of the component performance, condition, and compliance with the licence requirements. This program ensure that these four major components will perform safely and reliably, maintaining design and licensing bases and operational safety requirements while optimizing production and cost effectiveness.

N-PROG-MA-0017, *Component and Equipment Surveillance*: this interfacing program document describes the program elements that establish a focused surveillance monitoring process. Implementation of these programmatic requirements provides a consistent methodology for performing component and equipment surveillance for select components at all OPG nuclear stations and Nuclear Sustainability Services Facilities. It consists of activities to evaluate, inspect, test and report on the health of a select group of nuclear facility components. The effectiveness of the component and equipment surveillance engineering programs are periodically evaluated against the nine attributes of an effective aging management program as listed in CNSC REGDOC-2.6.3.

N-PROG-MA-0026, *Equipment Reliability*: this interfacing program established the process for maintenance activities and system performance monitoring of critical components. The Equipment Reliability program and its implementing procedures ensure that critical components meet their defined or desired level of reliability for the lifespan of the station.

N-STD-MA-0024, *Obsolescence Management*: this interfacing process takes authority from the aging management governance. The purpose of this standard is to define and implement a sustaining process to manage the proactive and reactive obsolescence issues associated with critical equipment and components. The process activities should interface with equipment reliability and life-cycle management strategies designed to sustain continued safe and reliable plant operation.

N-PROG-OP-0004, *Chemistry*: this interfacing program specifies processes, requirements, and staff accountabilities to ensure effective control of plant chemistry, including provisions for analytical services. Systems are operated and consistently tested using approved operating procedures and chemistry specifications to ensure aging degradation remains as documented in the design basis and completed condition assessments.

There are several other programs, processes and activities implemented throughout the facility's life cycle, including design, construction, commissioning, operation (including extended shutdowns) and decommissioning. The description of these programs and their purpose in supporting aging management are described in Section 1.8 of N-PROG-MP-0008, and include such programs as EQ, Fuel, Design Management, ECC, PI, Nuclear Operations, Conduct of Maintenance, Reactor Safety, Risk and Reliability, Decommissioning, Nuclear Waste Management, and Items and Services Management.

OPG Nuclear's comprehensive monitoring of component and equipment aging is accomplished through the implementation of all the above programs and the integration of interfacing activities that are managed under the various programs listed above.

2.6.3.1 Systems, Structures or Components-Specific Aging Management Plans

An SSC-specific Aging Management Plan (AMP) defines all relevant aging mechanisms, current condition, any accredited engineering, inspection, or maintenance programs, and preventative actions to maintain or improve the health of the SSC and minimize degradation.

AMPs are addressed via LCMPs for major components (listed below) as per the guidelines described in procedure N-PROC-MA-0100, *Major Components Life Cycle Management Plan*, which is based on the methodology presented in N-PROC-MP-0060, and compliant with the requirements of CNSC REGDOC-2.6.3. A 10-year outlook detailing required inspection and maintenance activities is provided within each of the following plans and updated annually. The LCMPs define the inspection and maintenance activities required to support the operation of Pickering NGS Units 5 to 8 leading into refurbishment, required to be performed during refurbishment (including replacements), and required to support safe and reliable post-refurbishment operation.

The LCMPs for the Major Components are:

- N-PLAN-01060-10001, Feeders Life Cycle Management Plan;
- N-PLAN-01060-10002, Fuel Channels Life Cycle Management Plan;
- N-PLAN-01060-10003, Reactor Components and Structures Life Cycle Management Plan; and
- N-PLAN-33110-10009, Steam Generators Life Cycle Management Plan.

OPG ensures that AMPs are reviewed periodically to ensure continued effectiveness and that they meet the following requirements:

- Supplement the ongoing engineering surveillance activities.
- Are implemented in accordance with the overall IAM program framework.
- Address the nine attributes of an effective aging management program as listed in CNSC REGDOC-2.6.3.

Since OPG completed CNSC REGDOC-2.6.3 (2014) implementation in July 2017, effectiveness reviews of the IAM are periodically performed and these reviews have confirmed that the implementation of Pickering NGS's IAM program is effective and sustaining, compliant with its governance and REGDOC-2.6.3 (2014).

These programmatic activities will continue through Pickering refurbishment and the post-refurbishment operating life of the station. Component replacement, inspection, and maintenance activities to be performed during refurbishment are described in Section 2.6.7.6.

Fuel Channel Aging Management

Fuel channel aging management is a comprehensive program of in-service inspection, maintenance, engineering assessments and research and development for fuel channels. The fuel channel LCMP is prepared in accordance with N-PROC-MA-0044, *Fuel Channel Life Cycle Management* to ensure the applicable requirements of CSA N285.4, *Periodic inspection of CANDU nuclear power plant components* are satisfied. The LCMP describes and summarizes the major known fuel channel aging mechanisms, identifies expected life limits posed by each aging mechanism, and provides strategies required to manage fuel channels to station specific target operating life (pre- and post-refurbishment). Detailed reports regarding the status of aging mechanisms, compliant with CNSC REGDOC-2.6.3, are available as separate documents for Pickering NGS. Some of the aging-based inspection and maintenance activities are as follows:

- Flaw monitoring
- Body of tube and rolled joint scrapes
- Elongation measurements
- Diametral expansion
- Wall thinning
- Rolled joint predictions
- Pressure tube fretting
- Pressure tube to calandria tube (PT-CT) gap measurements
- Pressure tube volumetric inspection
- Annulus spacer fitness for service

Pressure tubes are periodically removed from operating reactors for material surveillance purposes. The primary purpose of the material surveillance program is to monitor changes in material properties with the objective of assessing the effect of aging mechanisms on pressure tube properties and confirming that material models remain valid for the fitness for service assessments of in-reactor pressure tubes. Clause 12.4 of CSA N285.4 identifies mandatory material surveillance requirements for pressure tubes removed for material property testing. An outline of the measurement and evaluation procedures performed on removed pressure tubes is provided in N-REP-31100-10041, *Acceptance Criteria and Evaluation Procedures for Material Surveillance Pressure Tubes*.

OPG is committed to the long-term use of CSA N285.8, *Technical requirements for in-service evaluation of zirconium alloy pressure tubes in CANDU reactors* for its pressure tube fitness for service evaluations. The plan to comply with CSA N285.8 is outlined in N-REP-31100-10061, *Compliance Plan for Long-Term Use of CSA N285.8 for In-Service Evaluation of Zirconium Alloy Pressure Tubes*.

The extensive operating experience gained through the above-listed activities performed to manage the pre-refurbishment Pickering NGS fuel channels will be leveraged and used to inform the inspection and maintenance activities necessary to support safe and reliable operation of the replacement fuel channels post-refurbishment. This Pickering operating experience, combined with broader industry operating experience, manufacturing advancements, and ongoing research and development activities, informed improvements made to the replacement fuel channels as described in Section 2.6.7.6. Strategies to support post-refurbishment operations will be defined in ongoing LCMP updates.

The fuel channel LCMP is updated annually to capture new information from outage inspections, research, and operating experience, in addition to activities planned in compliance with CSA N285.4. With the implementation of the fuel channel LCMP, OPG will continue to demonstrate that aging mechanisms are understood and confirm that component condition remains acceptable via monitoring and inspection for post-refurbishment operation.

Reactor Components and Structures Aging Management

The Reactor Components and Structures LCMP, N-PLAN-01060-10003, establishes the strategy to identify necessary actions to ensure that the effects of aging on reactor components and structures are appropriately managed for the operating life of OPG's fleet of nuclear units. The technical bases for these strategies and required activities are provided in N-PLAN-01060-10008, *Reactor Components & Structures Life Cycle Management Plan: Technical Basis Document*. The aging management of the components addressed within the reactor components and structures LCMP are as follows:

- Calandria and shield tank assembly
- Calandria tubes
- Calandria Tube to Liquid Injection Shutdown System (CT/LISS) nozzle clearance
- Guide tubes
- Moderator inlet nozzles/pipes
- Calandria end shield support
- Lattice tubes
- End fittings
- Calandria relief ducts
- Other reactor internals to maintain fitness for service

The reactor components and structures LCMP is updated annually to capture new information from outage inspections (including refurbishment activities), research, and operating experience, in addition to activities planned in compliance with CSA N285.4. Details on refurbishment inspection and maintenance activities are provided in Section 2.6.7.6.

Feeders Aging Management

The feeder piping system aging management program, documented in N-PLAN-01060-10001, *Feeders Life Cycle Management Plan*, contains the CSA N285.4, *Periodic inspection of CANDU nuclear power plant components* program, in-service inspection, and PROL compliance inspection activities, the overall strategy to maintain the system integrity, and the fitness for service guidelines. The most significant feeder aging management programs are listed below:

- Flow Accelerated Corrosion, managed through scheduled wall thickness measurements and stress analysis

- Fretting damage, managed through visual or clearance inspections and chafing shield installations on the reactor face and in the feeder cabinets
- Instrument line fretting inside the feeder cabinet, managed through visual inspections
- Feeder replacement, in place for feeders that are not expected to reach the end of the planned operating life of the unit

If detected wall thinning or a flaw indication does not satisfy CSA N285.4 acceptance criteria, the Standard permits a fitness for service assessment to determine acceptability. Evaluation procedures and acceptance criteria for performing such fitness for service assessments are provided in COG-JP-4107-V06, *Fitness-for-Service Guidelines for Feeders in CANDU Reactors*.

The extensive operating experience gained through the above-listed activities performed to manage the pre-refurbishment Pickering NGS feeder piping will be leveraged and used to inform the inspection and maintenance activities necessary to support safe and reliable operation of the replacement feeders post-refurbishment. This Pickering operating experience, combined with broader industry operating experience, manufacturing advancements, and ongoing research and development activities, informed improvements made to the replacement feeders as described in Section 2.6.7.6. Strategies to support post-refurbishment operations will be defined in ongoing LCMP updates.

The feeders LCMP is updated annually to capture new information from outage inspections, research, and operating experience, in addition to activities planned in compliance with CSA N285.4. The LCMP is updated annually to incorporate changes to these requirements that may be warranted from inspection results on the thinning rates and extent of active degradation, as well as significant feeder related operating experience from OPG and other CANDU stations. The plan also contains strategies to deal with plausible aging mechanisms that are not active but may become active. In the plan, the operational risk, areas of vulnerability in the piping system, and mitigating actions to ensure that feeders remain within the design basis leading into and post-refurbishment are identified.

Steam Generators Aging Management

The Steam Generator (SG) aging management program, documented in N-PLAN-33110-10009, ensures all units operate safely and reliably with the existing steam generators through the service life of the station, while maintaining the design and licensing bases, and optimizing station reliability, production, and cost-effectiveness.

SGs continue to be closely monitored by an inspection program to manage active and plausible degradation mechanisms. The main goal of the steam generator LCMP is to maintain thermal performance by means of an effective inspection and maintenance program to prevent or mitigate steam generator degradation and failures (i.e., tube leak). Inspection of pressure boundary shell welds, nozzles and external vessel supports is prescribed in the periodic inspection program specific to each unit in compliance with CSA N285.4 and the in-service inspection. If a flaw is detected in a steam generator tube through inspections, CSA N285.4 permits a fitness for service assessment to determine acceptability. Evaluation procedures and acceptance criteria for performing such fitness for service assessments are provided in Conexus Nuclear Inc Report COG-07-4089, *Fitness-for-Service Guidelines for Steam Generator and Preheater Tubes*.

The extensive operating experience gained through the above-listed activities performed to manage the pre-refurbishment Pickering NGS steam generators will be leveraged and used to inform the inspection and maintenance activities necessary to support safe and reliable operation of the replacement steam generators post-refurbishment. This Pickering operating experience, combined with broader industry operating experience, manufacturing advancements, and ongoing research and development activities, informed improvements made to the replacement steam generators as described in Section 2.6.7.6. Strategies to support post-refurbishment operations will be defined in ongoing LCMP updates.

Periodic and In-Service Inspection Programs

Periodic Inspection Programs (PIP) define the inspection plans required to ensure acceptability of specific nuclear power plant and containment components, in accordance with the relevant edition of CSA standards N285.4, *Periodic inspection of CANDU nuclear power plant components,* N285.5, *Periodic inspection of CANDU nuclear power plant containment components*, N285.8, *Technical requirements for in-service inspection evaluation of zirconium alloy in pressure tubes in CANDU reactors*, and N287.7, *In-service examination and testing requirements for concrete containment structures for CANDU nuclear power plants*.

The PIP plans are developed and maintained within the relevant governing programs identified above and include non-destructive examination techniques and procedures developed and implemented as per the CSA standards, specific program requirements, the nature of the degradation, and the regulatory requirements, as applicable. The generic process and accountabilities for evaluating CSA N285.4 and N285.5 periodic inspection results, and the requirements for preparing and submitting component dispositions when required, are established in N-PROC-MA-0052, *Flaw Dispositioning*.

The Pickering NGS CSA N285.4 PIP is divided into four system/component groups addressing specific clauses of CSA N285.4 including the general pressure boundary components, fuel channel pressure tubes, fuel channel feeder pipes, and steam generator tubes. See Section 2.6.5 for further details on PIP.

N-PROC-MA-0066, *Administrative Requirements for In Service Inspection and Testing for Concrete Containment Structures,* provides the administrative process required by CSA N287.7 and general requirements of CSA N287.1, *General requirements for concrete containment structures for nuclear power plants,* for the examination and testing of concrete containment structures at OPG under N-PROG-MA-0017. Additionally, the requirements of CSA N287.7 and N287.8, *Aging Management for concrete containment structures for nuclear power plants*, are met by N-PLAN-01060-10004, *Aging Management Plan for Concrete Containment Structures and Safety Related Structures*, and governed by N-PROG-MA-0008, *Integrated Aging Management*. CSA N287.2, *Material requirements for concrete containment structures for CANDU nuclear power plants,* is required to be used in concert with CSA N287.1 and CSA N287.8.

2.6.4 Chemistry Control

Chemistry control refers to the control of chemical impurities which contribute to degradation and accelerated aging in plant systems. Plant fitness for service is adversely affected when uncontrolled chemistry results in equipment damage and reduced system availability. Through implementation of management system programs and procedures, OPG maintains a robust system of processes to control plant chemistry, allowing plants to remain fit for service.

OPG implements a chemistry program via N-PROG-OP-0004, *Chemistry*, which ensures effective control of plant chemistry, including the provision of analytical services to ensure critical plant equipment performs safely and reliably over the life of the station. The chemistry program complies with CSA N286-12 and also interfaces with the environment program through

P-MAN-03480-10001, *Environmental Emissions Control Manual*, to limit and monitor the release of chemicals and radioactive material.

Control of system chemistry and chemistry work management procedures establish the chemistry surveillance program to detect undesirable trends and consequences. It is implemented through the suite of OPG Nuclear systems chemistry specification manuals.

N-PROG-OP-0004 and the following implementing documents capture the requirements to have defined chemistry specifications for systems, procedures for chemistry parameter monitoring, trending and monitoring activities, and procedures for the storage and handling of chemicals: N-PROC-OP-0012, *Control of Process Chemicals*, OPG-PROC-0126, *Hazardous Material Management*, and N-TS-01806.5 *Material Specifications* series manuals outline storage and handling requirements of chemicals. N-PROC-OP-0013, *Control of System Chemistry* defines processes to be followed to control system chemistry during all plant states and includes instructions regarding maintenance of chemistry specifications, monitoring of system chemistry conditions, control actions required to maintain optimum chemistry, and monitoring of actual performance. N-PROC-OP-0014, *Chemistry Laboratory Work Management* defines requirements for laboratory equipment, sampling and analysis, and quality control in order to perform chemistry monitoring.

Consideration is given to utilize online monitoring where possible through OPG nuclear systems chemistry specification manual and chemical control, under which specifications and corrective actions against online out-of-range chemistry are defined. The online instrumentation availability is tracked through performance indicator online analyzer availability to drive visibility and improvements throughout the station. The calibration and maintenance program for online and laboratory instrumentation is under chemistry work management.

In addition, the Pickering NGS chemistry laboratory ensures analytical services are available at all times. Defense in depth is employed through redundant instrumentation and an external laboratory.

Implementation and Management of Process Chemicals and Hazardous Materials

OPG has established procedures for the processes to prevent use of impure or ineffective process chemicals through the control of process chemicals procedure, and OPG-PROC-0126, *Hazardous Material Management* which outlines the approval, labeling, and training protocols to safeguard OPG employees and OPG supervised contract workers from risks related to working with or near hazardous materials. These procedures ensure the required quality of chemicals is maintained throughout their usage. OPG also maintains a list of approved process chemicals as specified by N-TS-01806.5-100XX, *Material Specifications*, and documented by the chemistry colour classification as per control of process chemicals procedure.

Chemistry Performance

The chemistry program execution performance is provided through quarterly program fleetview reports (as per N-PROC-RA-0023) which is approved by the program authority and presented at the Nuclear Executive Committee for endorsement. The Chemistry Corporate Functional Area Manager (CFAM) provides oversight on station chemistry performance and operational chemistry control effectiveness is assessed using a set of KPIs; CNSC Chemistry Index (CI) and Chemistry Compliance Index (CCI) are reported in the Fleetview Program Health and Performance Report as one of the KPIs of the chemistry program functional area summary and in station program health reporting.

2.6.5 Periodic Inspection and Testing and Structural Integrity

The objective of the PIP is to ensure structural integrity of the nuclear plant systems and components, including containment components in Pickering NGS. The programs are documented in specific PIP plans and associated inspection schedules, and they are administered under corporate and station governing documents. The main objective of the PIPs is to ensure they satisfy the associated CSA standards as outlined in the sections that follow.

Periodic inspections are conducted to provide assurance of the improbability of:

a) A failure that can produce radiological conditions exceeding the health and safety limits for normal operation as stated in the safety report (CSA N285.4).

b) The structural failure of containment components when the containment system is required to perform its function as defined in the safety report (CSA N285.5).

c) Concrete components and their parts failing and leading to:
1) compromising the leak tightness of the containment envelope;
2) adversely affecting the operability and structural integrity of the concrete containment systems (CSA N287.7).

d) The failure of structural components of non-containment, safety-related structures that could negatively impact nuclear safety systems (CSA N291).

Pickering NGS CSA N285.4 and N285.5 Periodic Inspection Programs

The CSA N285.4-14 program requires inspection of over 1000 locations across Pickering NGS 5 to 8 Units. Each location is inspected once within each unit's 10-year inspection interval. Inspected components include piping and vessel welds, pumps, valves, piping, and component supports, and mechanical couplings.

The CSA N285.5 program consists of over 1000 inspection locations across Units 5 to 8 and containment systems. Each location is inspected once within each unit's 10-year inspection interval; except for components whose inspection requires a Vacuum Building Outage, where inspections are performed nominally every 12-years. Inspected components include containment penetration seal welds, pipe supports, piping/ducting, valves, containment dampers and other containment components.

Inaugural inspections are performed for newly installed components in accordance with the requirements in the CSA N285.4 and CSA N285.5 standards. These inspections are performed to establish the condition of the components at the time it was placed into service. This ensures that when periodic inspections are performed, there will be at least one previous result for each component, thus allowing for comparative analysis between the inspection results.

Pickering NGS CSA N287.7 Periodic Inspection Program

The CSA N287.7 program addresses inspection and testing of concrete containment structures. Separate PIP plans have been created, submitted to and accepted by the CNSC for the vacuum building, reactor buildings, and Pressure Relief Duct (PRD) concrete containment components. These inspection plans identify the civil containment structures and components to be inspected, describe relevant mechanisms potentially affecting these components, identify inspection methods and acceptance criteria, and define reporting requirements.

The PIP for Reactor Buildings (RBs) are performed during every planned unit outage and the PIP for VBs and PRD are performed during a station outage nominally every 12 years with some of the scope being performed while online. In service inspections will continue for the RBs during the presently planned maintenance outages on Unit 6 in 2025 and Unit 8 in 2026, until the start of refurbishment. The VB and PRD containment structures inspections were last performed during the 2022 VB Outage. The inspection activities were conducted on the concrete components, vacuum building joint sealant, vacuum building roof seal and pressure relief duct joint seals.

In service examinations as part of the PIPs on the concrete, reinforcement, steel, non-metallic liners and coating systems, joint sealant and elements necessary to support the containment structure are performed on each RB, VB and PRD. The current in-service examinations will support the station until refurbishment.

Pickering NGS CSA N291 Periodic Inspection Program

CSA N291-19, *Requirements for nuclear safety-related structures for CANDU nuclear power plants* specifies requirements for the material, analysis and design, construction, fabrication, inspection, examination, and aging management of nuclear non-containment, safety-related structures. The CSA N291 PIP plan, P-PIP-03643.2-00001, *Pickering NGS, In-service Inspection Periodic Inspection Program for Non-Containment Buildings and Safety-Related Structures and Components*, was prepared to describe requirements for performing inspections, evaluating the results, and documenting inspection reports for the non-containment, safety-related structures at Pickering NGS. This PIP describes the processes and activities required to monitor, evaluate, and document aging effects on safety-related structures to ensure they will maintain their performance throughout the life of the plant to withstand design basis loads. The goal of inspection is to provide observations which lead to identification of deficiencies associated with building facades, concrete structures and components, masonry wall, roofings and steel structure condition.

2.6.5.1 Structural Integrity

The station's principal structures are discussed in Section 2.5.3.

Inspections to confirm structural integrity are performed in accordance with the associated PIP documents and to the requirements of CSA N285.5-18, N287.7-17, and N291-19.

OPG carries out inspections and tests (as applicable) of the inaccessible components of the Vacuum Building, the Dousing system and the PRD at least once every 12-years. The PRD is tested to measure leakage rates against pre-determined acceptance criteria that meet the requirements of the CSA N287.7-17. The VB in-leakage testing is conducted at the end of a Vacuum Building Outage (VBO) to confirm the VB is buttoned-up following a VBO.

In addition, OPG inspects the accessible portions of the concrete structures of the VB and PRD and their components once every 6-years in accordance with the CSA N287.7-17 PIP.

2.6.5.2 Non-Destructive Examination

Non-destructive Examination (NDE) has a direct bearing on the safe and reliable operation of nuclear facilities and is performed in accordance with applicable codes and standards. NDE is governed by I-STD-AS-0003, *Non-Destructive Examination*, which specifies the principles and requirements tied to the conduct of non-destructive examination services provided by Advanced Inspection and Maintenance under the Conduct of Inspection and Maintenance Services program, I-PROG-AS-0001. NDE services are conducted in accordance with CSA B51, N285.0, N285.4, N285.5 and N287.7.

2.6.6 Pickering NGS Units 1 to 4 Decommissioning

This section provides additional information regarding the Fitness for Service SCA with respect to Units 1 to 4 decommissioning. It is intended to supplement the information provided in the general SCA discussion above and therefore only addresses those specific areas where additional decommissioning-related details are needed.

Equipment Fitness for Service/Equipment Performance (Reliability)

The Equipment Reliability program, N-PROG-MA-0026, remains applicable during Decommissioning, recognizing that changing station conditions will reduce the extent of activities required in support of this program.

For SSCs that are fully removed from service as specified in the ESDRs, ER program implementation activities will no longer be required.

For systems that remain active or partially active, the ER program will remain in place with maintenance strategies (including frequency of monitoring and maintenance activities) adjusted to be commensurate with remaining hazards and safety significance of systems. System health monitoring will be reviewed for applicability for in-service systems as well as ensuring critical spares remain available where required (recognizing there will be significantly fewer critical components). Work on specific obsolescence issues deemed necessary during Decommissioning will continue.

Maintenance

The Conduct of Maintenance program, N-PROG-MA-0004, remains applicable during SWS as described in the SWS Plan, recognizing that changing station conditions will reduce the extent of activities required in support of this program.

Similarly, the Conduct of Inspection and Maintenance Services program, I-PROG-AS-0001, remains applicable during decommissioning, recognizing that changing station conditions will reduce the extent of activities required in support of this program. Systems that have been end-stated will be removed from the PIP.

2.6.7 Pickering NGS Units 5 to 8 Refurbishment

This section provides additional information regarding the Fitness for Service SCA with respect to Units 5 to 8 refurbishment. It is intended to supplement the information provided in the general SCA discussion above and therefore only addresses those specific areas where additional refurbishment-related details are needed.

2.6.7.1 Maintenance

A major portion of the refurbishment maintenance work program will be completed by vendor partners for activities such as fuel channel replacements, fuel channel feeder replacements, turbine and generator overhaul and modifications, balance of plant system and equipment work and various other mechanical work, computer and electrical system work.

Contractor work during the refurbishment outage will be completed using a combination of OPG procedures and contractor developed procedures that meet the requirements of CSA N286-12.

OPG will maintain oversight of vendor management programs and vendor performance.

Cyclical and backlog work that includes preventative maintenance will be performed and supported by OPG staff.

Preventative Maintenance

Nuclear refurbishment PMs are PMs that have been created, scheduled, and accepted for execution during the nuclear refurbishment outage (including return to service) and are managed by the nuclear refurbishment organization to meet the needs of the project.

2.6.7.2 Refurbishment Outage Scope

Major scope for Pickering refurbishment was identified and approved through Program Scope Review Board (PSRB). Major scope will continually be evaluated through the Refurbishment Change Control Board (RCCB). Cyclical / Backlog work will be managed through the minor scoping milestone in 2025.

Refurbishment scope includes the following key activities:

1. Replacement of select reactor components
2. Replacement of all Boilers
3. Replacement and upgrades of the bulk Turbine and Generator centerline and auxiliary systems
4. Replacement of select Fuel Handling equipment
5. Replacement and modification of various Balance of Plant systems and components both in Nuclear and Conventional
6. SIOs
7. Installation of firewater pumps for Pickering NGS Units 5 to 8
8. Activities supporting refurbishment such as site facility / infrastructure, the environment, climate change and management of nuclear waste materials
9. Preventative Maintenance and Backlog work

2.6.7.3 Refurbishment Outage Management

A planned Refurbishment outage management procedure will be issued which will capture the specific details of roles and responsibilities required to establish an outage management process within the refurbishment project structure.

In addition to the major refurbishment projects being undertaken, the outage will include normal breakdown and preventive maintenance. Breakdown maintenance will be selected to ensure a high level of system reliability on restart. Existing PM tasks will be evaluated to select those that are required to support the unit and equipment condition.

The outage will be coordinated to link the cyclic maintenance work with the refurbishment project work in defined windows. It is anticipated that system layup requirements will dominate the positioning of outage work windows for non-critical path work. OPG's current plan is to start systems up as early as possible in order to ensure that most system testing and corrective maintenance is completed before the system is required for planned start-up evolutions. This plan will also place systems in normal operational state as a preferred layup condition for many systems.

The coordination of refurbishment projects with cyclic maintenance work will be accomplished using an integrated schedule. This integrated schedule uses key activities from each individual project schedule and ties them together through interfacing milestones.

2.6.7.4 Systems Important to Safety

Assessments and analyses of the specific unit configurations being performed will identify which specific systems are required and which have been declared out of service for all refurbishment configurations.

Systems which are required to be in-service will be subject to testing and reliability monitoring (and reporting) in accordance with current OPG procedures and practices. Systems declared out of service will not be serving any safety related function and thus, do not need to be tested, monitored, or reported on. As with many other plant systems, SIS which have been modified or taken out of service during the refurbishment outage will be subject to the RTS plan prior to returning the refurbishment unit to commercial operation. This plan will ensure that the SIS conform to the defined physical, functional, performance, safety, and control requirements, and that management arrangements have been appropriately updated.

2.6.7.5 Equipment Surveillance and Testing

OPG will perform surveillance and testing of equipment and systems that are put into a shutdown or lay-up state, in accordance with applicable equipment and system lay-up specifications.

Equipment Lay-up Specifications have been prepared for the following major equipment categories: pumps, motors, valves, piping and piping components, heat exchangers, pressure vessels, and transmitters and controllers.

Systems that are refurbished early in the outage, upon completion of the refurbishment, will be put into a normal shutdown, or lay-up state. The system lay-up specification identifies the end state after refurbishment, and the applicable equipment and system surveillance requirements.

Systems that are being refurbished later in the refurbishment outage and are not required to be put into a shutdown or lay-up state may not require system lay-up surveillance and testing. They would progress directly to the associated surveillance and testing during Commissioning and AFS as part of the Return to Service Strategy.

Some components, the condition of which cannot directly be determined based on observed results (e.g., piping not subject to periodic inspections) may be removed from the system they belong to and subjected to special testing or inspections.

Requirements for testing of removed components to confirm aging mechanisms are driven through OPG's Aging Management Program in accordance with N-PROC-MP-0060, *Aging Management Process.* Inspection of removed components (e.g., as found inspections) are a subset of activities to confirm aging mechanisms and predictions.

2.6.7.6 Aging Management

As part of refurbishment, when equipment is refurbished or replaced, resetting the aging management for this equipment is accomplished through the Integrated Aging Management Program. Guides have been prepared to:

a) Provide requirements for obtaining baseline system/ component performance data, including data for the aging management program.

b) Prepare detailed restart specifications that:

- Identify baseline data to be collected to support the aging management programs.
- Specify any tests required to re-establish baseline information for future system monitoring, if such tests are not already included in operating procedures, test procedures or detailed commissioning specifications.

OPEX

Lessons learned from Darlington NGS OPEX and industry major component replacement projects are actively incorporated into the Pickering Refurbishment for feeders, fuel channels, reactor components, and steam generators. For Pickering Refurbishment, a newly dedicated section has been established within the Major Component Engineering Department (MCED) to have oversight during the planning, design, manufacturing, installation, layup, and preservation stages of the four major component replacements.

This has provided the opportunity to integrate and incorporate component-specific enhancements into Pickering Refurbishment, where design, execution, manufacturing, installation, layup, and preservation will have an impact on Fitness for Service and life cycle management activities. The goal is to maximize component life, optimize the in-service inspection scope, and minimize post-return-to-service outage dose and duration.

Fuel Channel Aging Management

The replacement of the fuel channel assemblies during Pickering NGS refurbishment will reset the effects of aging related degradation mechanisms related to fuel channel deformation and deuterium ingress.

Improvements to the manufacturing process of the new pressure tubes to be installed during refurbishment are expected to mitigate known major life-limiting aging mechanisms. Trace amounts of impurities including hydrogen and chlorine remain in the pressure tube from the manufacturing process which contribute to decline of pressure tube material properties over the operating life of the unit. Reducing the level of impurities during manufacturing is expected to control initial concentration levels to improve fracture toughness of the pressure tubes and reduce susceptibility to delayed hydride cracking. Improved processes will also minimize the possibility of lamination type flaws forming during manufacturing.

Design changes have been made to the annulus spacers and pressure tubes for post-refurbishment Pickering NGS Units. All fuel channels will be installed with Zr-Nb-Cu tight fitting annulus spacers to eliminate known material degradation issues with pre-refurbishment Inconel X-750 annulus spacers and spacer movement issues with pre-refurbishment Zr-Nb-Cu loose fitting annulus spacers. The new pressure tubes have been specified with higher wall thickness than the pre-refurbishment pressure tubes, which will increase in-service flaw tolerance and reduce diametral strain and operating stress.

OPG expects that continued inspections and monitoring will confirm fuel channel fitness for service to the new target end of life, which will be reflected in future revisions of the LCMP. Programmatic activities that will continue to be performed to manage the post-refurbishment life of the fuel channels are described in Section 2.6.3.1.

Reactor Components and Structures Aging Management

The potential for contact between the calandria tube and LISS nozzle will be mitigated with the replacement of the calandria tubes during Pickering NGS refurbishment. Improvements are also being made to the manufacturing process of the new calandria tubes. The changes (glass shot peening, better control of impurities, and modern stress relief techniques) will increase the overall integrity of the calandria tube during accident scenarios and reduce sag during future operation.

OPG expects that continued inspections and monitoring will confirm the reactor components remain fit for service to the new target end of life through the existing LCMP. Programmatic activities that will continue to be performed to manage the post-refurbishment life of the reactor components and structures are described in Section 2.6.3.1.

Feeders Aging Management

Feeder replacements will be performed during refurbishment with the elimination and mitigation of major degradation mechanisms achieved through improved material, fabrication, and installation specifications. Continued monitoring of feeders through the LCMP is performed to ensure that the aging effects are appropriately managed to support post-refurbishment operation. Programmatic activities that will continue to be performed to manage the post-refurbishment life of the feeders are described in Section 2.6.3.1.

Steam Generators Aging Management

All 12 Steam Generators (Boilers) per unit for Pickering NGS Units 5 to 8 will be replaced as part of refurbishment.

The replacement of steam generators during Pickering NGS refurbishment will reset the effects of aging related degradation mechanisms as well as operational/environmental degradation mechanisms.

Improvements to the material selection of steam generator internal components have been made in order to improve long term reliability and corrosion resistance. Replacement Steam Generator tubing will be made using alloy 690 material providing improved corrosion resistance when compared to Monel 400 tubing used in Original Steam Generators. Carbon steel components within the replacement steam generators that are exposed to secondary fluid will contain a minimum specified chromium content such that the materials and weldments will be resistant to detrimental flow assisted corrosion (FAC) over the life of the steam generator. Support structure material within the replacement steam generators have been changed to 410 stainless steel compared to carbon steel in the original steam generators.

Design changes to both the primary and secondary side of the replacement steam generators have been incorporated to improve long term reliability. On the primary side, this includes changes to the design of the primary divider plates and primary head drains. On the secondary side, design changes include improvements to the tube supports and steam separators. Design changes to the tube supports have also been made utilizing a lattice grid type support as opposed to the broached support plate in the original steam generators. The improved tube support design will help minimize flow obstructions and potential for tube support fouling in the replacement steam generators. Improvements have also been made to the continuous blowdown rate of replacement steam generators, increasing the continuous blowdown capacity up to 1.0% steaming rate.

OPG expects that continued inspections and monitoring will confirm steam generator fitness for service to the new target end of life, which will be reflected in future revisions of the LCMP. Programmatic activities that will continue to be performed to manage the post-refurbishment life of the steam generators are described in Section 2.6.3.1.

2.6.7.7 Chemistry Control

Chemistry lessons learned from Darlington NGS Refurbishment OPEX are actively incorporated into the Pickering Refurbishment project. During refurbishment, a modification is being made to accommodate an increased continuous boiler blowoff rate for the new steam generators, which will result in improved chemistry control.

2.6.7.8 Periodic Inspection Program

CSA N285.4 PIPs will continue to be performed in accordance with the accepted PIP plans until December 6, 2027, and then the revised PIP plans, which are complaint with the CSA N285.4-19 Update No. 1, as of December 7, 2027 during refurbishment.

CSA N285.5 PIPs will continue to be performed in accordance with the accepted PIP plans, until June 1, 2027, and then the revised PIP plans, which are complaint with CSA N285.5-22 Update No. 1, as of June 2, 2027 during refurbishment.

A baseline inspection will be performed for modifications, repairs, replacements, etc. as required by CSA periodic inspection standards during Pickering NGS Units 5 to 8 refurbishment. Maintaining current PIP inspections and performing baseline inspections will support Pickering NGS Units 5 to 8 beyond refurbishment.

An inaugural PIP for safety related concrete structures for Pickering NGS is in progress and will be issued and implemented prior to Unit 5 to 8 Refurbishment.

2.6.8 Pickering Waste Management Facility

The OPG documents in the table below require written notification of change per PWMF Licence Conditions Handbook, LCH-W4-350.00/2028 R003:

Table 31. SCA 6 – PWMF Fitness for Service

Document Number	Document Title
W-PROG-WM-0001	Nuclear Waste Management
N-PROG-MA-0026	Equipment Reliability
N-PROG-MP-0008	Integrated Aging Management
N-PROG-MP-0009	Design Management
N-STD-MP-0028	Conduct of Engineering
00104-PLAN-79171-00001	Ontario Power Generation Used Fuel Dry Storage Container Aging Management Plan
00104-PLAN-79171-00002	Dry Storage Container – Base (Underside) Inspection Plan
92896-PLAN-01060-00001	Pickering Re-Tube Components Storage Facility: Dry Storage Modules (DSM) Aging Management Plan

OPG is committed to maintaining PWMF systems, structures, equipment and components that are critical to the safe, reliable and economic transportation, processing and storage of nuclear waste in a fit-for-service state. The implementation of OPG's Equipment Reliability and Aging Management Programs, as described in Sections 2.6.1 and 2.6.3 respectively, ensures the ongoing fitness-for service of these systems.

The following subsections describe aspects of the PWMF fitness for service program.

2.6.8.1 Equipment Reliability

Under OPG's Equipment Reliability Program, system performance monitoring is performed on critical PWMF systems to ensure ongoing reliable operation. System performance monitoring involves the trending of system performance and initiation of investigations or maintenance activities before failures occur. Process parameters, field observations, maintenance work order backlogs, Station Condition Records, inspection results and spare parts status are some of the typical sources of data for performance monitoring. Where appropriate, equipment critical to system reliability are identified and maintenance strategies are prepared. Actions to maintain or improve system health are also prepared. Routine reviews of system health status, maintenance strategies and improvement plans are held. There are currently 6 systems at PWMF (Fire, Electrical, Security, Welding, Vacuum Carts and DSC Transporters) that are included in the system performance monitoring program. Other systems are monitored to address specific issues. Ongoing management oversight of these improvement plans provides assurance that the plans are being implemented, and the improvements are being achieved.

2.6.8.2 Maintenance

The PWMF's recurring preventive maintenance activities are planned, scheduled and executed according to the preventive maintenance program. The management and scheduling of preventive maintenance activities are completed using OPG's enterprise software system 'Asset Suite' which also retains records of all maintenance tasks completed. Feedback from maintenance staff and changes to preventive maintenance activities are managed in the Engage Program. Non-routine maintenance (corrective maintenance) activities are requested, planned and executed using Asset Suite as well. Significant corrective maintenance issues may be identified using the Corrective Action Program and tracked to completion in Asset Suite's Action Tracking module. As part of system performance monitoring, the status of the maintenance program is routinely assessed and reported to facility management for their review. Metrics for the completion of preventive and corrective maintenance activities are presented, and Station Condition Records are issued to address adverse conditions related to equipment health or the execution of maintenance activities. Corrective actions to address maintenance issues are provided for management approval and are monitored to completion.

2.6.8.3 Structural Integrity

OPG conducts various activities to ensure the structural integrity of the storage structures to protect the health and safety of persons and the environment. At PWMF, OPG conducts Phased Array Ultrasonic Testing to verify the integrity of the lid closure weld on each loaded DSC. OPG conducts annual visual inspection of DSMs and carries out on-going maintenance activities for the storage structures. During the current licence period, the following activities were completed: window replacement in 2021, roof replacement in 2022, and concrete floor replacement in 2024.

2.6.8.4 Aging Management

OPG's Aging Management Program is compliant to CNSC REGDOC-2.6.3. Aging is effectively managed if aging effects are understood and controlled, and if aging related degradation mechanisms are mitigated through implementation of appropriate corrective actions to prevent the loss of primary safety functions through the asset's service life.

- *Dry Storage Containers Aging Management Program:* The DSC Aging Management Program addresses aging mechanisms, such as corrosion, which could potentially affect DSCs. Current aging management activities include:
    - General visual check of the condition of the protective coating on the exterior of the DSC, with emphasis on the condition of the coating on the containment welds;
    - Periodic inspection and re-inspection of the base plates of a baseline population of DSCs;
    - Ultrasonic inspection of indications in the metal of the base perimeter flange; and
    - Monitoring of chloride levels which have the potential to accelerate corrosion.

    The aging management reports have yielded the following results:
    - Condition of the coating on the containment welds and the DSCs themselves remain in good-to-excellent condition. To date, very few areas on the containment welds have required re-coating (i.e. touch-up);
    - No change in the condition of the base plates between the time of their initial inspection and re-inspection that would have any impact on their ability to safely store the fuel. CNSC is provided with annual summary reports of these inspections; and
    - Measured chloride levels to date have a negligible effect on the potential corrosion of the DSC external surfaces.
- *DSC In Bay and Transfer Clamps Aging Management Program:* DSC In Bay and Transfer clamps have pre-operational checks prior to use as well as annual inspections (Visual and NDE).
- *Dry Storage Modules Aging Management Program:* During the current licence period, annual visual inspections of the Dry Storage Modules were performed. Twice annually, dose rates at the Dry Storage Modules are recorded, and surfaces checked for contamination, to confirm Dry Storage Module integrity. No loose contamination has been recorded to date. Dose rate measurements taken at the east and south fences of the Retube Component Storage area show no significant change over the current licence period.

    As part of the on-going aging management plan, the Dry Storage Modules with the higher contact dose rates are monitored to confirm Dry Storage Module integrity has not changed and contents remain in design configuration.

Planned Activities

The following activities are planned for PWMF to address aging, obsolescence and to ensure ongoing fitness for service of critical structures, systems and components:

- The last major modification on the welding system was in 2023 for installation of the new welding camera system along with trigger kit. Future upgrades include a new automated welding system which is expected to be in service by 2027.
- Transporters have been operating without any major issues. Future plans include engine replacement (newer smaller and more efficient engines) on the transporters starting in 2026. This will ensure reliable operation of these transporters for 10-15 years.

- Security system upgrades include Entry Control system, Security Monitoring system, Intrusion Detection and Closed-Circuit Tele-Vision (CCTV).
- Facility upgrades include HVU and HVAC refurbishment, vacuum cart replacement, LED lighting upgrades, Phase 2 supply transformer, Uninterruptable Power Supply (UPS), Standby generator, automatic transfer switch, crane refurbishment, and fire detection system upgrade (new SB3 booster panel and new PWMF fire panel).

2.7 Radiation Protection

Pickering NGS has an effective Radiation Protection (RP) program that meets all applicable regulatory requirements and related objectives.

The RP program, N-PROG-RA-0013, controls occupational and public exposure ALARA and prevents and monitors for the uncontrolled release of contamination or radioactive materials from the site through the movement of people and materials. The RP program includes a set of action levels to provide an alert before a regulatory dose limit is reached.

The OPG documents in the table below require written notification of change per Pickering NGS Licence Conditions Handbook, LCH-PR-48.00/2028-R007:

Table 32. SCA 7 – Pickering NGS Radiation Protection

Document Number	Document Title
N-PROG-RA-0013	Radiation Protection
N-STD-RA-0018	Controlling Exposure As Low As Reasonably Achievable
N-STD-RA-0044	Occupational Radiation Protection Action Levels for Power Reactor Operating Licenses
N-PROC-RA-0019	Dose Limits and Exposure Control
N-PROC-RA-0027	Radioactive Work Planning, Execution and Close Out
N-MAN-03416-10000	Radiation Dosimetry Program – General Requirements
N-MAN-03416.1-10000	Radiation Dosimetry Program – External Dosimetry
N-MAN-03416.2-10000	Radiation Dosimetry Program – Internal Dosimetry
OPG-PROC-0132	Respiratory Protection

2.7.1 Application of ALARA

ALARA is a foundational principle in RP. Radiation dose to all persons shall be kept as low as reasonably achievable, economic and social factors being considered.

ALARA is implemented at Pickering NGS in accordance with the OPG RP program. This program ensures compliance with regulatory requirements to keep exposures ALARA, implement control of occupational and public exposure, and plan for unusual situations. Notable elements of this program include:

- Limiting individual worker dose
- Managing dose as a resource

- Establishing facility design consistent with ALARA principles (as well as considering ALARA principles in any facility changes)
- Assessing hazards for planning and maintaining knowledge of conditions
- Planning and performing work to keep exposures ALARA and avoiding unplanned exposures
- Controlling the use of licensed radioactive devices and equipment

The Pickering NGS site ALARA strategy identifies initiatives, actions and programs that support achieving these objectives, and how the effectiveness of these initiatives are measured. The strategy applies to all Pickering NGS Units, whether the unit is operating (online), shutdown for planned maintenance, shutdown for safe storage, or refurbishment, and applies to all Pickering NGS personnel, contractors and visitors.

The ALARA department plays an important role in managing the station Collective Radiation Exposures (CRE) and ensuring it is ALARA by providing expertise and knowledge in dose reduction to work groups to minimize their collective exposure for every task they perform.

Frequent updates of department RP performance are communicated to the station with an optimized dashboard, highlighting key RP metrics, the latest RP events and the current status of the department's RP score. Departments are placed in various levels of oversight, depending on current RP performance and score.

The majority of annual station collective dose occurs during major planned maintenance outages. N-PROC-MA-0013, Planned Outage Management outlines key milestones required to be met prior to and following planned maintenance outages including a review of lessons learned identified during planning and execution. RP and ALARA stakeholders play integral roles in reviewing lessons learned from all outage campaigns. They contribute valuable insights to a report that consolidates these lessons, outlining a strategic plan for their implementation in future outages. Online projects follow the same process for capturing lessons learned, the integrated online work schedule provides guidance and timelines for implementation. Recent industry OPEX regarding neutron dose rates associated with irradiated reactor components has been captured and incorporated into future Pickering NGS reactor maintenance activities as well as full integration into OPG RP Program documentation.

Radiological Exposure Permits (REPs) are one of the primary administrative controls by which radiological work is planned and controlled. Radiological controls are applied to all hazard levels of radioactive work and a graded approach is applied to higher-risk work. Requirements to use full-scale mock-ups, and participate in training and simulations are in place to familiarize workers prior to execution to minimize dose during actual execution. Additional radiological controls also include stay time limits, stay timekeeping and remote dosimetry monitoring, to further reduce collective exposure.

The permitted dose and dose rate constraints are subjected to a thorough understanding of the workplace conditions based on radiological surveys and operating experience. In the latter, historical dosimeter records are periodically reviewed, and constraints are updated using industry guidance. Over the licence period, the use of dose constraints in OPG has ensured no internal Administrative Dose Limits (ADLs) or regulatory dose limits have been exceeded (for all sources of radiation).

N-STD-RA-0018, *Controlling Exposures As Low As Reasonably Achievable*, and N-PROG-MP-0001, *Engineering Change Control*, are interfacing processes that drive the use of tools and checklists for radiological safety to ensure a comprehensive, robust review is performed during the design phase of new designs or proposed engineering changes. These reviews help to understand how exposures can be eliminated or hazards reduced. When appropriate, the administrative controls within the RP program help bridge areas within the chosen design features. Extensive RP oversight has been present to support Refurbishment and Safe Storage to ensure that all radiological safety aspects have been considered for design changes, such as the setup and operation of the vacuum drying system. For example, the use of temperature elements with local readings was challenged, resulting in the use of Bluetooth-enabled displays that will greatly reduce the number of vault entries required.

Circumferential Wet Scrape Tool (CWEST), I-PLAN-30744-50002, *CWEST Training Plan*, was designed to replace conventional sampling tools used to conduct CANDU pressure tube inspections during planned maintenance outages. Periodic inspections of pressure tubes are required according to CSA standards and are typically performed each outage, contributing to the majority of outage collective dose. Since its implementation, CWEST minimized the required time spent at the reactor face, where dose rates are higher, and thus significantly minimized personnel exposure for pressure tube inspections. CWEST has achieved a 4-fold dose reduction compared to previous outages and has saved over 0.2 sieverts of dose during the licence period.

The ALARA program drives continuous improvement through annual self-assessments to align with industry best practices and the latest technological development that can be used to minimize dose.

Continuous improvement is also driven through the RP dashboard, which identifies early indicators in decline of department-level RP performance. Additional oversight is provided to improve performance and lessons learned are shared with other station departments to drive overall station RP performance improvements.

2.7.2 Worker Dose Control

Individual worker doses, including those for contractors and visitors, are managed to Exposure Control Levels (ECLs) that are below administrative control levels that are in turn below the regulatory limits. N-PROC-RA-0019, *Dose Limits and Exposure Control*, specifies requirements to manage dose within ECLs and ADLs to control any worker's dose below CNSC regulatory limits. During the licence period, ECL management has migrated to online interactive forms.

N-INS-08965-10012, *Requirements for Radiological Respiratory Protection*, and OPG-PROC-0132, *Respiratory Protection*, reference the requirements for the selection, care and use of respiratory protection. OPG-PROC-0132 identifies conventional respiratory protection requirements (e.g. fit testing) while N-INS-08965-10012 outlines RP program requirements.

Collective dose performance targets for each facility are established annually and consider the reductions achievable through the application of ALARA techniques. As work is planned in detail, collective dose projections are reviewed and actions are taken to ensure the dose is ALARA. Actual performance against targets is reviewed and corrective actions are taken where warranted. Management of collective dose is implemented in N-STD-RA-0018 *Controlling Exposure As Low As Reasonably Achievable*.

When making engineering changes, engineers and RP staff maintain or improve upon designs that reduce occupational exposures throughout the lifecycle of the facility, in accordance with N-PROC-MP-0083, Constructability, Operability, Maintainability, and Safety (COMS). Access to certain areas of the station that are subject to high radiation fields are strictly controlled using procedures and physical controls.

All radioactive work is planned and includes anticipation and evaluation of radiation hazards, selection of appropriate protective measures and dosimetry. The supervisor ensures persons assigned to the work will not exceed exposure control levels in the course of performing the work as planned. The requirements for planning and execution are implemented in N-PROC-RA-0027, Radioactive Work Planning, Execution and Close Out.

Radiation Personal Protective Equipment (RPPE) is provided for workers and used by workers based on anticipated exposure conditions and maintained in accordance with N-PROC-RA-0096, Lifecycle Management of Radiation Personal Protective Equipment. The procedures for usage of RPPE are implemented in N-PROC-RA-0025, Selection of Radiation Personal Protective Equipment.

Action Levels

Action levels are either a specific radiation dose or other parameter that, if reached, may indicate a loss of control of part of the RP program. Action levels for the PROL are provided in N-STD-RA-0044, *Occupational Radiation Protection Action Levels for Power Reactor Operating Licences.*

Any event that results in exceeding an action level is filed as an SCR in accordance with N-PROC-RA-0022, *Processing Station Condition Records*, and is reported to the CNSC within the required time frames. During the current licence period, there were two action level exceedances at Pickering NGS for internal dose. Both action levels were reported to the CNSC and corrective actions were taken. Changes to the RP Program were made after the event including revision to the tritium protection planning review form and Radiation Exposure Permits.

Radiological Hazard Surveys

Radiological hazard surveys are performed using approved instruments on both a routine basis and prior to the performance of radioactive work. The process for ensuring approved instruments are used, maintained and calibrated is implemented in N-PROC-RA-0066, *Lifecycle Management of Radiation Protection Instruments*.

As per the N-INS-09071-10009, *Requirements for the Calibration and Maintenance of Radiation Protection Instruments,* all RP instruments, fixed or portable, are calibrated at least once a year. Pickering NGS uses a software to track the maintenance and calibration of RP instruments through N-PROC-MA-0070, *Calibration of Field Equipment* and N-PROC-MA-0015, *Tool Control.*

Routine surveys are performed to support the early discovery of unexpected hazards and to identify longer-term trends in hazard conditions from all radioactive hazard sources. Airborne contamination monitoring is routinely carried out in order that hazards can be accurately assessed. In areas where variable high gamma radiation fields or high airborne radiological hazards could occur, area alarming monitoring equipment is provided, and set to warn against sudden unexpected increases in radiation levels, to prevent a significant acute dose to an individual. Hazard assessment is implemented in N-PROC-RA-0024, *Hazard Surveys Posting and Labeling*.

Bioassay and Reporting Doses for Workers

Through work planning, workers use dosimetry appropriate to the anticipated radiological hazard. The OPG Dosimetry program is documented in N-MAN-03416-10000, *Radiation Dosimetry Program – General Requirements*, N-MAN-03416.1-10000, *Radiation Dosimetry Program – External Dosimetry* and N-MAN-03416.2-10000, *Radiation Dosimetry Program –*

Internal Dosimetry. The criteria and methods for the use of radiation dosimetry are implemented in N-PROC-RA-0012, *Dosimetry and Dose Reporting*.

All workers are required to wear dosimetry and submit bioassay samples and perform Whole Body Counts (WBC) as required by procedures. The frequency of bioassay submissions and WBCs are determined based on the type of work performed. Electronic Personal Dosimeters (EPDs) are worn in conjunction with Thermoluminescent Dosimeter (TLDs) to record doses received while performing radioactive work. EPD dose is recorded in the Dose Management System (DMS) when the EPD is downloaded. This provides a record of the cumulative dose received by the worker. TLDs are collected and analyzed on a quarterly basis by the OPG dosimetry laboratory, operating in accordance with a CNSC Dosimetry Service License. Bioassay samples and other dosimetry (e.g., personal air samplers, extremity TLDs) are collected frequently and analyzed by the OPG dosimetry laboratory. Health Physics staff at site review all EPD dose, bioassay and WBC results as received and investigate any unusual results. All dose data is reviewed on a quarterly basis by the Dosimetry Health Physicist prior to submission to the National Dose Registry. Workers are able to obtain their dose status via the DMS. All worker exposure controls and limits are specified in DMS. Dose reports are sent to all individuals at year-end, to fulfill OPG's obligation to annually provide them with their dose status in writing, as required by the CNSC *Radiation Protection Regulations*.

Monitoring of Workers During Emergency Conditions

During a station emergency, all staff on site are required to report to designated assembly areas and to refrain from drinking, eating or smoking until RHP approval is granted. Frequent surveys are performed of the emergency assembly areas and personnel located there. Hourly habitability surveys are also performed at the Site Management Centre (SMC). During an accident or emergency, the Automated Source Term Gamma Monitoring System (ASTGMS) and Automated Near Boundary Gamma Monitoring Systems are available. ASTGMS provides remote gamma dose rates at incident airlocks and vacuum building. ASTGMS data is used for event categorization, adjustment of off-site dose projections, and associated on-site protective actions. Both Source Term and Near Boundary gamma measurement data are used by the Province to determine protective actions required in response to a potential radioactive release. The ASTGMS provides timely data collection, and determination of possible fuel damage and eliminates the requirement for manual Source Term surveys. The Health Physics Manager (HPM) in the Site Management Centre also reviews data from radiological survey teams, process system sample results, Fixed Area Gamma Meter (FAGM) readings and remote radiation area monitor trends. HPM also provides recommendations for on-site protective measures including issuance of potassium iodide (KI) pills, ongoing restrictions on eating and drinking and airborne on-site radiological controls. If there are suspected exposures or uptakes, the HPM arranges for expedited readout of bioassay samples or TLDs.

Radiation Protection Training and Qualification

All personnel working at a nuclear site are assigned an RP qualification level based on the successful completion of training. Personnel maintain their qualification through the successful completion of periodic continuing training and requalification. The requirements for achieving and maintaining qualification levels are documented in N-TQD-443-00001, Radiation Protection Training and Qualification. RP training is delivered in accordance with N-PROG-TR-0005, Training. Personnel performing radioactive work are either qualified to perform the associated RP activities, or there is an individual with the necessary qualification assigned to the work to provide RP for personnel performing radioactive work. The working rights and restrictions placed on each qualification level are specified in N-PROC-RA-0010, Facility Access and Working Rights (Radiological).

Key positions in the RP program organizations are given additional radiation protection-related training to become qualified to perform in their specialized positions within the program.

2.7.3 Radiation Protection Program Performance

The RP program direction is established in response to the results of monitoring and oversight and based on recommendations and feedback from site RP managers and other stakeholders. The RHP is accountable for ensuring that decisions regarding the RP program are technically consistent with sound RP practice and applicable regulations. The RHP approves the execution of specific key activities related to the RP program. The accountabilities of the RHP are documented in role document N-MAN-08131-10000, Sheet CNSC 031, *Responsible Health Physicist.* The Joint Committee on Radiation Protection provides a forum for communication between management and employee representatives on RP topics, and to develop recommendations to senior management for improvements in the RP program.

RP program self-assessments are conducted to identify opportunities for continual improvement and to confirm that work meets the requirements of the management system. Reviews of the RP program are conducted in accordance with N-PROC-RA-0097, *Self-Assessment and Benchmarking.*

Records generated by the RP program have an established retention period and are only destroyed when they exceed the retention period. Retention and disposal of records meet the requirements of CNSC regulations.

The effectiveness of the RP program with respect to radiological hazard identification and assessment can be measured using collective dose for the facility and compared against industry benchmarks and station targets. These targets are established based on the approved work scope for the year. In some years the target may be impacted from additional approved work activities to maintain high plant reliability.

Collective and individual doses were managed well below administrative and regulatory dose limits in the current licence term. OPG employs exposure control levels to ensure administrative limits are not exceeded.

The station sustained strong dose performance due to various factors, including strong equipment reliability, reduced radiological source term, low unit forced loss rate and implementation of dose reduction initiatives. Some key achievements in radiological hazard identification and assessment during the licence term include:

- Implementation of shielding on areas with elevated radiological hazards; the design was customized such that installation and removal time is optimized. This has short and long-term benefits which will be realized during subsequent unit outages.
- Implementation of portable containment driers to control airborne tritium hazards to supplement current plant drier systems; this reduces dose to personnel and the environment.

Overall, the effective identification and assessment of radiological hazards has continued to ensure high standards in ALARA work planning, execution, and close-out. ALARA initiatives, such as improved shielding, source term reduction initiatives and work methods improvements and efficiencies, contribute to year over year improvements in dose performance.

2.7.4 Radiological Hazards Control

The protected area (inside the inner security fence) of the station is divided into zones to facilitate the movement of personnel and materials and control access to areas where radioactive systems are present. Indoor areas of the station are divided into three zones (Zones 1, 2 and 3) based on the presence of radioactive systems and the potential for radioactive contamination in each area. Outdoor areas at ground level within the security perimeter, but outside the powerhouse are referred to as 'Unzoned Areas'. Boundaries of the zones are marked and the RHP approves changes to the boundaries. All materials released into Zone 1 or the public domain are monitored for contamination. Certain areas within the protected area are designated as clean laydown areas for materials that are contamination-free and awaiting shipment off-site.

The general processes for moving people and materials within and out of radiological zones and the actions to be taken when contamination is discovered are documented in N-PROC-RA-0014, *Radiological Zoning, Personnel/Material Monitoring*. Workers moving through the radiological zones monitor themselves and material as required when crossing zone boundaries (depending on the direction of travel) and at other designated monitoring points. Loose contamination is not tolerated within the zones except within establish contamination control areas in accordance with N-PROC-RA-0015, *Contamination Control While Performing Work* to control anticipated radioactive contamination. If workers detect contamination through monitoring processes, then all efforts are taken to limit the spread of contamination, take action to identify the source of contamination and ensure that it is contained or removed when found.

The requirements for transferring inactive material and material containing naturally occurring radioactive material under a permit are documented in N-PROC-RA-0124, *Transfer of Materials from Radiological Zones to Zone 1/Public Domain*. When approving the monitoring methods for determining that material is inactive, OPG meets the constraints specified in N-STD-RA-0029, *Unconditional Clearance of Low-Level Radioactive Materials from OPG Regulated Facilities*.

Trained and qualified personnel utilize portable instrumentation to provide relevant job-site-specific hazards assessments for the safe conduct of work activities. Day-to-day conditions are routinely monitored by these trained personnel as well to ensure conditions are stable and controlled. The results of hazards are communicated to all workers in the facility through local hazard postings and electronically logged for reference in a common database. This information is used to provide a thorough assessment and plan prior to work execution. The common goal is to ensure work activities are predictable and doses to personnel and the public are kept ALARA.

Enhancements and Methods for Improved Radiological Hazards Control

The following outlines the various enhancements and methods OPG implements with respect to improving radiological hazard control.

Advanced Radiation Instrumentation

Use of advanced radiation instrumentation provides visuals for updated radiological hazards. These updates can support advancements in work planning assessments and worker knowledge of radiological hazards. For example, Pickering NGS utilizes a gamma spectroscopy instrument which visually identifies areas of the station that that can have high radiation levels. This supports shielding areas of the plant to lower collective radiation exposure to workers.

Dose Reducing Resin in Heat Transport Ion Exchange Columns

Dose-reducing resin has been used in the Primary Heat Transport Ion Exchange Columns to lower dose rates from the system. This resin has a higher affinity for capturing key source term radionuclides, including Co-60.

Improved Shielding

Specialized shielding, tooling and training have been utilized for several years for fuel channel and boiler inspection outage work programs which have contributed to lower collective radiation exposures. For example, for boiler inspections, Pickering NGS has custom shielding for the size and shape of the Pickering NGS' boilers internal surfaces. In addition, Pickering NGS has recently started 3D printing custom shielding in-house, which has been used in areas such as the reactivity mechanism decks and fuel handling areas.

Real-Time Hazard Monitoring with Remote Instrumentation

Remote instrumentation is used to provide real-time hazard information to staff. This information is displayed directly outside certain radioactive work areas, through dedicated software available to qualified workers and supervisors, and includes historical logs for detailed reviews and trending. When applicable, approved radioactive work plans mandate the use of remote instrumentation such that detailed area hazard maps can be used to optimize personnel exposure conditions during radioactive work activities. This is important for activities that present elevated risks or when multiple areas could be impacted. Monitoring of this instrumentation is conducted by personnel who often have a direct line of sight to personnel at the work site through a dedicated audio and video system. When possible, robotic equipment is used by operations staff to reduce exposure during on-power entries and allow for searches in areas previously inaccessible. For example, the reactor vaults are normally inaccessible while on-power; however, in 2022, an on-power entry was performed with a robot entering the vault to evaluate the Unit 1 Fueling Machine bridge. In addition, in 2023, drone entries into the Unit 5 vault were used to conduct inspections of the vault air conditioning units. Dose savings from robotics for the past licence period have saved more than 0.5 sieverts of dose.

Internal/External Operating Experience (OPEX)

Pickering NGS makes use of relevant CANDU operations outside of OPG with its participation in COG. Conexus Nuclear Inc. actively collaborates with other CANDU organizations around the world to advance nuclear technologies, including successful RP programs. A recent Conexus Nuclear Inc. Radiological Protection Task Force has collectively agreed to address management of tritiated hazards, based on common CANDU plant experiences. External and Internal operating experience reviews are completed for relevant radiological applications. This includes the disposition of how relevant internal and external plant experiences may help shape radiological hazard identification and assessment during routine and abnormal plant operations.

The organizational drive for continuous improvement within RP is also observed through the site's interface with the broader nuclear industry, including international organizations whose common goal is excellence in operational nuclear safety. This is manifested in the RP program through its active internal self-assessments which focus on understanding how industry best practices can be incorporated, supplemented by industry peer review evaluations, which provide an unbiased perspective to the site's RP performance.

Additional Methods for Improving Radiological Hazards Controls

- Characterization studies are independently performed by an approved vendor and verified by OPG to ensure the hazards identified remain within their predicted operating envelope.
- Periodic review of industry standards are performed to ensure alignment and best practices for dose control events. Pickering NGS has updated the processes for establishing oversight of radiological work. The process for workers using specialized dose tracking technology has been improved to ensure there is accountability for monitoring radiological dose during work execution.
- Task specific dose goals are used to anticipate external gamma dose prior to performing radiological work. During a pre-job brief, workers and supervisors discuss the time, distance, and shielding applicable to their assigned work activity. This form of communication is considered fundamental during the work planning and execution processes.
- OPG maintains an instrumentation lifecycle management process. Pickering NGS is currently updating instrumentation in support of personnel monitoring as a result of lifecycle management. Status reports are completed on the health of radiation instrumentation to track emerging issues and trends. In addition, Pickering NGS has recently received a new handheld gamma spectrometer with neutron detection, which is being assessed for several uses, such as characterizing contaminated material.
- Routine radiological surveys are performed in the facility at a frequency sufficient to prevent the prolonged presence of an unknown condition in accessible, normally frequented areas. A review of these surveys is performed to ensure there are no unexpected radiological hazards. Dynamic Learning Activities (DLAs) engage facilitators and observers to examine how workers use their skills and knowledge while performing activities in a simulated environment (e.g., mock-up). The activities reflect plant conditions as realistically and authentically as possible within a non-radiological environment. A DLA can be used to improve worker proficiency, work processes and procedures. Recent DLAs for radiological protection have included contamination control and radiological hazard identification.

2.7.5 Pickering NGS Units 1 to 4 Decommissioning

This section provides additional information regarding the Radiation Protection SCA with respect to Units 1 to 4 decommissioning. It is intended to supplement the information provided in the general SCA discussion above and therefore only addresses those specific areas where additional decommissioning-related details are needed.

The RP Program for Decommissioning will be in compliance with N-PROG-RA-0013, *Radiation Protection* and its implementing procedures.

The existing program for surveying and zoning the facility will be followed, and non-routine activities resulting from decommissioning will be identified and dose limits will be outlined in accordance with ALARA.

Facility dose target setting will continue to be developed and approved in accordance with N-PROC-AS-0078, *Nuclear Performance Monitoring and Reporting*. ALARA plan development for stabilization activities follows the work management milestone process as described in P-PROC-06931-00001, *Storage Execution Planning Management*. ALARA plans have been created for stabilization activities, such as Primary Heat Transport dewatering.

Unit 1 defuel was completed in February 2025, and Unit 4 defuel was complete in June 2025. Radiological hazards during defueling activities are expected to be comparable to that of a refurbishment unit undergoing defuel. OPEX from Darlington NGS refurbishment and Pickering NGS outages have been used to develop routine radiological surveys used for hazards. Hazard monitoring during defueling will include tritium, gamma, iodine, and airborne particulate surveys in boiler rooms as well as real-time monitoring in the accessible areas of the reactor building and airborne particulate monitoring in the IFBs.

One aspect of the RP program that will change during decommissioning is provisions supporting the Access Control System. Radiological hazards will remain after a unit is defueled. However, the access hazards, those involving high radiological fields associated with reactor operation, irradiated fuel and Fuel Handling operation which form the basis for the need for the Access Control System, will no longer be present in the Reactor Building and cannot be reintroduced.

The vast majority of all radioactive work performed at Pickering NGS is not performed in access-controlled areas and the processes outlined in the RP procedures provide adequate guidance and controls and will continue to do so once the Access Control System is suspended. The *Radiation Protection* program and its procedures will remain in effect. Access by persons to the radiological zones will continue to be controlled and all radioactive work, dosimetry and control of radiological hazards will be governed and controlled by the RP procedures. The only change will be the removal of current areas specifically designated as “access controlled” due to the presence, or potential introduction of access hazards.

Access control will be in effect for the duration of defueling which will restrict parts of the boiler room, Fueling Machine Vaults and Fueling Machine Service rooms in accordance with P-INS-09071-00002, *Access Control*. During the dewatering stage, additional radiological hazards will be introduced as the primary HTS and moderator systems are drained. The bulk of the radioactive work and the majority of the dose accrued will be completed during this stage. Routine radiological surveys have been established to address the potential increases in tritium from these activities as well as the potential for changing gamma hazards. Real-time gamma monitors will be set up throughout the boiler room, and moderator room as well as accessible areas of the reactor building during draining activities to monitor for hot spots or increases in gamma dose rates. Radiological surveys have been established at various stages of the dewatering campaign to monitor for gamma, neutron, tritium and airborne hazards. The purpose of these surveys is to identify and respond to changing conditions in accordance with RP procedures.

All radioactive work during decommissioning will be assessed. Work order review and Radiation Exposure Permit assignment for tasks will be performed in accordance with P-PROC-06931-00001, *Safe Storage Execution Planning Management* and N-PROC-RA-0027, *Radioactive Work Planning, Execution and Close Out*.

Routine alpha surveys will be conducted at various stages of safe storage to monitor for changing alpha ratios and to confirm the alpha levels that will be established at the beginning of the campaign. It is expected alpha to beta/gamma ratios will change especially with the heat transport/fuel handling systems once defueling is complete. Workplace monitoring, RPPE selection and dosimetry considerations for alpha areas will be performed in accordance with N-INS-09071-10013, *Workplace Alpha Contamination Monitoring and Control.*

2.7.6 Pickering NGS Units 5 to 8 Refurbishment

This section provides additional information regarding the Radiation Protection SCA with respect to Units 5 to 8 refurbishment. It is intended to supplement the information provided in the general SCA discussion above and therefore only addresses those specific areas where additional refurbishment-related details are needed.

The RP Program for refurbishment will be in compliance with N-PROG-RA-0013, *Radiation Protection* and its implementing procedures.

Refurbishment will be executed in a manner consistent with OPG's safety values and objectives, as well as best industry practices. OPG RP field staff will provide oversight to EPC contractors and will ensure that OPG RP program requirements are met. EPC contractors will follow OPG RP procedures for refurbishment activities including compliance with the OPG's RP action levels and ADLs for Pickering NGS.

Lessons Learned from Darlington NGS OPEX is actively incorporated into Pickering Refurbishment planning. The Darlington RP team received the John Hewitt award in 2021 in recognition for innovations in tooling/equipment, shielding and RPPE which resulted in a 38% dose savings to vendor partners and OPG workers involved in the refurbishment of Darlington NGS Unit 3. RP staff who previously worked on Darlington Refurbishment have been assigned to Pickering Station to facilitate planning for refurbishment pre-requisite activities.

The refurbishment project will develop and implement strategies during the execution of refurbishment, such as:

- Controlling or eliminating radiation hazards and implementation of shielding to reduce collective dose;
- Routinely analyzing and reviewing radiological source terms associated with major systems and components likely to interface with the refurbishment; operations, in order to minimize the possibility of unforeseen radiation hazards;
- Ensuring contamination control is adequately addressed in tool, equipment, and process designs;
- Performing thorough review of plans to achieve dose reduction and minimization;
- Ensuring lessons learned from the first outage experience are documented and applied to subsequent outages to further reduce collective doses;
- Monitoring refurbishment work scope that may provide dose reduction benefits for continued operations, such as closure plug redesign, reactor component crud removal, radiation hot spot removal/remediation, and breathing air upgrades; and
- Ensuring Darlington Refurbishment OPEX is incorporated into Pickering Refurbishment, for example enhanced measures for the monitoring, control and assignment of neutron doses associated with reactor components.

Extensive RP oversight has been present to support Refurbishment activities to ensure that all radiological safety aspects have been considered for design changes, such as planning for the removal of steam generators and zoning changes, which include the setup and operation of Refurbishment and Common Services Satellite buildings.

2.7.7 Pickering Waste Management Facility

The OPG documents in the table below require written notification of change per PWMF Licence Conditions Handbook, LCH-W4-350.00/2028 R003:

Table 33. SCA 7 – PWMF Radiation Protection

Document Number	Document Title
N-STD-RA-0045	Occupational Radiation Protection Action Levels for Nuclear Waste Management Facilities
N-PROG-RA-0013	Radiation Protection
N-PROC-RA-0010	Facility Access and Working Rights (Radiological)
N-PROC-RA-0012	Dosimetry and Dose Reporting
N-PROC-RA-0019	Dose Limits and Exposure Control
N-PROC-RA-0024	Hazard Surveys, Postings, and Labelling
N-PROC-RA-0027	Radioactive Work Planning, Execution and Close Out
N-INS-09071-10009	Requirements for the Calibration and Maintenance of Radiation Protection Instruments
N-MAN-03416-10000	Radiation Dosimetry Program – General Requirements
N-MAN-03416.1-10000	Radiation Dosimetry Program – External Dosimetry
N-MAN-03416.2-10000	Radiation Dosimetry Program – Internal Dosimetry

OPG has implemented and maintains a RP program, which includes a set of action levels. The RP Program is implemented through a series of standards and procedures for the conduct of activities within nuclear sites and with radioactive materials including the PWMF as described in Section 2.7.

The following subsections describe aspects of the PWMF RP program.

Management Control over Worker Practices for Dose and Contamination Control

Performing radioactive work within PWMF requires a systematic approach and is managed via the OPG RP program, which includes the following processes:

- Limiting individual worker dose.
- Managing dose as a resource, in terms of constraints on work activities.
- Establishing facility design consistent with ALARA principles.
- Assessing hazards for planning and maintaining knowledge of conditions.
- Controlling the use of licensed radioactive devices and equipment, and
- Planning all radioactive work, taking into account personnel, engineering controls, procedures, supervision, and the physical environment of the job.

The planning process includes the anticipation and evaluation of radiation hazards and the selection of appropriate protective measures and dosimetry. The degree of formalization of the planning process and the approval levels for a job are proportional to the potential for exposure. Plans include backout conditions and contingencies. RP planning decisions are documented in a radiation exposure permit.

Radioactive contamination controls are in place to reduce occupational and public exposure, and to minimize the release of radioactive materials to the environment. The objectives are to prevent a loss of radioactive contamination control, to minimize the area affected if contamination occurs, and to restore the condition to acceptable levels as soon as possible.

Radiation Protection Program Monitoring and Oversight at PWMF

Established performance indicators include RP Program effectiveness measures commonly used in the nuclear industry and OPG defined indicators established for the purpose of monitoring particular program elements. These are captured in OPG's Electronic Performance Reporting systems as well as key performance indicators and RP report card. Specific measures include personnel contamination incidents, regulatory infractions, as well as dose performance versus dose targets. During the current licence period, enhanced health physics oversight has been available. In addition to Fleetview reporting and assessments, the design and execution of the RP Program is subject to ongoing monitoring through mechanisms including but not limited to:

- Management review and assessment which includes:
  - Joint Committee on Radiation Protection, and
  - Monthly Management Oversight Meetings.
- Exceptional dosimetry and dose control device measurement results.
- Dose trends.
- Annual review of ALARA targets.
- RP program self-assessments and independent audits.
- Observations and coaching.
- Investigation of events in which an Action Level has been exceeded, trending, benchmarking, and review of industry operating experience.

Dose and Contamination Control

During the reporting period there have been no action level exceedances related to worker dose at PWMF or any loss of contamination control events in excess of PWMF's contamination control action levels. The current action levels for dose to workers and for contamination control are provided in N-STD-RA-0045 *Occupational Radiation Protection Action Levels for Nuclear Waste Management Facilities*.

During the current licence period, there has been increased radiological reporting as a result of incorporation of CNSC REGDOC-3.1.2 *Reporting Requirements, Volume I: Non-Power Reactor Class I Nuclear Facilities and Uranium Mines and Mills.*

Collective Dose and Maximum Individual Dose per Year for NEW

OPG's administrative limits include two control levels for exposure: (1) the Exposure Control Level is 10 mSv/year, and (2) the ADL is 20 mSv/year. Exposure control levels are set below administrative control levels, which are in turn below the regulatory limits. Figure 26 shows the OPG individual exposure control level of 10 mSv (1 rem) per calendar year is significantly below the single year regulatory limit of 50 mSv (5 rem) in a year, and the five-year regulatory limit of 100 mSv (10 rem) over five years for a NEW.

Doses are maintained ALARA, taking into consideration socio and economic factors) through the use of engineered barriers, work planning and use of exposure control levels for NEWs.

OPG's contamination control sub-program continues to be in full compliance with regulatory requirements. Facility targets are set annually, based on DSC throughput and other operations, and communicated in Annual Compliance Reports (ACR).

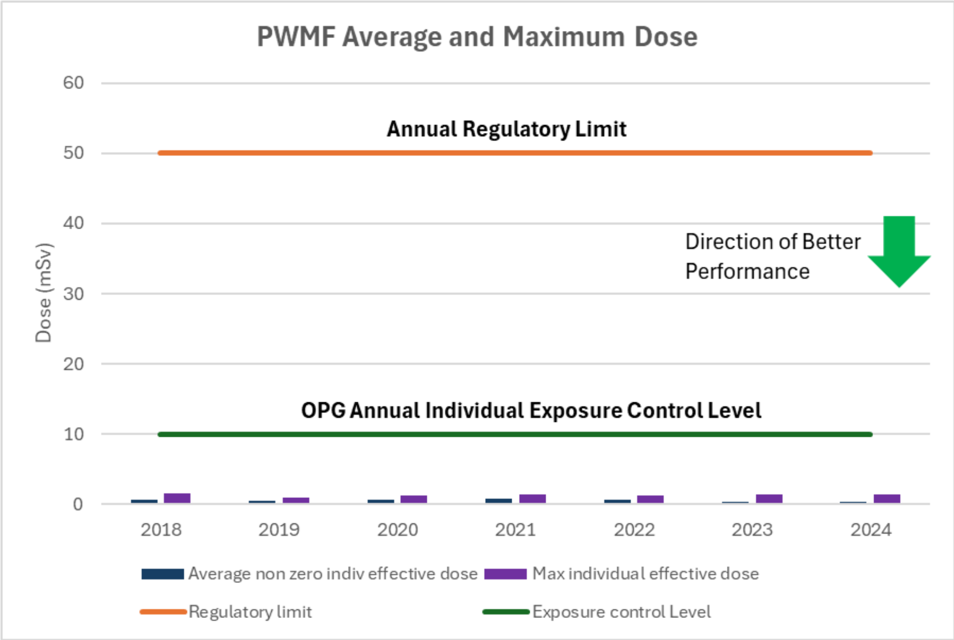

Figure 26. Average and Maximum Dose at PWMF

PWMF Perimeter Dose Monitoring (non-NEW)

Environmental Thermoluminescent Dosimeters are mounted on the perimeter fence of the PWMF on Figure 27 and Figure 28 and are changed and analyzed quarterly. The Thermoluminescent Dosimeters are located on the perimeter fence – demarking the limit of approach for a non-NEW. Data is reported to the CNSC in the PWMF Quarterly Operations report. Target Dose Rates for these locations is to be less than 0.5 µGy/h (air kerma rate).

A dose rate of 0.5 µSv/h (or 0.5 µGy/h for air kerma) for 2,000 hours of exposure would result in a dose to the public of 1 mSv, the regulatory annual limit. Dose rates at the PWMF non-NEW boundary have historically been well below the derived dose rate target of 0.5 µ Sv/h, with an average value of 0.11 µSv/hr or 22% of the target measured in 2024. The maximum potential dose at the site boundary over the course of a year to a member of the public is well below the regulatory annual dose limit of 1 mSv for a member of the public.

All measured dose rates have been below target. Annual performance is reported as the average of all dose rates.

Note: The following figures show the general arrangement of Thermoluminescent Dosimeters around the Pickering Waste Management Facility sites. The drawings are not to scale since they are for Thermoluminescent Dosimeters layout information only.

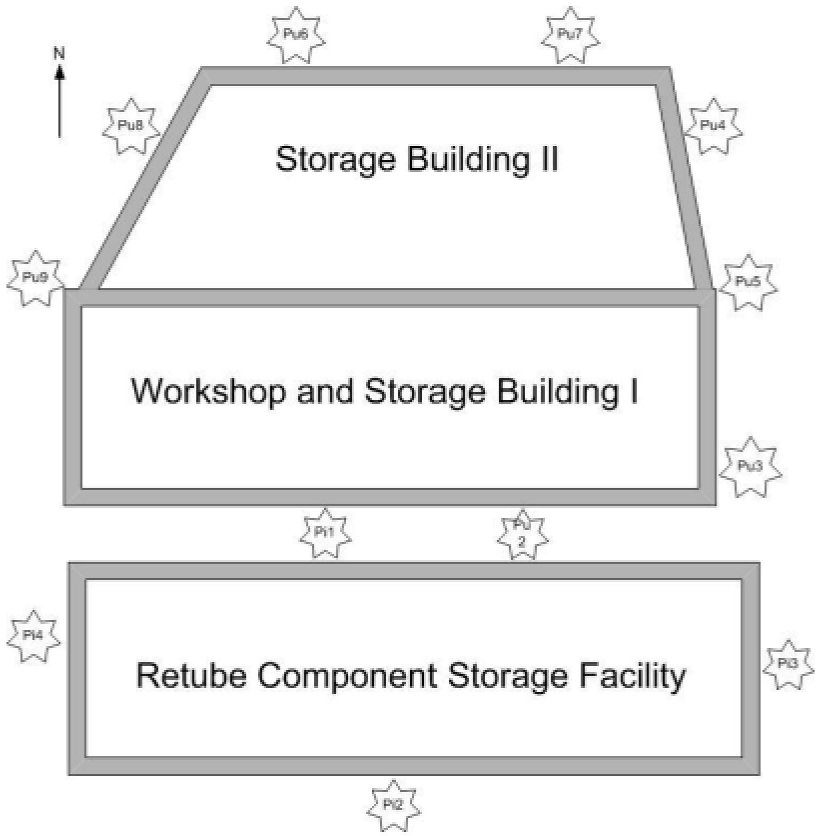

Figure 27. Thermoluminescent Dosimeter Locations around the PWMF Phase I site.

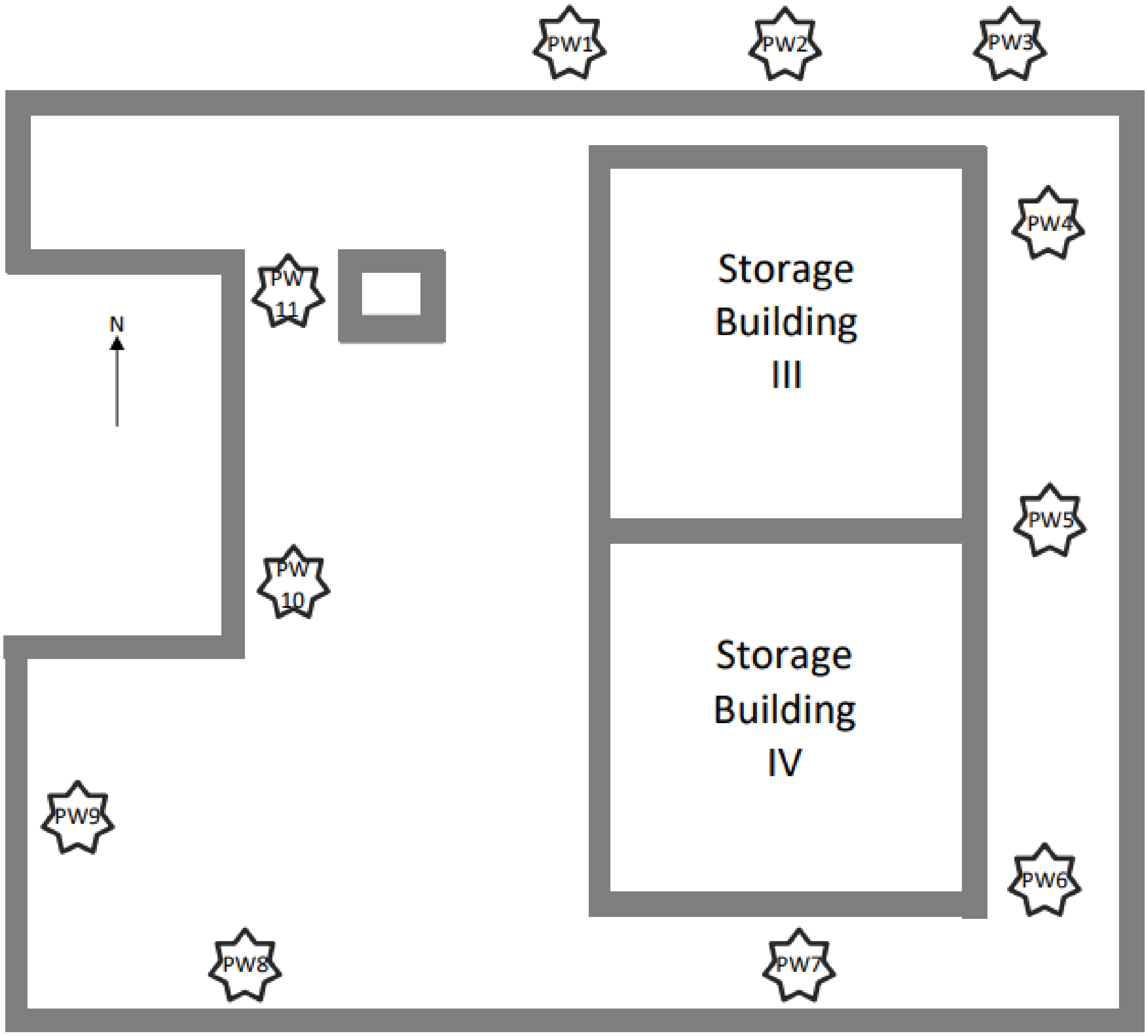

Figure 28. Thermoluminescent Dosimeter Locations around the PWMF Phase II Site

Dose monitoring plans for future buildings will be established in accordance with OPG's RP Program.

From 2018 to 2024 there were three events reportable to the CNSC at the PWMF related to RP. In each case, immediate action was taken to resolve the condition and as practical recurrence control actions were implemented.

During the current licence period, routine self-assessments were conducted and improvement actions were taken to achieve best in class performance.

Planned Activities

RP has plans to review the radiological surveys program to assess frequency and scope. As part of Pickering Refurbishment planned activities, Health Physics is looking to deploy state of the art neutron dosimetry (e.g. Starlite) and will be reviewing additional radiological instrumentation for neutron detection purposes. Enhancements to automated report preparation using data analytic tools (such as PowerBI) or other in-house applications are being pursued to support CNSC REGDOC-3.1.2 deliverables.

Any new structures and system modifications will adhere to the RP program.

2.8 Conventional Health and Safety

OPG is committed to preventing workplace injuries, optimizing health, and continuously improving employee health and safety performance. The foundational document that upholds this commitment is the *Employee Health and Safety Policy*, OPG-POL-0001. The Health and Safety Policy describes OPG's approach to Conventional Health and Safety for the organization and outlines the requirements and accountabilities of all employees to uphold this commitment.

OPG's program OPG-PROG-0005, *Environment Health and Safety Managed Systems* and its supporting governance documents establish operating standards and process requirements for health and safety risk identification, elimination, and where not possible, mitigation or reduction. It also prescribes the roles and responsibilities of various entities and individuals at all levels in the organization to ensure the activities described above are performed to meet the requirements of OPG's *Health and Safety Policy*.

The Environment Health and Safety Managed Systems (HSMS) includes:

- Occupational conditions and factors that could affect the health and safety of workers in all workplaces, or work-related activities under OPG's control.
- Non-occupational health-related conditions and factors that could affect the health of OPG's workers, which impacts the achievement of OPG's business objectives.
- Contractor health and safety.

The goal of OPG's Conventional Health and Safety program is to ensure a healthy and injury-free workplace by managing risks arising from all aspects of activities that support the safe operations of Pickering NGS.

Risk reduction activities occur across multiple levels. These begin with strategic enterprise risk registries and extend to detailed risk management in work planning. Building resilience to risk is a function of cultivating a competent and proficient workforce and maintaining meticulous safe work planning practices. This approach ensures the implementation of redundant controls capable of mitigating human error and achieving safe outcomes across all aspects of OPG's operations.

OPG's HSMS program ensures alignment with internal and external specifications or standards such as N-CHAR-AS-0002, Nuclear Management System, and is structured in accordance with the requirements of International Organization for Standardization (ISO) 45001, *Occupational Health and Safety Management System*.

The OPG documents in the following table require written notification of change per Pickering NGS Licence Conditions Handbook, LCH-PR-48.00/2028-R007:

Table 34. SCA 8 – Pickering NGS Conventional Health and Safety

Document Number	Document Title
OPG-POL-0001	Employee Health and Safety Policy
OPG-PROG-0005	Environment Health and Safety Managed Systems
N-PROG-MA-0015	Work Protection
OPG-PROC-0132	Respiratory Protection

2.8.1 Performance

OPG staff engagement in personal safety and associated initiatives and programs has instilled behaviours within the organization that have contributed to performance free of lost time injuries since 2021.

Pickering NGS continuously strives for excellence and continual improvement in our Health and Safety performance. Health and Safety has focused efforts on benchmarking with industry leaders; and based on these benchmarks, OPG has introduced new initiatives and programs to support continual improvement in Conventional Safety.

OPG's vision has been to cultivate a value-based culture. A value-based culture means the company's fundamental beliefs are at the heart of everything it does, starting from safety, as OPG's top value.

Health and Safety culture at OPG has been further strengthened through the station advocacy observation and coaching program. This initiative has been instrumental in building a self-critical, healthy, and engaged workforce.

OPG's Fail Safe strategy drives continuous improvement of OPG's performance in HSMS and human performance. It relates to the concept that OPG's programs have built-in protections (capacity) against significant injury and consequences, even in the event of employee error or equipment failure. OPG's Fail-Safe approach to safety and human performance is proactive and focuses on building a resilient organization.

During the current licence term, Pickering NGS has demonstrated excellent safety performance throughout its operations. Below are a few examples:

- Pickering NGS Serious Injury Incidence Rate (SIIR) has remained at zero for the past 3 consecutive years. The SIIR is defined as the number of work-related accidents for all OPG employees that result in serious injuries or fatalities, per 200,000 person-hours worked. This metric focuses on more serious injuries, assists in maintaining attention on high-consequence hazards, and accounts for the actual injury instead of the type of medical treatment.
- Over the last 3 years the Pickering NGS reached 11 million hours without a lost time accident. 2021 represented the best Total Recordable Injury Frequency (TRIF) performance with 0.10.
- OPG has been awarded the Electricity Canada President's Award for Excellence in Employee Safety nine times in the last 10-years. The award recognizes OPG's achievement of being in the top quartile for both all injury/ illness frequency and lost time injury (LTI) severity rates.

- The Timely Completion of Safety Corrective Actions (TCSCA) was introduced by OPG as a leading indicator to create transparency and accountability in the corrective actions stemming from significant events and audit findings. The TCSCA is measured in percentage, which factors in number of actions completed with extensions or days late. From 2019 to 2024, Pickering NGS has remained at 100%, completing all actions on time.

Safety Performance Indicators (SPIs) for Conventional Health and Safety such as Accident Frequency Rate (AFR), Industrial Safety Accident Rate (ISAR) and Accident Severity Rate (ASR) are reported to the CNSC quarterly per CNSC REGDOC-3.1.1, *Reporting Requirements for Nuclear Power Plants*. OPG's commitment to continuously improve performance is reflected by setting challenging targets for safety performance metrics.

Accident Frequency Performance

Previously, OPG measured safety performance using All Injury Rate (AIR) as a metric. Accident Frequency (AF) is the sum of the fatalities, lost-time injuries and medically treated injuries multiplied by 200,000 person hours works at a Nuclear Power Plant, per exposure hours. In the context of this application, AF is the same as AIR.

In 2018, AIR was changed to measuring TRIF to align with Canadian industry benchmarks. TRIF includes restricted work injuries (RWI), however since the conversion, OPG has not yet had a RWI, leaving AIR, TRIF, and AF virtually equivalent to one another. From 2018 to 2023, Pickering NGS has shown a strong performance for AF. Overall, there is a downward trend in AF/TRIF. Strong AF performance is expected to continue as OPG continues to drive health and safety program enhancements such as Fail Safe which aim to shift our mindset to proactively identify where we have strong defenses and barriers in place to prevent consequential events.

OPG's Darlington NGS Refurbishment Project has maintained an exemplary safety performance to date, upholding the highest industry standards throughout its execution. Safety performance on the project continues to be better than the average construction industry performance in Ontario. Programmatically, OPG has implemented the Fail-Safe methodology that attempts to build capacity by adding defenses in a layered approach with the mindset to reduce risk and chance of injury to the worker. The Pickering NGS Refurbishment Project will implement all OPEX and Lessons Learned from the Darlington NGS Refurbishment Project to ensure continuous improvement and the highest standards of safety, efficiency, and performance.

Industrial Safety Accident Rate (ISAR)

The ISAR is a frequency rate based on the number of lost-time injuries for OPG Nuclear Power Plant personnel per 200,000 hours worked.

The Pickering NGS has maintained a consistent record of zero lost time injuries from 2021 as shown in Figure 29. There was one LTI in 2021 as a result of slip and trip injury due to ice. All incidents were reviewed, and lessons learned were reinforced.

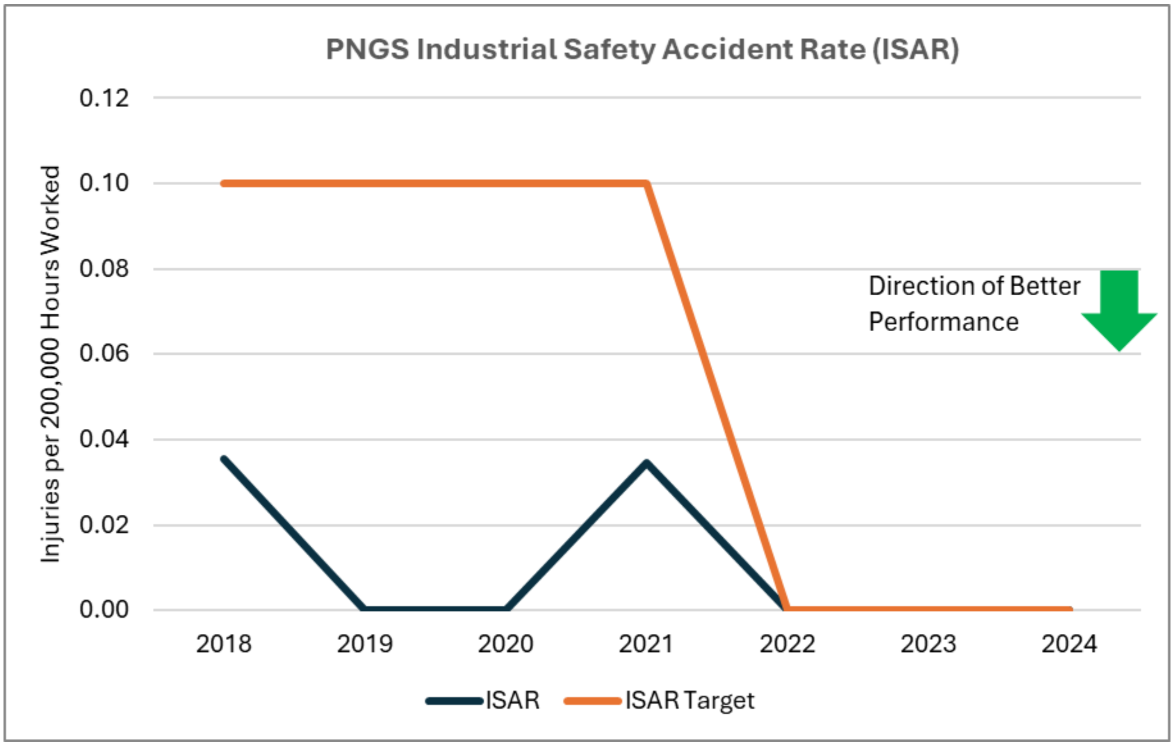

Figure 29. Pickering NGS Industrial Safety Accident Rate (ISAR)

Accident Severity Rate (ASR)

The ASR is the number of days lost multiplied by 200,000 person hours worked at a Nuclear Power Plant, per exposure hours.

Pickering NGS has upheld a consistent record of zero lost time injuries, resulting in top quartile performance in the Canadian utility generation sector for ASR. There are no targets set for ASR.

2.8.2 Health and Safety Management (Practices and Awareness)

Occupational Health and Safety Act (OHSA) and Corporate Safety Rules

OPG is committed to upholding robust workplace health and safety practices aimed at managing risks for both employers and workers. To fulfill this commitment, OPG has established the OPG Corporate Safety Rules (OPG-STD-0144), ensuring compliance with or exceeding applicable health and safety legal obligations mandated by the OHSA and applicable regulations (*Occupational Health and Safety Ac*t, R.S.O. 1990, c. O.1).

Health and Safety Management System

Continuous improvement opportunities for OPG's HSMS program are identified using a "Plan-Do-Check-Review" management cycle. The objective is to ensure conventional health and safety risks, work practices and conditions are appropriately managed to achieve a high degree of employee safety. Our Compliance Assessment functions to monitor KPI by conducting field assessments, document reviews and interviews with stakeholders to help identify systemic issues before they result in safety events and/or injuries.

Pickering NGS Joint Health and Safety Committee

To further enhance worker safety, the Pickering NGS Joint Health and Safety Committee (JHSC) has been established to work cooperatively to improve health and safety in the

workplace, as set out in the OHSA. One of Pickering NGS's goals is to have healthy people working safely in an accident-free environment.

In addition, a Building Trades Union JHSC has been established, which supports contractors supporting construction and project work on site; both unions work co-operatively to support their respective workers.

Internal Responsibility System

The Internal Responsibility System (IRS) is a system applied consistently throughout OPG, where everyone has personal and shared responsibility for working together cooperatively to prevent occupational injuries and illnesses. The duties for a healthy and safe workplace fall on every individual, to the degree they have authority and ability to do so. Each person is expected to take the initiative on health and safety issues, work to solve problems, and make improvements on an on-going basis.

Employees are encouraged to raise their concerns and bring potential safety issues forward to ensure that hazards are addressed promptly and effectively. As part of this system, employees have the right to refuse work if they believe it poses an undue health or safety risk to themselves or others. This right is protected and is integral to the governance of the system. Management and leadership are committed to listening to these concerns and resolving them in a timely manner, in alignment with the core principles of the IRS.

Incident Investigation

N-STD-RA-0008, *Incident Investigation,* provides a systematic and consistent approach for evaluating adverse conditions at OPG Nuclear stations including determining the cause of an adverse condition or event and developing effective corrective actions to eliminate or reduce the probability of similar events occurring in the future.

Work Protection

The *Work Protection* program is governed by N-PROG-MA-0015 which describes requirements that are in place within OPG Nuclear to isolate and de-energize equipment to ensure worker safety. For more details on the *Work Protection* program, refer to Section 2.3.1.

Respiratory Protection

Respiratory Protection, OPG-PROC-0132, describes the requirements for the selection, care and use of respiratory protection. For more details on *Respiratory Protection*, refer to Section 2.7.2.

WHMIS

OPG is compliant with Workplace Hazardous Material Information System (WHMIS) 2015 and has processes in place for the management, handling, and storage of hazardous materials to ensure regulatory compliance and to ensure workers have information to safely work, store and dispose of hazardous materials in the workplace.

Training

The Nuclear Conventional Safety Training and Qualification document describes required Initial and Continuing Conventional Safety Training and related qualifications for all major job families and contractors.

Environmental Health and Safety Audits and Assessments

OPG-PROC-0044, *Environment Health and Safety Audits and Assessments,* establishes the methodology, frequency, responsibilities, planning, and reporting requirements for internal and compliance audits on the effective implementation and maintenance of the Environment Health and Safety Managed Systems, in accordance with applicable ISO standards and other regulatory requirements.

2.8.3 Safety Enhancements and Areas of Strength for the Future

Several health and safety improvement initiatives have been implemented at Pickering NGS as part of the continuous improvement cycle of the HSMS. These initiatives remain on-going which include:

- Implementation of *Fail-Safe Culture Change* initiatives, is a culture shift that recognizes that human error can occur, and ensuring when that happens, the individuals are protected. It is a shift in mindset to proactively identify whether the defences in place are sufficient. The initiative has been incorporated into safe work planning, work execution, and event learning. This provides the platform to further improve OPG's safety program. OPG has introduced industry accepted hazard assessment tools including the energy wheel, to better identify hazards in the planning stage to eliminate, control and ultimately protect workers against workplace hazards.
- Continue the adoption of the *Safety Classification and Learning Model (SCL).* The SCL model will allow OPG to take its safety performance to the next level by vastly increasing the number of learning opportunities from events and to better characterize our safety performance. Currently, SCL is being implemented in the following ways at Pickering NGS:
    - Creation of a failsafe dashboard to analyze and interpret SCL learnings.
    - Classifying events using SCL models as they occur in real time.
    - Training for staff on the SCL model.
    - Updating safety event investigation process to include SCL classifications.
- Proactive utilization of the *Nuclear Performance Area Trending, Prevention and Intervention Process (TPI)*. The general principle applied is a graded approach in support of continuous monitoring of Staying on Top values and improving overall performance. This graded approach involves early identification of declining performance by increasing oversight and establishing clear responses from the line. TPI will be used proactively to address early signs of negatively trending performance or behaviours. Leading indicators of observed behaviours will be used with the intent of correcting those behaviours prior to the occurrence of events. The workgroups impacted must demonstrate that there is a sufficient level of intrusiveness in managing and correcting overall performance in order to close gaps promptly.
- Increase utilization of the eSWP platform. The eSWP tool was fully implemented in early 2024. The eSWP facilitates effective safe work planning and pre-job brief (PJB) process with comprehensive identification of hazards through the utilization of the energy wheel. The tool also allows for the identification of appropriate barriers and controls to mitigate exposure to the identified hazards. Additionally, the eSWP platform takes into account human performance factors as well making worker qualification checks and OPEX information readily available for workgroups to use.

- Leverage *Quality of Safe Practices (QSP)* information to address drifts in worker safety behaviour. The QSP is a safety monitoring report which has been introduced to the station workgroups as a proactive measure to identify gaps in worker safety behaviours concerning high energy hazards. QSP information has been integrated into the station safety scorecard to identify strengths and vulnerabilities. A significant drop in the QSP score can trigger a deep dive into underlying factors to arrest declining performance.
- The *TCSCA* metric was introduced in 2018 and is the percentage of corrective actions, arising from safety events, that are completed on or before the initial due date. TCSCA encourages positive behaviours and outcomes desired in OPG employees and work programs. TCSCA will continue to be reinforced to focus on completing safety related actions in a timely manner.
- Implementation of a *Total Health Initiative* supporting employees and their families in their efforts to achieve an optimal level of health, primarily through health education, health promotion, disease and injury prevention and crisis intervention. There is a continued focus on mental health with training, services and campaigns to raise awareness in this area.
- *SIIR metric* will continue to be reinforced to focus on prevention of serious injuries that have life-altering consequences.
- Implementation of a safety-related work order strategy aimed at the timely repair/correction of identified equipment and plant conditions that pose safety risks.
- OPG's commitment to continuously improve performance is reflected by setting challenging targets for safety performance metrics.

2.8.4 Pickering NGS Units 1 to 4 Decommissioning

This section provides additional information regarding the Conventional Health and Safety SCA with respect to Units 1 to 4 decommissioning. It is intended to supplement the information provided in the general SCA discussion above and therefore only addresses those specific areas where additional decommissioning-related details are needed.

The decommissioning program is aligned with OPG's health and safety framework, covering all previously identified initiatives. Conventional Health and Safety for workers will be managed through OPG's robust Health and Safety program and Systematic Approach to Training program. In addition, documented protection programs and safety assessments will be in place to ensure safety of workers.

A thorough assessment of the radiological, chemical and construction safety hazards that might be encountered during the decommissioning project will be performed during the preparation for decommissioning. A preliminary assessment of some of the hazards likely to be encountered during the decommissioning of the Pickering NGS is summarized in the DDP.

Decommissioning contractor(s) will be retained to perform the dismantling, demolition, and site restoration work. OPG will provide the necessary oversight during planning and execution of the work. The decommissioning contractor(s) will be a company or consortium selected based on factors such as decommissioning experience, health and safety programs, safety record, overall approach, and cost.

OPG will remain the owner and licensee of the Pickering NGS throughout the course of decommissioning, but the decommissioning contractor(s) may be given charge and control of the site during the dismantling & demolition and site restoration. Other contractors may also be given charge and control of designated portions of the site during certain phases of the decommissioning. During these periods, the contractor will become the 'Constructor' for the decommissioning work as defined by the construction safety regulations made pursuant to the Occupational Health and Safety Act. The decommissioning contractor(s) and sub-contractors will be required to comply with OPG procedures related to Nuclear Energy Workers and all federal and provincial *Regulations*.

2.8.5 Pickering NGS Units 5 to 8 Refurbishment

This section provides additional information regarding the Conventional Health and Safety SCA with respect to Units 5 to 8 refurbishment. It is intended to supplement the information provided in the general SCA discussion above and therefore only addresses those specific areas where additional refurbishment-related details are needed.

Nuclear Refurbishment will comply with program OPG-PROG-0005, *Environment Health and Safety Managed Systems* document for both OPG employees and contractors.

Nuclear Refurbishment engages contractors that have proven health and safety programs and experience. This is verified in a prequalification process that review industry experience, historical safety performance, implemented management system elements and prior OPG experience. With respect to Enterprise Project Contractors, OPG Nuclear Refurbishment is the “constructor”, and the contractors will be the “employer” as defined in OHSA and are governed by the requirements set therein. External construction and support staff work under the “employer” programs and procedures. This allows contractor front line supervisors and workers to work within OPG’s programs and procedures they are trained and experienced in. This improves performance and reduces human performance errors related to working with multiple programs and systems. The process aligns with the internal responsibility methodology fostered in the OHSA.

Guiding health and safety principles, originally developed, documented and effectively used in the Darlington NGS Refurbishment project, are being updated to apply to the Pickering NGS Units 5 to 8 Refurbishment. The guiding principles and requirements will be built into contracts related to the Nuclear Refurbishment program. The guide sets the expectations for conventional health and safety elements related to Pickering NGS Units 5 to 8 Refurbishment, thereby ensuring the contractor is fully aware of and will be held accountable to OPG’s health and safety expectations. OPG reviews the contractor health and safety submissions against our expectations prior to approval and commencement of activities. The document also sets out common elements that will apply to all contractors within the Nuclear Refurbishment, such as:

- Safety performance metrics and key performance indicators
- Problem/incident notification and investigation requirements
    - Common safety rules
    - Safety culture requirements
    - Communication requirements
    - Oversight and surveillance

The Nuclear Refurbishment team recognizes that effective oversight throughout all stages of the program life cycle is paramount to the program’s success. Health and Safety has a dedicated team of advisors who will provide daily support and ensure contractors are held accountable to OPG's health and safety expectations.

Lessons Learned from Darlington NGS OPEX are actively incorporated into Pickering NGS Refurbishment planning. Conventional H&S staff who have previously worked on Darlington NGS Refurbishment have been assigned to Pickering Station to facilitate planning for refurbishment pre-requisite activities.

In collaboration with vendor counterparts, we are jointly working through the COMS process to incorporate applicable OPEX when warranted. The H&S team works with the project team to provide inputs within project team managed forums on items that may pose a challenge based on OPEX and H&S legislation reviews.

Additionally, we utilize the Safety Essentials Guide (N-GUID-09701-10011) to capture H&S programmatic improvements, OPEX and HU concepts in a one stop shop document that is part of vendor contracts tendered. This document is the bridge document for the vendor program and OPG governance and helps shape the Project Site Safety Plan for bundles executing scope on Pickering Refurbishment.

2.8.6 Pickering Waste Management Facility

The OPG documents in the table below require written notification of change per PWMF Licence Conditions Handbook, LCH-W4-350.00/2028 R003:

Table 35. SCA 8 – PWMF Conventional Health and Safety

Document Number	Document Title
OPG-POL-0001	Employee Health and Safety Policy
OPG-PROG-0005	Environment Health and Safety Management System Program

OPG has implemented and maintains a Conventional Health and Safety program as described in Section 2.8.

PWMF demonstrates its commitment to safety by working without a lost time accident for its entire operational period. This period has lasted 30 years. During the current licence period, Serious Incidence Injury Rate has remained zero (0) since the introduction of the new safety performance metric. Completion of safety corrective actions performance is 100% completion rate.

To ensure that the overall objective of managing occupational hazards is met, OPG monitors the following performance indicators / elements: TRIF, ASR, SIIR and TCSCA.

Total Recordable Injury Frequency (TRIF)

The TRIF is defined as the number of fatalities, lost-time injuries, restricted work, and medically treated injuries divided by exposure hours and multiplied by 200,000. In 2018, the decision was made to change the safety performance indicator from ASR to TRIF.

The TRIF and ASR are inclusive for the entirety of NSS, which the PWMF is part of. During the licence period, there was one (1) safety event that occurred at the PWMF that impacted the TRIF for the reporting period. In 2022, there was one medically treated injury due to a laceration on a worker's hand.

Accident Severity Rate (ASR)

The ASR is defined as the total number of calendar days lost due to a work-related injury multiplied by 200,000 person-hours, divided by the total exposure hours worked. OPG made the decision in 2014 to no longer set a target for ASR.

NSS ASR remained at zero (0) from 2018 through 2024, as there were zero lost time injuries experienced in the reporting period. Specifically at PWMF, to date, there have not been any lost time safety events. This shows a strong commitment to safety with an exceptional performance of 30 years without a lost time event at PWMF.

Serious Injury Incident Rate (SIIR)

Serious Injury Incidence Rate is defined as the number of work-related accidents for all OPG employees that result in serious injuries or fatalities, per 200,000 person-hours worked. This metric focuses on more serious injuries, assists in maintaining attention on high-consequence hazards, and accounts for the actual injury instead of the type of medical treatment.

PWMF Serious Injury Incidence Rate has remained at zero since the introduction of the new safety performance metric in 2020.

Timely Completion of Safety Corrective Actions (TCSCA)

TCSCA aims to prioritize completion of safety related actions in a timely manner. TCSCA is the percentage of corrective actions, arising from safety events, that are completed on or before the initial due date (zero extensions).

Strong TCSCA performance has been observed for PWMF since the introduction of the metric in 2020 with 100% completion rate, which is better than the target of 98%.

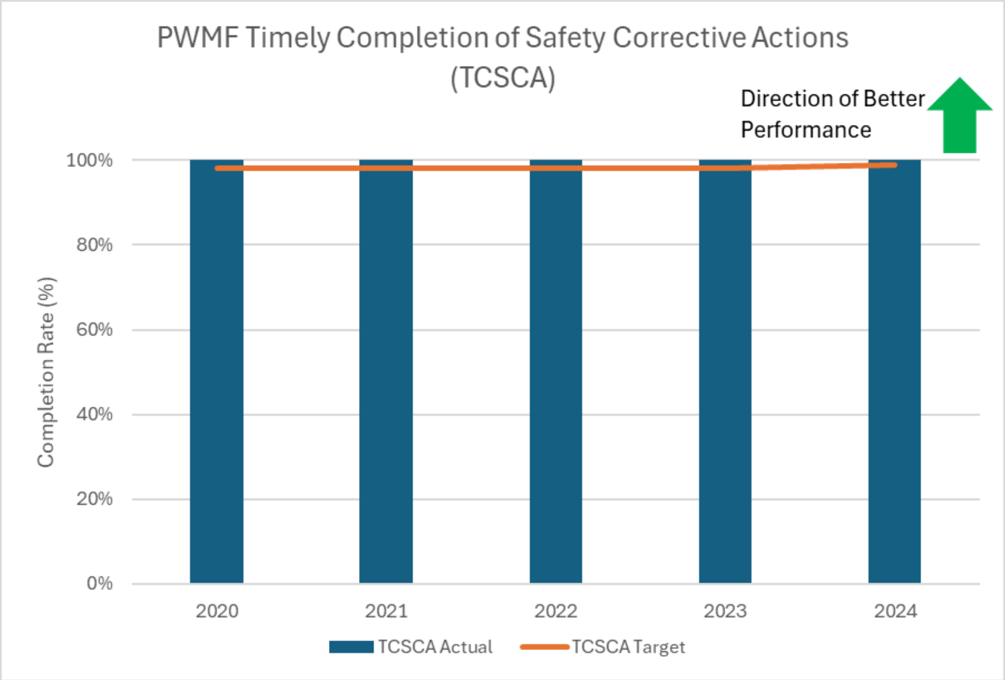

Figure 30. PWMF Timely Completion of Safety Corrective Actions

Safety Event Classification

During the licence period, Maximum Reasonable Potential for Harm (MRPH) rating system was used to classify incidents, and to determine the potential severity of safety incidents. In April 2024, OPG introduced the Safety Classification and Learning (SCL) model and transitioned away from the Maximum Reasonable Potential for Harm (MRPH) system.

The SCL model is focused on learning from events to prevent recurrence and keep workers safe. The SCL also aligns with OPG's Fail Safe shift by focusing on high-energy, high-consequence events and the use of barriers and strong defenses. It helps to understand where workers may be exposed to greater risk and hazards that could lead to serious injury. Through better data quality and consistent classification, OPG will be able to address risks and protect workers from harm more effectively. Since the introduction of the metric, there have been no high-energy, high-consequence events within the SCL classification.

Safety Enhancements

During the current licence period, a number of safety enhancements have been made to equipment and systems at PWMF, some examples are:

- LED lighting upgrades completed within the facility to increase visibility in work areas.
- Additional cameras were installed on the DSC transporter to support safer operation and increase the range of sightlines for the operator.
- Improved access to DSC SB4 roof with permanent stairs and guardrail system.
- Completed engineering modification to replace single bottles of weld cover gas with a productivity pack, reducing the need for multiple attachment points and limiting manual material handling.
- Procured three stainless steel transfer clamps to support facility operations and reduced the required number of crane movements in the IFBs.

A number of health and safety improvement initiatives have also been implemented at PWMF as part of the continuous improvement cycle of the health and safety management system, which include:

- Implementation of Fail-Safe Culture Change initiatives to build defenses into the planning of work, creating a learning organization, recognizing our workers are solutions, avoiding blaming the worker, and other key Fail-safe concepts.
- Continuing to maintain the iCare Safety Culture initiatives in areas of Communications, Recognition, Risk Management, Human Performance and Coaching, and Total Health Strategies. The initiatives focus on how safety messages are presented and transition the tone from “do this because we are required” to “do this because you care and don’t want an injury”.
- Implementation of a “Total Health Initiative” supporting employees and their families in their efforts to achieve an optimal level of health and functioning, primarily through health education, health promotion, disease and injury prevention, and crisis intervention.
- A continued focus on mental health and Musculoskeletal Disorder prevention with campaigns to raise awareness in these areas.

- The leading indicator safety performance metric, TCSCA continues to be reinforced to focus on completing safety related actions in a timely manner. Focusing on safety related actions to ensure completion builds on the iCare safety culture.
- Industry leading SIIR metric continues to be reinforced to focus on prevention of serious injuries that have life-altering consequences.
- Continuing effective use of SCL model for event classification. Focusing on high-energy, high-consequence events and the use of barriers and strong defenses. Through consistent classification, OPG will be able to more effectively address risks and protect workers from harm.
- OPG's commitment to continuously improve performance is reflected by setting challenging targets for safety performance metrics.

2.9 Environmental Protection

OPG's comprehensive environmental protection programs aim to continually minimize impacts from station operation on the environment and human health. This is achieved by ensuring that there are multiple barriers in place to control and minimize emissions to the environment and to ensure all emissions are monitored.

OPG implements environmental protection programs at the Pickering NGS site in accordance with CNSC regulatory document REGDOC-2.9.1, *Environmental Protection: Environmental Principles, Assessments and Protection Measures, Version 1.2.* Given OPG's robust programs and processes, it is expected that the Pickering NGS site will continue to meet or exceed regulatory requirements and expectations within this SCA over the next licence term.

The OPG documents in the table below require written notification of change per the Pickering NGS Licence Conditions Handbook LCH-PR-48.00/2028-R007:

Table 36. SCA 9 – Pickering NGS Environmental Protection

Document Number	Document Title
N-STD-OP-0031	Monitoring of Nuclear and Hazardous Substances in Effluents
P-REP-03482-00001	Derived Release Limits and Environmental Action Levels for Pickering Nuclear Sewage Effluent
P-REP-03482-00006	Derived Release Limits for Pickering Nuclear
P-REP-03482-00007	Action levels for Environmental Releases – Pickering Nuclear
N-PROC-OP-0037	Environmental Approvals
OPG-POL-0021	Environmental Policy
OPG-PROG-0005	Environment Health and Safety Managed Systems
N-PROC-OP-0044	Contaminated Lands Management
OPG-PROC-0126	Hazardous Material Management
N-PROC-OP-0038	Abnormal Waterborne Tritium Emission Response
N-PROC-OP-0025	Management of the Environmental Monitoring Programs
P-MAN-03443-00002	Pickering Environmental Monitoring Program

Document Number	Document Title
N-STD-OP-0046	Groundwater Protection and Monitoring Program
P-REP-07701-00002	Predictive Effects Assessment for Pickering Nuclear Safe Storage
P-REP-07701-00006	Predictive Effects Assessment for Pickering Nuclear Safe Storage – 2022 Addendum Report

2.9.1 Environmental Management System

OPG maintains an Environmental Management System (EMS), OPG-PROG-0005, *Environment Health and Safety Managed Systems*, which defines the procedures and supporting documents that implement the requirements of OPG's *Environmental Policy* (OPG-POL-0021). The EMS is consistent with the ISO 14001 *Environmental Management System Standard* and CNSC REGDOC-2.9.1 *Environmental Protection, Environmental Principles, Assessments and Protection Measures.*

The objectives of the OPG Environmental Policy are to:

- Establish an EMS and maintain registration for this system to the ISO 14001.
- Work to prevent or mitigate adverse impacts on the environment, with a long-term objective of continual improvement in its EMS and its environmental performance.
- Strive to be a leader in climate change mitigation.
- Manage OPG's sites in a manner that strives to maintain, or enhance where it makes business sense, significant natural areas and associated species of concern. OPG will work with its community partners to support regional ecosystems and biodiversity through science-based habitat stewardship. Where disruption is required, OPG shall take reasonable steps to manage the residual impact to these areas and species.
- Set environmental objectives as part of its annual business planning process, monitor performance against these objectives, maintain associated documented information and communicate environmental performance to employees, governments, local communities, and other stakeholders.

The current OPG ISO 14001 EMS certificate, issued in 2024 following a successful external audit, is valid for 3-years.

The EMS uses a risk-based approach to identify and assess areas of concern with respect to environmental management at the Pickering NGS site. Elements of OPG's activities, products, and services that interact or can interact with the environment are considered environmental aspects per OPG-PROC-0036, *Environmental Aspects Identification and Significance Rating*. Significant environmental aspects are environmental aspects that have or can have a significant environmental impact. Identified environmental aspects, including significant environmental aspects, are managed as appropriate through operational controls at the sites.

The identification of significant environmental aspects allows for more focus on areas where there is the potential to have a negative impact on the environment. The significant environmental aspects that have been identified for Pickering NGS include the following:

- Spills (refer to Section 2.9.1.1 for details)
- Fish impingement/entrainment/spawning disruption (refer to Section 2.9.6 for details)
- Wildlife habitat: enhancement or disruption (refer to Section 2.9.1.3 for details)
- Radiological emissions: production or reduction (refer to Section 2.9.4 for details)
- Non-radiological emissions: production or reduction (refer to Section 2.9.4 for details)
- Radiological waste: generation or diversion (refer to Section 2.11 for details)
- Non-radiological waste: generation or diversion (refer to Section 2.11 for details)

Continual improvement of Pickering NGS operations is an ongoing effort under OPG's ISO 14001-certified EMS. Opportunities for continual improvement may be identified through routine EMS audit activities, the OPG performance improvement program, and strategic initiatives such as execution of OPG's Climate Change Plan and Reconciliation Action Plan (available at www.opg.com).

2.9.1.1 Spill Management Program

OPG has a framework in place per OPG-STD-0152, *Spill Management* to manage spills, ensuring implementation of spill prevention, preparedness, response, clean-up, and remediation processes in accordance with applicable regulations. Spills are classified as Category A (Very Serious), Category B (Serious), Category C (Less Serious), or Category D (Exempted or Potential Spills). Spills are identified, classified, and reported following OPG-PROC-0041, *Environmental Event Identification, Classification, and Reporting*.

During the current licence period (2018-2024), there were no Category A or B spills. As of December, 31, 2024, there were nine Category C spills at Pickering NGS. These spills were immediately reported, and every effort was made to recover any material spilt. As a result, there were no impacts to the environment or human health.

2.9.1.2 Regulatory Compliance

The Pickering NGS site operates under numerous environmental regulations governing plant operations. The primary regulators from an environmental perspective are the CNSC, Department of Fisheries and Oceans Canada (DFO), Environment and Climate Change Canada (ECCC) and the Ministry of the Environment, Conservation and Parks (MECP).

During the current licence term, Pickering NGS met the overall environmental regulatory requirements. However, there were sixteen non-compliances with the Environmental Compliance Approval (ECA) conditions, the majority of which were related to minor exceedances of effluent and the temperature limits specified in the ECA with no significant impact to the public or the environment. The temperature exceedances were primarily due to debris and algae runoff in the lake. Each event was reviewed and assessed and where appropriate, actions were implemented to prevent future occurrences.

2.9.1.3 Biodiversity

The Pickering NGS site has a strong Biodiversity and Natural Areas Management Program to protect, maintain and enhance the natural environment, species and wildlife habitat on, and in the vicinity of, the Pickering NGS site.

OPG's biodiversity conservation program OPG-STD-0119, *Biodiversity Conservation Standard,* meets the requirements of OPG-POL-0021, *Environmental Policy,* and aligns with OPG-PROG-0005, *Environment Health and Safety Managed Systems.*

On-site biodiversity initiatives include enhancement of wildlife corridors across the Pickering NGS site, protection of species of concern like peregrine falcons, and enhancement and protection of the ecological value of the Frenchman's Bay and Duffins Creek watersheds and associated natural areas on and adjacent to the site. In 2021, a new 3-year initiative began to remove non-native, invasive phragmites from the Pickering Hydro Marsh with the goal to increase biodiversity in the wetland.

Since 2018, approximately 2,700 trees and shrubs have been planted on or around Pickering NGS OPG property by volunteers from the community and OPG staff.

Pickering NGS continues to enhance habitat offsite through the ongoing partnership with ESP. Projects have included the creation of a wildflower garden at a local school, tree planting events and the creation of habitat structures for birds and pollinators.

OPG submits applications for Wildlife Habitat Council certification (powered by Tandem Global) of select sites. The Wildlife Habitat Council is an international non-profit, non-lobby group that promotes and independently certifies habitat conservation and management on corporate lands through partnerships and education. Pickering NGS currently holds the gold standard Wildlife Habitat Council certification for the period 2023-2025, which is the top tier certification.

2.9.2 Environmental Risk Assessment

Consistent with CNSC REGDOC-2.9.1 *Environmental Protection: Environmental Principles, Assessments and Protection Measures*, Version 1.2, and REGDOC-3.1.1 *Reporting Requirements for Nuclear Power Plants*, OPG updates the Pickering NGS site ERA at least once every five years. The 2022 ERA, P-REP-07701-00007-R001, *Environmental Risk Assessment Report for Pickering Nuclear*, focused on the years 2016 to 2020 and meets the requirements of the CSA standard N288.6-12 *Environmental risk assessments at class I nuclear facilities and uranium mines and mills*. The ERA is reviewed and updated based on ongoing environmental monitoring data, operational experience, and advances in scientific knowledge.

The purpose of the Pickering NGS site ERA is to assess potential human health and ecological risks from exposure to radiological contaminants, conventional contaminants, and physical stressors (e.g. noise) present in the environment as a result of site operations. This is achieved through completion of a human health risk assessment (HHRA) and an ecological risk assessment (EcoRA).

The results of the ERA inform the Environmental Monitoring Program and Effluent Monitoring Programs, as per CSA N288.4-19, *Environmental monitoring program at class I nuclear facilities and uranium mines and mills*, and CSA N288.5-22, *Effluent monitoring programs at class I nuclear facilities and uranium mines and mills*. These programs also inform the ERA by providing information on effluent concentrations and loading, and by providing environmental data to assist in model calibration and validation.

The 2022 ERA confirms that the Pickering NGS and PWMF continue to operate in a manner that is protective of the health of the public and the environment. The ERA results are intended to be conservative to not underestimate any risk to the public and the environment.

This report was also shared with Indigenous Nations and communities in 2023. OPG responded to comments received from MSIFN in 2024. OPG is committed to facilitating WTFNs engagement on ERAs and will continue to work with Indigenous Nations and communities to develop comprehensive and ongoing engagement around ERAs. The ERA report is available on www.opg.com.

2.9.2.1 Predictive Environmental Risk Assessment

The purpose of a PERA, previously referred to as a Predictive Effects Assessment (PEA), is to identify and assess the potential interactions with the environment as a result of future site activities and to determine whether adequate provision for the protection of the environment and health of persons has been made.

Both the 2017 PEA (P-REP-07701-00002) and the 2022 PEA Addendum (P-REP-07701-00006) reports concluded that there are no potential adverse effects predicted to human health or the environment from continued operation of Pickering NGS (Unit 5 to Unit 8) to 2026 and the proposed Stabilization Phase and SWS Phase activities. OPG shared the 2022 PEA Addendum Report with Indigenous Nations and communities in 2023 and responded to comments received from MSIFN in 2024.

For this licence renewal application, OPG has prepared a PERA in accordance with CSA N288.6-22 and CNSC REGDOC-2.9.1 for the refurbishment and continued operation of Pickering NGS Units 5 to 8, as well as the decommissioning of Units 1 to 4 in accordance with CNSC REGDOC-2.11.2. The PERA also encompasses project activities associated with the PWMF.

Based on feedback from the WTFNs during engagement on other OPG PERAs and ERAs, a Harvester receptor was included to conservatively account for Indigenous people who may live and work near the facility and consume traditional foods harvested near the facility. OPG is making efforts to seek additional information to refine the characteristics of the new Harvester receptor over time.

The PERA concluded that there are no potential adverse effects predicted to human health or the environment as a result of the project activities. However, in the future, climate change and rising lake temperatures may result in effects to local fish communities when considered in combination with Pickering NGS discharge. Monitoring and mitigation measures are recommended to reduce potential risks and to confirm assumptions. Activities associated with the project activities will be considered as part of the periodic review and update of the monitoring programs and ERAs resulting in a continual assessment of effects on human and non-human biota. The PERA (P-REP-07701-00014) was submitted to CNSC staff on June 20, 2025.

OPG is committed to engaging with the WTFNs on this PERA to broaden OPG's understanding of surrounding land use and receptor characterization. OPG has shared a draft of the PERA report for review and comments with the WTFNs.

As the project is in its planning phase, the PERA may be updated in the future to incorporate additional environmental data or any notable project changes.

2.9.3 Assessment and Monitoring

OPG maintains an EMP in the vicinity of Pickering NGS site in accordance with licence requirements. The EMP is implemented through N-PROC-OP-0025, *Management of the Environmental Monitoring Programs*, and complies with CSA N288.4-19, *Environmental Monitoring Programs at Nuclear Facilities and Uranium Mines and Mills,* as demonstrated in P-MAN-03443-00002, *Pickering Environmental Monitoring Program*. The scope of the Pickering

EMP encompasses protection of both the public and the environment from nuclear substances, hazardous substances, and physical stressors resulting from operations at the Pickering NGS site.

Additionally, environmental sampling and analyses for the Pickering EMP supports the annual calculation of radiological public dose resulting from operation of Pickering NGS, as required by CNSC REGDOC-3.1.1, *Reporting Requirements for Nuclear Power Plants*. The annual public dose attributed from the operations of the Pickering NGS during the licence period has consistently been a very small fraction of the public dose limit of 1,000 µSv/year.

OPG reports the results of its nuclear facility EMPs annually to the CNSC. They have also been shared with Indigenous Nations and communities and the report is made available to the public on www.opg.com.

2.9.3.1 Groundwater Protection and Monitoring Program

The Pickering NGS Groundwater Protection and Monitoring program was established to confirm the predominant on-site groundwater quality and flow characteristics of the Pickering NGS site and to detect any emergent issues. The overall objective of the program is to ensure there are no adverse off-site impacts from impacted groundwater. In 2020, OPG implemented the requirements of CSA N288.7-15, *Groundwater protection programs at class I nuclear facilities and uranium mines and mills*, at the Pickering site. This standard focused on both groundwater monitoring and groundwater protection. In November 2024, an implementation plan for CSA N288.7-23 was submitted to CNSC staff; OPG will be in compliance with CSA N288.7-23 by June 30, 2025.

Pickering NGS's annual groundwater monitoring program, involves collecting samples from over one hundred sampling locations annually on the Pickering site. Collected samples are mainly analyzed for tritium, but some locations are also analyzed for petroleum hydrocarbons, benzene, toluene, ethylbenzene, xylenes, and dissolved iron. Sampling points include monitoring wells, foundation drains, sumps, catch basins, and ground tubes. These samples are analyzed statistically to identify any trends.

As a result of Pickering NGS continued focus on performance improvement, including environmental performance, from 2018 to 2023, the groundwater data collected from many of the key areas at Pickering NGS indicate that the low levels of contamination (e.g. tritium, petroleum hydrocarbons, benzene, toluene, ethylbenzene, xylenes, and dissolved iron concentrations) have mostly remained constant or decreased, showing stable or improved environmental performance. Tritium concentrations in samples taken from the site-perimeter monitoring wells during this licence period have been stable and within historical ranges demonstrating that there are no off-site impacts.

Water level elevation data collected as part of the Pickering NGS site's annual groundwater monitoring program has shown that groundwater flow patterns remained consistent over the licence period. The 2023 inferred shallow groundwater contour map is provided in Figure 31. Outside of the protected area, groundwater generally is inferred to flow from the landfill towards the station buildings to the southwest and towards the Lake Ontario in the south. Inside the protected area and in the vicinity of the powerhouse, groundwater is inferred to flow towards the Turbine Auxiliary Bay and IFB. Further south of the powerhouse, groundwater is inferred to flow toward Lake Ontario.

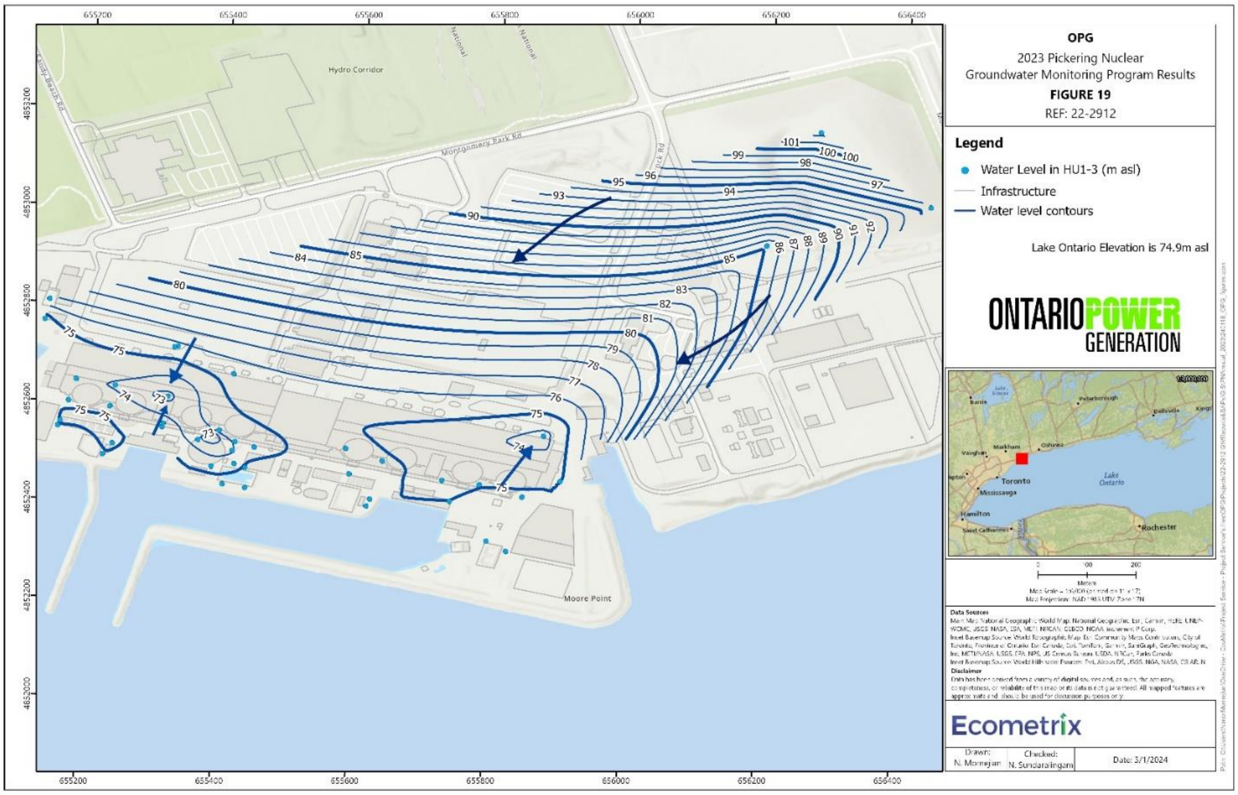

Figure 31. 2023 Inferred Shallow Groundwater Contour Map

The annual *Pickering Nuclear Groundwater Monitoring Program Results* report is submitted to CNSC and subsequently posted online (opg.com) along with a GIS map for public access and viewing.

2.9.4 Effluent and Emission Control

2.9.4.1 Radiological Emissions to Air and Water

The Pickering NGS site effluent monitoring program documented in N-STD-OP-0031, *Monitoring of Nuclear Hazardous Substances in Effluents*, is compliant with CSA N288.5-22, *Effluent monitoring programs at class I nuclear facilities and uranium mines and mills.* The objectives of the effluent monitoring program are to:

- Demonstrate compliance with authorized release limits and any other regulatory requirements concerning the release of nuclear and hazardous substances from the source.
- Demonstrate adherence to internal objectives and targets set on release amounts, for purposes of effluent control.
- Confirm the adequacy of controls on releases from the source.
- Provide an indication of unusual or unforeseen conditions that might require corrective action or additional monitoring.

- Provide data to assess the level of risk on human health and safety, and the potential biological effects in the environment of the nuclear and hazardous substances of concern released from facility.
- Confirm predictions in the environmental impact statement made through the environmental review process.
- Provide assurance to the public on the effectiveness of effluent and emissions control.
- Provide data which, when combined with the results of environmental monitoring and modelling, can be used to test or refine the models used in the ERA or dose assessments.
- Address any other objective identified by the nuclear facility or licensed activity (e.g., demonstrating due diligence, meeting a stakeholder commitment, or other business reasons).

P-PLAN-03480-00001, *Pickering Nuclear Radioactive and Hazardous Emissions Monitoring Plan,* is developed as a requirement of N-STD-OP-0031 and addresses design requirements, reporting requirements, and sampling/analytical procedures use, in alignment with CSA N288.5-22, section 6.2 *Systematic planning process for the development of an effluent and emissions monitoring program;* and, as required by section 6(i) of the *Class I Nuclear Facilities Regulations*. Information provided includes:

- the location of points of release (including maps and equipment designation);
- the maximum expected quantities and concentrations (e.g., Maximum Probable Emission Rates and Action Levels for radiological substances, or regulatory limit for contaminated substances); and
- the anticipated volume and flow rate of releases of nuclear substances and hazardous substances into the environment, including their physical, chemical, and radiological characteristics under normal operating conditions.

Information on treatment systems and control technologies to control releases of nuclear and hazardous substances can be found in the 2022 ERA, P-REP-07701-00007-R001, *Environmental Risk Assessment Report for Pickering Nuclear.*

Derived Release Limits

Derived Release Limits (DRLs) are calculated using CSA N288.1-20, *Guidelines for calculating derived release limits for radioactive material in airborne and liquid effluents for normal operation of nuclear facilities,* and submitted to CNSC. The DRL for a given radionuclide is the release rate to air or surface water during normal operation of a nuclear facility that would cause an individual of the most highly exposed group around the Pickering NGS site to receive and be committed to a dose equal to the annual regulatory dose limit over the period of a calendar year. DRLs are used to establish controls on the releases of radioactive materials and are calculated for radionuclides of potential dose significance in effluent streams, to facilitate the control, reporting, and regulation of radionuclide emissions. The DRL values shown below in Table 37 and documented in P-REP-03482-00006, *Derived Release Limits for Pickering Nuclear*, are for the Pickering NGS site which includes both Pickering NGS and the PWMF. For operational purposes, the airborne DRLs are divided into weekly amounts and waterborne DRLs into monthly amounts. OPG transitioned to the 2020 edition of N288.1 effective December 31, 2024. The updated Pickering NGS site DRLs shown in Table 37 became effective January 1, 2025.

Table 37. Pickering NGS site - Derived Release Limits

Release Category	Radionuclide	DRL (Becquerel/year)	Operational DRL (Becquerel/week)
Air	Tritium (HTO)	1.14E+17	2.19E+15
	Carbon-14	3.25E+15	6.24E+13
	Noble Gases[2]	3.07E+16	5.91E+14
	Particulate	4.95E+11	9.51E+09
	Iodine (mixed fission products)	3.69E+12	7.10E+10
	Gross Alpha	8.74E+10	1.68E+09
Release Category	**Radionuclide**	**DRL (Becquerel/year)**	**Operational DRL (Becquerel/month)**
Water[3]	Tritium (HTO)	7.54E+17	6.28E+16
	Carbon-14	3.00E+13	2.50E+12
	Gross Beta-Gamma	1.49E+12	1.24E+11
	Gross Alpha	2.06E+12	1.72E+11
Release Category	**Radionuclide**	**DRL (Becquerel/year)**	**Operational DRL (Becquerel/month)**
Sewage	Tritium	5.4E+16	4.5E+15
	Carbon-14	9.9E+13	8.2E+12
	Gross Beta-Gamma (limited by Co-60)	1.2E+11	1.0E+10

Action Levels

An Environmental Action Level (EAL) for environmental release is an effluent monitoring level (concentration, activity, rate, etc.) that, if exceeded, triggers an investigation to determine whether a loss of control of the environmental protection program has occurred. This enables the initiation of corrective action, if warranted. In 2017, a standardized methodology for calculating and applying EALs was developed and documented in CSA N288.8-17, *Establishing and implementing action levels for releases to the environment from nuclear facilities*. The primary changes introduced by the standard are that the scope of the EALs must consider both hazardous and radioactive substances, and the EALs calculations are based on the historical performance of the station.

The Pickering NGS site EALs, updated to reflect the guidance and methodology in CSA N288.8-17 are shown in Table 38 and documented in P-REP-03482-00007, *Action Levels For Environmental Releases - Pickering Nuclear.* As with the DRLs, the EALs apply to the Pickering NGS site which includes the Pickering NGS and PWMF. The updated EALs were implemented

[2] Units are in Bq-MeV/year and Bq-MeV/week.

[3] Waterborne DRLs are based on Units 1 and 4 being shut down (reduced condenser cooling water flow condition)

effective December 31, 2023. Exceeding an EAL requires notification and reporting to the CNSC, investigation of the cause, and corrective action as required.

Table 38. Pickering NGS site – Action Levels for Environmental Releases

Release Category	Radionuclide (units)	EAL (Gaseous Releases)
Air	Tritium (Bq/week)	2.59E+13
	Carbon 14 (Bq/week)	3.30E+11
	Iodine-131 (Bq/week)	6.85E+06
	Noble Gas (Bq-MeV/week)	9.99E+12
	Particulate (Bq/week)	5.88E+06
	Gross Alpha (Bq/week)	Not Required
Release Category	**Radionuclide (units)**	**EAL (Liquid Releases)**
Water	Tritium (Bq/month)	1.41E+14
	Gross Beta / Gamma (Bq/month)	2.49E+10
	Carbon 14 (Bq/month)	Not Required
	Alpha (Bq/month)	Not Required

Note: Waterborne EAL values stated are for releases to the lake outfall.

During the current licence term, the emissions from the Pickering NGS have consistently been orders of magnitude below DRL values as shown in Figure 32 and Figure 33.

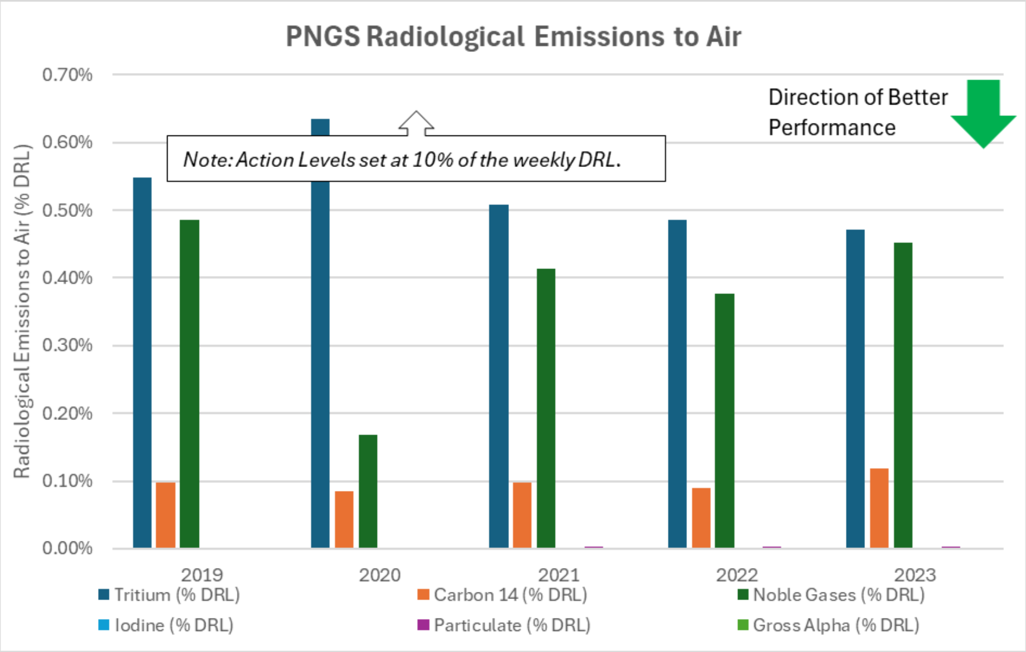

Figure 32. Pickering NGS Radiological Emissions to Air (% of DRL)

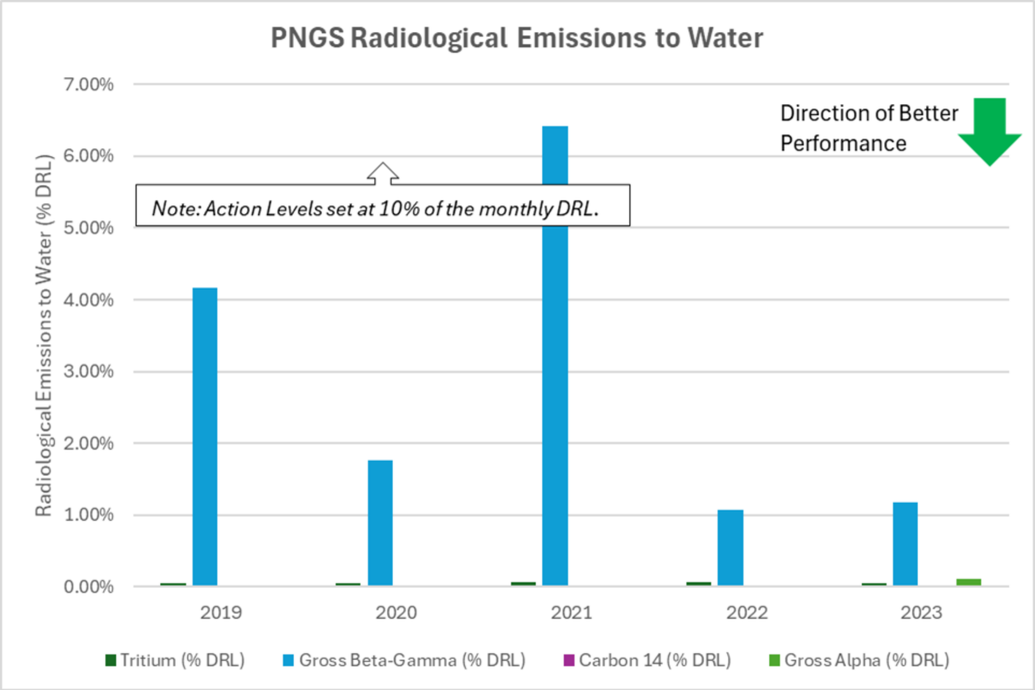

Figure 33. Pickering NGS Radiological Emissions to Water (% of DRL)

Powerhouse stack ventilation flows are monitored to measure the gaseous effluent releases (tritium, elemental tritium, iodine, carbon-14, noble gases, and particulate). The results are compiled weekly and compared to the applicable weekly DRL. There were no weekly EAL exceedances for radiological emissions to air during this licence period (2018-2024).

Waterborne radiological release data are compiled monthly and compared to monthly DRLs. Most radiological releases are routinely managed through the active liquid waste management system, collecting in tanks which are monitored prior to discharge. During the current licence period (2018-2024), there were four monthly EAL exceedances for radiological emissions to water (for gross-beta gamma) majority of which were attributed to sediment entrainment from the Lake or laboratory sample contamination. There was also one monthly DRL exceedance (for gross-beta gamma) which was attributed from accumulation of lake sediment and not due to station operations.

Monitoring of sewage discharges includes tracking tritium, carbon-14, and gross beta-gamma activities to detect potential releases. Data from 2018 to 2024 indicates that the EAL for sewage gross beta-gamma was exceeded four times. These exceedances did not impact the health of the public or the environment and were investigated fully. Efforts continue to prevent recurrence.

2.9.4.2 Conventional Emissions

The Pickering NGS site also monitors conventional substances emitted to air and water as a result of site operations. Reports on emissions of conventional substances are prepared in accordance with provincial and federal regulatory requirements and submitted to provincial and federal agencies throughout the year.

Nitrogen Oxides, and Carbon Dioxide Emissions

Pickering NGS has standby generators to provide back-up electrical power to the station if required. These generators, which produce nitrogen oxides and carbon dioxide emissions, are routinely tested to ensure availability. There were no regulatory non-compliances associated with air emissions from these generators during the licence period.

Hydrazine and Ammonia

Hydrazine is used in the boiler feedwater systems to prevent corrosion. Ammonia is a resulting by-product. Hydrazine and ammonia are released to the environment when steam is vented to the atmosphere and from station water systems (to Lake Ontario). There were no regulatory non-compliances associated with hydrazine and ammonia emissions during the licence period.

Ozone-Depleting Substances

Ozone-depleting substances (ODS) are used in refrigeration systems. Refrigerant leaks to air are minimized through routine inspections and maintenance of equipment. ODS releases between 10 kg and 100 kg are reported to Environment Canada in semi-annual halocarbon release reports. ODS releases greater than 100 kg are reportable as spills. During the current licence term (2018-2024), there were no ODS releases greater than 100 kg at Pickering NGS.

2.9.5 Protection of People

The EMP monitors off-site air, water (municipal drinking water, well water and lake water), aquatic samples (fish, sediment, and beach sand), and terrestrial samples (fruits, vegetables, milk, soil and animal feed). Data gathered from this program, along with Pickering NGS emissions data, are used to assess the annual radiological dose to members of the public living or working in the vicinity of the Pickering NGS site.

The effective dose limit for members of the public as set out in the *Radiation Protection Regulations*, is 1,000 µSv/year. As shown in the logarithmic scale in Figure 34 and illustrated in Figure 35, dose to the public from operation of the Pickering NGS site is a very small fraction of both the annual legal dose limit and the annual natural background radiation in the area.

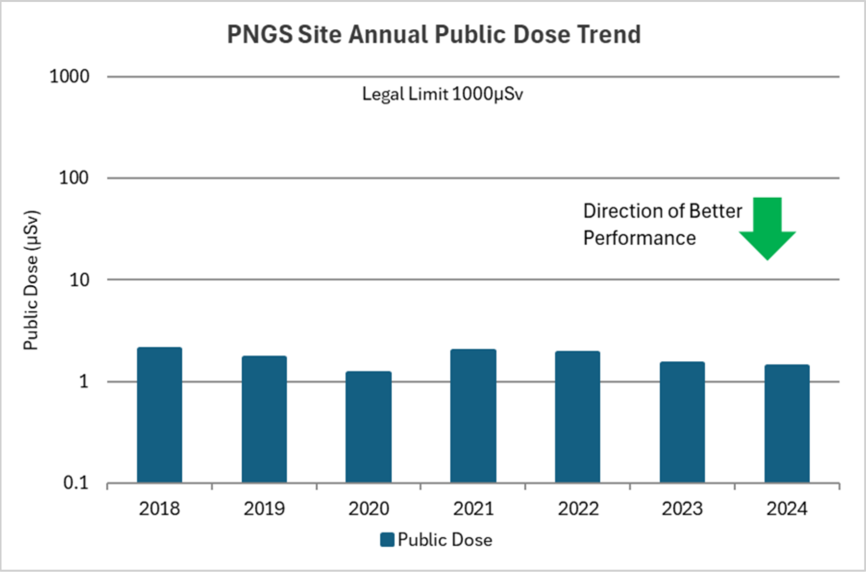

Figure 34. Pickering NGS site Annual Public Dose Trend

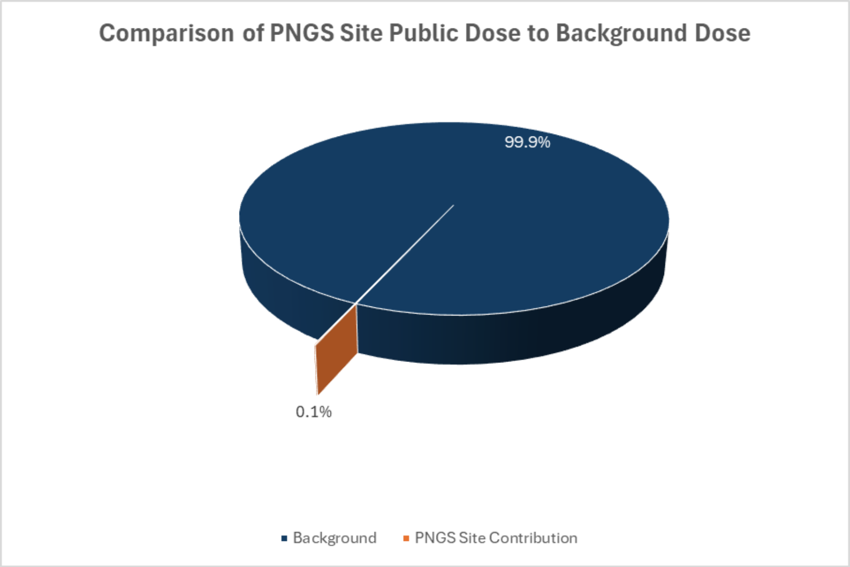

Figure 35. Comparison of Pickering NGS site Public Dose to Background Dose

Municipal drinking water samples collected from downstream water supply plants as part of the annual OPG EMP were well below the Ontario Drinking Water Quality Objective for tritium of 7,000 Bq/L.

2.9.5.1 Abnormal Waterborne Tritium Emission Response

N-PROC-OP-0038, *Abnormal Waterborne Tritium Emission Response*, provides direction for response to an abnormal waterborne tritium emission from OPG's nuclear sites, and provides guidance for staff to manage the required external notifications in a consistent and effective manner. Specifically, it addresses notifications, default sampling, interfacing with external groups, response network, response facilities, drills and training to support this capability.

Radioactive Liquid Emission Response drills and exercises are conducted annually to demonstrate and assess OPGs ability to respond to simulated Abnormal Waterborne Tritium Emissions, including the effectiveness of response facilities, and the interface with external stakeholders. Radiological liquid emission drills will continue to be conducted with the operation of the refurbished Pickering NGS units.

On November 26, 2023, Pickering NGS conducted an evaluated drill that included participation by the Provincial Emergency Operations Centre (PEOC) to receive notification from OPG. The purpose of the drill was to test the ability of Pickering NGS personnel to determine the extent of the liquid emission, make initial contact promptly and effectively with internal departments and external agencies, notifying that a liquid emission had occurred, and to prepare personnel for the next stage of response. All objectives of the drill were successfully met, including projected tritium release times, and proper and timely notifications to external agencies.

2.9.6 Fish Impingement and Entrainment

Impingement and entrainment of fish within the Pickering NGS occurs from the use of lake water in the condenser cooling water system. In 2018, Pickering NGS was issued a Fisheries Act Authorization (FAA) by the DFO. The FAA approved OPG to impinge and entrain a fixed number of fish, eggs and larvae and to counterbalance these losses by undertaking an approved offsetting plan. Effectiveness monitoring is also conducted to assess the efficacy of applied avoidance, mitigation and offsetting measures. The valid FAA period extends from the date of issue (January 2018) through December 31, 2028.

The Fish Diversion System (FDS) is the primary measure to avoid and mitigate fish impingement. The FDS is installed annually by May 1 and removal commences no earlier than November 1. The Authorization requires OPG to demonstrate the FDS is functioning as intended. During operations, functionality and performance are measured through visual checks, inspections and maintenance.

Figure 36. Looking South from Pickering Nuclear Generating Station at Intake, West (right) and East (left) Groynes, Installed Debris and Ice Booms (centre) and Fish Diversion System (top)

Routine monitoring of fish impingement is conducted weekly throughout each year of the Authorization. The estimated biomass of impinged fish is reported annually to the CNSC and DFO, and reports are posted to OPG's website.

Over the 2018-2023 period, the combined biomass of all species and ages impinged was below the two-year consecutive threshold of 3,619 kg per year, except in 2018 and 2019. In 2018, impingement was influenced by above average impingement rates in May, June and October which were all higher than the same months in the previous 5-year period. In 2019, annual biomass was influenced by above average impingement rates in January, June, November and December. Subsequent investigations determined that none of the exceedances were caused by Pickering NGS operations and were primarily attributed to unusually cold weather and thermal upwellings or downwellings that can result in cold shock or cold stress to fish, which is outside of OPG's operational influence. From 2020 to 2023, impingement rates have remained below the two-year consecutive threshold, with annual biomass of impingement for all species ranging from 2,479 – 3,525 kg per year (Figure 37).

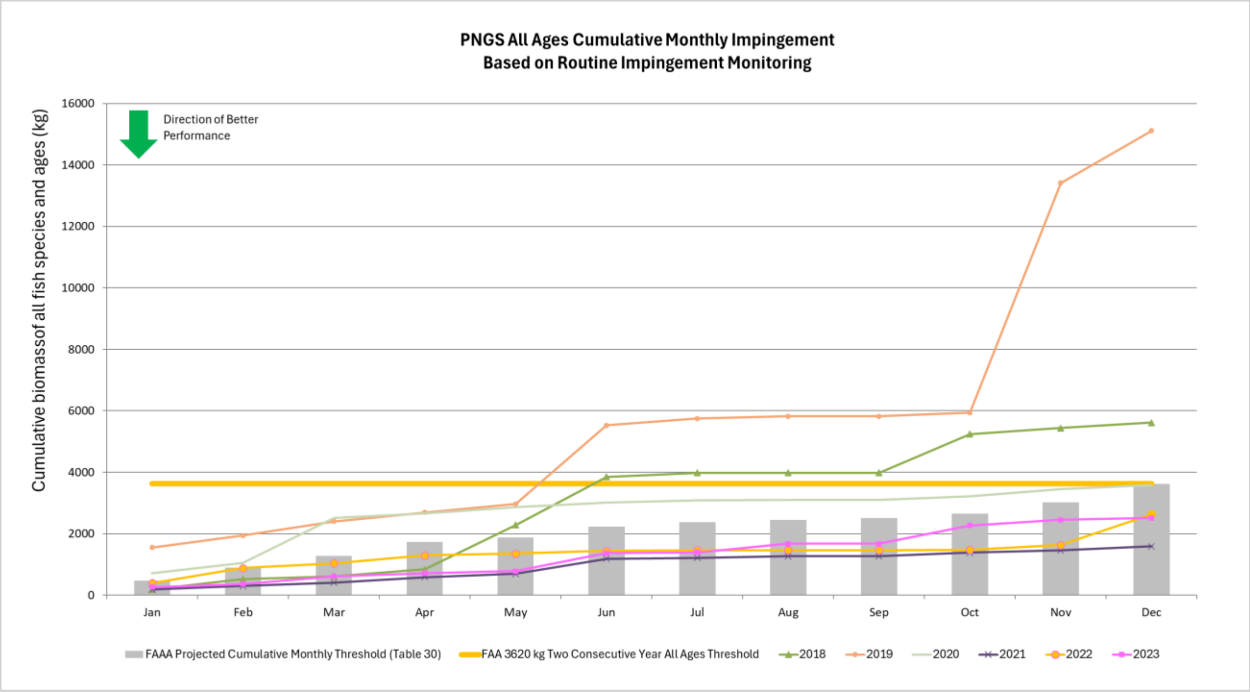

Figure 37. Pickering NGS Annual cumulative biomass (kg) of fish of all species and ages impinged

As per condition 3.2.3 of the FAA, OPG commenced the field phase of a 12-month entrainment study on October 29, 2024. The goal of the entrainment study is to quantify residual impacts from the entrainment of ichthyoplankton (the eggs and larval stages of freshwater fish) at Pickering NGS associated with condenser cooling water withdrawals from Lake Ontario. The field data will be used to: (i) calculate densities of fish eggs and larval stages; (ii) model species specific and cumulative entrainment; and, (iii) calculate entrainment biomass metrics to estimate actual (2018-2025) or predict future (2025-2028) entrainment losses during the period that the Pickering NGS Fisheries Act Authorization is valid.

OPG recognizes that fish impingement and entrainment are important areas of interest to Indigenous Nations and communities. In advance of finalizing the study design and commencing the study in October 2024, OPG shared the fish entrainment study design with the Williams Treaties First Nations Rightsholders for review and comment. For those Nations who submitted comments on the study design, OPG provided responses and adjusted the study design, as appropriate. Based on feedback from the Michi Saagiig Nations, OPG continues to provide updates on the study's progress and remains open to facilitating participation on sampling activities. Once the fish entrainment study is completed, OPG will share the results of the study with the Williams Treaties First Nations Rightsholders and any other Indigenous Nations and communities that express an interest in the results.

The Pickering NGS FAA requires that residual impacts from the death of fish (in this case resulting from impingement or entrainment during Pickering NGS operations or SWS phases) are monitored and reported, and that the productivity losses are ultimately counterbalanced through the implementation of an offsetting plan. The Pickering NGS FAA approved three distinct offsetting measures to counterbalance fish impingement or entrainment losses, with the expectation of achieving a net benefit in fisheries productivity occurring over the duration of the Authorization. The Big Island Wetland, located in the Bay of Quinte, is a wetland fish habitat restoration measure and Fish Habitat Bank. The Simcoe Point Wetland is a combination Habitat

Restoration and Enhancement measure situated near the mouth of Duffins Creek. The third offset measure is stocking of Atlantic Salmon into Duffins Creek, which is a component of the broader Lake Ontario Atlantic Salmon Restoration Program. In addition, the rate of impingement will be reduced with the planned construction of DWI.

2.9.7 Thermal Plume

The 2022 ERA Report for Pickering NGS concluded that the thermal plume from Pickering NGS is not having an effect on Round Whitefish embryo survival. It is unlikely that there are any effects arising from the thermal plume in the lake for juvenile or adult stages of any fish species.

Based on the embryo survival study completed from December 2018 to April 2019 and from December 2019 to April 2020, the largest relative survival loss during 2018-2019 and during 2019-2020 was found to be 3.8% and 1.5%, respectively. These values are well below the 10% loss threshold that CNSC requires to implement further mitigation measures. The 2018-2019 and 2019-2020 studies supported the 2018 Pickering NGS ERA (P-REP-07701-00001) conclusion that there are no chronic or likely acute adverse effects on Round Whitefish egg survival. These findings have been incorporated into the 2022 Pickering NGS ERA. ECCC accepted that no further monitoring for potential chronic effects on Round Whitefish will be needed for operations up to December 31, 2026. The need for, and scope of, future thermal monitoring of the Pickering NGS discharge will be proposed by OPG in consultation with DFO, ECCC and First Nations Rightsholders.

2.9.8 Pickering NGS Units 1 to 4 Decommissioning

This section provides additional information regarding the Environmental Protection SCA with respect to Units 1 to 4 decommissioning. It is intended to supplement the information provided in the general SCA discussion above and therefore only addresses those specific areas where additional decommissioning-related details are needed.

OPG's Environmental Protection policy, programs and implementing procedures will continue to apply to Pickering NGS Units 1 to 4 Decommissioning.

The following general mitigation approaches will be employed throughout the decommissioning process:

- Continued oversight and periodic review of environmental monitoring programs, including quality assurance processes, adequacy assessments, and systematic evaluation of enhancement opportunities
- A site-specific project Environmental Management Plan with mitigation measures identified and any necessary monitoring identified will be prepared
- Carrying out activities in a manner consistent with requirements of OPG's Environment, Health, and Safety Managed Systems Program
- Ongoing engagement with regulatory bodies, Rightsholders and other Indigenous Nations and communities, and stakeholders

2.9.9 Pickering NGS Units 5 to 8 Refurbishment

This section provides additional information regarding the Environmental Protection SCA with respect to Units 5 to 8 refurbishment. It is intended to supplement the information provided in the general SCA discussion above and therefore only addresses those specific areas where additional refurbishment-related details are needed.

OPG's Environmental Protection policy, programs and implementing procedures will continue to apply to Pickering NGS Units 5 to 8 refurbishment activities. Lessons learned and OPEX from the Darlington NGS Refurbishment project with respect to environmental considerations such as spills and emissions monitoring will be incorporated, as applicable, to Pickering NGS refurbishment planning and execution.

As discussed in Section 1.2.1, a new DWI structure similar to Darlington NGS, is being considered at Pickering NGS. In addition to the tunnel itself, as part of the DWI program, there are associated site preparation modifications which may include bridge installation, road improvements, clearing and grubbing, potential lake infill, forebay cutoff wall and potential cut and fill of laydown/storage areas. These modifications/activities will be completed in accordance with applicable permits and approvals. An environmental management plan will be in place to implement mitigation and control measures during the construction of these modifications and activities. Preliminary works include the geotechnical study that is being performed in the lake and onshore. The study will provide subsurface details to inform the design of the tunnel, intake, potential lake infill, cutoff wall, roads, bridge, and material storage areas. These modifications will all support construction and logistics associated with the DWI tunnel itself.

2.9.10 Pickering Waste Management Facility

The OPG documents in the table below require written notification of change per the PWMF Licence Conditions Handbook, LCH-W4-350.00/2028 R003:

Table 39. SCA 9 – PWMF Environmental Protection

Document Number	Document Title
OPG-PROG-0005	Environment Health and Safety Managed Systems Program
OPG-POL-0021	Environmental Policy
N-PROC-OP-0025	Management of Environmental Monitoring Program
N-STD-OP-0031	Monitoring of Nuclear and Hazardous Substances in Effluents
P-REP-03482-00006	Derived Release Limits for Pickering Nuclear
P-REP-03482-00007	Action Levels for Environmental Releases – Pickering Nuclear
P-REP-07701-00007	Environmental Risk Assessment Report for Pickering Nuclear
P-REP-07701-00002	Predictive Effects Assessment for Pickering Nuclear Safe Storage
P-REP-07701-00006	Predictive Effects Assessment for Pickering Nuclear Safe Storage – 2022 Addendum Report
N-STD-OP-0046	Groundwater Protection and Monitoring Program
92896-REP-07701.8-00001	Pickering Waste Management Facility Phase II – Environmental Assessment Follow-up Plan

2.9.10.1 Environmental Management System

OPG's Environmental Health and Safety Managed Systems program is described in Section 2.9.1. As described, the identification of significant environmental aspects allows for more focus on areas where there is the potential to have a negative (or positive) impact on the environment.

The significant environmental aspects that have been identified for the PWMF include the following:

- Wildlife Habitat (Enhancement or Disruption) (see Section 2.9.1.3)
- Spills

Performance measures are established to ensure the controls perform as designed and are corrected and/or improved under the EMS framework. For example, spill and compliance targets have been established and tracked during the licence period. Since that time, OPG has consistently met or surpassed these targets. In the last 10 years, there have been no reportable spills and no environmental non-compliances at the PWMF.

2.9.10.2 Environmental Risk Assessment

The 2022 ERA, P-REP-07701-00007-R001, *Environmental Risk Assessment Report for Pickering Nuclear*, including its overall conclusions for the Pickering NGS and PWMF is described in section 2.9.2.

The expansion of PWMF Phase II area to accommodate additional used fuel storage capacity will result in future changes to the stormwater catchments. Per the requirements of CSA N288.6-12 Clause 11.1 to periodically review changes to the facility, the 2022 ERA has recommended stormwater monitoring be completed in this area after the completion of the PWMF Phase II area.

Predictive Environmental Risk Assessment for the Pickering Component Storage Structure

A PERA (92896-REP-07701-00019) was completed for the proposed PCSS. The PCSS will be used for the storage of low and intermediate level waste from potential Pickering NGS refurbishment and decommissioning, including components such as steam generators, pressure and calandria tubes, calandria tube inserts, and end fittings. The PCSS PERA includes both a predictive EcoRA and a HHRA.

The PCSS PERA was shared with the Williams Treaties First Nations for review in December 2024. On June 5, 2025, a revised PCSS PERA was submitted to CNSC staff; the PERA was revised to incorporate feedback received through engagement activities with the WTFNs and concludes that the construction and operation of the PCSS will be protective of human and ecological receptors residing in the vicinity of the Pickering NGS site.

2.9.10.3 Assessment and Monitoring

The PWMF is covered by the Pickering Nuclear Environmental Monitoring Program described in section 2.9.3. Radiological emissions from the PWMF are an extremely small fraction of the overall emissions from the Pickering NGS site. OPG has a comprehensive environmental monitoring program that provides data to confirm that all facilities on the Pickering NGS site are operating in a manner that is protective of human and ecological receptors residing in the surrounding area. Dose to the public from the operation of facilities on the Pickering NGS site (including the PWMF) is less than 1% of the regulatory limit.

Groundwater Monitoring

As part of the Pickering NGS operations, the PWMF is integrated into the overall Pickering NGS groundwater monitoring program described in section 2.9.3.1. The PWMF operations are considered low risk to groundwater given the nature of the above ground dry storage and sealed containment of the used fuel. As a result, no groundwater monitoring is completed specific to the PWMF operations. However, groundwater monitoring is completed in various locations across the Pickering NGS site including some locations near the PWMF storage areas. No impacts to groundwater have been identified as a result of the PWMF operations.

2.9.10.4 Effluent and Emission Control

Airborne Emissions (Radiological)

Under normal operating conditions, no airborne emissions are expected from loaded (DSCs) during transfer from the Fueling Facility Auxiliary Areas (FFAAs) to the PWMF. Airborne releases are also unlikely to arise under normal operating conditions during storage of seal welded DSCs. There is a small potential for airborne emissions resulting from DSC processing operations such as welding and vacuum drying. The DSC processing building also has a dedicated active ventilation system with High Efficiency Particulate Air (HEPA) filtration.

Although no significant particulate emissions are expected from the exhaust at the PWMF, it was formerly monitored for confirmation purposes. Since monitoring began, particulate emissions have been confirmed to be negligible, being below or near the laboratory detection limit. Based on the monitoring results over the years and in alignment with the monitoring standards, this monitoring was determined to be no longer required. In 2024, CNSC staff accepted OPG's request to discontinue the ventilation stack monitoring. Public notification of this change was provided in the 2023 Environmental Emissions Data reports posted online at www.opg.com and has been communicated to the local Indigenous communities via routine meetings. All data was reported to the CNSC in the PWMF quarterly and annual compliance reports and are available to the public on the OPG website at www.opg.com.

Figure 38 shows a summary of the radiological airborne emissions from the DSC Processing Building stack until 2024 when the stack monitoring was discontinued. As shown in the graph below, particulate emissions have consistently been well below the DRL and EAL.

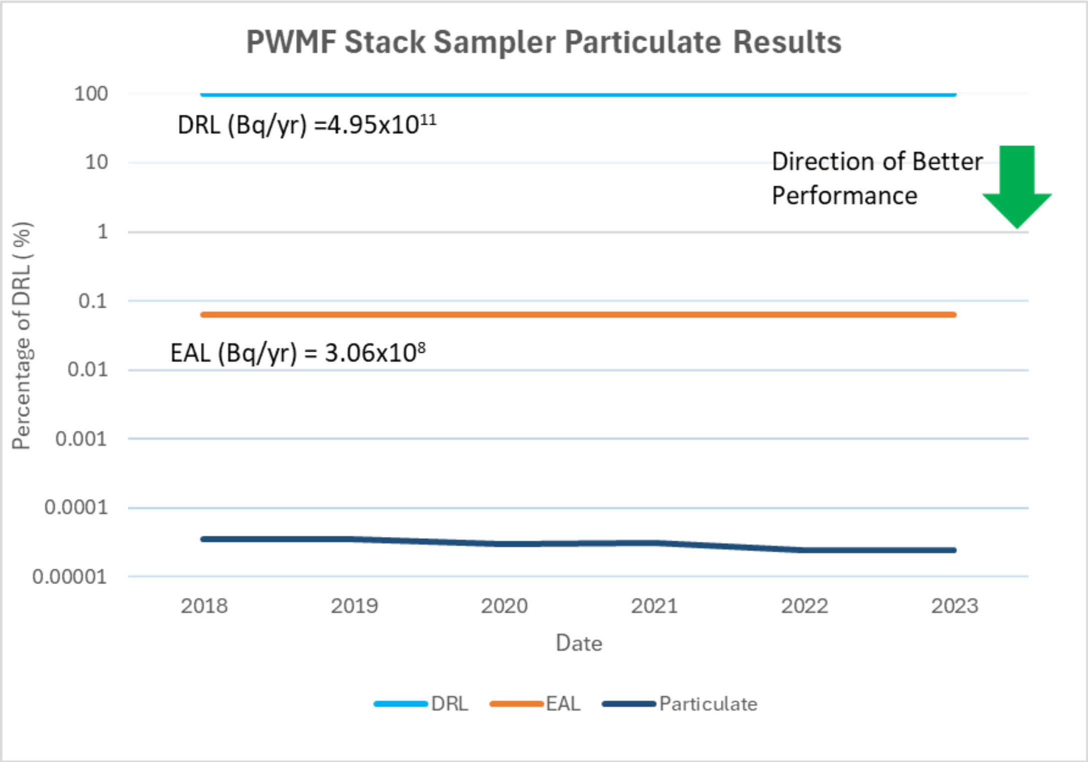

Figure 38. PWMF Airborne Particulates from DSC Processing Building Stack Sampler

Note: Airborne particulate data (Bq/yr) was calculated by multiplying the reported airborne contamination (weekly average) by the number of fiscal weeks per month, then summing the months into an annual total.

Waterborne Emissions (Radiological)

The DSCs are fully drained and vacuum dried after loading at the station FFAAs and the elastomeric seals and drain plugs are present during transfer. The DSCs are also decontaminated prior to transfer; and spot decontamination operations, which may be carried out in the DSC Processing Building, are not expected to generate liquids.

Water collected in the floor drains (e.g., from floor wash water, precipitation such as snow or rainwater that enters the building during DSC transfer and from condensate from the air conditioners). No contamination is expected in the sump water from the DSC operations, however, the sump water is analyzed for tritium and gross beta-gamma activity prior to being transferred to the station's active liquid waste management system to ensure it meets the station's acceptance criteria.

Water is sampled from the RCS stormwater catch basins for gross beta-gamma activity for confirmation purposes. This provides assurance that any radioactive contamination of the stormwater water originating from the storage area is detected, however, no contamination of the stormwater water is expected from the DSMs. In the last 10 years, all the gross beta-gamma sample results were equal to or less than the Minimum Detectable Activity.

Conventional Emissions

Non-radiological (conventional) air emissions may include emissions from welding and DSC paint touch-ups. DSC paint touch-up operations involve minimal paint quantities. Residual paint aerosols from the paint bays are removed through filters before exhausting to the active ventilation system. Due to small quantities, painting methods, and the use of appropriate filtration, no significant emissions of paint materials are expected. Welding fumes from DSC seal-welding operations are additionally exhausted through the High Efficiency Particulate Air filtered active ventilation system. The emissions from the welding operations are also considered insignificant. Consequently, there is no monitoring program required for non-radiological emissions at the PWMF.

Stormwater management at industrial facilities is regulated by the MECP under the *Environmental Protection Act* and the *Ontario Water Resources Act*. Pickering NGS stormwater works are approved under the site ECA No. 1859-C5AKBZ for industrial sewage works. The stormwater works are designed, approved and maintained per the ECA process to ensure stormwater is properly managed to prevent erosion, flooding and degradation of receiving water bodies. The PWMF employs oil and grit separators for the treatment of stormwater.

2.9.10.5 Environmental Assessment Follow-up Program

Prior to PWMF expanding to a Phase II site, OPG performed a screening level Environmental Assessment in 2003 in accordance with the *Canadian Environmental Assessment Act* 1992 to provide additional storage capacity of used fuel in DSCs. The scope of the project included construction and operation of DSC SB3 and SB4.

The results of the assessment identified no significant residual adverse environmental effects of the PWMF Phase II project with the proposed mitigation measures in place. In 2004, the Commission concluded that the project, taking into account the appropriate mitigation measures identified in the Screening Report, was not likely to cause significant adverse environmental effects, and approved the Environmental Assessment. The PWMF operating licence was amended in 2005 to include the construction of DSC SB3 and SB4.

As part of the PWMF Phase II project, OPG submitted an Environmental Assessment Follow-up Plan, 92896-REP-07701.8-00001, which outlined the monitoring requirements for the project. The Environmental Assessment follow-up plan included monitoring related to the following:

- Stormwater Management,
- Visual Screening of the Buildings from the Waterfront Trail,
- Shoreline Stability, and
- Public Attitude Research Survey

Environmental Assessment follow-up monitoring reports were provided to the CNSC in 2010 and 2021 following the construction of SB3 and SB4 respectively. Results of the monitoring are summarized below.

Since the Environmental Assessment Follow-up Plan 92896-REP-07701.8-00001 has been completed as required per WFOL Licence Condition 9.2, OPG requests the removal of this Licence Condition in the next licence.

Stormwater Management

The stormwater management systems associated with SB3 and SB4 consist of asphalt surfaces with catch basins, storm sewers, oil and grit separators, and an engineered outfall to the lake. The stormwater management systems are designed to MECP standards. The follow-up monitoring indicates that the constructed stormwater management systems met the intent of the design with no erosion or significant sediment transport evident.

Visual Screening

Trees were originally planted following the construction of SB3 to enhance visual screening of the building from various viewpoints from the Waterfront Trail. Following the construction of SB4, additional trees were planted and measures to enhance growth of existing trees were completed to the east of the PWMF Phase II Area to improve visual screening of SB4 from the Waterfront Trail. Follow-up monitoring of the trees was completed in 2023 and some were noted to require replacing due to damage to the bark from rodents. These trees were subsequently replaced in 2024 with additional trunk protection.

Shoreline Stability

Due to the proximity of the PWMF Phase II Area to the shoreline and the bluff, an erosion hazard assessment was completed to determine the appropriate setback of the buildings from the shoreline and the bluff per Ontario Regulation 166/06 under the *Conservation Authority Act*. The required setback from the bluff is based on the sum of 100 times the average annual recession rate, the stable slope allowance, plus an additional 10 meters landward. SB3 and SB4 were constructed outside of this limit per the regulatory requirements. OPG continues to monitor shoreline periodically in the vicinity of the PWMF Phase II Area.

2.10 Emergency Management and Fire Protection

Pickering NGS has effective nuclear, conventional and fire emergency preparedness and response programs that meets regulatory requirements and related objectives. Emergency preparedness measures and fire protection response capabilities are in place at Pickering NGS to prevent and mitigate the effects of nuclear and hazardous substances releases, both onsite and off-site, and fire hazards in order to protect workers, the public, and the environment.

The OPG documents in the table below require written notification of change per Pickering NGS Licence Conditions Handbook, LCH-PR-48.00.2028-R007:

Table 40. SCA 10 – Pickering NGS Emergency Management and Fire Protection

Document Number	Document Title
N-PROG-RA-0001	Consolidated Nuclear Emergency Plan
N-PROC-RA-0045	Emergency Preparedness Drills and Exercises
N-STD-AS-0010	Nuclear Crisis Communications Standard
N-REP-03491-0650826	Updated Emergency Planning Technical Basis for Provincial Nuclear Emergency Response Plan
N-PROC-RA-0133	Management of Equipment Important to Emergency Response
N-PROG-RA-0012	Fire Protection

2.10.1 Conventional Emergency Preparedness and Response

OPG-PROG-0030, *Ontario Power Generation Emergency Management Program*, ensures the security of OPG facilities and that strategies are in place that allow OPG to prepare for, respond to, and recover from emergencies that impact its operations or the public.

The objectives of the OPG Emergency Management program are to protect the health and safety of employees, contractors, the public and responders; the environment; OPG and third-party property; OPG's assets; OPG's reputation; and operational continuity.

The OPG Emergency Management program applies the all-hazards approach and Five Pillars of Emergency Management to facilitate: Prevention, Mitigation, Preparedness, Response and Recovery Efforts for all hazards and incidents that pose a risk to OPG's Emergency Management Program objectives. At OPG, incident management is carried out by several individual programs and initiatives spanning multiple business units.

Security Emergency Preparedness and Response

The Nuclear Security program supports the protection of nuclear assets at OPG. This program ensures security readiness and maximizes response capability to contain, mitigate, and terminate security events while minimizing the adverse impact on plant staff, operations and functions. Details regarding the development and maintenance of OPGs defensive strategy such as tactical deployment plans are classified as OPG Confidential—Security Protected or higher. In addition, the Cyber Security program manages potential cyber security issues affecting physical security at Pickering NGS. OPG also maintains plans for Information Technology Emergency Response which includes preparing, detecting and assessing, containing, eradicating and recovering from cyber incidents. See Section 2.12 for additional information regarding the Nuclear Security and Cyber Security programs.

2.10.2 Nuclear Emergency Preparedness and Response

OPGs Nuclear Emergency Preparedness program is documented in N-PROG-RA-0001, *Consolidated Nuclear Emergency Plan (CNEP).* This plan implements the requirements of CNSC REGDOC-2.10.1, *Nuclear Emergency Preparedness and Response, Version 2,* and serves as the basis for the site-specific nuclear emergency preparedness and response arrangements at OPG's nuclear generating stations. It describes concepts, structures, roles and processes to implement and maintain an effective OPG response in the unlikely event of a nuclear emergency that could endanger on-site staff, the public, or the environment. The objective of the program is to ensure OPG has adequate provisions for preparedness and response capability to mitigate the effects of accidental releases of radioactive material and ensure the health and safety of persons and the environment. The CNEP also provides a framework for interaction with external authorities and defines how OPG commitments under the Provincial Nuclear Emergency Response Plan (PNERP) are implemented. OPG acknowledges there is interest from Indigenous Nations and communities in the conduct of the Nuclear Emergency Preparedness program and has begun to undertake actions to facilitate further engagement.

In the unlikely event of a nuclear emergency at Pickering NGS, OPG would perform the appropriate notifications to the Province, CNSC, and local municipalities in accordance with established procedures and requirements under the PNERP. The ERO takes actions to control and mitigate the emergency on-site and minimize off-site effects. Under the PNERP, the Province takes actions to notify and protect the public, including directing protective actions such as sheltering, potassium iodide ingestion, or evacuation. The local municipalities support the implementation of Provincial directions. The response of OPG and a range of other organizations are integrated to ensure effective emergency measures are in place (Figure 39), and this inter-operability capability is demonstrated successfully during full scale exercises.

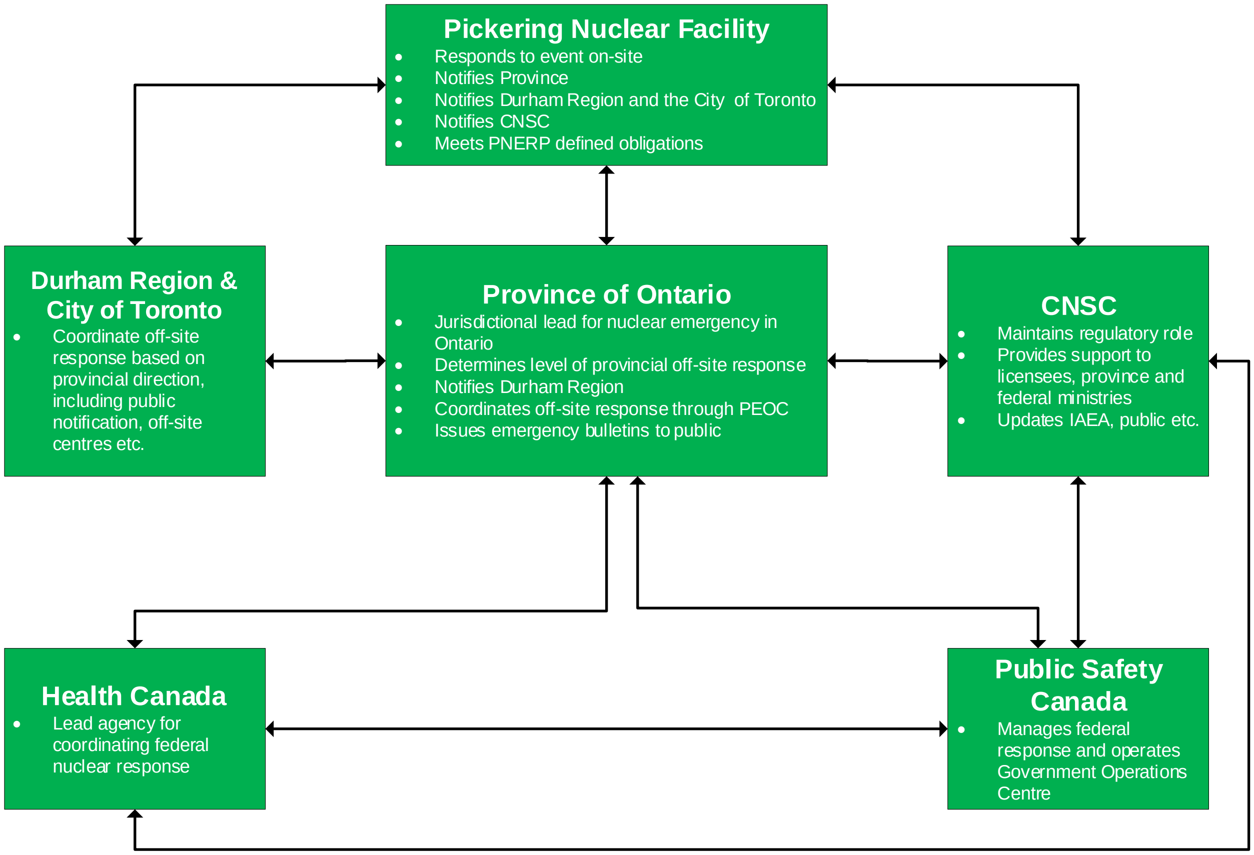

Figure 39. Emergency Response Agency Interactions

The PNERP, last revised in 2017, is undergoing a revision by Emergency Management Ontario (EMO) to align with international best practices. The review and update of the PNERP began in 2021 and is ongoing, with a draft issued on December 3, 2024. The Province will conduct a public consultation process with the objective of obtaining a Cabinet approved PNERP in 2025. Once the PNERP revision is complete, EMO will revise the Pickering NGS PNERP Implementing Plan. OPG will enhance its CNEP and related emergency plans to align with any PNERP requirements.

Nuclear Emergency Drills and Exercises at OPG

OPG frequently conducts emergency preparedness drills and exercises to ensure the capability to effectively respond to a nuclear emergency is sustained. Station-based radiological and nuclear emergencies are developed under the directive of N-PROC-RA-0045, *OPG Nuclear Emergency Response Organization Drills and Exercises* to meet the requirements of N-PROG-RA-0001 and CNSC REGDOC-2.10.1.

Pickering NGS drills and exercises serve to:

a) Develop and maintain the skills of the ERO members;

b) Test the effectiveness of emergency plans, procedures, facilities, equipment, and training; and to

c) Demonstrate the adequacy of plans and the preparedness to respond to events ranging from minor to SAs.

In September 2023, OPG executed a full-scale nuclear emergency response exercise (Exercise Unified Command) at Pickering NGS which included the participation by a range of external partners at all levels of government. The exercise and scenario were designed to test emergency plan arrangements less commonly demonstrated, including recovery operations. The exercise was successful in achieving its overall purpose of validating the preparedness of OPG and assessing the interoperability with government agencies and local communities to respond to a severe event. Lessons learned from this exercise included:

- Strategies to enhance drill realism, ensuring participants derive maximum benefit from the exercise.
- Enhancements to the methodology for designing extended duration exercise scenarios and managing the associated complexities.
- Enhancements in guidance to staff during event recovery phase.
- Improvements in processes, equipment, and training.

Equipment Important to Emergency Response

Equipment Important to Emergency Response (EITER) includes the procedures, SSCs, as well as essential tools and equipment necessary to implement the CNEP. EITER procedures ensure maintenance is prioritized and contingency actions are taken when EITER designated equipment is taken out of service or becomes unavailable. EITER ensures OPG has the capability to implement the CNEP through the readiness and availability of the EITER equipment, facilities, or through enacting compensatory measures or use of designated alternate facilities where the primary means may be unavailable. EITER requirements are integrated into the work management process for planned maintenance activities.

In 2020, OPG received an Industry Strength rating during an external review for the EITER program because of its innovative practices for tracking, managing, and maintaining this equipment.

Potassium Iodide (KI) Pills

Ingestion of KI is one protective action that may be directed by Provincial authorities in the unlikely event of a nuclear emergency. OPG continues to provide the Regional Municipality of Durham with the necessary resources and support to pre-distribute KI within the 10 km Detailed Planning Zone (DPZ), to meet the requirements of CNSC REGDOC-2.10.1 and the PNERP. Pre-distribution ensures that KI is available quickly for residents and businesses within 10 km of Pickering NGS. The KI pill inventory for the pre-distribution program is maintained separately from the emergency inventory that is maintained by the Province of Ontario. KI tablets pre-distributed within the DPZ are available at schools, childcare centres, health care facilities and municipal services. OPG also provides the ability for qualifying population outside the DPZ to receive KI free of charge. In the unlikely event of a nuclear emergency, additional supplies of KI are available at Reception Centres, Emergency Workers Centres, and for the Ingestion Planning Zone (IPZ).

The Prepare to Be Safe website (preparetobesafe.ca) serves as a platform for KI pill Frequently Asked Questions (FAQs) and provides a means for businesses and residents within 50 km of Pickering NGS to request KI pills. Website information is translated into the most common languages spoken within 10 km (based on census data). New households and businesses in the 10 km DPZ are identified by Canada Post and sent KI pills with supporting information included. Public awareness campaigns are conducted several times each year to raise awareness of KI availability, focused on the public residing within the 10 km DPZ, but extending into the IPZ, through various media (e.g., news releases, print advertisements, social media, and digital display boards). Durham Region has produced videos to raise general awareness about KI, one of which focused on the availability of KI within the 50 km IPZ.

OPG is committed to building long-term mutually beneficial working relationships and information sharing with other utilities, as well as organizations responsible for public health and emergency management coordination proximate to our operations. OPG continues to monitor the changes in the updated regulatory requirements and PNERP, and will maintain compliance. OPG continues to participate as engaged members in the CNSC-led Potassium Iodide Working Group (KIWG), and continues to offer support to the KIWG on all matters as needed, including engagement and outreach with Indigenous Nations and communities.

Engagement with Indigenous Nations and Communities

OPG has received interest from Indigenous Nations and communities to better understand OPG's Emergency Management program and continues in productive two-way dialogue with the Nations to share information, build relationships, and to further understand how they would like to be engaged.

In 2024, Emergency Management staff attended Framework Meetings with each of the Michi Saagiig First Nations to provide programmatic updates, and an overview of OPG's emergency response exercises, drills and programs. As part of the discussion, OPG learned more about the Nations' interest in future engagement opportunities in emergency response exercises and drills. Additional meetings and further engagement have continued into 2025, including plans to facilitate Michi Saagiig First Nation participation in exercises and drills.

In May 2023 and June 2024, Emergency Management was invited to participate in a Métis Nation of Ontario community open house where various emergency preparedness, transportation, and waste topics were discussed with attendees.

Public Engagement

OPG Enterprise Emergency Management staff participate in various annual public engagement opportunities where nuclear emergency planning, preparedness and response are discussed. A variety of platforms are used to engage and inform the public, including in-person events (and public information centres), printed products (newsletters, fact sheets), website information, and various traditional and social media strategies. OPG communicates with our local residents, as well as the public beyond our local communities, through a number of these communication products and forums.

Presentations are made every year to each to the Pickering Community Advisory Council and the Durham Nuclear Health Committee. In these meetings, overview of Ontario's nuclear emergency response framework, OPG emergency preparedness structure, and key program updates are presented as well as addressing various points of interest and questions. In 2024, during OPG's annual open house, emergency management information was made available to all attendees.

In early 2024, four separate public engagement events were attended by OPGs Emergency Management team where several emergency management areas of interest were discussed, and questions were answered. These events were well attended and generated productive discussion on OPG's programs.

Land Use

OPG monitors land use policies and activities in proximity to OPG nuclear facilities. Enterprise Emergency Management personnel support this activity, when required, to ensure planned activities have no adverse impact on the implementation of nuclear emergency plans.

The following table (Table 41) provides a list of Regional or Municipal Emergency Services within the 10 km area around Pickering NGS.

Table 41. Regional or Municipal Emergency Services

Regional/Municipal Emergency Service	**Name/**Location
Fire Emergency Stations	9: Pickering x4, Ajax x2, Scarborough x3
Regional Police Station	2: Durham Regional Police—West Division, and Toronto 43 Division
Hospitals	2: Lakeridge Health Ajax Pickering Hospital and Scarborough Health Network—Centenary

The table below (Table 42) is a list of Transportation systems within 10 km of Pickering NGS.

Table 42. Transportation Systems

Transportation System	**Name/**Location
Major Highways	401, 407, 412
Railway lines	Canadian National, south of Highway 401 Canadian Pacific, south of Highway 401
Naval Ports	Frenchman's Bay Yacht Club Liverpool Road Pier

Emergency Response Organization Performance

OPG has put a large focus on developing and sustaining a culture of innovation, resulting in several impactful initiatives being implemented successfully through annual Excellence Plans. To promote and sustain ERO performance through the pandemic, OPG implemented a remote drill evaluation solution to facilitate the continued execution of ERO drills in-person, at a time when the majority of industry had moved to conducting tabletop style drills. This solution has been recognized as an industry leading initiative and has been benchmarked externally by domestic and international partners. Although OPG's program has returned to in-person drill evaluation since the end of the COVID-19 pandemic, this innovative evaluation process remains available in case it is needed in the future.

As part of a program excellence initiative, a new ERO performance summary process and tool were implemented in 2023 to provide an accurate picture of overall ERO performance of ERO responders across facilities, teams, and ERO roles. This change improved how ERO performance is measured, tracked, and reported to provide data-driven insights into performance strengths and areas requiring improvement. In one example, this new process identified a need that was fulfilled by one-to-one targeted training for specific initial responders to increase their proficiency in their ERO role. This change improved response time to external

agencies and increased responder confidence. OPG intends to sustain and continually improve this ERO performance focus.

Public Address System

The Pickering NGS Public Address system provides immediate notification and messaging to staff working on site of important information, including emergency conditions and associated actions. This includes emergency tones and verbal messaging indicating different types of emergencies and required actions of staff.

Public Alerting

In the unlikely event of an emergency where the Province initiates protective actions under the PNERP, the need to shelter, evacuate or take other actions is communicated to the public as follows:

- *Sirens:* Mounted on poles, sirens emit a single tone alarm that can be heard outdoors. These sirens are located within 3 km of the Pickering NGS site.
- *Alert Ready:* Canada's National Public Alerting System provides public alerts through radio, television, and on LTE connected and compatible wireless devices (i.e., cellular phones).
- *Telephone Dialing System:* An automated telephone dialing system will deliver a recorded emergency message through landline home and business phone numbers within 10 km of the Pickering NGS site.
- *Radio, Television, Social Media:* Local radio and television stations, and social media, will broadcast information on public health, safety, and welfare. Instructions on what to do in the event of a nuclear emergency will be provided.

OPG provides resources and support to the Regional Municipality of Durham who owns, operates, and routinely tests the public alerting system including testing the sirens each fall and spring.

Alert Ready officially launched in March 2015; at which time it distributed alerts solely through broadcasters. In April 2018, wireless providers were also required to implement the system and started distributing alerts via smartphones. This system is in regular use by response agencies for a variety of public interest issues.

OPG is aware that Indigenous Nations and communities have ongoing interest regarding the notifications required under the current PNERP and has encouraged the Nations to engage through the Province's upcoming public consultation process for the PNERP revision.

Evacuation Time Estimates

OPG provides updates to the Pickering Evacuation Time Estimates (ETE) as new federal census data becomes available, which is typically every 5 years. An update to the Pickering ETE study using 2021 census data was issued in May 2023 and results were shared with off-site emergency planners and on opg.com.

The ETE study takes into consideration the time required to evacuate the emergency planning zones defined in PNERP, as well as evacuations of schools, hospitals, and other residential institutions. This work is completed with support and inputs from the Province, local municipalities, police, and transit organizations. Variables such as time of day, day of week, road restrictions, special event assemblies and weather are assessed as to how those factors may impact the evacuation duration. The full study, including scenarios analyzed, assumptions, inputs and results are available on opg.com.

Off-Site Support

In May 2022, OPG and EMO endorsed a new 5-year agreement to support EMO in the planning, maintenance, and execution of the PNERP. This new agreement supports the Province who provide staff with expertise in nuclear and radiological science, hazard identification and risk assessment, emergency planning, drills, and exercises, maintenance of 24/7/365 nuclear emergency response capability, and nuclear education and emergency preparedness materials.

A 10-year Nuclear Emergency Mutual Aid Agreement between Canada's four major nuclear operators (OPG, Bruce Power, Canadian Nuclear Laboratories and New Brunswick Power) was renewed in December 2022 which outlines emergency support that may be provided, and the processes involved in the unlikely event that a nuclear operator suffers a major emergency and requires mutual aid assistance.

OPG provides Monitoring and Decontamination capability at Emergency Worker Centres and Reception Centres. Enterprise Emergency Management maintains equipment inventories at these designated offsite locations for use by OPGs ERO, with the support of the local facility staff. OPG is continuously working with community partners and external stakeholders to improve off-site support.

OPG and its partners have conducted a wide range of drills to test this capability in recent years. Reception Centre exercises were conducted at Durham College Reception Centre in Oshawa in June 2018 and at Delpark Homes Centre in Oshawa in September 2019. More recently, in February 2022 an exercise was conducted at Orono Arena as an Emergency Workers Centre, and in October 2024 at York University as a Reception Centre. During these exercises, the OPG Monitoring and Decontamination Unit was activated and processed members of the public or emergency workers and their vehicles, and participation of community partners was present. Lessons learned from these exercises have been incorporated into OPG, City of Toronto, and Durham Region processes and procedures.

OPG continues to collaborate with its off-site partners to conduct off-site center drill and exercises and drive improvements to emergency plans and operations and to improve familiarization of local nuclear emergency planners.

2.10.3 Fire Emergency Preparedness and Response

OPG's comprehensive Fire Protection program consists of two elements: the Fire Protection programs group which provides programmatic oversight for regulatory compliance, and the Fire Protection Operations group (Emergency Response Team) which provides fire emergency response at Pickering NGS. OPG's Fire Protection program and its elements are outlined in N-PROG-RA-0012, *Fire Protection* and is based on the requirements of CSA N293-12 (R2017)[4], *Fire protection for nuclear power plants.* OPG has processes to ensure that all reasonable measures are taken to prevent fires, and to promptly detect and suppress any fires that may occur at the plant. Oversight of the inspection, testing, and maintenance of fire protection systems to ensure they operate as designed during the life of the systems.

[4] Application of N293-23, "Fire Protection of Nuclear Power plants" will follow the implementation plan process as part of this PROL renewal.

Furthermore, OPG maintains, and updates the station's Annual Plant Condition Inspection (APCI) Report, FHA Report, Fire Safe Shutdown Analysis (FSSA) Report, and the Code Compliance Review (CRR) Report, to demonstrate regulatory compliance to the requirements of CSA N293 as stipulated in the LCH for Pickering NGS.

The latest 2024 APCI for Pickering NGS was completed by an independent, qualified third-party vendor. The vendor reported that there was sufficient evidence to conclude that OPG Fire Protection Program was being followed and effectively maintained to ensure compliance with the applicable requirements of CSA N293-12 (R2017), NFCC, and NBCC.

A CCR covering 2024 verified the as-built conditions of the station complied with the applicable requirements of CSA N293-12 (R2017) and its references (NFCC and NBCC).

Pickering NGS's Fire Protection Assessments, which consist of the FHA and Fire Safety Shutdown Assessment were re-affirmed in 2022 and submitted to the CNSC. In general, the analysis concluded that Pickering NGS is provided with effective design, construction, fire protection features and operational controls to mitigate the fire hazards present and maintain the fire, life and nuclear safety goals defined in CSA N293.

Emergency Response Team

OPG maintains an on-site, 24/7 Emergency Response Team (ERT) for manual fire suppression operations at the Pickering NGS site. The Pickering NGS ERT is a team consisting of full time 24/7 Emergency Response Maintainers (ERMs), Shift Emergency Response Managers (SERMs) and day-based light duty staff. Individual ERMs of the ERT hold the same basic qualifications as professional firefighters at a municipal fire department, and the ERT as a group, and the ERMs as individuals also meet the requirements of internationally recognized NFPA 600, *Standard on Facility Fire Brigades, and* NFPA 1081, *Standard for Facility Fire Brigade Member Professional Qualifications* respectively. As a result, many of the ERMs act in volunteer positions with the nearby municipalities and well recognized for their extensive training and knowledge of conventional and industrial firefighting.

A Memorandum of Understanding (MOU) is established between OPG and the Municipality of Pickering Fire Services (PFS), to structure the mutual aid agreement and financial support between OPG and PFS. As part of this MOU, PFS will respond to all fire emergencies at the Pickering NGS site and provides assistance as needed.

The Pickering NGS ERT participates in multiple annual drills to demonstrate ERT's training and technical capabilities ranging from site drills, contaminated casualty and hospitalization drill, EME deployment drill, to live fire drills at the Wesleyville Fire and Rescue Academy. The latest drills in 2024 were successful and demonstrated the Pickering NGS ERT's ability to respond to realistic scenarios that may occur at the Pickering NGS site.

OPG's Wesleyville facility provides on-site training to Pickering NGS ERT including fire response, medical response, and other specialized training such as hazardous materials response and high-angle rescue. Wesleyville has supplemented traditional emergency response training by facilitating aerial drone courses for OPG Emergency Services, municipal fire, police and transit. Through joint training and inter-operability drills at Wesleyville with local municipal fire departments, OPG continually strengthens relationships and collaboration between OPG and these off-site partners.

As part of its regular equipment upgrade initiative, Pickering NGS ERT has acquired new Self-Contained Breathing Apparatus (SCBA) Air-Pak X3 for firefighting. The purchase of new SCBA ensures that the ERMs are provided with new tools for their firefighting needs. The new Air-Pak

X3s are also the same equipment used by Pickering Fire Services Department, which allows for compatibility, interchangeability and flexibility during a joint Pickering NGS ERT and PFS response.

In the past four years, Pickering NGS ERT has been incorporating aerial drones from the OPG Security and Emergency Services Aerial Support Unit into its training. The aerial drones are used during training to film fire training evolutions and exercises for enhanced evaluation and feedback, as well as reconnaissance and surveillance tools in a variety of scenarios to minimize fire and radiation exposures to firefighters at the scene.

The OPG Aerial Support Unit (ASU) has been working with local fire and police for cross training at our fire academy, supporting public safety events in the surrounding towns. The ASU has been on standby and gone on several mutual aid calls for search and rescue and public safety related responses from Peterborough Police, Port Hope Fire and Police, Clarington Fire and Durham Regional Police, providing real world benefits and strengthening these partnerships.

2.10.4 Pickering NGS Units 1 to 4 Decommissioning

This section provides additional information regarding the Emergency Management and Fire Protection SCA with respect to Units 1 to 4 decommissioning. It is intended to supplement the information provided in the general SCA discussion above and therefore only addresses those specific areas where additional decommissioning-related details are needed.

Emergency Preparedness and Response

The Nuclear Emergency Preparedness Program N-PROG-RA-0001, Consolidated Nuclear Emergency Plan, will be adhered to during and following the decommissioning of Pickering NGS Units 1 to 4. Validated adjustments will be made to the Minimum Shift Complement and Pickering NGS Units 1 to 4 Main Control Room staffing. Emergency preparedness response procedures will be transitioned to the Pickering NGS Units 5 to 8 Shift Manager. The remaining ERO structure, including the Emergency Operations Centre, will remain unchanged, as it serves as a central function to the Pickering NGS. OPG is committed to ensuring safe operation of the Pickering NGS facility and will ensure there are adequate emergency response capability at all times.

Nuclear Emergency Drills and Exercises

Requirements for ERO drills for Pickering NGS Units 1 to 4 Decommissioning and Pickering NGS Units 5 to 8 Refurbishment are under review. After Pickering NGS Units 5 to 8 refurbishment is complete the station will be operated with one controlling authority (shift manager) and an Emergency Response Organization. OPG will continue to meet the drill and exercise requirements in the Consolidated Nuclear Emergency Plan.

Fire Protection Systems

Existing monitoring, inspection, and maintenance activities will continue during the SWS period. A system or portions of the system in the abandoned state do not require any special considerations except for routine operator rounds for general surveillance as described in the SWS Plan.

The Fire Protection Assessment documents are made up of Code Compliance Review and FHA and will be maintained during SWS. These documents are required to confirm the fire protection requirements based on facility end-state configuration, including hazard levels, staffing, and fire response strategies. During SWS, these documents will be reviewed and revised as required by CSA N293.

Design modifications will be completed during SWS for new fire detection and alarm equipment where new detection is required based on the results of the SWS FHA and CCR. Similarly, existing equipment will be removed from service if it is no longer required based on the results of the SWS FHA and CCR.

2.10.5 Pickering NGS Units 5 to 8 Refurbishment

This section provides additional information regarding the Emergency Management and Fire Protection SCA with respect to Units 5 to 8 refurbishment. It is intended to supplement the information provided in the general SCA discussion above and therefore only addresses those specific areas where additional refurbishment-related details are needed.

Emergency Preparedness and Response

OPG's Nuclear Emergency Preparedness Program, N-PROG-RA-0001, *Consolidated Nuclear Emergency Plan* is being maintained during the refurbishment period, though the types of nuclear emergency scenarios possible during this period will be significantly reduced. OPG will ensure that personnel, programs and processes for emergency preparedness are integrated into refurbishment activities, and capabilities to respond to the events possible during this period will be sustained. This will include contractors following the same site emergency procedures as OPG staff. Additional assembly and accounting areas will be set up to accommodate refurbishment staff and contractors.

For the refurbishment project, N-PROG-RA-0012, *Fire Protection* is being followed. During refurbishment, OPG will:

- Prepare fire protection strategies.
- Provide support for the FHA and FSSA for the islanding areas and refurbishment units.
- Act as CA and fire protection subject matter expert for Combustible Material Safety Permits (CMSPs).

  The CA term is defined as the person who is “Evaluating Combustible Material Safety permits and working with Subject Matter Expert (SME) reviewers and permit owners to approve or reject the Combustible Material Safety permit request”.
- Act as Ignition Source Permit issuer.
- Provide sufficient resources to response to first aid, firefighting, rescue and hazmat incidents in refurbishment units and operating units.

Lessons learned from the Darlington NGS OPEX are actively being integrated into the planning for the Pickering Refurbishment. Fire Protection is proactively establishing a robust support team to address the anticipated increase in vendor partners, combustible materials, and hot-work activities in the field. Comprehensive oversight by Fire Protection is being implemented in preparation for refurbishment activities through thorough reviews of engineering changes/modification, emergency response planning, and storage area assessments. These measures are designed to ensure the safety of personnel, property, and the environment by minimizing the risk of fire-related incidents.

2.10.6 Pickering Waste Management Facility

2.10.6.1 Emergency Preparedness Program

The OPG documents in the table below require written notification of change per PWMF Licence Conditions Handbook, LCH-W4-350.00/2028 R003:

Table 43. SCA 10 – PWMF Emergency Preparedness

Document Number	Document Title
N-STD-RA-0036	Radioactive Materials Transportation Emergency Response Plan
N-PROG-RA-0001	Consolidated Nuclear Emergency Plan

The purpose of the Consolidated Nuclear Emergency Plan (CNEP), as described in Section 2.10.2, is to outline the essential program elements, objectives, roles, and responsibilities necessary for OPG to effectively respond to nuclear emergencies. The primary goal of this plan is to safeguard the public, employees, and the environment in the event of a nuclear emergency.

While potential scenarios at the PWMF do not present a radiological hazard to the public and, therefore, would not necessitate protective actions as outlined in the Provincial Nuclear Emergency Response Plan, there may still be a risk to on-site personnel or the environment. In such cases, the procedures outlined in the CNEP would be implemented to manage the situation, particularly if a station emergency is declared or if support from the Emergency Response Organization is required.

PWMF on-site staff participate in regular, site-wide emergency drills, which include assembly and accounting, as well as site evacuation of non-essential personnel. Procedures are specifically defined for both the Phase I building (protected area) and the Phase II building (outside the protected area) of the OPG site, with distinct instructions for each.

The PWMF staff actively participate in emergency response drills organized by the Pickering NGS. PWMF buildings engage in Full Site Assembly and Accounting drills, which are conducted annually. During these drills, staff are required to demonstrate their ability to complete accounting procedures and to execute various ERO activities, including:

- Implementing the station’s emergency response plan and procedures,
- Mobilizing the Emergency Response Organization and associated facilities,
- Developing and executing a mitigation strategy to reduce the consequences of accidents,
- Conducting Full Site Assembly and Accounting of all personnel within the Protected Area (PA),
- Formulating and implementing protective actions for plant personnel.

Additionally, full site evacuation drills are held every five years, testing the ability to evacuate and relocate on-site personnel. PWMF staff are required to participate in these comprehensive drills.

OPG is committed to enhancing and refining its Emergency Preparedness program to ensure compliance with evolving regulatory requirements and industry best practices. OPG is currently in compliance with CNSC REGDOC-2.10.1 Version 2; OPG will conduct a gap analysis and prepare an implementation plan for meeting the requirements of the REGDOC-2.10.1 Version 3 as well as the revised PNERP. OPG maintains a robust framework for continuous improvement by incorporating valuable insights and lessons learned from drill and exercise reports. These reports play a pivotal role in identifying areas for enhancement, enabling OPG to continuously strengthen its preparedness, response capabilities, and overall program effectiveness.

Emergency response for Radioactive Materials Transportation is discussed in Section 2.14.

2.10.6.2 Fire Protection Program

The OPG documents in the table below require written notification of change per PWMF Licence Conditions Handbook, LCH-W4-350.00/2028-R003:

Table 44. SCA 10 – PWMF Fire Protection Program

Document Number	Document Title
N-PROG-RA-0012	Fire Protection

The purpose of the Fire Protection Program, as described in Section 2.10.3, is to define the key program elements, objectives, and roles and responsibilities, with the overall goal to minimize the risks and consequences of fire to OPG Nuclear facilities.

The fire protection provisions for PWMF are currently required to conform to the following:

- CSA N393-13 (Reaffirmed 2018), *Fire protection for facilities that process, handle or store nuclear substances,*
- NRC NBCC (2015)
- NRC NFCC (2015).

In 2023, OPG conducted code-over-code reviews for the following:

- CSA N393-22 vs CSA N393-13 (Reaffirmed 2018)
- NBCC 2020 vs NBCC 2015
- NFCC 2020 vs NFCC 2015

The code-over-code reviews resulted in implementation plans and actions to ensure PWMF will be in compliance with these latest codes and standards, which were submitted to CNSC staff. PWMF will be compliant with NBCC-2020, NFCC-2020 and CSA N393-22 by December 19, 2025.

During the current licence period:

- Annual Fire drills were performed in accordance with the CSA N393 and NFCC, with satisfactory findings from these drills.
- Third-party reviews, analysis and audits have been completed confirming compliance with CSA N393 requirements.
- OPG issued its Fire Impairment Manual, which describes how OPG manages impairments for NSS facilities, including PWMF.
- OPG issued its NSS Combustible Material Safety Instruction, to ensure that all transient combustible materials are minimized in NSS facilities, including PWMF.

These activities are described in more detail in the subsections below.

Governance

PWMF's facility specific Fire Protection Program has been incorporated into OPG Nuclear's Fire Protection Program to ensure a consistent approach to fire protection across all the nuclear sites. NSS fire protection procedures and other elements derive their authority from the OPG Nuclear Fire Protection Program. NSS governance has been reviewed to ensure effective alignment with OPG Nuclear's Fire Protection Program. A comprehensive program ensures adequate fire protection by minimizing both the probability of occurrence and the consequences of fire at the facilities. Fire Protection governance will be frequently reviewed to maintain the alignment of NSS, including PWMF, with OPG Nuclear.

Engineering Change Control

All new structures and existing design modifications are reviewed for fire protection impact through the ECC process.

Fire Safety Plan

The PWMF Fire Safety Plan provides direction with respect to fire prevention, fire protection, emergency procedures, training and drills. The Fire Safety Plan is reviewed and revised accordingly on an annual basis to ensure it reflects current field conditions and practices. The Fire Safety Plan at PWMF meets the requirements of the National Research Council of Canada (NRC) NFCC.

Inspection, Testing, Maintenance

During the current licence period, in accordance with the PWMF operating licence, the inspection, testing and maintenance of the fire detection and suppression systems was performed at the required frequency, as stipulated in the NFCC (2015). The inspection and testing were performed by OPG and reviewed by a third party tri-annually, to confirm the PWMF fire systems have been operated, inspected, tested, and maintained in accordance with the NRC NFCC (2015) and the standards listed therein.

The independent third-party report indicated that PWMF is in general compliance with the CSA N393-13 (Reaffirmed 2018), and NFCC (2015) requirements. Findings resulted from these reviews have been addressed via corrective actions to:

- Perform 5 years internal piping inspection of the fire water main and the standpipe system.
- Ensure the dry leg piping of the standpipe system is hydrostatically tested every 5 years.

A new requirement of NFCC (2015) is to perform fire dampers testing every 4 years; the testing has been completed to achieve compliance with the new requirement.

Fire Drills

During the current licence period, fire drills were performed in accordance with the CSA N393-13 (Reaffirmed 2018) and NFCC (2015). Findings from drills have been satisfactory with no major findings. The full scall fire drills were performed with the participation of the municipal fire department.

Analysis, Assessments, Reviews, Audits

To maintain the compliance of PWMF with CSA N393, the following required third-party reviews, analysis and audits have been completed within the intervals stipulated in CSA N393:

- Fire Hazard Assessment.
- Code Compliance Review.
- Fire Protection Program Audit.
- Annual Facility Condition Inspection.
- Fire Response Needs Analysis.

The results of the compliance reviews have been submitted to the CNSC as required by the PWMF operating licence and CSA N393. The analysis, assessment and audit reports have confirmed the overall compliance of PWMF with the requirements of CSA N393.

Fire Protection Response

An *MoU* between the Municipal of Pickering and OPG applies to the provision of fire protection services, including coordinated emergency response. In the event of an on-site incident, City of Pickering's Fire Services will be called for assistance.

The initial response for extinguishing fires in the PWMF Phase II, the facility's portion within its own protected area, rests with the Pickering Fire Services, with support from the Pickering NGS Emergency Response Team.

The initial response for the PWMF portion inside the Pickering NGS protected area (Phase I) rests with Pickering NGS Emergency Response Team with support from Pickering Fire Services. Pickering Fire Services is familiar with PWMF, participating with the facility's annual fire drills at PWMF.

PWMF Fire Impairment Manual

During the current PWMF licence period, OPG has issued its NSS Fire Impairment Manual, which describes how OPG manages impairments for OPG's NSS facilities, including PWMF. This manual provides resource information to guide trained staff who are directly involved with planned and unplanned impairment to the fire protection system in evaluating, establishing, planning, controlling and executing outages of fire protection systems. The manual also provides detailed compensatory measure information for impaired fire systems.

Waste Combustible Material Safety Program

OPG has issued its Waste Combustible Material Safety Instruction to ensure that all transient combustible materials are minimized, properly assessed, analyzed, and authorized before being placed in the waste management facilities, including PWMF. Combustible materials, combustible equipment, and ignition sources, other than that forming part of the approved facilities design that is located outside of designed storage areas, shall be eliminated. When elimination is not practical, combustibles shall be minimized, controlled, analyzed, and located in accordance with this combustible material safety instruction.

Planned Activities

The following activities and improvements are planned for the PWMF:

- *Fire Protection - Detection System:*
    - Continue to perform inspections, testing, and maintenance of the fire detection system as per the current preventive maintenance schedule.
    - Install new equipment to improve the performance of PWMF SB3 booster panels.

- Replace the existing (obsolete) fire panel at PWMF Processing Building with new fire panel.

- *Fire Protection - Suppression System:*
  - Continue to perform inspection, testing, and maintenance as required by the applicable codes and standards.
  - Inspect PWMF Fire Protection Standpipe System for the presence of foreign organic and inorganic material using Ultrasonic Testing (UT) method (frequency every 5 years).
- *New Structures:*
  - New construction structures within PWMF will comply with CSA N393-22, NBCC 2020, NFCC 2020, and applicable fire Codes and Standards. The new structure's Fire Hazard Assessment report, Code Compliance Review report and the results of the Third-Party Review, will be added to PWMF Fire Hazard Assessment report and Code Compliance Review report during the next review/update cycle of these reports, as stipulated in CSA N393.

2.11 Waste Management

OPG has a mature and effective waste management program that ensures adequate provisions are in place to limit the generation of radioactive and non-radioactive wastes and if created, control/manage its handling, storage, and disposal. The waste management program ensures the safety of workers and the public and facilitates continuous improvement in environmental performance in support of OPG's Environmental Policy.

Non-radioactive (conventional and hazardous waste) and radioactive waste elements of this SCA are managed via two waste management programs:

- OPG-PROG-0005, *Environment Health and Safety Managed Systems*; and,
- W-PROG-WM-0001, *Nuclear Waste Management*.

The *Environment Health and Safety Managed Systems* program, OPG-PROG-0005, describes how OPG's EMS meets the requirements of the ISO 14001, *Environmental Management Systems* standard, including waste management activities. Standard OPG-STD-0156, *Management of Waste and Other Environmentally Regulated Materials*, is part of the EMS program and describes OPG's processes and procedures to address regulatory requirements with respect to waste management. OPG is subject to federal and provincial waste management regulations which include general waste management practices, transportation of dangerous goods, Polychlorinated Biphenyl (PCB) management, ODS management, and CNSC requirements for nuclear facilities. The radiological waste content of OPG-STD-0156 is limited to low and intermediate level radioactive waste only.

The *Nuclear Waste Management* Program, W-PROG-WM-0001, is a mature and effective program applicable to all OPG Nuclear. The objective of this program is to ensure adequate provisions are in place to limit the production of radioactive waste and to control its handling, storage, and disposal. Activities are performed in accordance with licensing basis standards and governing documents that prescribe controls and responsibilities to ensure the activities are carried out in a safe and effective manner by qualified personnel. W-PROG-WM-001 is the program that implements the requirements of CNSC REGDOC-2.11.1 *Waste Management*, CSA N292.0-19 *General principles for the management of radioactive waste and irradiated fuel*, CSA N292.2-13 *Interim dry storage of irradiated fuel* and Update No. 1 (2015) and CSA N292.3-14, *Management of low and intermediate level radioactive waste*.

Transportation of radioactive waste material is managed by W-PROG-WM-0002, *Radioactive Material Transportation*. This program ensures safe, compliant and efficient transportation of radioactive material from the site to an off-site interim storage facility.

All waste handling and management activities are conducted in a manner that meets the requirements of OPG's RP Program. Waste streams are handled and processed in a manner that ensures the safety of employees, the public, and the environment, while applying best practices to reduce and effectively segregate the generated waste. Additionally, OPG's RP Program ensures the safe transfer of radioactive materials on site.

The OPG documents in the table below require written notification of change per Pickering NGS Licence Conditions Handbook, LCH-PR-48.00.2028-R007:

Table 45. SCA 11 – Pickering NGS Waste Management

Document Number	Document Title
W-PROG-WM-0001	Nuclear Waste Management
OPG-STD-0156	Management of Waste and Other Environmentally Regulated Materials
N-PROC-RA-0017	Segregation and Handling of Radioactive Waste
OPG-PROG-0005	Environment Health and Safety Managed Systems
W-PROG-WM-0003	Decommissioning Program
W-STD-WM-0006	Planning for Decommissioning
W-STD-WM-0005	Conduct of Decommissioning
N-PROC-WM-0001	Disposal of Oil and Chemical Waste

2.11.1 Waste Management Practices

Pickering's waste management program provides direction on waste handling and disposal processes and ensures proper planning, segregation, handling and disposal of Low and Intermediate Level Waste (L&ILW). N-PROC-RA-0017, *Segregation and Handling of Radioactive Waste*, provides direction to workers on the segregation and handling of potentially radioactive solid and liquid waste resulting from operation and maintenance activities.

Waste is generated at Pickering NGS from daily operations and maintenance activities as well as during planned and unplanned outages. Over the next licence period, waste will also be generated from decommissioning of Pickering NGS Units 1 and 4 and the refurbishment of Pickering NGS Units 5 to 8.

Employees working within the station typically dispose of wastes using one of the following methods:

1. Solid wastes are brought to a collection area, where solid waste can be initially sorted as Active Waste, Likely Clean Waste, or Active Metal Waste.
2. Liquid and chemical wastes are dropped off at the Pickering Incoming Outgoing Transfer System.

3. Pickering Common Services Waste Handling is contacted for assistance in containing, securing, or picking-up large, heavy, or hazardous material.

To facilitate safe disposal of waste, qualified Waste Handlers collect waste from designated areas throughout the station, segregate it and categorize the waste into one of the following waste streams:

- Solid radioactive waste, which is shipped to a licenced WMF for incineration or interim storage (compactable and non-processible).
- Radioactive oil, which is shipped to a licenced WMF for incineration.
- Radioactive liquid chemicals, which are solidified on site and shipped to be stored at a licenced WMF.
- Inactive solid conventional waste, which is shipped to public landfill or recycled.
- Inactive chemicals/liquid industrial waste, which is shipped to an approved waste receiver for disposal via incineration or placement in a hazardous landfill.
- Inactive PCBs, which are shipped to a licensed waste facility for destruction.

Storage of waste, including radioactive LLW and ILW, at Pickering NGS is transient and limited to the timeframe required to characterize, package and send the waste for interim storage or off-site disposal.

2.11.2 Waste Characterization

Waste generated at Pickering NGS is categorized as either radioactive waste or inactive (non-radioactive) waste depending on the radiological zone of its origin and based on radiological surveys and analysis. Radioactive waste is further categorized as LLW, ILW, or High Level Waste (HLW), to meet the Waste Acceptance Criteria (WAC) for the waste receiving facilities. Inactive (non-radioactive) waste is further segregated as conventional waste or hazardous chemical waste. For gaseous wastes (i.e. emissions), refer to Section 2.9.4.

To further segregate and reduce active waste volumes, LLW is sorted into three categories: incinerable; compactable; and, non-processible LLW. ILW largely consists of resins, filters and used reactor core components. HLW comprises used nuclear fuel that has been withdrawn from the nuclear reactors following irradiation.

Pickering NGS adheres to W-PROC-WM-0096, *Nuclear Waste Characterization*, which documents the requirements for the characterization of L&ILW; this procedure is currently being updated to comply with the requirements of CSA N292.8-21, *Characterization of radioactive waste and irradiated fuel,* including guidance on preparing a waste characterization plan. Plan W-PLAN-034691.1-00001, *Low- And Intermediate-Level Waste Characterization Plan*, provides further detail on the characterization for routine L&ILW generated at Pickering NGS and is also being revised to comply with CSA N292.8. For the non-routine radioactive waste generated at Pickering NGS, waste characterization plans in compliance with W-PROC-WM-0096 will be generated. As communicated to CNSC staff, OPG will be compliant with CSA N292.8-21 by December 19, 2025.

CANDU used fuel has historically been characterized and documented to support development of safe handling and storage requirements. This information with an assessment basis is captured in the PWMF safety report and meets the intent of CSA N292.8-21.

Radioactive Solid Waste

Figure 40 shows the volume of L&ILW generated annually by Pickering NGS since 2018, during regular operation and maintenance conditions.

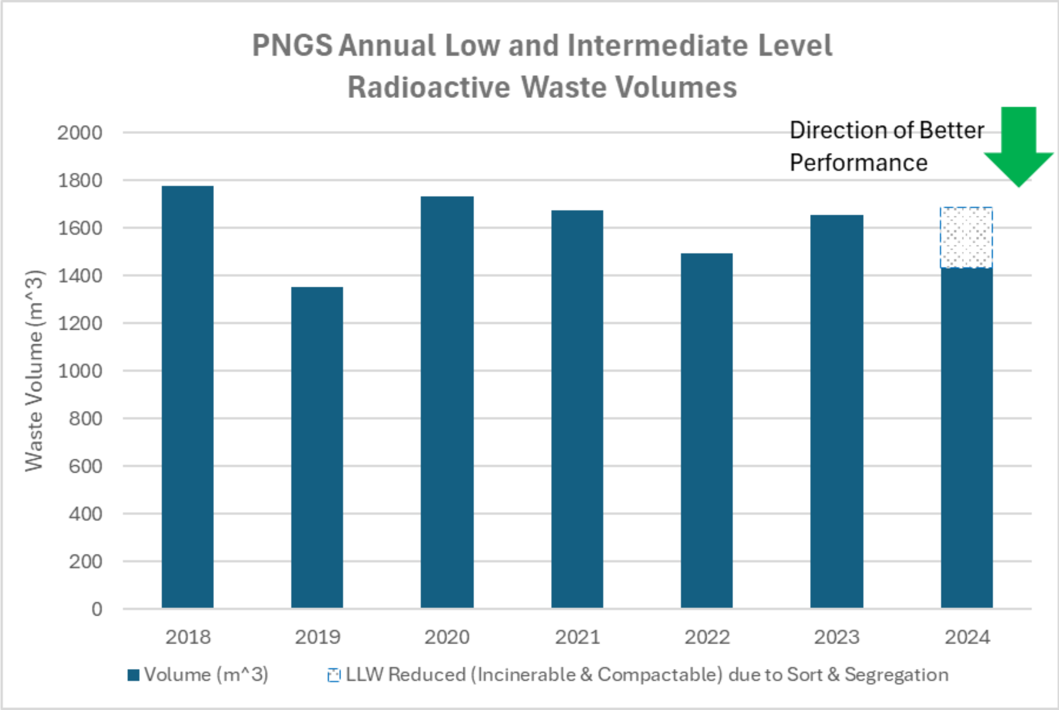

Figure 40. Pickering NGS Low and Intermediate Level Radioactive Waste

The refurbishment and decommissioning projects for Pickering NGS will produce increased conventional and radioactive waste volumes resulting in an increased demand for radioactive waste management services and radioactive material transportation services. Most of decommissioning work during this licence period will generate inactive waste.

During the 2024 to 2040 timeframe, changes will be required with respect to OPG's waste management infrastructure due to the diverse needs of these overlapping and continuing projects. To further enhance and support the safe and effective management of the waste volumes, OPG is currently investigating plans to potentially expand existing waste handling areas within Pickering NGS.

Given each project bundle has a different and direct effect on the volume of L&ILW generated, improvements to waste management capabilities will correspond with each project's distinct timelines as required. This will ensure ongoing innovative, effective, and timely waste management planning and support the overall continued success of Pickering NGS and PWMF. Recognizing the significance of radioactive waste management and the importance of waste segregation/diversion techniques that are currently being utilized will aid in achieving the effectiveness and efficiencies to ensure that plans not only incorporate these strengths but also expand them to accommodate the additional work and waste generation. OPG Pickering implemented a Sort and Segregation Program in late 2023. The program has proven our ability to divert low level radioactive waste to the conventional waste stream as seen in Figure 40. In 2024, Pickering reduced a total of 254.42 m^3 of compactable and incinerable low level radioactive waste. These efforts will yield a reduced environmental footprint and will support the overall waste strategy of preventing, safely managing and harnessing waste. This also supports the waste hierarchy of Prevention, Minimization, Reuse, Recycling, Treating and Disposal.

High Level Waste

Each year, approximately 30,000 used fuel bundles from the Pickering NGS are safely transferred from the IFBs into DSCs and stored at the PWMF. This secure and carefully managed process ensures full traceability — Pickering NGS can account for every fuel bundle ever used in the station's history, representing over 100 reactor operating years of nuclear energy generation.

As of the end of 2024, a total of 1,339 DSCs were safely housed across four SBs at the PWMF. The current PWMF licence also authorizes OPG to expand storage capacity by constructing two additional storage buildings at the Phase II site.

Currently, a SB5 is in the planning stages. With a design capacity to hold 1,410 DSCs, SB5 is expected to be in service by approximately 2027, further reinforcing OPG’s commitment to the safe, long-term stewardship of used nuclear fuel.

Conventional Solid Waste

Once “Likely Clean” solid waste collected from within the station and PWMF have been confirmed not to be contaminated, the material is routed to the conventional waste stream and taken to designated conventional waste handing areas where it is packaged and sent for off-site disposal. Conventional solid waste is also volume-reduced where possible to minimize its environmental impact and any materials that can be recycled are segregated for that purpose. Recyclable material collected and processed at Pickering NGS includes wood, cans, cardboard, paper, paper towels, plastic, asphalt, concrete, compost, metal, and glass.

Hazardous Chemical Waste

Hazardous waste generated at Pickering NGS includes chemicals and liquids such as cleaning agents, grease, oil, waste fuels, acids, batteries, and PCB light ballasts, and may include asbestos. The liquid and chemical wastes are generated as a result of operations, use of equipment and systems, maintenance, and outage activities. Additionally, some systems that will be drained as part of safe storage and decommissioning activities could contain liquid and chemical waste.

Hazardous and chemical waste handling and disposal is governed by OPG-STD-0156, *Management of Waste and Other Environmentally Regulated Materials*. The volume of chemical drums on site is tracked and reported monthly and compared to established targets to ensure liquid waste volumes are maintained at a low manageable level and that the waste is disposed as required by Ontario Regulation 347 requirements.

2.11.3 Waste Minimization

Waste minimization is a shared responsibility amongst all OPG employees implemented through the concept of “Reduce, Reuse, Recycle”. Waste minimization and segregation are part of work planning processes.

Pickering NGS’s waste minimization goals are two-fold: to minimize the volume of waste generated overall and to reduce the quantity of radioactive waste which is generated. The main initiatives that contribute to radioactive waste minimization are:

- Washable personal protective equipment: personal protective equipment worn inside the station is collected, washed and decontaminated by a licensed contractor for re-use.

- The “Likely Clean” program: segregates waste generated inside the PA. “Likely Clean” waste cans are placed next to “Active Waste” cans and waste generated in Zone 3 areas that is believed to be uncontaminated is placed in the Likely Clean receptacles. Likely Clean waste is surveyed and, if confirmed free of contamination, is disposed of as conventional waste.
- "Active Metal" bins: allows for the segregation of active metal (non processible waste) from other radioactive waste (incinerable and compactible). When active metal waste is mixed with incinerable and compactible waste the entire volume of waste is categorized as non-processible waste. Therefore, the segregation of active metal waste helps reduce non-processible radioactive waste.

OPG tracks LLW diversion metrics on a quarterly basis. A total of 85.9% of LLW was diverted in 2024, with washable Personal Protective Equipment (PPE) contributing to 22% of the total waste diverted.

Waste handlers separate the solid waste into conventional, radioactive, and hazardous waste streams and where possible, conduct additional sorting and segregation of LLW to further minimize LLW volumes. To reduce radioactive waste, plastic, wood and cardboard packaging is removed from items entering the station, thus reducing the risk of the packaging from becoming contaminated LLW.

Site-wide communications on waste reduction expectations continue to improve behaviours and performance in waste reduction initiatives. Work groups are held accountable for waste reduction strategies and implement them in daily activities and work tasks.

2.11.4 Decommissioning Plans

The *Decommissioning* program, W-PROG-WM-0003 describes the requirements and processes to safely and cost effectively decommission OPG owned nuclear facilities and provide assurance that decommissioning work will be performed in accordance with the applicable regulatory requirements and Codes and Standards.

In accordance with the requirements of CSA standard N294-19, *Decommissioning of facilities containing nuclear substances*, CNSC regulatory documents REGDOC-2.11.2, *Decommissioning* and REGDOC-3.3.1, *Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities,* OPG has prepared the following decommissioning plans for the Pickering NGS site*:*

- The DDPs, NA44-PLAN-00960-00004 *PNGS-A Detailed Decommissioning Plan Volume 0 – Program Overview,* NA44-PLAN-00960-00005 *PNGS-A Detailed Decommissioning Plan Volume 1 – Out-Buildings,* NA44-PLAN-00960-00006 *PNGS-A Detailed Decommissioning Plan Volume 2 – Non-Nuclear Component Removal*. The DDPs were submitted to the CNSC in December 2024. Five years from the submission of the DDPs, the DDPs (Volume 0, Volume 1, Volume 2 and any active volume) will be reviewed and updated as per regulatory requirements. These documents supersede P-PLAN-00960-00001, *Pickering Nuclear Site Preliminary Decommissioning Plan*.
- The PDP, NK30-PLAN-00960-00001 *PNGS-B Preliminary Decommissioning Plan*. The PDP was submitted to the CNSC in March 2025. Five years from the submission of the PDP, the PDP will be reviewed and updated as per regulatory requirements. This document supersedes P-PLAN-00960-00001, *Pickering Nuclear Site Preliminary Decommissioning Plan*.

- The PDP, P-PLAN-00960-00008 *PNGS Site Overarching Document*. The PDP was submitted to the CNSC in March 2025. Once approved, the PDP will be reviewed and updated as per REGDOC 2.11.2 requirements. This document supersedes P-PLAN-00960-00001, *Pickering Nuclear Site Preliminary Decommissioning Plan*.
- The PDP, 92896-PLAN-00960-00001 *Preliminary Decommissioning Plan – Pickering Waste Management Facility*. This PDP will be submitted to the CNSC in 2027. The revision of the PDP will include the expansion of PWMF Used Fuel Dry SB5 and PCSS. The requirements of REGDOC 2.11.2, CSA N294-19, as well as any relevant domestic and international experience obtained in the previous five years will be incorporated into the revision. Five years from the submission of the PDP, the PDP will be reviewed and updated as per regulatory requirements.

The DDP and PDPs describe the activities that will be required to decommission Pickering site and restore the site for other uses. The DDP and PDPs demonstrate that decommissioning is feasible with existing technologies, and it provides the schedule as well as the basis for estimating the cost of decommissioning. OPG has provided opportunities for engagement with the WTFN Rightsholders on the DDP and the Michi Saagiig Nations have undertaken a DDP technical review. OPG welcomes additional input and further engagement on the DDP with the Rightsholders. On June 26, 2025, CNSC staff accepted the DDP for the removal of non-nuclear SSCs.

On an ongoing bases, OPG reviews key factors such as relevant domestic and international experience, best practices from industry, technology advancements, input from engagement with Indigenous Nations and local stakeholders and incorporates it into DDP and PDPs through the periodic update cycle.

OPG plans to focus decommissioning efforts in Pickering NGS Units 1 to 4, through the licence period, on conventional, likely clean systems and structures. Waste generated from decommissioning activities during this period is expected to be comprised largely of conventional solid waste. A small volume of LLW may be generated from decommissioning activities during the licence period. All decommissioning waste will be managed in accordance with existing programs and governance as described above.

2.11.5 Pickering NGS Units 1 to 4 Decommissioning

This section provides additional information regarding the Waste Management SCA with respect to Units 1 to 4 decommissioning. It is intended to supplement the information provided in the general SCA discussion above and therefore only addresses those specific areas where additional decommissioning-related details are needed.

Waste management during Pickering Unit 1 to 4 Decommissioning will be conducted in accordance with the DDP and the existing waste management program and governance. OPG has produced waste volume estimates to ensure adequate resources will be in place to sort, package, transport, store, and/or dispose of all waste. Program reviews will be performed to determine whether updates are required to address hazards or for risk reduction. Should this demonstrate potential changes in any of the programs identified in this SCA, they will be reflected in subsequent revisions of the relevant documents. CNSC notification of changes to program documents will take place as required by the LCH.

2.11.6 Pickering NGS Units 5 to 8 Refurbishment

This section provides additional information regarding the Waste Management SCA with respect to Units 5 to 8 refurbishment. It is intended to supplement the information provided in the general SCA discussion above and therefore only addresses those specific areas where additional refurbishment-related details are needed.

Waste management during the refurbishment of Pickering NGS Units 5 to 8 will be conducted in accordance with existing waste management programs and governance. These program documents will control the handling, storage, and disposal of both conventional and radioactive waste. OPG has produced waste volume estimates to ensure adequate resources will be in place to sort, package, transport, store, and/or dispose of all waste. As refurbishment approaches, program reviews will be performed to determine whether updates are required to address hazards or for risk reduction. Should this demonstrate potential changes in any of the programs identified in this SCA, they will be reflected in subsequent revisions of the relevant documents. CNSC notification of changes to program documents will take place as required by the LCH.

During the refurbishment of Units 5 to 8, each reactor will be “retubed”, i.e., the fuel channels and calandria tubes will be removed and replaced and the feeders and feeder cabinets will be removed and replaced. The waste that will be produced is referred to as “retube waste”. Containers are required to safely manage this waste. Waste will be segregated and volume reduced (if applicable) based on the geometries and radioactivity of the different types of retube wastes.

Low Level Waste Containers will be used for most LLW generated (e.g. feeder piping, feeder cabinets, position assembly hardware, outboard parts of end fittings, miscellaneous Active LLW, etc.) except the steam generators. Once ready, these LLW containers will be transferred or shipped from the Pickering NGS to the planned PCSS, Western Waste Management Facility (WWMF) or an equivalent licensed facility that can accept LLW. The steam generators will not be volume reduced and will be stored intact at the planned PCSS. It is currently estimated that 16,762 m^3 of LLW will be generated during refurbishment.

Different containers will be used for the ILW, these containers are referred to as Retube Waste Containers (RWCs). It is expected that two types of RWCs will be required. The first type will be used to manage the inboard parts of end fittings. The second type of RWC will be used to manage combined pressure tubes and calandria tubes or calandria tube inserts. Other containers will be used for any miscellaneous Active ILW which could include feeder pipe hot spots, cutting tool shavings and highly contaminated tooling. It is currently estimated that 1,600 m^3 of ILW will be generated during refurbishment.

During removal activities, OPG will volume reduce extracted reactor components and load the ILW containers with applicable waste inside the station. An on-site transfer will then be completed of each container from the station to the planned PCSS. Each RWC will be stored in the PCSS for a nominal period of 30 years. This storage time is required to allow radioactive decay to reduce the hazards of the waste and for a final repository to be sited and built.

Prior to the start of refurbishment, OPG is implementing actions to ensure that the IFBs will be ready from a heat removal and space standpoint prior to receiving a unit’s full core discharge of fuel, in accordance with CNSC REGDOC-2.5.2, *Design of Reactor Facilities: Nuclear Power Plants*.

Other non-active waste classified as “Likely Clean” can be put into bins that are provided and managed by OPG. This may also include miscellaneous mechanical and electrical equipment (such as pumps, valves, wiring, etc.).

The Pickering Waste Organization benchmarked the Darlington NGS Refurbishment Project to better forecast the waste that will be generated during Pickering NGS Units 5 to 8

Refurbishment. It was also important to consider unique factors affecting Pickering NGS Units 5 to 8 Refurbishment, specifically that Pickering will also generate waste from safe storage, decommissioning and station operations at the same time. As a result, the waste estimations for Pickering are expected to be greater than those for Darlington NGS Refurbishment, and additional waste processing footprint is required for the anticipated increase in waste generation. There is a planned expansion of the current Waste Operations to scale the existing activities for the anticipated increase in waste volumes, creating space for accounting, sorting and segregation of Refurbishment LLW.

P-PLAN-00120-00006, *Program Management Plan – Pickering NGS Radioactive Waste Management,* has been created to support radioactive waste management during Units 5 to 8 Refurbishment.

2.11.7 Pickering Waste Management Facility

The OPG documents in the table below require written notification of change per PWMF Licence Conditions Handbook, LCH-W4-350.00/2028 R003:

Table 46. SCA 11 – PWMF Waste Management & Decommissioning

Document Number	Document Title
N-PROC-RA-0017	Segregation and Handling of Radioactive Waste
OPG-STD-0156	Management of Waste and Other Environmentally Regulated Materials
W-PROG-WM-0001	Nuclear Waste Management
W-PROG-WM-0003	Decommissioning Program
92896-PLAN-00960-00001	Preliminary Decommissioning Plan Pickering Waste Management Facility

2.11.7.1 Waste Management Program

OPG's Nuclear Waste Management program is described in Section 2.11 and establishes the overall program for PWMF operations.

Waste receptacles are located throughout the PWMF for likely clean and active waste. Minimal radioactive waste is generated from activities conducted at the PWMF. LLW generated by PWMF typically is restricted to floor sweepings that have a potential to contain contamination from preparing and welding DSCs. Annual volumes amount to less than one drum and are sent to Pickering NGS for segregation as necessary and eventual transportation to the WWMF for processing and/or interim storage. PWMF does not generate intermediate or high level waste.

The volume of low level radioactive waste produced at PWMF will remain minimal during the next licence period with an expected slight increase proportional to the number of DSCs processed.

Interim Storage of Radioactive Waste

After radioactive waste has been processed at Pickering NGS, OPG's NSS is responsible for safely managing the waste on an interim basis until permanent disposal solutions are made available.

W-PROC-WM-0025, *Waste Acceptance Criteria for Low and Intermediate Level Radioactive Waste,* defines the acceptance criteria for LLW and ILW which is stored at the WWMF, including waste generated from operations at Pickering NGS. Once received at the WWMF, the L&ILW is further volume reduced and stored on an interim basis. The existing LLW in storage buildings at WWMF is further reduced at the Western Clean-Energy Sorting and Recycling, where waste is sorted and segregated to reduce the LLW volume and optimize the use of waste storage space.

The proposed PCSS is required for storage of L&ILW that will be generated by Pickering NGS. This additional interim storage capacity, intended for radioactive component waste and material, will be required to support the refurbishment of Pickering NGS Units 5 through 8 and decommissioning activities. L&ILW from the reactor core components include but not limited to steam generators, pressure tubes, calandria tubes, calandria tube inserts, annulus spacers and end fittings. W-STD-WM-0007, *Waste Acceptance Criteria for PCSS,* is currently being developed to define the acceptance criteria for LLW and ILW which is intended to be stored at PWMF.

In August 2024, the CNSC Commission amended the PWMF operating licence to allow OPG to process and store up to 100 DSCs at a time containing used fuel that has been cooled for a minimum of 6 years. After a minimum of 6-years of storage in the Pickering NGS IFB, HLW is loaded into DSCs, transferred to PWMF, processed and stored. W-PROC-WM-0082, *Eastern Waste Acceptance Criteria for Used Fuel Dry Storage Containers*, defines the criteria for the acceptance of DSC which are safely stored at PWMF on an interim basis.

The waste management program incorporates the fundamental safety principles as applied to nuclear waste. That is, the systems are designed and operated to assure subcriticality, control radiation exposure, assure heat removal, assure containment and allow retrievability on an ongoing basis. During the next licence period, dry storage of spent nuclear fuel will continue to be managed as per the existing waste management program.

Long Term Disposal of Radioactive Waste

OPG remains committed to the safe and permanent disposal of nuclear waste.

The NWMO, in accordance with the federal *Nuclear Waste Act* (2002), is responsible for implementing Canada's plan for the safe, long-term management of used nuclear fuel. Under the NWMO's plan, a deep geological repository for used fuel is expected to be in-service in the mid-2040s. On November 28, 2024, the NWMO announced the selection of the Wabigoon Lake Ojibway Nation and Township of Ignace as the host communities for the future site for Canada's deep geological repository for used nuclear fuel. After extensive technical study and community engagement, the NWMO selected a site that is safe and where the host communities have demonstrated that they understand the project and support making it part of their community. This process was guided by the NWMO's commitment to Reconciliation, based on co-creating a shared future, built on rights, equity and well-being for Indigenous peoples.

Additionally, under the Federal Government's Integrated Strategy for Radioactive Waste (ISRW), the NWMO is also responsible for the long-term disposal of ILW. As per the ISRW, ILW is to be disposed in a deep geological repository with an expected in-service date by 2050.

As outlined in the NWMO's ISRW, waste owners, including OPG, are responsible for the disposal of LLW. OPG intends to initiate outreach to find solutions for disposal of LLW and will begin with a learning phase focusing on two-way information sharing and education, starting with Indigenous communities. Before starting outreach, OPG has acted on feedback from Indigenous Nations who have requested greater information about the energy sector to make informed decisions about activities in their territories. In 2024, OPG developed an energy fundamentals outreach program which will commence in 2025 and help frame next steps for OPG's LLW permanent disposal solutions. As per the ISRW, LLW is to be disposed of in near surface disposal facilities with an expected in-service date by 2050.

As OPG's waste strategy for permanent disposal continues to evolve, OPG will continue to engage with Rightsholders and other Indigenous Nations, communities and stakeholders, and seek amendments to the associated licences as required.

2.11.7.2 Decommissioning Plan

The Decommissioning program and the decommissioning plan for PWMF are described in Section 2.11.4.

2.12 Security

The objective of the Nuclear Security program is to ensure the safe and secure operation of the Pickering NGS by supporting the protection of nuclear assets in accordance with regulatory requirements, OPG-POL-0032, *Safe Operations Policy* and N-POL-0001, *Nuclear Safety and Security Policy*.

Through the use of equipment, personnel and procedures described in N-PROG-RA-0011, *Nuclear Security*, OPG Nuclear Security ensures tactical readiness and maximizes response capability to prevent, contain, mitigate and terminate security events while minimizing the adverse impact on plant staff, operations and functions.

The Security and Emergency Services organization within OPG has accountability and responsibility for the effective management of security risk based on OPG risk tolerance, the Design Basis Threat (DBT) and required compliance with CNSC regulations and regulatory documents. The Nuclear Security program meets the expectations of N-CHAR-AS-0002, *Nuclear Management System*, by establishing, implementing, maintaining and improving a nuclear security management system with a focus on OPG high security sites that encompasses all licensing activities. This includes but is not limited to Security Threat Identification and Risk Assessments, which are performed annually to identify credible threats to a specific site or facility. OPG is required to take any credible threats identified in a Threat Risk Assessment (TRA) into account in the design of the physical protection system.

The TRA program is a strategic process governed by standard OPG-STD-0063, *Security Threat Vulnerability and Risk Assessment* for the evaluation of physical security in accordance with *Nuclear Security Regulations* (NSR) Section 7.5. N-PROG-RA-0011 implementing instructions contain the tactical directions to implement during abnormal operations and/or emergency situations to ensure continual compliance within the NSRs as a whole. The implementing instructions documented in N-PROG- RA-0011 provide guidance for abnormal operations and emergency situations such as: detection, assessment and compensatory measures, defensive strategy, search, access and egress control.

The security program is based on credible risks and vulnerabilities, and as such, and in accordance with the *Nuclear Security Regulations*, has identified vital areas at Pickering NGS and implemented physical protection measures, including access control, and measures designed to delay unauthorized access considering the DBT and any other credible threat identified by the TRA. The OPG Nuclear Security Operations at Pickering NGS has continued to ensure uncompromised safety and security of employees, the public and the environment. The need to improve security performance is recognized and OPG is ensuring security is held to the same high standards and intrusive oversight as all other organizations at OPG that impact nuclear safety.

The following documents are the applicable OPG documents which support the licensing basis and are listed in the Pickering NGS Licence Conditions Handbook, LCH-PR-48.00.2028-R007:

Table 47. SCA 12 – Pickering NGS Security

Document Number	Document Title
N-PROG-RA-0011	Nuclear Security
8690-REP-61400-10003	Pickering Nuclear Generating Station Security Report
8690-PLAN-61400-10006	Pickering – Nuclear Security Tactical Plan
OPG-PROG-0042	Cyber Security
N-PROC-RA-0135	Cyber Security
OPG-POL-0035	Cyber Security Policy
P-LIST-69000-00001	Pickering Cyber Essential Assets
N-LIST-08161-00001	Physical Security Cyber Essential Assets
N-LIST-08161-00002	Emergency Preparedness Cyber Essential Assets
N-LIST-08161-00003	Radiation Safety Cyber Essential Assets

OPG Nuclear Security has progressed towards a more proactive approach to identifying program improvements that is evident in the implementation of a Security Excellence Plan that has established a Security Excellence Meeting with the pillars of Our People, Our Performance and Our Future. The Excellence Meeting process is a strategic model that has been proven to drive continuous improvement at the OPG station level.

OPG corporate oversight has recently moved the Security program from a Tier 3 level program to a Tier 1 level program with OPG's managed system. This shift from Tier 3 to Tier 1 resulted in heightened management of our Security program, generating a comprehensive and enhanced oversight body, including but not limited to a fleetwide functional peer team which reviews performance and trends regularly. Security performance and results are reviewed and challenged at the Nuclear Executive Committee on a regular frequency to continually drive performance. The process includes the use of N-PROC-RA-0023, *Fleetview Program Health and Performance Reporting*. In support of OPG's safety culture, Security continues to work toward improved performance in all elements of the Security program through a critical lens using effective and established managed processes, in addition to new initiatives.

OPG holds forums such as the quarterly Security Director's meeting and the Nuclear Security Advisor Group which includes security representatives from all Nuclear High Security Sites in Canada and CNSC staff. The group is focused on ensuring nuclear security programs in Canada continue to meet future requirements, through the sharing of operating experience and the promotion of best security practices. OPG Security has also formed a Compliance Audit and Governance group, dedicated to unbiased, risk-based assessments of the Security Program. Through these internal self-assessments, OPG can monitor performance and trend worker behaviour indicators, gather KPI data for analysis and proactively identify latent organizational or process-based gaps more effectively.

In accordance with the *Nuclear Security Regulations*, OPG Nuclear Security conducts a large-scale security exercise through a Performance Testing Program audit at Pickering NGS every 2-years. The exercise tests and evaluates the integrated response capabilities of the Nuclear Security armed and unarmed elements against adversaries equipped within the DBT. This exercise is highly dynamic and realistic, incorporating laser systems to enhance realism. The CNSC staff also observe and audit these exercises. OPG Security conducts a detailed after-action audit of the results, which has been provided to the CNSC. The exercise feedback is used in the development of the training objectives for each subsequent year. Pickering NGS conducted an exercise on March 7, 2024. OPG Nuclear Security has been operating with an onsite armed response force since January 18, 2010, and maintains a program in place to provide ongoing training for Armed Nuclear Security Officers (ANSO) (also referred to as the Nuclear Response Force) and unarmed Nuclear Security Officers (NSO).

The Security Training organization structure has been realigned to report into the Nuclear Training Organization, which enables the incorporation of lessons learned and best practices from across OPG’s departments and will support overall alignment. In accordance with the *Nuclear Security Regulations* and the Security Program, Security drills are regularly conducted to evaluate security physical protection systems including tactical deployment plans under realistic conditions to ensure regulatory compliance as well as to identify security improvements. OPG Security also maintains an ongoing Memorandum of Understanding (MOU) with the Durham Region Police Service (DRPS) for offsite tactical response support. OPG Security will continue to operate at a high standard and meet the CNSC licensing requirements throughout the life of the Pickering NGS.

The 2025 excellence plan is developed and currently being executed.

- Pickering NGS is in the process of upgrading its security systems. The Entry Control System upgrade has been completed, and the Security Monitoring System project upgrades are set to be completed in Q1 2025.
- Integrate the fundamental principles of human performance with emphasis on procedural adherence, enabling the organization to proactively identify potential risks, enhance safety measures, and continually improve performance.
- Transform the organizational culture by strengthening organizational capabilities, enhancing workforce engagement, and developing skills essential for future growth and operational effectiveness.
- Improve the operational reliability of all security equipment (cameras, alarms, and access control systems, etc.) by conducting regular maintenance, developing, maintaining, and monitoring a lifecycle management program, and establishing a monthly performance tracking system.
- Ensure all strategic initiatives undergo a systematic implementation process, supported by well-structured business cases, basis documentation, and decisions supported through data mining.
- Strengthening international collaboration to ensure alignment with global nuclear security standards, excellence in physical, electronic, and procedural security, strategy, exercise program, self-assessment, tactical effectiveness, and technology/innovation.
- Mandating that technological innovation is applied to business outcomes and is a core capability of the team to build a sustainable culture of continuous improvement.

2.12.1 Facilities and Equipment

The OPG Security Program ensures the possession, deployment and operation of required facilities and equipment at Pickering NGS complies with the *Nuclear Security Regulations*, and CNSC REGDOC-2.12.1, *High-Security Facilities, Volume II: Criteria for Nuclear Security Systems.*

The Pickering NGS Site Security Report describes in detail the physical security measures and systems and the security organization in place to ensure security of Pickering NGS employees, the public and the environment in accordance with the regulatory requirements. Changes to security systems are documented in the Site Security Report, as well as the Quarterly Security Report per CNSC REGDOC-3.1.1, *Reporting Requirements for Nuclear Power Plants,* and are required to be submitted to the CNSC.

Personnel

Entry to the protected area at Pickering NGS requires all personnel to be searched for weapons and explosive substances at the Main Security Building and Auxiliary Security Building, in accordance with the *Nuclear Security Regulations*. The Pickering NGS search facilities are equipped with dedicated equipment for conducting security searches that meet CNSC REGDOC-2.12.1 Volume II requirements. Once personnel have passed the security search screening process, they are then required to use their proximity card and biometric hand scanners to activate the revolving door to enter the PA.

Vehicles

All vehicles entering the protected area are searched for weapons, explosive substances and unauthorized persons in accordance with the *Nuclear Security Regulations* as well as contraband and prohibited items. All vehicles, upon entrance and exit from the PA are surveyed for Category I and II nuclear material using the Vehicle Radiation Monitor. Pickering NGS has physical protection measures against forced land vehicle penetration of the protected area. The measures are compliant with CNSC REGDOC-2.12.1 Volume II.

Powerhouse Doors

All exterior doors of the Pickering NGS powerhouse are hardened and secured with a robust lock system. Exits are also monitored with portal monitors for the detection of Category I, II or III nuclear material to prevent theft of material.

Material Security

Searches are conducted on all packages and equipment entering the protected area for weapons and explosive substances.

Sealed sources and nuclear fuel are protected, stored and managed in compliance with CNSC REGDOC-2.12.3, *Security of Nuclear Substances: Sealed Sources and Category I, II and III Nuclear Material, Version 2.1* and in accordance with the *Nuclear Security Regulations*.

Physical Protection System

The Pickering NGS protected area is surrounded by a security fence equipped with devices intended to detect any attempt at unauthorized intrusion into the protected area, and to detect any tampering or component failures that could cause the system to malfunction. The system is always monitored by Nuclear Security officers in the Central Alarm Station. Alarms within the protected area are responded to by armed Nuclear Security officers. Pickering NGS also has physical protection measures against forced land vehicle penetration of the protected area. OPG employs Defence in Depth approach to the physical security protection system which is designed to deter, prevent, detect, assess, delay and respond.

Improvements include several strategic initiatives aimed at implementing innovation and technology opportunities. These include the implementation of life cycle management programs ensuring equipment reliability is maintained, and establishing and maintaining an effective maintenance and training program which will ensure the safe and reliable operation of security equipment.

Other improvements include a Security Excellence plan focused on initiatives for technology and infrastructure.

On-site and off-site communication

In accordance with the *Nuclear Security Regulations*, OPG Nuclear Security has a primary communications system which is interoperable with DRPS the primary offsite responder. Redundant secondary communication systems are available to ensure lines of communication to the field and beyond can be established.

There are several initiatives underway to enhance security systems at Pickering NGS including hardware updates, upgrades to the Central Alarm System (CAS), and integration of the Entry Control System.

2.12.2 Response Arrangements

OPG has a Memorandum of Understanding (MOU) with the DRPS to provide off-site armed response force support to the Pickering NGS pursuant to the *Nuclear Security Regulations*.

OPG Nuclear Security has a tactical response plan for Pickering NGS that sets out clear expectations on how to maintain the security of the site and to ensure an effective response to security events including the unauthorized removal of nuclear or radioactive material or to the sabotage of nuclear facilities, as required by the *Nuclear Security Regulations* and CNSC REGDOC-2.12.1, *High Security Facilities, Volume I: Nuclear Response Force, Version 2*. The tactical plan implements the primary objective of Nuclear Security to make an effective intervention considering the CNSC DBT and any other credible threat identified by the TRA to the protected area. DRPS provide support to this tactical plan.

2.12.3 Security Practices

The OPG Nuclear Security organization has accountabilities and responsibilities for the delivery of security services to effectively manage security risks based on OPG risk tolerance levels, the DBT and required assurance of compliance with CNSC regulations.

Frontline Pickering NGS Security personnel consist of two roles, Nuclear Security Officers (NSOs) and ANSOs. NSOs perform all security functions for Pickering NGS primarily personnel, bulk material and vehicle searching, surveillance and patrolling, while ANSOs provide on-site armed support capable of dealing with situations outlined in the DBT in addition to core NSO duties. A defensive strategy is followed along with a tactical plan as required by the *Nuclear Security Regulations* and CNSC REGDOC-2.12.1 Volume I.

The OPG Security clearance process ensures personnel requiring access to OPG business units, locations, or access to OPG Confidential, OPG Confidential Exclusive or Security Protected information do not pose a risk to the facilities, its employees, or company assets. Personnel, including OPG employees and contractors who require unescorted access to the Pickering NGS protected area, must comply with the applicable requirements of *Nuclear*

Security Regulations. This process is governed by OPG-PROC-0119, *Clearance Process,* and OPG-GUID-61400-0001, *Guide to Security Clearance*, which is in compliance with CNSC REGDOC-2.12.2, *Site Access Security Clearance*. A proximity card is given to each approved applicant, and the proximity card and biometric scans permit entry to and exit from the protected area, as per the *Nuclear Security Regulations*. Upon exit from the protected area, in accordance with the *Nuclear Security Regulations*, all personnel and vehicles are scanned for Category I or II nuclear substances.

Prescribed information is controlled and released only on a 'need to know' basis to those who possess the appropriate security clearance.

The trait of Vigilance was added to OPG's Nuclear Safety and Security Culture traits. OPG maintains vigilance as part of its defense-in-depth security strategy through requirements such as OPG's Supervisory Awareness Program, Continuous Behavioural Observation Program. The program ensures all supervisors have the skill and knowledge to recognize behaviours that might constitute a risk to the health and safety of employees, the plant and the public. Since 2023, OPG has been performing an annual vigilance campaign focused on a variety of topics.

2.12.4 Drills and Exercises

The OPG Security Program ensures the Nuclear Security Response Force conducts effective interventions, based on the DBT and any other credible threats identified through threat and risk assessments within the protected area. The objective is to prevent sabotage of the nuclear facilities or the sabotage and theft of Category I, II, or III nuclear materials.

To achieve this objective, the Nuclear Response Force is equipped with gear prescribed by CNSC REGDOC-2.12.2 Volume I, which includes tactical equipment, both lethal and less lethal options, and tactical personal protection equipment. A yearly maintenance program is in place to ensure firearms are maintained and armored to manufacturer specifications.

NSOs and ANSOs are required to qualify in specific training program elements and must requalify within established requalification periods as per CNSC REGDOC-2.2.4, *Fitness for Duty, Volume III: Nuclear Security Officer Medical, Physical, and Psychological Fitness*, and REGDOC-2.12.1, Volume I. N-TQD-603-00001, *Nuclear Security Training and Qualification Description,* establishes the training requirements for NSOs and ANSOs, including initial and subsequent requalification training requirements. The position of a Nuclear Security Training Officer is specifically used to implement and manage programs that support and adhere to nuclear security regulatory requirements, ensuring that employees meet qualifications and are recertified as necessary.

OPG deploys a Security Training Team consisting of Tactical Trainers and Training Technicians who are responsible for developing and utilizing various training methods aimed at enhancing the competence and confidence of Security Officers. Additionally, Security Supervisors utilize on-crew trainers to ensure proficiency in specific aspects of officer's duties as well as conducting monthly drills and crew practice sessions to evaluate proficiency in specific aspects of officer's duties. A team has been formulated, specifically for the drills and exercise portion of the program. This team coordinates monthly drills and crew practice sessions at the Pickering site with the objectives of validating security practices and proficiency, ensuring regulatory compliance, and identifying security improvements. The team then documents, assesses, and archives the results of these activities and considers findings to inform future security training objectives.

2.12.5 Cyber Security

In 2019, OPG established an enterprise-wide cyber security program outlined in OPG-PROG-0042, *Cyber Security*, to establish and maintain processes, procedures and controls to ensure OPG meets or exceeds regulatory requirements for cyber security, specifically CSA N290.7-14, *Cyber security for nuclear power plants and small reactor facilities* standard. Moreover, OPG has implemented a Nuclear Cyber Security procedure, N-PROC-RA-0135, *Cyber Security* which identifies systems that are Cyber Essential Assets and the requirements to protect them from internal and external cyber threats, up to and including the design basis threat. This program is under the purview of OPG's Nuclear Cyber Security section, which operates under the Corporate & Technology Services organization.

The cyber security program objectives address the following elements:

- *Defensive strategy and security architecture:* N-STI-08161-10001, *Defensive Cyber Security Architecture Standard* (DCSA) specifies the requirements for establishing a DCSA that is specifically tailored to the needs of OPG Nuclear Facilities including Pickering NGS. DCSA focuses on the arrangement of zones to establish defence-in-depth, and specifies the requirements for boundary protection, secure communications and interconnections between zones, and common security control requirements that provide for protection across the facility.
- *Policies and procedures:* OPG-POL-0035, *Cyber Security Policy* requires OPG to establish and maintain a management system that reduces cyber risk, protects critical information and operational technology assets in accordance with internationally recognized cyber security standards while, at a minimum, maintaining compliance to regulatory and legal requirements. The policy supports the respective program, nuclear specific procedure and lower-level documents tailored to address specific clauses of CSA N290.7-14.
- *Asset identification and classification:* N-PROC-RA-0135 defines instructions for the identification of Cyber Assets and Cyber Essential Assets per the definitions defined by CSA N290.7-14. Further, these assets are classified and prioritized using a graded approach for applicable cyber security controls commensurate to their significance and susceptibility.
- *Security Controls:* N-PROC-RA-0135 makes use of a graded approach to establish the necessary cyber security controls to protect Cyber Essential Assets.
- *Roles and responsibilities:* Roles and responsibilities for staff to meet program, process and lower-level document expectations are well defined under N-PROC-RA-0135.
- *Awareness and Training:* Qualifications and trainings are documented in training plan, N-PLAN-08161-00008, *Training Plan*. System Owners confirm that all cyber security activities performed on systems that they are responsible for are completed by competent individuals with the necessary qualifications.
- *Cyber Asset Configuration Management and Life Cycle Approach:* Applicable change control processes are listed under N-PROC-RA-0135 to ensure Cyber Essential Asset configuration management and life cycle management follows CSA N290.7-14.
- *Coordination with other programs:* Nuclear Cyber Security process, N-PROC-RA-0135 receives its authority from the enterprise-wide OPG-PROG-0042, *Cyber Security* program. Furthermore, N-PROC-RA-0135 is compliant with CSA N286-12, *Management system requirements for nuclear facilities*, and interfaces with other nuclear processes to

provide the necessary elements of a comprehensive cyber security program in OPG Nuclear.

- *Incident response, reporting and recovery plan:* N-PLAN-08161-00010, *Nuclear Cyber Security Incident Response Plan* provides guidance to cyber security incidents that potentially impact Nuclear Operational Technology digital assets supporting OPG Nuclear facilities.
- *Program review and maintenance:* OPG's Nuclear Cyber Security process emphasizes program review through monthly program performance updates, annual Fleetview reports, continuous improvement through annual self-assessments, operating experience lessons, corrective actions, and updates to relevant CSA standards and CNSC regulations and REGDOCs. Furthermore, the process integrates lessons learned from cyber security incidents, audits, as well as supplemental drills or exercises.

Cyber security related updates have been made to the ECC process, employee training, and various maintenance and engineering instructions, guides, procedures and standards in addition to OPG's corporate cyber security policy.

OPG continues to maintain compliance with CSA N290.7-14, *Cyber security for nuclear power plants and small reactor facilities* and pursues continuous improvement initiatives to enhance our cyber security posture. This includes work efforts towards meeting the requirements identified in CSA N290.7-21, *Cyber security for nuclear facilities*, along with cyber security best practices.

2.12.6 Pickering NGS Units 1 to 4 Decommissioning

This section provides additional information regarding the Security SCA with respect to Units 1 to 4 decommissioning. It is intended to supplement the information provided in the general SCA discussion above and therefore only addresses those specific areas where additional decommissioning-related details are needed.

OPG's program, N-PROG-RA-0011, *Nuclear Security* will be followed during Decommissioning.

When fuel is removed from the Pickering NGS Units 1 and 4 IFBs into DSCs and heavy water is processed, there may be modifications to the Protected Area boundary to reflect the changed security requirements. Specifically, the delineation between the operational station (Pickering NGS Units 5 to 8) and the Decommissioning zone (Pickering NGS Units 1 to 4) will be established through the implementation of the Pickering AB Gate, which serves as a combination of physical and administrative barriers.

Once the AB Gate is established, all existing systems required for the continuing operation of Pickering NGS Units 5 to 8 will be fully contained on the eastern (operational) side of the gate. This includes all equipment, supply piping, cables, control systems, etc. Any new equipment supporting Pickering NGS Units 5 to 8 operations that needs to be installed west of the Service Wing wall will require prior discussion and concurrence with both the Safe Storage and Decommissioning teams to ensure coordination and security compliance.

As per the current *Nuclear Security Regulations*, only Category I, II, and III nuclear materials are required to be within a PA. Other nuclear materials on site will have security requirements that may be prescribed in future revisions of the 2.12 series of CNSC REGDOCs. OPG will apply security measures commensurate with those requirements as they are established, ensuring that all materials are secured appropriately based on their classification and associated risks.

2.12.7 Pickering NGS Units 5 to 8 Refurbishment

This section provides additional information regarding the Security SCA with respect to Units 5 to 8 refurbishment. It is intended to supplement the information provided in the general SCA discussion above and therefore only addresses those specific areas where additional refurbishment-related details are needed.

OPG's program, N-PROG-RA-0011, *Nuclear Security* will be followed during refurbishment.

To support the large numbers of contractors on site during refurbishment activities, an upgrade to both the Main Security Building and Auxiliary Security Building is scheduled in order to expand the search area to accommodate an increase in refurbishment staff upon entry and exit. Using OPEX from Pickering A Restart project, the gate on the west side of the station will be utilized for key material and equipment movements. In support of this, upgrades will be made to standardize it with existing vehicle portals. The expansion of the Main Security Building, Auxiliary Security Building and development of the vehicle entry portal, are being designed to meet all the requirements of the *Nuclear Security Regulations*. Furthermore, Lessons Learned from Darlington NGS OPEX is actively incorporated into Pickering Refurbishment planning. Security has hired support specific for refurbishment and has completed several turnovers with DNGS Security Refurbishment SPOC. Turnovers included searching at vendor facilities, enhanced sally port protocols, resourcing requirements and scheduling and planning. All turnover has been incorporated into the planning process and continues to be monitored and addressed through the Pickering Security Change Management Plan.

The DWI project will require moving the south PA boundary fence at Dike Road east of the intake channel to accommodate expanding Dike Road and providing the minimum required space for the construction Island. A new permanent PA boundary fence meeting the requirements of the NSR will be built and is planned to be commissioned prior to the removal of existing boundary security measures.

Security staffing requirements will increase over the next few years to meet the needs of the station and refurbishment work that will be conducted at Pickering NGS. The Design Basis Threat will be reviewed and updated to include changes being made in support of the refurbishment specific to the new Sally Port. An access authorization process is followed to ensure personnel and contractors requiring access to Pickering NGS or access to OPG Confidential, OPG Confidential Exclusive or Security Protected information, do not pose a risk to the facility, its employees or company assets.

2.12.8 Pickering Waste Management Facility

The OPG documents in the table below require written notification of change per PWMF Licence Conditions Handbook, LCH-W4-350.00/2028-R003:

Table 48. SCA 12 – PWMF Security

Document Number	Document Title
92896-REP-08160-00001	Pickering Waste Management Facility Phase II Security Report
92896-REP-08160-00001 ADD 001	Pickering Waste Management Facility Security Report Addendum
8690-PLAN-61400-10006	Pickering – Nuclear Security Tactical Plan
NA44-REP-08160.3-00001	Pickering Nuclear Generating Station Threat and Risk Assessment

Document Number	Document Title
N-PROG-RA-0011	Nuclear Security
N-PROC-RA-0135	Cyber Security

OPG has implemented and maintains a Nuclear Security program and Cyber Security program. PWMF's security program and cyber security program is defined by the programs as described in 2.12.1 and 2.12.6.

PWMF Phase I is contained within the Pickering NGS protected area and as such the security program with respect to that site is described in documentation relating to the Pickering NGS. PWMF Phase II is contained within a separate protected area located on the Pickering NGS controlled area site. The security provisions described in this section relate to both phases of the PWMF unless stated otherwise.

OPG's Nuclear Security program ensures the security of the PWMF's assets through physical and administrative security measures utilizing equipment, personnel, and procedures. The security program at the sites has continued to evolve to meet industry best practices and all regulatory requirements.

The security program includes the following:

- Security measures for PWMF are evaluated against annual OPG threat and risk assessments to ensure credible threats are mitigated.
- Training programs are in place to enhance and sustain improved performance of OPG's Security Divisions.
- A comprehensive drill program is in place as a means of validating security practices, ensuring regulatory compliance, and identifying areas for improvement in security operations. CNSC evaluated force on force exercises, conducted at the nuclear generation sites, which provide performance testing of the nuclear security program. Lessons learned through OPG security drills and exercises are applied to enhance the program at PWMF.
- OPG continues to participate in an Inter-Utility Security Working Group, which includes representation from all nuclear power operators in Canada. This group provides benchmarking opportunities to ensure that the program meets industry standards.
- OPG conducts regular meetings with CNSC staff to ensure that evolving security requirements are understood. Interface meetings between NSS Waste Facility Management, Security Management and key staff are held on a quarterly basis.
- Security requirements in accordance with the *Nuclear Security Regulations* are in effect at OPG's High Security Sites, including the PWMF.

Planned Activities

OPG is currently in the design phase to build DSC SB5 in PWMF Phase II, with an anticipated in-service date in 2027. It will be located to the east of SB4, and the protected area will be expanded to accommodate the new structure. Construction plans include consideration for:

- Expansion of the protected area boundary to enclose the footprint of the new SB5 for used fuel in the PWMF Phase II.
- Using leading technology for perimeter intrusion detection and assessment.

- Construction of temporary protected area barriers which will be placed into service at PWMF to separate the operating facility from the area where construction is occurring. These temporary protected area barriers will be placed into service during construction and remain in place until the conclusion of the construction.
- Replacement of the existing entrance to the PWMF Phase II area with a new security entrance (i.e. Security Kiosk) to the PA. The entrance will be constructed to facilitate the search of persons and packages for weapons and explosives through the use of explosives and metal detection; and for nuclear materials upon egress, utilizing industry leading technology carried out by nuclear security officers, and,
- Both permanent and temporary protected area barriers will be constructed to meet the requirements of the *Nuclear Security Regulations* and CNSC REGDOC-2.12.1 Volume I and Volume II.

Prior to these construction activities, OPG will submit the proposed security arrangements and measures for SB5 and the new security entrance (i.e. Security Kiosk) as upgrading security infrastructure for the existing Phase II SB in the Security Report Annex and obtain acceptance from the CNSC.

Furthermore, planned upgrades to Phase II include:

- PWMF integration into a Pickering site entry control system upgrade,
- Updates to the Pickering site security monitoring room infrastructure,
- Replacing existing intrusion detection and assessment systems with devices utilizing leading technology.

Pickering NGS plans to carry out a DWI project consisting of constructing an offshore intake tunnel and offshore intake shaft to bring deeper lake water from Lake Ontario.

To provide the minimum required space for the tunnel boring machine launch shaft pad construction and operation, the following two modifications will be completed:

1. The relocation of the DSMs consists of moving the DSMs (i.e.36 DSMs) from their current position in the PWMF Phase I RCS area (southeast corner of the station protected area) to the Phase II licensed storage area in PWMF. The target relocation timeline is late 2025.
2. The existing Pickering NGS PA boundary fence, which provides the PA boundary fence for PWMF Phase I, will be relocated following the ECC process.

The PWMF Site Security Report (92896-REP-08160-00001) will be updated to include the DSMs in the Phase II site.

2.13 Safeguards and Non-Proliferation

Safeguards and Non-Proliferation refers to an international system of monitoring and verifying nuclear material and specified nuclear activities, administered in Canada by the CNSC and verified by the IAEA, to deter the diversion of nuclear material from legitimate peaceful activities. This system facilitates the IAEA to evaluate compliance with its obligations pursuant to its international safeguards agreements.

Canada has entered into a Safeguards Agreement and an Additional Protocol (hereafter referred to as "safeguards agreements") with the IAEA pursuant to its obligations under the *Treaty on the Non-Proliferation of Nuclear Weapons* (INFCIRC/140). The international *Treaty on the Non-Proliferation of Nuclear Weapons* is the cornerstone of Canada's efforts to promote its objectives of international disarmament, non-proliferation, and the peaceful use of nuclear energy. More specifically, Canada maintains obligations under the following Canada-IAEA safeguards agreements:

- *Agreement Between the Government of Canada and the International Atomic Energy Agency for the Application of Safeguards in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons INFCIRC/164; and,*
- *Protocol Additional to the Agreement Between Canada and the International Atomic Energy Agency for the Application of Safeguards in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons INFCIRC/164/Add.1.*

For Nuclear Power Plants in Canada, the non-proliferation program is limited to the tracking and reporting of foreign obligations and origins of nuclear material as per CNSC regulatory document REGDOC-2.13.1, *Safeguards and Nuclear Material Accountancy*. The Additional Protocol contains further requirements for the provision of information and access, including the obligation to allow access to some locations on 24 hours' notice, and the obligation to provide information on and access to certain nuclear manufacturers and researchers, neither of which need to involve nuclear material.

Pickering NGS has an effective Safeguards and Non-Proliferation program that ensures compliance with Canada's safeguard agreements with the IAEA, the *General Nuclear Safety and Control Regulations* and other measures arising from the Treaty on the Non-Proliferation of nuclear weapons. This program consists of, in the following hierarchy:

- OPG's N-PROG-RA-0015, *Safeguards and Nuclear Material Accountancy* program is designed to establish, maintain, and verify compliance with Safeguards and Nuclear Material Accountancy requirements, ensuring all necessary measures are taken to facilitate Canada's compliance with international safeguards agreements and any other measures arising from the Treaty on the Non-Proliferation of Nuclear Weapons.
- N-STD-RA-0024, *Safeguards and Nuclear Material Accountancy Implementation* provides further direction to ensure OPG complies with its licence conditions, the *Nuclear Safety and Control Act*, the *General Nuclear Safety and Control Regulations*, and any other related *Regulations* in support of Canada's safeguards and nuclear material accountancy agreements.
- N-PROC-RA-0136, *OPG Safeguards and Nuclear Material Accountancy Requirements* captures specific requirements for the establishment and maintenance of the Safeguards program at OPG Nuclear; this procedure closely follows and where possible, exceeds the CNSC regulatory document, REGDOC-2.13.1, *Safeguards and Nuclear Material Accountancy.*

Throughout the current licence period, the OPG Safeguards program was successful in meeting all international Safeguards and Non-Proliferation agreements. Since 2018, Pickering NGS received satisfactory results from all inspections performed by the IAEA, with the exception of four unsatisfactory records on Unannounced Inspections in 2024 due to untimely access / notification of changes which OPG has taken corrective actions to address. Pickering NGS provided satisfactory support to the IAEA including nuclear material accountancy and control, access and assistance to the IAEA, operational and design information, support for Safeguards equipment, and containment and surveillance. In addition, the Pickering NGS safeguards program is internally evaluated each year through self-assessments to ensure the continued health of the program, the program remains in compliance with regulatory requirements, and a satisfactory working level structure is in place to ensure success in meeting OPG obligations.

The OPG documents in the table below require written notification of change per Pickering NGS Licence Conditions Handbook, LCH-PR-48.00/2028-R007.

Table 49. SCA 13 – Pickering NGS Safeguards and Non-proliferation

Document Number	Document Title
N-PROG-RA-0015	Safeguards and Nuclear Material Accountancy
N-STD-RA-0024	Safeguards and Nuclear Material Accountancy Implementation
N-PROC-RA-0136	OPG Safeguards and Nuclear Material Accountancy Requirements

2.13.1 Nuclear Material Accountancy and Control

Nuclear material accountancy involves activities that establish and report the quantities of nuclear material present within defined areas, as well as the changes in those quantities within defined time periods. This includes nuclear material measurement, record keeping, preparation and submission of accounting reports, and verification of accounting information.

All units of nuclear material have a unique identifier which is tracked and accounted for. For all non-exempted nuclear material, Pickering NGS has Material Balance Areas (MBAs), where the inventory of nuclear material can be categorized, tracked, and measured. Any movements from one MBA to another are promptly reported to the CNSC and IAEA. Nuclear material movements within the same MBA are also tracked internally to ensure precise status. Inventory changes are input into Nuclear Material Accountancy software by staff qualified to move nuclear material. This software supports tracking and report generation. Reports of inventory status are submitted to the CNSC and IAEA as required by CNSC REGDOC-2.13.1.

Pickering NGS utilizes an electronic system to help track deadlines associated with CNSC/IAEA Safeguards requirements to ensure submissions are made on time in accordance with CNSC REGDOC-2.13.1. This system also supports historical traceability by documenting when submissions were made, in addition to record keeping of submitted files.

Pickering NGS, in accordance with N-PROG-RA-0015, *Safeguards and Nuclear Material Accountancy*, discloses to the CNSC, the IAEA, or an IAEA inspector, any records required to be kept or any reports required to be made under a safeguards agreement. In accordance with the *General Nuclear Safety and Control Regulations*, Section 31, OPG files reports with the CNSC within 21 days of becoming aware of any inaccuracy or incompleteness in a record to be kept under the *Act*.

All communications with the CNSC and IAEA which contain sensitive information, such as nuclear material accounting, is performed using only secure means. To ensure timely communication and report submissions, procedures are kept in alignment with CNSC REGDOC-2.13.1 requirements and relevant staff are trained on these procedures to be aware of reporting requirements and timelines. Between 2018 to 2024, Pickering NGS submitted an average of 130 Safeguards Nuclear Material Accountancy submissions per year to the CNSC and IAEA.

2.13.2 Access and Assistance to the IAEA

The IAEA may require access to a given site for a variety of purposes pursuant to the Canada-IAEA safeguards agreements. Pickering NGS will grant prompt access to all locations within the licence to the IAEA and CNSC inspector(s), or to person(s) acting on behalf of the IAEA/CNSC, where such access is required to carry out an activity pursuant to a safeguards agreement. Site procedures are written to allow access for inspection at all operating hours. Initial access to areas for inspection will be attained within two hours of the IAEA arriving onsite provided it is safe to do so. The IAEA has the right to request complementary access to any location in Canada with at least 24 hours' notice, or two hours' notice, if the IAEA is already present at a facility or location outside the facility, on the same site, for an inspection or Design information Verification.

IAEA and CNSC inspectors regularly perform site visits to review the status of monitoring equipment, accessible nuclear material inventory, submitted records, station design, procedures, and worker practices. Site visits are also required to perform maintenance of IAEA surveillance equipment, for example the successfully completed IAEA replacement of Core Discharge Monitors with significant support from OPG. These inspections and maintenance prevent gaps in nuclear material safeguarding provisions.

Existing procedures have been in place for some time and have been reviewed against the safeguards agreements and Canadian regulations to ensure compliance; they have also been tested through many years of use at the Pickering NGS site. During site visits, there are opportunities to share concerns and potential improvements to existing processes to make the OPG safeguards program, access and assistance more effective.

2.13.3 Operational and Design Information

There are three primary reports provided by Pickering NGS to the CNSC and IAEA to capture relevant design and operational information required by CNSC REGDOC-2.13.1. The reports are Design Information Questionnaire (DIQ), Operational Program, and Additional Protocol.

Through Pickering NGS's internal routine electronic tracking (typically yearly), the DIQ is reviewed for any changes; any identified changes are included in a revision to the DIQ and it is resubmitted to the CNSC and IAEA. In addition, the Pickering NGS safeguards specialist maintains awareness of potential site developments that may necessitate updates and resubmission of the DIQ at any time. The OPG *Engineering Change Control* program, N-PROG-MP-0001, also requires design changes to be reviewed for potential impact to Safeguards in the early planning phase (for additional information on OPG's ECC program see Sections 2.1.5 and 2.5.1). Design changes flagged for potential impacts to Safeguards are discussed with the Pickering NGS safeguards specialist and reported to the CNSC and IAEA for alignment prior to implementation. Direct communications from the design change team allows for detailed and applicable information to be gathered for accurate reporting. Moreover, OPG's design change process requires rigorous documentation to capture all details that would be needed for Safeguards. Relevant information as confirmed through documentation and discussion with the design change team, IAEA and CNSC (where applicable) is then included in the DIQ update.

To further ensure the accuracy of the submitted DIQ and the site-specific safeguards measures, the IAEA also performs routine Design Information Verifications (DIVs). During a DIV, the IAEA performs in person inspections of the provided DIQ information to verify it is accurate and sufficient to make decisions on the safeguard measures.

The Operational Program is submitted annually as per CNSC REGDOC-2.13.1. Typically, quarterly updates are also provided to deliver confirmation of no change or identify any changes.

Much like the DIQ preparation, the Pickering NGS safeguards specialist maintains awareness of site operating plans that may necessitate revision and resubmission of the Operational Program at any time. The Pickering NGS safeguards specialist gathers the required information from site contacts most applicable to the information; this ensures accurate information is provided from the source.

OPG submits the Additional Protocol annually which assists the CNSC and IAEA in reviewing the site Safeguards approach, looking for gaps, or future areas of increased concern, to address.

In addition to the above three reports, Pickering NGS maintains communication with the CNSC and IAEA Safeguards divisions. Operational activities that could not be foreseen, such as sudden power loss, that may affect Safeguards are promptly reported to the CNSC and IAEA. Furthermore, OPG supports industry peer team meetings, benchmarking of other nuclear generating stations, and routine trilateral meetings with the IAEA and CNSC to discuss the Safeguards program, process improvements, emerging trends etc. These are excellent environments to learn from each other and identify areas for improvement in the overall safeguards program.

OPG strives to be transparent with the CNSC and IAEA to ensure alignment and facilitate the objectives of the Safeguards and Non-Proliferation agreements.

2.13.4 Safeguards Equipment, Containment, and Surveillance

There are several IAEA Safeguards equipment installed at Pickering NGS to allow remote monitoring of necessary nuclear material movements within the station; for instance, cameras and radiation monitors which are strategically placed at critical transfer locations. Pickering NGS supports this equipment by providing the required services and operating safeguards equipment as specified by the IAEA; such services include power supplies, lighting, internet connections, etc. The installed equipment provides the IAEA with continuous detailed data of nuclear material movements. The IAEA use the information to compare against Pickering NGS's nuclear material accountancy reports to ensure all nuclear material movements are accounted for and used for legitimate purposes in accordance with the non-proliferation treaty.

IAEA equipment is labelled and sealed to deter interference, damage, or tampering. Site procedures and staff training clearly detail that tampering or disruption of IAEA surveillance equipment must be immediately reported to the CNSC.

Additional critical support parameters, such as the minimum required ambient lighting for IAEA cameras or a specified range of ambient temperature for IAEA computers, have requirements captured in site procedures and training, reinforce expectations to perform all due diligence to satisfy these bounds.

During the current licence period, there were four events reportable to the CNSC related to temporary loss of power to Safeguards equipment or late submission of an inventory change document. In each case there was no risk to the public and immediate action was taken to restore power to the safeguards equipment or submit the inventory change document. Where practical, recurrence control actions were implemented following the event.

Besides the reported events, there were no observations of adverse equipment support identified by the IAEA. Such observations can be made by IAEA remote monitoring of equipment, site inspections and maintenance. Visual inspections of accessible Pickering NGS IAEA equipment were performed at least once per year since 2017 by both OPG and IAEA. In all cases inspections met requirements.

2.13.5 Import and Export

The scope of the non-proliferation program at Pickering NGS is limited to the tracking and reporting of foreign obligations and origins of nuclear material. Import and export of controlled nuclear substances, equipment and information as identified in the *Nuclear Non-proliferation Import and Export Control Regulations*, is not currently permitted under the Pickering NGS site licence and any application is made in accordance with applicable regulations.

2.13.6 Pickering NGS Units 1 to 4 Decommissioning

This section provides additional information regarding the Safeguards SCA with respect to Units 1 to 4 decommissioning. It is intended to supplement the information provided in the general SCA discussion above and therefore only addresses those specific areas where additional decommissioning-related details are needed.

The existing safeguards arrangements for used fuel will continue until modified or terminated by agreement with the CNSC. All Pickering NGS Units 1 to 4 safeguards equipment, including power supplies to the IAEA equipment and bay lighting, will be maintained until IAEA concurrence that they are no longer required, after the AIFB and IFB-A are empty of fuel.

The process for inspecting and removing damaged and defective fuel will incorporate operational experience from Hydro Quebec's Gentilly 2 facility and leverage the canning process (see Section 1.2.2.1 for details about the canning process). Trained, experienced operations staff will perform this work, implementing measures to identify, mitigate, and monitor radiological hazards.

The sorting, segregation, and canning of damaged and defective fuel is expected to commence in approximately 2030. OPG will follow existing Nuclear Management Systems to implement any changes required for these activities. When reinspecting this fuel, it will be recorded in the Nuclear Fuel Location and Storage History (Nuflash). After canning, the unique can serial number will also be recorded in Nuflash to ensure full traceability.

2.13.7 Pickering NGS Units 5 to 8 Refurbishment

This section provides additional information regarding the Safeguards SCA with respect to Units 5 to 8 refurbishment. It is intended to supplement the information provided in the general SCA discussion above and therefore only addresses those specific areas where additional refurbishment-related details are needed.

The Safeguard program, equipment, containment, and surveillance will remain in place during the refurbishment period.

Pickering NGS will provide required routine and advance notifications and declarations to the IAEA on refurbishment outage dates and details related to defueling, initial core loading, and maintenance work which may impact with the functionality of safeguards equipment.

2.13.8 Pickering Waste Management Facility

The OPG documents in the table below require written notification of change per PWMF Licence Conditions Handbook, LCH-W4-350.00/2028-R003:

Table 50. SCA 13 – PWMF Safeguards and Non-proliferation

Document Number	Document Title
N-PROG-RA-0015	Safeguards and Nuclear Material Accountancy
N-STD-RA-0024	Safeguards and Nuclear Material Accountancy Implementation
N-PROC-RA-0136	OPG Safeguards and Nuclear Material Accountancy Requirements

The safeguards program at the PWMF is defined by the OPG Nuclear Safeguards program as described in Section 2.13.

The safeguards program includes the following elements:

- A communication protocol between the IAEA, CNSC and OPG.
- Obligations to meet applicable regulatory requirements and the requirements of safeguards agreements.
- Reporting to meet applicable regulatory requirements and the requirements of safeguards agreements.

OPG Nuclear management stays current with the IAEA's safeguards requirements and is committed to meeting OPG's safeguards obligations in an efficient and timely manner. As of February 2007, in accordance with the IAEA requirements, OPG has adopted the integrated safeguards protocol. Under the integrated safeguards protocol, all safeguards' commitments were met at the PWMF, for the current licence period.

From 2018 to 2024 there were two events reportable to the CNSC at the PWMF related to damaged Safeguards seals. In each case, there was no risk to the public and immediate action was taken to resolve the condition and replace the seals. Where practical, recurrence control actions were implemented following the event.

PWMF also performs annual Safeguards self-assessments to ensure adherence to the OPG Nuclear Safeguards program. As a result of the self-assessments, improvements have been made in the areas of communication with the IAEA, and planning and support for IAEA's activities, including Unannounced Inspections and Physical Inventory Verification, through a revision to operating procedure 92896-OP-35570-00001, *IAEA Safeguards*.

PWMF has met all safeguards conditions in its operating licence, and the terms of the agreement between Canada and the IAEA pursuant to the Treaty on Non-proliferation of Nuclear Weapons. The PWMF staff have fully co-operated with the IAEA and facilitated the achievement of IAEA safeguards goals. All reports and information necessary for safeguards implementation and compliance continue to be provided on a timely basis. No compliance issues have been identified by IAEA or CNSC staff.

The following subsections describe aspects of the Safeguards program at PWMF.

IAEA Fuel Verification Program

The IAEA Fuel Verification Program includes material accounting, the IAEA monthly remote monitoring report, and the use of surveillance equipment such as cameras, portable verification equipment, and containment equipment.

PWMF's compliance with the Fuel Verification Program is met through the following ongoing activities:

- Complying with the Safeguards Agreement and the Additional Protocol.
- Providing services and assistance for IAEA staff tasks and equipment operation.
- Disclosing any records to the IAEA upon request.
- Not interfering in any way with Safeguards equipment, samples or seals
- Making no changes to operations, equipment or procedures that would affect Safeguards implementation without prior written CNSC approval.
- Preparing and submitting nuclear inventory reports as per CNSC REGDOC-2.13.1, *Safeguards and Nuclear Material Accountancy*.

Physical Inventory Taking and Verification

PWMF staff completes an annual physical inventory taking as part of licence conditions pursuant to the implementation of safeguards by the IAEA. This is a snapshot of the fuel physical inventory at the time of the PIT.

Canadian facilities are selected at random by the IAEA for a physical inventory verification that follows the physical inventory taking. If a facility is not chosen for a physical inventory verification, then CNSC safeguards staff may perform limited confirmation activities following the annual physical inventory taking process. The IAEA completed a physical inventory verification at PWMF in November 2024.

These IAEA inspections are often attended by CNSC staff to review the facility's support for IAEA inspectors, including escorts and equipment, the provision of accountancy information and supporting documents, the facility compliance with safeguards licence conditions relevant to the inspection activity, and the IAEA's adherence to its rights and obligations relevant to the inspection. No significant compliance issues were identified.

Laser Mapping Container Verification System

In 2021, the PWMF and IAEA completed full inventory scanning for DSCs in storage at the PWMF. All new containers with full height welds will now only have the Cobra Seal (Figure 41) applied, and Laser Mapping Container Verification (LMCV) completed negating the requirement for the metallic seals.

The LMCV system (Figure 42), designed by the IAEA, is a digital weld identification scanner created to verify and uniquely identify DSC in-situ, a powerful tool for acquiring and verifying the "weld fingerprint" of the DSC.

Figure 41. DSC in Storage showing IAEA Cobra Seals

Figure 42. LMCV System

As of year-end 2024, there were 1339 DSCs currently in storage at the PWMF. There is one DSC (#3310) in storage with a 5/8” weld height which passed visual and Phased Array Ultrasonic Testing (PAUT) inspection acceptance criteria and met the existing design and safety margin. The LMCV tool used for fingerprinting the lid weld was not performed by IAEA on this DSC, rather it has dual Cobra and metal seals. OPG has since decided to forgo the 5/8” weld initiative, and thus DSCs will be full height welded.

NSS Design is currently in the detailed engineering phase of a DSC design change as described in Section 2.5.7. This change, named MKIII, involves revision of the lid weld groove from an asymmetrical groove to a symmetrical V-groove. The changes are likely to impact the LMCV tooling. OPG will work with the CNSC and the IAEA as per the requirements in the LCH and the established processes to implement DSC design changes.

Planned Activities

OPG is working to implement the equipment-based approach as proposed and developed by the IAEA with consultation with the CNSC, and other Multi-Unit CANDU stations in Canada.

The equipment-based approach in the PWMF will involve:

- Installation of Mobile Unit Neutron Detectors on the DSC Transporter
- Installation of a surveillance camera on the DSC Transporter
- Installation of equipment within the PWMF to support the charging of the MUND and surveillance cameras on the DSC Transporter.
- Change in laydown period within the Pickering NGS during loading operations.

Minor updates are also planned to the Safeguards and Nuclear Material Accountancy Program to correct some minor discrepancies and to clarify requirements.

2.14 Packaging and Transport

Pickering NGS has an effective packaging and transport program that meets or exceeds all applicable regulatory requirements and related objectives. Packaging and transport of nuclear substances are conducted safely.

The program document, W-PROG-WM-0002, *Radioactive Material Transportation* (RMT), establishes the program and necessary controls for safe, regulatory compliant and efficient transportation of radioactive material at OPG. The RMT program establishes procedures for the handling, packaging, shipment, and receipt of radioactive materials. Under the RMT program, N-STD-RA-0036, *Radioactive Material Transportation Emergency Response Plan*, addresses emergency response to transportation accidents involving radioactive material, which meets the requirements of Transport Canada. The RMT program and its associated procedures fully comply with the CNSC and IAEA requirements for a management system.

The OPG documents in the table below require written notification of change per Pickering NGS Licence Conditions Handbook, LCH-PR-48.00/2028-R007:

Table 51. SCA 14 – Pickering NGS Packaging and Transport

Document Number	Document Title
W-PROG-WM-0002	Radioactive Material Transportation
N-STD-RA-0036	Radioactive Materials Transportation Emergency Response Plan

2.14.1 Packaging and Transport Program

The objective of the RMT program is to ensure that shipments of radioactive material for which OPG is the consignor are prepared and offered for transport in a manner that is compliant with the *Transportation of Dangerous Goods Regulations* (TDG) and the *Packaging and Transport of Nuclear Substances Regulations, 2015* (PTNSR). The RMT program also establishes the necessary controls for safe and compliant transportation and handling aspects of radioactive material within OPG's control where OPG is the consignee or when OPG Class 7 carriers are used. This is done to ensure the safety of workers, the public, and the environment.

As per W-PROG-WM-0002 and W-PROC-WM-0033, *Radioactive Shipments*, OPG ensures that radioactive shipments are characterized, classified, packed, shipped, and received in accordance with approved procedures and applicable *Regulations*.

OPG ensures that staff who handle (i.e., load, unload, receive, classify or ship) radioactive material in preparation for transport must be adequately trained or under the direct supervision of someone who is. Within OPG, evidence that an employee is adequately trained for their function is demonstrated by holding a valid Class 7 Certificate of Training as per the TDG regulations. All Type A or Type B radioactive shipments and shipments requiring a Licence to Transport are supported by a RMT Transportation Officer.

OPG has been safely transporting radioactive materials. During the current licence period, all radioactive material shipments to and from the Pickering NGS site were safely transported.

Radioactive Materials Transportation Emergency Response Plan

N-STD-RA-0036 identifies the OPG responsibilities and the concepts to enable effective response to a transportation incident involving an OPG shipment of radioactive material. This plan also identifies the liaison and potential interface with external ERO. This plan applies to off-site shipments only. On-site incidents are addressed through the site ERO implementing instructions.

A Pickering NGS Transportation Emergency Response Plan (TERP) drill was conducted on October 29, 2024 to demonstrate the ability of qualified personnel to respond to an off-site radioactive waste transportation emergency per Transport Canada regulations. This is covered under OPG’s Emergency Response Assistance Plan (ERAP) for the transportation of dangerous goods and is a requirement under federal law.

This drill combined the efforts from OPG and external agencies including the designated external contractor, Ministry of Environment Spills Action Centre, Transport Canada (CANUTEC), and the Clarington Fire Department. There were no significant findings, and all drill objectives were met. Minor observations were identified to improve future response, including revising response area maps. As a matter of continuous improvement, the use of drone technology will continue to be reviewed for TERP response to improve response capabilities and personnel safety.

2.14.2 Package Design and Maintenance

OPG controls the design of its radioactive materials packaging and performs maintenance on the packaging to ensure compliance with the PTNSR.

Each OPG radioactive materials transportation packaging (with the exception of one-time use packaging) is subject to an annual maintenance outage. Packaging maintenance is performed in a dedicated facility at the Western Waste Management Facility.

Each packaging is maintained in accordance with a packaging-specific procedure. The containment system of each Type B or Type A packaging is tested to ensure its effectiveness.

Modifications to OPG’s existing radioactive materials transportation packaging are a rare occurrence due to the maturity of the designs. All packaging has been maintained in good condition without any reduction in safety or operability.

An improved version of the OPG Trillium Transportation Package, designated as Trillium TP-03, will be added to the OPG fleet in 2025 to increase the fleet’s capacity to transport spent ion exchange resins and ILW from the Pickering, Darlington and Bruce Power stations. The design of the Trillium TP-03 was developed in accordance with OPG’s *Design Management* (N-PROG-MP-0009) and *Engineering Change Control* (N-PROG-MP-0001) programs.

2.14.3 Registration for Use

Users of Type B packages must register with CNSC and acknowledge that they have the necessary instructions to properly prepare the package for shipment. OPG’s process for use of packages of certified design is specified in W-PROC-WM-0006, *Radioactive Materials Transportation Records*.

Currently OPG is a registered user for 11 different package designs. These packages include OPG’s ILW and tritiated heavy water transportation packages.

2.14.4 Pickering NGS Units 1 to 4 Decommissioning

This section provides additional information regarding the Packaging and Transport SCA with respect to Units 1 to 4 decommissioning. It is intended to supplement the information provided in the general SCA discussion above and therefore only addresses those specific areas where additional decommissioning-related details are needed.

The decommissioning of Pickering NGS Units 1 to 4 will follow the RMT program W-PROG-WM-0002, *Radioactive Material Transportation*, and N-STD-RA-0036, *Radioactive Materials Transportation Emergency Response Plan*.

Management of Operational Waste in Fuel Bays

There are operational wastes present in the fuel bays, such as adjusters, shield plugs, and other components, which will be removed during the SWS phase as detailed in the SWS plan. New containers capable of being loaded underwater are being developed. These containers will allow for the safe handling and removal of intermediate level waste from the IFBs beginning during the requested licence period. A dedicated transportation package is being designed to support the movement of these containers for future permanent disposal. All developments, including the container designs and transportation methods, will adhere to existing governance frameworks.

Handling of Defective Fuel

Defective fuel assemblies require specific measures to restore the containment of radionuclides and the new process is under development. The defective fuel will be placed into welded canisters, effectively re-establishing containment barriers. After obtaining regulatory concurrence, these canisters will be placed into DSCs for on-site storage. As the defective fuel will remain on-site, there is currently no need for additional packaging or transportation off-site. Information on defective fuel is provided in Section 1.2.2.1.

2.14.5 Pickering NGS Units 5 to 8 Refurbishment

This section provides additional information regarding the Packaging and Transport SCA with respect to Units 5 to 8 refurbishment. It is intended to supplement the information provided in the general SCA discussion above and therefore only addresses those specific areas where additional refurbishment-related details are needed.

The refurbishment of Pickering NGS Units 5 to 8 will follow the RMT program W-PROG-WM-0002, *Radioactive Material Transportation*, and N-STD-RA-0036, *Radioactive Materials Transportation Emergency Response Plan*.

OPEX from other refurbishment programs indicates that a limited volume of new ILW, such as magnetite, may be generated. This waste can be shipped in the same manner as is currently used for spent resin.

2.14.6 Pickering Waste Management Facility

The OPG documents in the table below require written notification of change per PWMF Licence Conditions Handbook, LCH-W4-350.00/2028-R003.

Table 52. SCA 14 – PWMF Packaging and Transport

Document Number	Document Title
W-PROG-WM-0002	Radioactive Material Transportation
N-STD-RA-0036	Radioactive Materials Transportation Emergency Response Plan
N-PROG-RA-0013	Radiation Protection

The packaging and transport program at the PWMF is defined by the RMT program as described in Section 2.14.

Under the PWMF operating licence, used fuel in DSCs is transferred on-site from the Pickering NGS IFBs to the PWMF. The *Packaging and Transport of Nuclear Substances Regulations* do not apply to the on-site transfer of used fuel in DSCs between the Pickering NGS and the PWMF. Nonetheless, in the absence of any specific regulations for on-site packaging and transport, OPG provides an equivalent degree of safety to workers, the general public and the environment as would be applied for off-site transportation. As described in Section 2.11, the on-site DSC transfers and storage complies with CSA N292.0-19 and N292.2-13 and is controlled through N-PROG-RA-0013, *Radiation Protection*.

The on-site transfer of used fuel in DSCs from the Pickering NGS to the PWMF is conducted on designated transfer routes in accordance to OPG's procedures. At the end of 2024, 1339 DSCs are in storage at four DSC SBs at the PWMF.

The on-site transfer of low and intermediate level refurbishment and decommissioning waste from Pickering NGS to the planned Pickering Component Storage Structure and the relocation of Dry Storage Modules will adhere to existing programs.

3.0

Facility-Specific Information

3.0 Facility Specific Information

3.1 Cobalt-60

Pickering NGS currently provides a consistent supply of Cobalt-60 (Co-60), an important radioisotope with a wide range of industrial, medical, and food processing applications that provides broad societal benefits. Through the continued operation of Pickering NGS Units 5 to 8 there's a potential opportunity for Pickering to contribute to the continued supply of this critical isotope, if needed.

Pickering currently provides as much as 20% of the world's supply. Co-60 is predominantly used to sterilize medical equipment including swabs, gloves and gowns used in medical settings. Approximately 30% of the world's single-use medical devices are sterilized using Co-60. Food products are also treated with gamma irradiation from Co-60 to extend shelf life.

Co-60 production has been an important part of the Canadian nuclear industry since its inception, and Pickering NGS currently plays a large role through production on Units 6, 7 and 8. These units are fitted with adjuster elements (cobalt rods) consisting of a number of bundles strung end to end (similar in configuration to that of a fuel bundle). Each bundle is comprised of several pencils containing cobalt slugs. The cobalt adjuster elements are irradiated during unit operation, harvested during planned unit outages and transported to a third party offsite, where it is commercialized for market. Co-60 is transported in accordance with the *Transportation of Dangerous Goods Regulations* and *Packaging and Transport of Nuclear Substances Regulations*. The procedures which are used for Cobalt-60 processing and transfer are listed below.

Table 53. Cobalt-60 Procedures for Processing and Transfer

Document Number	Document Title
P-OM-018-31985-01	Cobalt Processing - Table of Contents/Revision History
P-OP-31985-0001	Cobalt Processing Procedure
P-OM-018-31985-04.04.12	Cobalt Processing – Cobalt Handling

In 2024, Pickering NGS completed one Co-60 harvest during the planned maintenance outage on Unit 7. In the current licence period, there are two remaining planned Pickering Co-60 harvests: Unit 6 in 2025, Unit 8 in 2026.

Following refurbishment, and pending favourable technical, operational, and economic reviews, Pickering NGS Units 6, 7 and 8 may continue Co-60 production.

4.0

Additional Matters of Regulatory Interest

4.0 Additional Matters of Regulatory Interest

4.1 Financial Guarantees, Nuclear Liability Insurance, and Cost Recovery

Financial Guarantees

The objective of OPG's financial guarantee is to ensure that sufficient funds are estimated, collected, and administered for the management of liabilities associated with operating, refurbishing and decommissioning of all its nuclear facilities. The PWMF is also included within this consolidated financial guarantee scope.

In addition to the decommissioning program, OPG's Financial Guarantee also covers financial provisions for the long-term management (storage and eventual disposal) of all operational and decommissioning wastes (Used Fuel, Low Level Waste, and Intermediate Level Waste).

OPG's financial guarantee is prepared and maintained on a 5-year cycle in accordance with the requirements set out in CSA Standard N294, *Decommissioning of facilities containing nuclear substances* and CNSC regulatory document, REGDOC-3.3.1, *Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities*. OPG also provides an annual financial guarantee report to the CNSC detailing the status of the guarantee including the amounts accumulated in segregated funds and the value of the Provincial guarantee (when required). The report compares the amount of the liabilities and the financial resources available to discharge the obligations.

The financial guarantee provisions for Pickering NGS and PMWF demonstrate that the current level of funding is adequate for decommissioning the station and returning the site to an end state agreed with the Regulators. CNSC access to these funds is provided by the CNSC Financial Security and Ontario Nuclear Funds Agreement Access Agreement between the CNSC, OPG and the Province of Ontario, and, as required, the Provincial Guarantee Agreement between the CNSC and the Province of Ontario. In December 2022, the Commission accepted OPG's proposed 2023-2027 consolidated financial guarantee as documented in Record of Decision DEC 22-H104.

OPG will continue to provide annual Financial Guarantee reports to the CNSC detailing the status of the guarantee, including the amounts accumulated in segregated funds.

Nuclear Liability Insurance

OPG is required, under the *Nuclear Liability and Compensation Act* (NLCA), to maintain financial security in an amount equal to $1 billion for its Pickering nuclear generating station in 2025. The following four figures provide certificates of insurance that verify the financial security OPG has secured as required by the NLCA for 2025.

Marsh

Certificate of Insurance

No.: **2025-1** Dated: **December 12, 2024**

This document supersedes any certificate previously issued under this number

This is to certify that the Policy(ies) of insurance listed below ("Policy" or "Policies") have been issued to the Named Insured identified below for the policy period(s) indicated. This certificate is issued as a matter of information only and confers no rights upon the Certificate Holder named below other than those provided by the Policy(ies).

Notwithstanding any requirement, term, or condition of any contract or any other document with respect to which this certificate may be issued or may pertain, the insurance afforded by the Policy(ies) is subject to all the terms, conditions, and exclusions of such Policy(ies). This certificate does not amend, extend, or alter the coverage afforded by the Policy(ies). Limits shown are intended to address contractual obligations of the Named Insured.

Limits may have been reduced since Policy effective date(s) as a result of a claim or claims.

Certificate Holder:	Named Insured and Address:
Canadian Nuclear Safety Commission Headquarters **280 Slater Street P.O.Box 1046 Station B** **Ottawa, ON K1P 5S9**	**Ontario Power Generation Inc.** **700 University Avenue, H18-J18** **Toronto, ON M5G 1X6**

This certificate is issued regarding:
Pickering Nuclear Generating Station

Type(s) of Insurance	Insurer(s)	Policy Number(s)	Effective/ Expiry Dates	Sums Insured Or Limits of Liability	
NUCLEAR LIABILITY	Nuclear Risk Insurers Limited - Licensed	L18CAN2100	Jan 01, 2025 to Jan 01, 2026	Limit of Liability	CDN 600,000,000 45% of total limit of liability

Notice of cancellation:
The insurer(s) affording coverage under the policies described herein will not notify the certificate holder named herein of the cancellation of such coverage.

Marsh Canada Limited
120 Bremner Boulevard
Suite 800
Toronto, ON M5J 0A8
[redacted]

Marsh Canada Limited
By: [redacted]

Figure 43. Nuclear Liability Insurance – Marsh – Certificate of Insurance

Marsh

Certificate of Insurance

No.: **2025-3-REV-2** Dated: **December 23, 2024**

This document supersedes any certificate previously issued under this number

This is to certify that the Policy(ies) of insurance listed below ("Policy" or "Policies") have been issued to the Named Insured identified below for the policy period(s) indicated. This certificate is issued as a matter of information only and confers no rights upon the Certificate Holder named below other than those provided by the Policy(ies).

Notwithstanding any requirement, term, or condition of any contract or any other document with respect to which this certificate may be issued or may pertain, the insurance afforded by the Policy(ies) is subject to all the terms, conditions, and exclusions of such Policy(ies). This certificate does not amend, extend, or alter the coverage afforded by the Policy(ies). Limits shown are intended to address contractual obligations of the Named Insured.

Limits may have been reduced since Policy effective date(s) as a result of a claim or claims.

Certificate Holder:	Named Insured and Address:
Canadian Nuclear Safety Commission Headquarters **280 Slater Street P.O.Box 1046 Station B** **Ottawa, ON K1P 5S9**	**Ontario Power Generation Inc.** **700 University Avenue, H18-J18** **Toronto, ON M5G 1X6**

This certificate is issued regarding:
Pickering Nuclear Generating Station : issued for ELINI (unlicensed carrier)

Type(s) of Insurance	Insurer(s)	Policy Number(s)	Effective/ Expiry Dates	Sums Insured Or Limits of Liability	
NUCLEAR LIABILITY	Euro Liab. Ins for the Nuc. Ind. (ELINI)	25EL/0045	Jan 01, 2025 to Jan 01, 2026	Limit of Liability	CDN 285,000,000

Notice of cancellation:
The insurer(s) affording coverage under the policies described herein will not notify the certificate holder named herein of the cancellation of such coverage.

Marsh Canada Limited
120 Bremner Boulevard
Suite 800
Toronto, ON M5J 0A8
[redacted]

Marsh Canada Limited
By: [redacted]

Figure 44. Nuclear Liability Insurance – Marsh – Certificate of Insurance

NIAC | NUCLEAR INSURANCE ASSOCIATION OF CANADA

401 Bay Street, Suite 1600, Toronto, ON Canada M5H 2Y4

CERTIFICATE OF INSURANCE

This is to certify to: Canadian Nuclear Safety Commission
280 Slater Street P.O. Box 1046 Station B, Ottawa, ON, K1P 5S9

The policies of insurance as herein described have been issued to the Insured named below and are in force at this date.

Name of Insurer:	**Name and Address of Insured:**
Nuclear Insurance Association of Canada 401 Bay St., Suite 1600 Toronto, ON M5H 2Y4	Ontario Power Generation Inc. and its subsidiaries 700 University Ave., Toronto, ON M5G 1X6

TYPE OF INSURANCE	LIMITS OF LIABILITY	DEDUCTIBLE	POLICY NUMBER	POLICY PERIOD*
Nuclear Energy Liability Policy Operators Form No. 610 (08/24) - Pickering Nuclear Generating Station (Power Reactor Class) - Claims Expense Form No. 620 (04/16)	$330,000,000 $33,000,000	Nil	OF104	Jan. 1, 2025 to Jan. 1, 2026, 12:01 AM Standard Time at the Location of the Insured

*NIAC Operators Form is continuous until cancelled. Policy Period refers to the current annual continuation certificate in force.

The insurance afforded is subject to the terms, conditions and exclusions of the applicable policy. This Certificate is issued as a matter of information only and confers no rights on the holder and imposes no liability on the Insurer. The Insurer will endeavour to mail to the holder of this Certificate 30 days' written notice of any material change in or cancellation of these policies but assumes no responsibility for failure to do so.

The Nuclear Insurance Association of Canada's collective liability is limited to 55.0000% of the Limit of Liability of $600,000,000 under Operators Form No. 610 (08/24) and $60,000,000 under Claims Expense form No. 620 (04/16).

Issued at: Toronto, Ontario

NUCLEAR INSURANCE ASSOCIATION OF CANADA

[redacted]

Dated: December 12, 2024

Authorized Representative

Figure 45. Nuclear Liability Insurance – NIAC – Certificate of Insurance

Northcourt
Nuclear Risk Specialists
An Optio company

CERTIFICATE OF INSURANCE

This is to certify to: Canadian Nuclear Safety Commission
280 Slater Street P.O. Box 1046 Station B, Ottawa, ON K1P 5S9

Name of Insurer	Name and Address of Insured
NORTHCOURT LIMITED The Bastions Office No. 2, Triq Emvin Cremona, Floriana FRN 1281, Malta	Ontario Power Generation Inc. and its subsidiaries 700 University Ave., Toronto, ON M5G 1X6

Type of Insurance	Nuclear Energy Liability Policy Operator's Form - Pickering Nuclear Generating Station (Power Reactor Class)	Policy No	NCNTPL56
Limit of Liability	CAD 1,000,000,000		
Deductible	Nil		
Policy period	1 January 2025 to 1 January 2026, both days 12:01AM Standard Time at the Location of the Insured		

Operator's Form is continuous until cancelled. Period refers to the current annual continuation certificate in force.

The insurance afforded is subject to the terms, conditions and exclusions of the applicable policy. This Certificate is issued as a matter of information only and confers no rights on the holder and imposes no liability on the Insurer. The Insurer will endeavour to mail to the holder of this Certificate 30 days' written notice of any material change in or cancellation of these policies, but assumes no responsibility for failure to do so.

Northcourt's liability is limited to **11.5000%** of the Limit of Liability (being CAD 115,000,000).

Insured at: London, UK
Dated: 16 December 2024
For and on behalf of Northcourt Limited

[redacted]

Authorised Signatory

16/12/24

UK: 10th Floor, 1 Minster Court, Mincing Lane, London, EC3R 7AA
MALTA: The Bastions Office No. 2, Triq Emvin Cremona, Floriana FRN 1281

Northcourt Limited is a company authorised under the Insurance Distribution Act Cap 487 to carry out insurance intermediaries activities and is regulated by the Malta Financial Services Authority (MFSA, Mdina Road, Zone 1, Central Business District, Birkirkara CBD1010 Malta.

Figure 46. Nuclear Liability Insurance – Northcourt – Certificate of Insurance

Cost Recovery

Pursuant to the *CNSC Cost Recovery Fees Regulations*, the CNSC prepares a Regulatory Activity Plan for Class I Nuclear Facilities and calculates an estimated annual fee payable for that fiscal year using the estimated full cost of the plan. OPG pays the CNSC's fees on a quarterly basis upon receipt of invoices. OPG will continue to make timely payment as required.

5.0

References

5.0 References

1. OPG Letter, K. Aggarwal to C. Salmon, “Pickering Waste Management Facility - Application for Waste Facility Operating Licence WFOL-W4-350.00/2028 Amendment to Construct and Operate the Pickering Component Storage Structure”, May 31, 2024, e-Doc 7293912, CD# 92896-CORR-00531-01544.
2. Attachments 1 to 4 in OPG Letter, P. Seguin to R. Richardson, “Pickering NGS, Units 1 to 4 – Submission of the Detailed Decommissioning Plan and Storage with Surveillance Plan”, December 9, 2024, e-Doc 7423802, CD# NA44-CORR-00531-37304.
3. CNSC Letter, Dr. T. Berube to OPG, “Record of Decision DEC 22-H104 – Application for Acceptance of Ontario Power Generation’s Revised Consolidated Financial Guarantee”, December 6, 2022, e-Doc 6930798, CD# N-CORR-00531-23514.

Appendix A: Definitions and Commonly Used Acronyms

Definitions

Component Coding

Components important to safety and reliability are coded to ensure that where those components can no longer reliably perform their function, the repair is executed with priority. These components receive coding as either Corrective Critical (CC), Corrective Non-Critical (CN), Deficient Critical (DC), or Deficient Non-Critical (DN), depending on component criticality as it relates to nuclear safety.

Corrective maintenance classifications:

- CC – to be performed on critical components (criticality 1).
- CN – to be performed on non-critical components (criticality 2 or 3).

Deficient maintenance (deficient equipment that is still operating) classifications:

- DC – to be performed on critical components (criticality 1).
- DN – to be performed on non-critical components (criticality 2 or 3).

Criticality Categories

Criticality 1 Reactor Safety Criteria:

- Components in an OSR system that is also a SIS whose failure results in a System Unavailability impairment condition, or
- Components credited in the Probabilistic Safety Assessment that satisfies the condition that the Risk Achievement Worth > 2 and Fussell-Vesely > 0.005, or
- Components credited in the Probabilistic Safety Assessment that satisfies the condition that the Risk Achievement Worth > 2 or Fussell-Vesely > 0.005.

Criticality 2 Reactor Safety Criteria:

- Components in an OSR system that is also a SIS whose failure results in a Total Loss of Redundancy impairment condition, or
- Component in an OSR system that is also a SIS system whose failure results in a Partial Loss of Redundancy impairment condition. or
- Component in an OSR system that is also a non SIS system whose failure results in a system unavailability impairment condition.

Criticality 3 Reactor Safety Criteria:

- Components in an OSR system that is also a non-SIS whose failure results in a Loss of Redundancy impairment condition. or
- Components not covered by any of the above that are included in any credited Safety Related System test or Surveillance Rounds credited in the PSA.

Defence in depth is a safety concept that aims to prevent and mitigate accidents through 5 independent levels of defence, applied to all nuclear power plants in Canada. The levels are as follows:

Level 1: Prevention of abnormal operation and failures;

Level 2: Control of abnormal operation and detection of failures;

Level 3: Control of accidents within the design basis;

Level 4: Control of severe plant conditions, including prevention of accident progression and mitigation of the consequences of SAs;

Level 5: Mitigation of radiological consequences of significant releases of radioactive materials.

Defueled: All fuel is removed from the Calandria

Dewatered: All heavy water has been drained from the Primary Heat Transport and the Moderator systems. These systems have been flushed and dried.

Acronyms

ACR	Annual Compliance Report
ACU	Air-Conditioning Unit
ADL	Administrative Dose Limit
AF	Accident Frequency
AFS	Available for Service
AIA	Authorized Inspection Agency
AIFB	Auxiliary Irradiated Fuel Bay
AIM	Abnormal Incident Manual
AIR	All Injury Rate
ALARA	As Low As Reasonably Achievable
AMP	Aging Management Plan
ANO	Authorized Nuclear Operator
ANSO	Armed Nuclear Security Officer
AOO	Anticipated Operational Occurrence
APCI	Annual Plant Condition Inspection
ARRR	Annual Risk and Reliability Report
ASME	American Society of Mechanical Engineers
ASR	Accident Severity Rate
ASTGMS	Automated Source Term Gamma Monitoring System
ASU	Aerial Support Unit
BDBA	Beyond Design Basis Accident
CA	Controlling Authority
CANDU	CANadian Deuterium Uranium
CAS	Central Alarm System
CC	Corrective Critical
CCI	Chemistry Compliance Index
CCoE	Construction Center of Excellence
CCR	Code Compliance Report
CCTV	Closed-Circuit Tele-vision

CI	Chemistry Index
CN	Corrective Non-Critical
CDR	Conceptual Design Report
CEO	Chief Executive Officer
CMSP	Combustible Material Safety Permit
CNSC	Canadian Nuclear Safety Commission
CofA	Certificate of Authorization
COG	CANDU Owners Group
COMS	Constructability, Operability, Maintainability, and Safety
CRE	Collective Radiation Exposures
CRO	Control Room Operator
CRSS	Control Room Shift Supervisor
CSA	Canadian Standards Association
CSFI	Counterfeit, Fraudulent and Suspect Items
CSI	CANDU Safety Issue
CSP	Critical Safety Parameter
CT	Calandria Tube
CTEP	Coaching to Enhance Performance
CWEST	Circumferential WEt Scrape Tool
DBA	Design Basis Accident
DBE	Design Basis Earthquake
DBT	Design Basis Threat
DC	Deficient Critical
DDP	Detailed Decommissioning Plan
DEC	Darlington Energy Complex
DEFDR	Department Event Free Day Reset
DFO	Department of Fisheries and Oceans Canada
DIRP	Discovery Issue Resolution Process
DIQ	Design Information Questionnaire
DIV	Design Information Verification
DLA	Dynamic Learning Activity(ies)
DN	Deficient Non-Critical
DNHWMBWA	DarlingtoN Heavy Water Management Building West Annex
DNWM	Decommissioning and Nuclear Waste Management
DMS	Dose Management System
DOM	Director of Operations and Maintenance
DPZ	Detailed Planning Zone
DRL	Derived Release Limit

DRPS	Durham Region Police Service
DSA	Deterministic Safety Analysis
DSC	Dry Storage Container
DCSA	Defensive Cyber Security Architecture
DSM	Dry Storage Module
DWI	Deep Water Intake
EAL	Environmental Action Level
ECA	Environmental Compliance Approval
ECC	Engineering Change Control
ECCC	Environment, Climate Change Canada
ECI	Emergency Coolant injection
ECO	End of Commercial Operation
EcoRA	Ecological Risk Assessment
ECL	Exposure Control Level
ED&I	Equity Diversity & Inclusion
EEM	Enterprise Emergency Management
EITER	Equipment Important To Emergency Response
EM	Emergency Management
EMC	Electromagnetic Compatibility
EME	Emergency Mitigating Equipment
EMEG	Emergency Mitigating Equipment Guideline
EMI	ElectroMagnetic Interference
EMO	Emergency Management Ontario
EMP	Environmental Monitoring Program
EMS	Environmental Management System
EOC	Emergency Operating Centre
EOP	Emergency Operating Procedure
EPRI	Electric Power Research Institute
EPC	Engineer Procure and Construct
EPD	Electronic Personal Dosimeter
EPI	Equipment Performance Index
EPS	Emergency Power System
EQ	Environmental Qualification
EQP	Equipment Performance Index
ER	Equipment Reliability
ERA	Environmental Risk Assessment
ERAP	Emergency Response Assistance Plan
ERI	Equipment Reliability Index

ERO	Emergency Response Organization
ERT	Emergency Response Team
ESA	Emergency Shift Assistant
ESDR	End State Determination Report
ESL	Equipment Status Log
ESM	Equipment Status Monitoring
ESP	Environmental Stewardship Pickering
eSWP	electronic Safe Work Plan
ETE	Evacuation Time Estimate
EV	Electric Vehicle
EWE	Extreme Weather Event
EWS	Emergency Water Supply
FAA	Fisheries Act Authorization
FAF	Flow Assisted Fueling
FAGM	Fixed Area Gamma Meter
FAQ	Frequently Asked Question
FARE	Flow Assisted Ram Extension
FDAS	Fire Detection and Alarm System
FDS	Fish Diversion System
FFAA	Fueling Facility Auxiliary Area
FHA	Fire Hazard Assessment
FHER	Fuel Handling Equipment Reliability
FLM	First Line Manager
FME	Foreign Material Exclusion
FPA	Fire Protection Assessment
FPP	Fire Protection Program
FSA	Fire Safety Assessment
FSSA	Fire Safe Shutdown Analysis
GAR	Global Assessment Report
GCC	Gradual Climate Change
GHS	Globally Harmonized System of Classification and Labelling of Chemicals
GIE	Global Innovation Effectiveness
GOSP	Governance, Oversight, Support and Perform
GSS	Guaranteed Shutdown State
HECA	High Efficiency Carbon Absorber
HEPA	High Efficiency Particulate Absorber
HFE	Human Factors Engineering

HHRA	Human Health Risk Assessment
HLW	High-Level Waste
HoW	Hours of Work
HP	High Pressure
HPECI	High-Pressure Emergency Coolant Injection
HPM	Health Physics Manager
HSMS	Health and Safety Managed Systems
HT	Heat Transport
HTS	Heat Transport System
HTS-AMS	Heat Transport System Aging Management Strategy
Hu	Human Performance
IAEA	International Atomic Energy Agency
IAM	Integrated Aging Management
IEC	International Electrotechnical Commission
IEP	Indigenous Engagement Plan
IFB	Irradiated Fuel Bay
IIP	Integrated Implementation Plan
IKS	Indigenous Knowledge Study
ILW	Intermediate-Level Waste
INPO	Institute of Nuclear Power Operators
ION	Indigenous Opportunities Network
IPZ	Ingestion Planning Zone
IRIS	Industry Reporting and Information System
IRS	Internal Responsibility System
ISRW	Integrated Strategy for Radioactive Waste
ISAR	Industrial Safety Accident Rate
ISB	Integrated Station Brief
ISO	International Organization for Standardization
ISP	Ignition Source Permit
ISR	Integrated Safety Review
IUC	Instrument Uncertainty Calculation
JHSC	Joint Health and Safety Committee
JITT	Just-in-Time Training
KI	Potassium Iodide
KPI	Key Performance Indicator
KIWG	Potassium Iodide Working Group
LBLOCA	Large Break Loss of Coolant Accident
LCH	Licence Conditions Handbook

LCMP	Life Cycle Management Plan
L&ILW	Low and Intermediate Level Waste
LISS	Liquid Injection Shutdown System
LLW	Low-Level Waste
LMCV	Laser Mapping Container Verification
LOCA	Loss of Coolant Accident
LP	Low- Pressure
LPSW	Low Pressure Service Water
LRF	Large Release Frequency
LTB	Lid-to-Base
LTI	Lost Time Injury
LWPRB	Local Work Protection Review Board
MBA	Material Balance Areas
MCCP	Minimum Complement Compliance Program
MCQ	Multiple Choice Question
MCR	Main Control Room
M&D	Monitoring & Diagnostics
MDR	Modification Design Requirement
MECP	Ministry of the Environment, Conservation and Parks
MIV	Mispositioning Index Value
MoU	Memorandum of Understanding
MRPH	Maximum Reasonable Potential for Harm
NBCC	National Building Code of Canada
NDE	Non-Destructive Examination
NEW	Nuclear Energy Worker
NFCC	National Fire Code of Canada
NGS	Nuclear Generating Station
NIEP	Nuclear Industry Evaluation Program
NLCA	Nuclear Liability and Compensation Act
NMS	Nuclear Management System
NPP	Nuclear Power Plant
NSA	Nuclear Safety Analysis
NSCA	Nuclear Safety and Control Act
NSO	Nuclear Security Officer
NSR	Nuclear Security Regulations
NSS	Nuclear Sustainability Services
NSRB	Nuclear Safety and Review Board
NSSCMP	Nuclear Safety and Security Culture Monitoring Panel

Nuflash	Nuclear fuel location and storage history
NWMO	Nuclear Waste Management Organization
O&C	Observation & Coaching
ODS	Ozone-Depleting Substances
OHSA	Occupational Health and Safety Act
ONEE	Other Natural External Event
OPEX	Operating Experience
OPG	Ontario Power Generation
OP&P	Operating Policies and Principles
OSL	Operator Shift Log
OSR	Operational Safety Requirement
OSST	Off-Site Survey Teams
OTO	Order to Operate
PA	Protected Area
PAUT	Phased Array Ultrasonic Testing
PB	Pressure Boundary
PCB	PolyChlorinated Biphenyl
PCSS	Pickering Component Storage Structure
PDS	Plant Damage State
PdM	Predictive Maintenance
PDP	Preliminary Decommissioning Plan
PE	Planning Envelope
PEA	Predictive Effects Assessment
PEOC	Provincial Emergency Operations Centre
PERA	Predictive Environmental Risk Assessment
PFS	Pickering Fire Services
PFU	Predicted Future Unavailability
PHC	Plant Health Committee
PgMP	Program Management Plan
PHT	Primary Heat Transport
PI	Performance Improvement
PIE	Postulated Initiating Event
PIP	Periodic Inspection Program
PMP	Project Management Plan
PNERP	Provincial Nuclear Emergency Response Plan
PNGS	Pickering Nuclear Generating Station
PM	Preventative Maintenance
PMMR	Preventative Maintenance Modification Request

PMT	Post-Maintenance Test
PMRB	Preventative Maintenance Review Board
PPE	Personal Protective Equipment
PSR3	Most Recent Pickering Periodic Safety Review
PRD	Pressure Relief Duct
PQO	Panel Qualified Operator
PROL	Power Reactor Operating Licence
PSA	Probabilistic Safety Assessment
PSC	Plant Status Control
PSR	Periodic Safety Review
PSRB	Program Scope Review Board
PT	Pressure Tube
PTNSR	Packaging and Transport of Nuclear Substances Regulations
PWMF	Pickering Waste Management Facility
QA	Quality Assurance
QSP	Quality of Safe Practices
RAP	Reconciliation Action Plan
RCCB	Refurbishment Change Control Board
RCS	Retube Component Storage
RCSA	Retube Component Storage Area
R&D	Research and Development
REP	Radiological Exposure Permit
RHP	Responsible Health Physicist
RMI	Reactivity Management Index
RMT	Radioactive Material Transport
ROR	Regulatory Oversight Report
RP	Radiation Protection
RPPE	Radiation Personal Protective Equipment
RRS	Reactor Regulating System
RTS	Return To Service
RWC	Retube Waste Container
RWI	Restricted Work Injury
SA	Severe Accident
SAA	Severe Accident Analysis
SAMG	Severe Accident Management Guideline
SAP	Stabilization Activity Plan
SAT	Systematic Approach to Training
SB	Storage Building

SCA	Safety and Control Area
SCBA	Self-Contained Breathing Apparatus
SCDF	Severe Core Damage Frequency
SCFF	Seismically-induced Containment Failure Frequency
SCL	Safety Classification and Learning
SCR	Station Condition Record
SDS	ShutDown System
SEFDR	Site Event Free Day Reset
SERM	Shift Emergency Response Manager
SG	Steam Generator
SHT	System Health Team
SIIR	Serious Injury Incidence Rate
SIO	Safety Improvement Opportunity
SIS	System Important to Safety
S&L	Safety and Licensing
SM	Shift Manager
SMA	Seismic Margin Assessment
SMC	Site Management Centre
SME	Subject Matter Expert
SMR	Small Modular Reactor
SOE	Safe Operating Envelope
SOSN	Southern Ontario Seismic Network
SOT	Staying on Top
SOW	Scope of Work
SpA	Specific Area
SPI	Safety Performance Indicator
SRE	System Responsible Engineer
SSC	Structure, System and Component
STEM	Science, Technology, Engineering, and Mathematics
SWS	Storage with Surveillance
TCR	Temporary Change Record
TCSCA	Timely Completion of Safety Corrective Action
TERP	Transportation Emergency Response Plan
TDG	Transportation of Dangerous Goods
TIMS	Training Information Management System
TLD	Thermoluminescent Dosimeter
TOE	Technical Operability Evaluation
TPAR	Technical Procedure Action Request

TPI	Trending, Prevention and Intervention process
TRA	Threat Risk Assessment
TRIF	Total Recordable Injury Frequency
TSSA	Technical Standards and Safety Authority
TWL	Trend Watch List
UECC	Unit Emergency Control Centre
UFDS	Used Fuel Dry Storage
UPS	Uninterruptable Power Supply
UT	Ultrasonic Testing
VB	Vacuum Building
VoT	Validation of Trend
WBC	Whole Body Count
WFOL	Waste Facility Operating Licence
WHC	Wildlife Habitat Council
WHMIS	Workplace Hazardous Materials Information System
WO	Work Order
WPPI	Work Protection Performance Index
WTFN	Williams Treaties First Nations
WMF	Waste Management Facility
WMP	Waste Management Plan
WWMF	Western Waste Management Facility

Appendix B: System Design and Performance

The subsections in this Appendix contain descriptions and performance details of specific station systems, including details on nuclear safety functions. Significant projects, modifications, and initiatives have been undertaken throughout the current licence term for continuous improvement in the reliability and performance of the SSCs, with continued prioritization of safe station operation. These improvements resolve issues such as equipment obsolescence, aging management, maintenance and operator burden, spare parts availability, and applicable performance or design issues identified through performance monitoring and trending. Successful completion of the improvements results in reliable SSC performance throughout the extended life of the station and positive long-term trends in system health. Execution of projects and modifications is planned and completed for each applicable unit through the applicable work management processes including Pickering NGS Units 5 to 8 refurbishment, outages, or on-line work. Throughout the subsections in this Appendix, the improvements listed for each system include completed, in-progress, and planned improvements for the current and upcoming licence term.

Safety Related System Tests are performed at their specified schedules for applicable systems and components to ensure all safety functions are reliable and meeting the design and operating requirements. The Preventative Maintenance program is also in place such that the required maintenance and testing for critical equipment is completed at the specified intervals.

OSRs are in place for applicable systems with safety functions and are in the LCH (refer to Section 3.0 for the list of OSRs). The starting point of the OSR is the determination of the Safety Limits, which are derived from the analysis limits used in safety analysis. The Safety Limits are used to define the hardware functional requirements and limiting system parameter values in the hardware subsystems. The Safety Limits are also used to ensure there is sufficient margin to the nominal actuation setpoints to account for instrument error and uncertainty.

System performance monitoring is an ongoing process which is planned and completed for every system. The rigour and frequency of each task is applied commensurate with the safety, criticality, and performance requirements of the system. Critical system performance monitoring tasks performed by System Responsible Engineers (SREs) include:

- Completion of System Health Reports at required frequency for each system. Methodology is in place for classification of system tiers and scoring mechanisms.
- Screening for maintenance work including PM and other work orders/requests for repairs and improvements. Scoping and prioritization of work execution is regularly monitored, and considered for system health improvements and continued safety adherence.
- Plant Information (PI) database checks to ensure system operating parameters are within the required ranges. SREs communicate with Control Room Operators (CROs) and ANOs as required, for verification of abnormal system trends.
- Monitoring & Diagnostic Centre has been implemented to perform additional monitoring on specific PI trends. It utilizes advanced pattern recognition software to build operational profiles, and monitor the condition and performance of SSCs.
- System walkdowns for field observation of system components and parameters.
- Monitoring and trending of the Station Condition Record database, including reportable events per CNSC REGDOC-3.1.1.

- ENGAGE software has replaced older software with an enhanced user interface, to facilitate efficient monitoring of PM status and system health report action items.
- Review of station briefing packages and equipment failure review packages for any engineering inputs and support required.

B.1 Special Safety Systems – Emergency Coolant Injection System

The emergency coolant injection (ECI) system is a special safety system. Its purpose is to refill the primary heat transport system and keep it refilled after a loss of coolant accident (LOCA) to enable emergency core cooling to be established. The ECI system also provides one of the long term heat sinks for emergency core cooling. The ECI system is designed to operate under conditions existing after a LOCA and subsequent reactor shutdown. The successful operation of the ECI system is of prime importance to the adequate fuel cooling following a LOCA.

The system belongs to Group 2, and the portion of the system inside containment is environmentally qualified for the conditions following a LOCA.

The system is partially seismically qualified for a DBE and a site design earthquake (SDE). An earthquake will not cause a LOCA because the HT system is qualified for a DBE. The low-pressure/recovery portion of the ECI system is SDE qualified to recover water from the recovery sump and return it to the HT system. Controls and monitoring for the recovery mode are provided in the UECC for use following a site design earthquake.

It is anticipated that the following system will undergo changes during the upcoming licence period:

- USI 33350, Emergency Injection Circuit (ECI)

B.2 Special Safety Systems – Negative Pressure Containment System

The containment system is a special safety system which forms an envelope around the nuclear components of the reactor and the reactor coolant system. Following accidents, it is one of the barriers between the radioactive fission products in the reactor fuel and the public. The system's overall purpose is to limit the release of radioactivity following accidents. To do this the containment system limits the pressure following LOCAs within the design pressure and reduces the pressure to sub-atmospheric for the long term. The eight units of the Pickering NGS Units 1 to 4 and Pickering NGS Units 5 to 8 share a common containment envelope comprising:

- pressure relief duct
- vacuum ducts
- pressure relief valves and vacuum piping
- vacuum building
- airlocks, transfer chambers, and extensions of containment at penetrations

The reactor buildings, which become part of the containment envelope following an accident, are isolated from the rest of the containment envelope during normal operation by pressure relief panels and rupture discs.

The vacuum building is a reinforced-concrete structure with a cylindrical perimeter wall enclosing an internal space frame. The frame supports the roof and the emergency water storage tank. A basement provides access to the underside of the floor slab for maintenance. The basement houses vacuum building equipment including vacuum pumps, electrical and instrumentation equipment, water recirculation and recovery system, and filtered air discharge system. Two floor hatches are sized for staff and equipment access. There are two hatches in the roof to access the water tank and a ramp to the basement for vehicle and staff access. There is a staff emergency exit. Services to the basement are routed through a tunnel connected to the reactor auxiliary bay.

The criteria for the structural design are based on the forces from the operation of the system combined with gravity loads, snow loads, wind loads, and earthquake forces.

It is anticipated that the following systems will undergo changes during the upcoming licence period:

- USI 34200, Negative Pressure Containment System
- USI 34220, Vacuum System

B.3 Special Safety Systems – Shutdown System #1 and #2.

1. Shutdown System #1

The primary method of quickly terminating reactor operation is the release of 28 gravity-drop, spring-assisted, shutoff rods. Shutdown system no.1 (SDS1) employs an independent triplicated logic system, which senses the requirement for reactor trip and de-energizes the direct current clutches to release the shutoff rods. SDS1 is a special safety system. It has no role during normal operation but is poised ready to drop the shutoff rods should an accident occur which requires rapid shutdown. SDS1 is a Group 1 system and is environmentally qualified for the conditions caused by LOCA and for the conditions caused by breaks on the secondary side. The structures of the system are DBE qualified.

2. Shutdown System #2

The second method of quickly shutting down the reactor is the rapid injection of a concentrated gadolinium nitrate solution into the moderator through six horizontally distributed nozzles. This second shutdown system has an independent triplicated logic system, which senses the requirement for shutdown and opens fast-acting helium pressure valves to inject the gadolinium poison into the moderator. SDS2 is a special safety system. It has no role during normal operation but is poised ready to inject poison into the core should an accident occur which requires rapid shutdown. SDS2 is a Group 2 system, is seismically qualified for a DBE and environmentally qualified for the conditions caused by LOCA and for the conditions caused by breaks on the secondary side.

B.4 Reactor Regulating System (RRS), Moderator Liquid Poison System and Liquid Zone Control System

1. Reactor Regulating System (RRS)

Normally, the RRS is used to shut down the reactor. During serious plant upsets or potentially unsafe operating conditions, the reactor is shut down or derated automatically by the setback function. The reactivity depth of the 14 light water zone controllers along with the four control absorbers is sufficient to shut down the reactor even with fresh fuel when the fuel temperature reactivity feedback is a maximum.

Reactor shutdown by the regulating system can be initiated manually through a keyboard or by a special setback pushbutton on the control panel.

The total reactivity depth of the light water zones, control absorbers, and adjusters is insufficient to keep the reactor shut down once the xenon decays away. The regulating system is therefore a short-term means to quickly reduce power.

2. Liquid Zone Control System

The Liquid Zone Control System is the primary means for regulating the reactor power level and the spatial distribution of power in the core. It is designed to perform two main functions:

- To provide short-term reactivity control to maintain the reactor power at the demanded level during normal operation.
- To regulate the spatial distribution of power by counteracting deviations in regional powers arising from reactivity perturbations.

The zone control system consists of 14 in-core flux detectors and 14 vertically oriented light water absorber compartments. The light water columns are contained within 6 vertical tubes running through the reactor, with 4 of the tubes divided into two compartments and two into three, for a total of 14 compartments. Each of the 14 reactor zones is controlled by a single compartment and its associated flux detector. The bulk reactivity is controlled by adjustment of the average light water level in the compartments, while differential adjustments of individual zone levels are used for spatial control aimed at maintaining the flux at the detectors in a constant ratio to the nominal detector flux, i.e., equal error signals depending on the reactor power setpoint.

The nominal flux levels at the detectors may be fixed at steady-state values or may be readjusted by the reactor control system to maintain a desired flux or channel power distribution.

The main consideration in selecting the locations of the zone control compartments are reactivity worth and effectiveness with respect to regulating the spatial power distribution.

Adjusting the flow into the compartment through a control valve, with the outflow maintained constant, can independently vary the level of light water in a compartment. An increase in the level of the light water introduces a negative reactivity due to the increased neutron absorption in the light water. To regulate the reactor bulk power, water level of all 14 compartments are adjusted in unison. Differential adjustments of the water level in individual compartments are made to control the spatial power distribution.

B.5 Reactor

The reactor comprises a calandria assembly, fuel channels and reactivity control units. The calandria assembly and reactivity control units are described here. The reactor is enclosed in a carbon-steel-lined concrete vault (the calandria vault) in which it is submerged in light water. The water provides thermal shielding and cooling. The core has neutron absorbing devices, both liquid and solid, to control reactivity. During operation, reactivity is controlled by adjuster rods, control absorbers, and zone controllers. Under emergency or accident conditions, shutoff rods or liquid poison injection into the moderator achieves fast reactor shutdown. In-core flux detectors and out-core ion chambers are the sensing elements for these regulating and protective devices.

The calandria/end-shield assembly comprises a calandria vessel, two end-shields, and an embedment ring at each end shield. The assembly supports and locates the fuel channels and the reactivity control units, and contains the moderator and reflector in the calandria vessel and light water in the end-shields. The assembly is submerged in the light water contained in the calandria vault.

It is anticipated that the following systems will undergo changes during the upcoming licence period:

- USI 34110, Calandria End Shield Cooling USI 35000, Fuel Handling & Storage
- USI 35200, Fuel Transfer System
- USI 35310, Fueling Machine Head (Fueling Machine and Carriage)
- USI 35390, Fueling Machine Auxiliaries
- USI 35330, Fueling Machine Bridge
- USI 35314, Fueling Machine RAM
- USI 32000, Moderator System

B.6 Reactor Process System – Heat Transport (HT) System

The HT system circulates pressurized heavy water through the reactor fuel channels to remove heat produced by the fission of uranium fuel. The heat is carried by the coolant to the steam generators where it is transferred to the light water on the secondary side to form steam, which drives the turbine/generators. The major components of the HT system are:

- 380 reactor fuel channels.
- 12 vertical steam generators.
- 16 motor-driven main circulating pumps (12 operating, four standby).
- 2 vertical multistage pressurizing pumps.
- 4 reactor inlet headers.
- 4 reactor outlet headers.
- 4 pump suction headers.
- 1 bleed condenser.
- 1 bleed cooler.
- 4 shutdown cooling loops and all the necessary inter-connecting piping and valves.

The fuel channels are horizontal to allow access to both ends of the reactor by the fueling machines. The headers, steam generators and pumps are located above the reactor.

It is anticipated that the following system will undergo changes during the upcoming licence period:

- USI 33000, Primary Heat Transport System

- USI 71380, Emergency Water System

B.7 Electrical Power Systems – Class I

The Class I power system provides a continuous source of 250 V (dc) for circuit breaker closing and tripping, electrical system protection circuits, turbine control and protection circuits, and for operation of the turbine standby lubricating, seal oil, and stator cooling water pumps, and the ECI H_2O injection valves 5/6/7/8-33350-MV156 and MV157.

The system comprises two distribution buses (odd and even) independently supplied from the Class III system by rectifiers/battery chargers, with batteries as the standby power source. In addition, the two buses can be automatically or manually interconnected so that a single rectifier or battery can supply the total unit loads.

Each of the batteries can supply the maximum 250 V (dc) loads on loss of Class III power for 40 minutes.

The rectifiers/battery chargers can supply the normal 250 V (dc) load, the turbine/generator standby pumps, and the battery charging load resulting from the loss of Class III.

The major components of the 250 V (dc) system are the batteries, the rectifiers/battery chargers, 250 V (dc) switchgear, and various 250 V (dc) fused distribution panels.

It is anticipated that the following systems will undergo changes during the upcoming licence period:

- USI 55100, Powerhouse 250 VDC Class I
- USI 55300, Switchyard 250 VDC System

B.8 Electrical Power Systems – Class II

The Class II power system includes three power supplies for the 600 V and 208 V, three-phase, 60 Hz buses. Each power supply, which includes a rectifier and inverter, is normally supplied from a Class III 600 V bus, with a battery backup to the inverter if Class III is lost.

UPSS for Pickering NGS Units 5 to 8 are provided utilizing 675 kVA, 600 V UPS with additional maintenance supplies. Each UPS is equipped with static bypass switch to ensure continuity of power supply in case of inverter failure. The step-down transformer is used to reduce the UPS output voltage from 600V AC to 208 VAC. Upgrades have been made to replace ageing UPSs with new software driven UPS to maintain reliability of the Class II power. The new and larger emergency coolant injection valves are also supplied from new 600V motor control centres (MCC 11 and MCC 12) which are directly powered from the new 600V Class II buses (A and B).

The new UPS units have 600V AC maintenance bypass switchgear that allows the UPS units to be isolated for maintenance while maintaining the supply to Class II loads from an independent Class III power source.

Each of the Class II 675 kVA UPS has a dedicated 540 VDC battery which has been sized to supply the maximum postulated load of the inverter for 40 minutes.

The third power supply is a 10 kVA-rated unit supplying 120 V (ac) for the third channel of the reactor regulating and safety circuits. It has a bypass arrangement to permit continuity of power directly from Class III following a Class IV power supply failure and a battery backup capable of sustaining the Class II load for 40 minutes in the event of Class III failure.

It is anticipated that the following system will undergo changes during the upcoming licence period:

- USI 54200, Class II Distribution System

B.9 Electrical Power Systems – Class III

The Class III electrical power system has higher reliability than the Class IV system. Sources of power are:

- Normal supply from Class IV, 4.16 kV buses.
- Standby supply from standby combustion turbine/generators.

A power interruption for a maximum of 4.5 minutes occurs whenever a switching operation from normal to standby supply takes place. This interval includes the starting time of the combustion turbine from cold, and the time to pick up all the necessary loads.

Loads supplied from Class III power are essential safety related systems, important processes in the turbine, water, and air systems, and normal power supplies to the Class I and Class II systems.

It is anticipated that the following system will undergo changes during the upcoming licence period:

- USI 54100, Class III Distribution System

B.10 Electrical Power Systems – Class IV

The Class IV, 4.16 kV system supplies all the unit service loads during normal operation. It consists of four buses. A and C are the odd buses normally supplied from the system service transformer TSS1, and B and D are the even buses normally supplied from the unit service transformer TGS1. Automatic transfer between A and B buses and between C and D buses is provided by a tie breaker. All the large 4.16 kV loads are permanently connected to these buses.

The Class IV, 4.16 kV bus is rated 3000 A continuous current and 50 kA symmetrical under short-circuit conditions. An automatic transfer circuit initiates a fast transfer of power between the odd and even buses if the supply to one of these buses is lost. The circuit has two modes of initiation:

- *Automatic.* When the supply breaker to (say) A bus trips, the tie breaker between A and B buses closes and power to the A bus loads is supplied from the unit service transformer. The transfer incurs a power interruption of about 50 ms, which has no ill effect on the motors' operation.
- *Manual.* Before shutdown or after startup, the transfer is initiated manually. A very brief overlap is allowed between periods of power supply from the two sources, so that no interruption of power occurs. Once initiated, the circuit operates automatically.

The Class IV, 600 V system consists of four buses, each supplied by a 1250 kVA, 4.16 kV to 600 V dry type air-cooled transformer. Medium size motors up to and including 200 hp, lighting circuits, and motor control centers are supplied from the 600 V system.

In Units 5, 6, and 7 a fifth Class IV, 600 V bus is used for the extra loads (mostly common station loads). In Unit 6, a sixth Class IV 600 V bus exists but is not in service. Furthermore, a 600 V standby bus is available to supply any of the regular 600 V buses (for Units 5-8) when the supply transformer to that particular bus is out of service. This 600 V standby bus extends to the Class III, 600 V buses to fulfil the same function.

The 600 V switchgear is rated 1600 A continuous, and 22 kA short-circuit capacity.

There are currently no major modifications expected during the licence period that affects the Class IV system (USI 53000) or the Site Electrical System (USI 53200).

B.11 Electrical Power Systems – Standby and Emergency Power System

Standby and emergency power is supplied to designated Class III and emergency (Group 2) loads at the 4.16 kV level.

There are two types of combustion turbine/generator sets and two types of electrical installations. The first type is known as standby Class III power system and the second type is the emergency power system (EPS). Both are described below.

Six standby combustion gas turbine/generator sets are arranged in two groups of three sets. Each group has enough capacity to supply 150% of the standby power requirements of two units. Four, 4.16 kV, Class III buses are interconnected to the three standby generators in a group by standby switchgear which provides a direct route from two of the three machines to one bus of each unit. The third backup standby set has direct access to any of the four buses. With load shedding and operator action, it is possible for one standby generator to supply the nuclear safety loads of two units.

For the SG1 generator in each unit pair, an additional cable bus ties its output to any of the three HPECI Pump buses. A circuit breaker connection exists at each supply-end and load-end of this cable bus, 018-53200-BUXYZ. This setup facilitates any SG1 to feed any HPECI Pump. No paralleling of the SG1’s or pumps is allowed.

To improve the availability of the new Turbine Control panels for the SGs, new instrumentation and control cables were installed under The SG Governor Upgrade Project.

The EPS is a critical infrastructure designed to ensure the continuous operation of essential systems during power outages or emergencies. In this setup, the EPS includes two combustion gas turbine/generator sets, each with a continuous rating of 2.5 MW at a 0.8 power factor, and an additional Emergency Power Generator (EPG3) system consisting of three diesel generators with a total capacity of 2.5 MW at the same power factor. These systems are seismically qualified and housed in separate, seismically reinforced structures to withstand design basis events.

In 2010, a temporary emergency power generator EPG3 was installed for controls upgrade projects, which has since been converted to a permanent component of the EPS. This highlights the system's adaptability and commitment to maintaining a continuous power supply for critical operations. Furthermore, the EPS distribution system includes a 4.16 kV bus divided into three sections, two 600 V EPS buses, and two service 600 V buses, ensuring flexibility through redundancy in power distribution.

The EPS supports critical loads during long-term outages of normal station services, powering systems such as the second SDS2, containment systems, emergency water systems, and ECI system vault recovery pumps. Additionally, the system provides power for building ventilation, heating, lighting, and essential auxiliaries.

It is anticipated that the following systems will undergo changes during the upcoming licence period:

- USI 54300, Emergency Power Distribution System (Emergency Power Supply)
- USI 54600, Standby Generators
- USI 54800, Emergency Power Generators

B.12 Electrical Power Systems –Main Power Output

The purpose of Main Power Output System carries the main generator output through the main transformer to the outgoing transmission lines and through the System Service Transformer and Generator Service Transformer, the station electrical service supply. The General Layout and Major Components are:

- Isolated Phase Bus
- Main Transformers
- Main Output Transformer
- Generator Service Transformer
- System Servies Transformer
- 230 kV circuit breakers (2 types)
- Disconnect switches (2 types)
- Potential transformers (2 types)
- Protective relaying
- Microwave Link System

It is anticipated that the following system will undergo changes during the upcoming licence period:

- USI 51000, Main Power Output System

B.13 Instrumentation and Control –Control Computers

A dual computer system is central to the instrumentation and control systems. The plant is highly automated and requires minimal operator action during operation.

Computers are used for station control, alarm annunciation, and data display. Direct digital control is used for functions such as regulating reactor power, steam generator pressure control, and moderator temperature control.

This system for station control and data acquisition is based on the successful systems used in other Canadian designed nuclear stations. There are two identical, independent computers each capable of complete unit control. Experience has proven that an availability more than 99% for each computer is readily achieved. Therefore, the dual computer system assures the very high reliability required for station control.

Each computer has its own core memory, bulk memory, station input-output interface, and peripheral equipment. The two computers communicate by a data link the system is organized so that one computer can be maintained while the other computer controls the station. A fault in any essential part of one computer causes an automatic transfer of control to the other computer. If both computers fail, the unit automatically shutdown without requiring any ANO interventions.

The high reliability of this dual computer control system comes from combining reliable solid state hardware with a self-checking system. Software or hardware faults are detected by a combination of internal hardware and software self-checking and an external watchdog timer. A restart system, which automatically reloads the core memory from the bulk memory and restarts the computer, is combined with the fault detection to provide a system practically immune to transient faults. A computer self-check program (CHK) is designed to monitor the performance of the computer and its peripheral (input/output) equipment, to warn the operator if any malfunction is suspected and restart the affected computer if required.
If a serious failure is detected, control is transferred to the standby computer and the failing system is shut down in a safe manner

The computer controllers are modular and large sections are replaceable. This simplifies fault diagnosis and reduces computer downtime.

Qualified functions essential to the operation of the plant are incorporated in both computers. Typical duplicated functions are:

- Reactor power control
- Plant load control
- Steam pressure control
- Moderator temperature control
- Alarm annunciation

Certain functions are resident in only one computer, for instance Fueling machine control programs.

Process signals are continually monitored and alarm messages are produced with an audible warning when pre-determined values are exceeded. The alarm messages are presented on two monitors within the control area at the ANO desk, and are logged by printers. Alarm summaries may be requested for the total unit or on a system basis. A sequence-of-events record is produced following all unit or station disturbances.

There are computer-driven monitor displays on the reactor, computer, turbine, and fuel handling panels. Standard displays in the form of numerical data, bar charts, or trend plots may be obtained from inputs to the computers. Special display formats improve process data presentation. A hard copy facility enables the operator to record display information for later use.

Keyboards mounted in the control room panels provide operator communication with the computers.

It is anticipated that the following system will undergo changes during the upcoming licence period:

- USI 66400, Digital Computer System

B.14 Instrumentation and Control – Control Centre

The control centre is an air-conditioned area comprising the control room and adjacent auxiliary control areas. . A control equipment area containing the bulk of the control and instrumentation equipment for each generating unit is located behind the main control panels. Expanding requirements for new logic and relay cubicles have necessitated the addition of an auxiliary control equipment area (common to Units 5 to 8) located on elevation 294 ft above the Unit 5 and 6 equipment areas. Also located in the control centre is a shift supervisor's office, a washroom, and a work control area.

The work control area accommodates staff requiring work permits, etc., thus limiting access to the control room. It also allows much of the clerical work, normally handled by the operators, to be done outside the control room. A section of the work control area contains the suit communications system, the maintenance telephone system panels, and breathing air supplies and masks.

1. Control Room

The main control room contains the control panels for the four generating units. Each unit has its own control panels. There are two additional panels for common equipment and electrical controls, and a separate console for the HPECI controls.

All essential indications, controls, and controls for any system requiring attention within 15 minutes of an alarm are located on the control room panels. There is local control for systems not requiring attention within 15 minutes.

To keep the control panel displays down to a reasonable size, a large amount of information is processed by the control computers. Colour monitors display plant data and alarms. Much of this information would otherwise have to be displayed on panel indicators. By taking the routine logging of this information away from the operators, they are free to give their full attention to the efficient operation of the unit. There is sufficient conventional display, annunciation, and recording of plant variables to maintain a safe shutdown condition with both computers out of service.

The control room is spacious for the operators and provides free movement around the control panels during all modes of operations/conditions. All suspended and floor standing equipment is supported and braced to prevent injury to control room staff.

2. Main Control Panels

The control panels form part of the boundary walls of the control room. Because of computer automation, the operators do not need to be at the control panels continuously or even frequently. The main control panels therefore are stand-up panels with no console.

The HPECI control panel is located beside the Unit 5 operator's desk. This panel is a console type so that the main panels are not obstructed from view.

The panels are laid out by system with the controls for a specific system located in one panel bay. Spacing between instruments is kept to a minimum to achieve a compact display of information.

The relative location of the controls is generally based on process function and/or plant location. The more complex process systems are displayed using coloured graphic lines or mimic diagrams.

The computer consoles are located centrally on each unit control panel, to provide maximum access for the operator when working on the reactor and fuel handling controls. The consoles have colour monitors and all the input-output devices required for man-machine communication.

The area on the panels above the normal working area is used for annunciator windows and the closed-circuit television monitors. Two colour monitors show annunciation messages.

All instruments are scaled in the International System of units (SI units).

B.15 Unit Emergency Control Centre (UECC)

The UECC is an additional control room for each generating unit. Each UECC is located directly to the south of its associated reactor building and immediately beneath the pressure relief duct. These rooms contain the unit controls and logic panels associated with the following systems:

- Shutdown system No. 2
- Emergency water supply
- Emergency power supply
- Containment
- Plant monitoring systems
- Emergency coolant injection recovery system (controls in Units 5 and 7, UECC only)
- Filtered air discharge system (controls in Unit 5, UECC only)

When the main control centre is not available for any reason, the reactor can be safely shut down and maintained in that state indefinitely from the UECC.

Each UECC is required to be accessible, operational, and habitable following any event requiring operator action in the UECC. On that basis, the following are the UECC room criteria:

- Self contained operation.
- Immunity from events which may disable the main control centre.
- Independence from the equipment in the main control centre.
- Independence from normal plant service systems

B.16 Steam Supply Systems – Steam Supply, Main Condenser, Main Steam and Steam Bypass

1. Steam Supply System

Four pipes transport the steam from the steam generators to the turbine/generator. Sixteen safety valves and 12 steam reject valves are installed on the steam piping in the reactor auxiliary bay as the piping emerges from the reactor building wall. The steam lines enter the turbine building at right angles to the turbine axis and run under the turbine hall floor to the steam balance header in front of the turbine. Pipes connected to the header supply steam to the four stop and control valve groups and to the two reheaters.

The wall thickness of piping greater than 35.5 cm (14 in.) complies with the ANSI B 31.1 Code; movements, stresses, and reactions at terminal points are limited to meet the requirements of the connected equipment.

Steam piping is sized to avoid erosion in critical areas and to limit the pressure drop from the steam generators to the turbine.

2. Main Condenser

Steam from the low-pressure (LP) turbine cylinders exhausts into condenser shells where it is condensed and collected in the hotwell. The hotwell is a source of condensate and static head for the condensate extraction pumps, as well as a reservoir for drains in the system.

The condenser is located with its main axis in a transverse direction to the turbine axis. The condenser has three separate shells, each operating at the same pressure. The shells are solidly mounted on the foundation block and connected to the turbine exhaust flanges by flexible rubber joints. The shell pressure is equalized by an arrangement of balance lines linking the outer shells to the middle one.

The balance lines are sized to allow for on-load cleaning of one of the two tube bundles in each shell without vacuum unloading of the turbine/generator. This arrangement allows on-load inspection of the tube inlets. Stainless steel steam impingement shrouding is installed on extraction steam piping subjected to high velocity steam and water impact. The condenser tubes and tubesheets are all manufactured from titanium to SB-338 Gr2.

3. Main Steam and Steam Bypass

The steam conditions at full load (rated continuous turbine capacity) are 4.03 MPa(a), 250.8°C and 99.78% steam quality at the high-pressure turbine emergency stop valves. The moisture is removed from the high-pressure (HP) exhaust steam and the exhaust steam is reheated to 226.1°C before flowing through the LP turbine.

The steam consumption is 752 kg/s to the HP cylinder and 61.4 kg/s to the steam reheater.

Two small and 10 large steam reject valves discharge steam from the main steam line if the turbine becomes unavailable. The two small valves discharge steam to the forebay when the reactor is warmed up and the 10 large valves discharge to atmosphere. Rapid shutdown of the turbine causes all the steam reject valves to open. The steam reject valves are also sized to pass the quantity of steam produced by the reactor in a poison prevent mode of operation.

A deaerator maintains the oxygen level in the feedwater at levels dictated by the steam generator tube material. In addition, the deaerator heats the condensate during poison prevent operation to limit the thermal stresses in the steam generator components.

The condenser also reduces the oxygen content of the feedwater. The condenser hotwell stores condensate for 5 minutes of full power operation.

It is anticipated that the following system will undergo changes during the upcoming licence period:

- USI 36000, Boiler Steam & Water Systems
- USI 42000, Condenser System
- USI 43000, Feedwater System

B.17 Steam Supply Systems – Turbine and Generator

The turbine is a tandem compound unit, directly coupled to the generator. It comprises one double-flow HP cylinder, external moisture separators, live steam reheaters, and three, double-flow LP cylinders. There are four external steam chests in front of the machine; each containing a governor valve and an emergency stop valve in series. The steam chests are supported on trunnion arms to allow freedom of movement in a horizontal plane.

Six reheat steam lines, each with an intercept valve, and reheat emergency stop valve, supply steam to the three LP turbine cylinders. The butterfly-type intercept valves normally control steam flow to the LP cylinders. The butterfly-type reheat emergency stop valves back up the intercept valves by closing on a turbine trip. Two rupture disc lines protect the separators and reheater shells from overpressure should there be major intercept valve failures. These lines connect to the cold reheat lines upstream of the separators.

There are two steam release valves; one dumps extraction steam from the HP turbine to the condenser and the other dumps separator drains to the condenser. During normal operation, these valves are closed and the flows go to the No. 6 and No. 5 HP feedwater heaters, respectively. During low-load operation when the HP feedheaters are ineffective, the release valves are open to maintain extraction steam flow. They also open on turbine trips and on high condensate level in the HP feedheaters.

The turbine startup from turning gear to synchronization is controlled from the central control room.

The generator is a three-phase, four-pole, cylindrical-rotor, synchronous machine of conventional construction. The rotor windings consist of hollow axially cooled end windings with radially cooled slot section. Each pole consists of four (4) coils: three (3) of the coils have eleven (11) turns per coil and the fourth coil has ten (10) turns. The stator core is constructed from iron laminations (to control eddy currents) with 72 slots.

The stator winding consists of two conductor bars per slot for a total of 144 conductor bars. Each conductor bar constructed from nineteen (19) copper substrands which are arranged with a Roebel transition and each sub-strand is hollow to permit direct water cooling of the stator winding. In addition to cooling the rotor winding, hydrogen is used to cool the stator core.

It is anticipated that the following systems will undergo changes during the upcoming licence period:

- USI 41200, Generator & Auxiliary Equipment
- USI 41000, Turbine Generator

B.18 Plant Auxiliary Systems - Main and Auxiliary Feedwater System

1. Main Feedwater System

The major components of the main feedwater system are:

- Three 50% condensate extraction pumps with electric motor drives, instrumentation, and a common recirculation line.
- Three 50% feed pumps with electric motor drives and instrumentation.
- Gland seal injection system.

- An individual recirculation line for each feed pump.
- Feedwater piping, valves and supports.

2. Auxiliary Feedwater System

The 5% auxiliary condensate extraction pump draws water from the condenser and pumps it through a separate line to the deaerator. A 5% capacity control valve automatically controls the flow to the deaerator. The valve is supplied from Class II power and fails open on loss of power or air. This pump is a multistage vertically mounted centrifugal pump with no recirculation facility.

3. Feedwater Heating System

The feedwater heating system has the following main functions:

- To supply feedwater to the steam generators under various operating conditions.
- To preheat the water to achieve a good heat rate.
- To deaerate the water at the optimum point in the thermal cycle.
- To provide storage to override transients and provide the suction head for the condensate and boiler feed pumps.
- To be a source of pressurized, treated water for the boiler feed pump gland sealing system and the turbine cooling system.

The condensate and feedwater train has three 50% condensate extraction pumps and three, 50% feed pumps. Reactor startup and cooldown requirements are provided by a 5% auxiliary condensate pump and a 3% auxiliary feed pump.

It is anticipated that the following system will undergo changes during the upcoming licence period:

- USI 43000, Feedwater Systems (Boiler Feed and Condensate)

B.19 Plant Auxiliary Systems – Demineralized Water Treatment System

The water treatment system supplies demineralized light water to both Pickering NGS Units 1 to 4 and Pickering NGS Units 5 to 8. It treats lake water taken from the Pickering NGS Units 5 to 8 CCW duct and supplies a variable demand of demineralized water at flow rates up to 66 L/s (1.046 USgpm), 5.7 million litres per day, for the eight-unit station. The water treatment system is designed and operated under a commercial supply contract.

Demineralized water is stored in eight 1890 m^3 (500,000 USgal) aluminum tanks (one tank per unit) and transferred through a common header to two systems:

- The main condensers (to make up condensate losses).
- The demineralized water makeup tanks in the turbine buildings.

High Pressure Demineralized water is taken from the 12-inch low pressure demineralized water headers of Pickering A (0-71620-L851) and Pickering B (05678-71620-L852) to three 50% duty inline single stage centrifugal pumps 71660-P1, P2, and P3. Each pump is rated at 6.3 L/s (100

USGPM) at 688 kPa (230 feet) total head. The shut-off head of the pumps is 717 kPa (240 feet). The pumps are connected in parallel and located in the basement of Unit 1.

It is anticipated that the following system will undergo changes during the upcoming licence period:

- USI 71600, Demineralized Water Treatment Plant

B.20 Plant Auxiliary Systems – Domestic Water System

Domestic water is supplied from the Pickering Township water mains at approximately 80 psig.

An emergency supply of domestic water is taken from the new water supply on Brock Road through a meter house. This supply line passes through the east wall of the turbine auxiliary bay.

B.21 Plant Auxiliary Systems – Condenser Circulating Water System

The open-loop circulating water system supplies cooling water to the condensers to maintain a temperature rise through the condenser of about 10.8°C (19.6°F). The pumping equipment consists of two vertical pumps, each capable of supplying about 50% of the required flow of 29,000 L/s (460,000 USgpm) at about 4.73 m (15.5 ft) of head. The maximum flow for single pump operation is 16,000 L/s (255,000 USgpm). The pumps are mounted independently in intake chambers in the powerhouse and are driven by induction motors using Class IV power.

The discharge ducts from the condensers function as syphons to recover the elevation head of the system. The syphon is developed initially and maintained by a vacuum priming system. The circulating water is returned to the lake through the discharge channel.

The system is protected from waterhammer by vacuum breaker valves. Bar screens and traveling screens prevent debris and weeds from entering the circulating water system. Chlorine can be injected, if required, to prevent algae formation in the condensers.

The traveling water screens are protected from plugging with frazil ice by the recirculation of warm water from the reactor building discharge channel back into the intake channel, whenever required.

An inline Debris Filter is installed in each of the 72” CCW inlet pipe to prevent debris from entering the condenser waterboxes.

It is anticipated that the following system will undergo changes during the upcoming licence period:

- USI 71210, Condenser Cooling Water Supply System
- USI 71100, Common Water Supply System

B.22 Plant Auxiliary Systems – Condenser Tube Cleaning System

The Condenser Tube Cleaning System has the following main functions:

- Prevention of fouling and scaling in tubes during operation.

- Maintaining constant heat transfer coefficient in the condensers.
- Reduction of heat consumption.
- Elimination of tube corrosion due to biological growth in the tubes.

In order to clean the condenser tubes, abrasive coated elastic ball-shaped cleaning elements (sponge balls) are injected into the main cooling water pipe lines. They are evenly distributed in the water box before entering the tubes. The sponge balls clean the tubes as they pass through them and are separated from the cooling water by the strainer section located at the cooling water outlet. They are then removed from the strainer section by a pump and fed back again via the ball collector and recirculating pipe, for reinjection at the cooling water inlet.

B.23 Plant Auxiliary Systems – Compressed Air

The compressed air services consist of:

- Instrument air.
- Service air.
- Breathing air.

Instrument air is provided on a unit basis and has, along with compressed air, its own group of compressors. The system has four compressors, one operating and three on standby [each capable of supplying a demand of 307 L/s (650 scfm)]. The individual instrument air systems have air receivers to supply air during a temporary loss of power. Local receivers in the reactor building area provide additional capacity for the nuclear systems.

The service air for all four units of the station is supplied by three compressors, each capable of supplying 307 L/s (650 scfm). Common Service instrument air is supplied from Service Air system through two 100% heatless type, 0.069 m^3/s (150 SCFM) air dryers operating alternatively. The two air dryers are similar to the Instrument Air dryers, having pre-filters and after filters, and are located on 225' elevation of the Turbine Hall.

The breathing air for Pickering NGS Units 5 to 8 is supplied by three compressors, each capable of supplying 307 L/s (650 scfm). There are three breathing air receivers, each with a capacity of 250 cubic feet. The breathing air system is designed to handle a maximum load of 0.928 cubic meters per second which is the equivalent of sixty men in plastic suits.

It is anticipated that the following system will undergo changes during the upcoming licence period:

- USI 75120, Instrument Air LP System (Breathing Air)
- USI 75110, Service Air System
- USI 75140, Breathing Air System

B.24 Plant Auxiliary Systems – Active/Inactive Drainage and Sewage

The drainage system is subdivided into:

- Inactive drainage.

- Active drainage.
- Sewage system.

1. Inactive Drainage

This system collects drainage from superstructure and sub-structure floors, and utility drains from the turbine hall and turbine auxiliary bay basement sumps, which are normally inactive, and discharges to the condenser cooling water discharge or intake channel depending on the location.

Clean drains, such as leakage from the main steam blowdown pipe trenches are returned to the lake through yard drains.

Waste from the Water Treatment Plant is directed to one of three points in the system.

- Streams not requiring neutralization are directed to the drain.
- Media filter backwash has the capability of being diverted to the sanitary sewer.
- All other streams are sent to the waste equalization tank.

The resin regenerant waste effluent from the water treatment plant neutralizing sump is pH-monitored and discharged to the condenser cooling water discharge channel.

2. Active Drainage

The active drainage system is water drainage from floor and equipment drains in the reactor buildings, reactor auxiliary bay and service wings. This drainage is transferred to the active liquid waste management system.

Where possible, the wastes are conveyed by gravity but where drain elevations or process requirements do not permit this, the liquids are pumped from local storage tanks by air pressure or from sumps by sump pumps.

Where wastes are discharged from processes that include ion exchangers for activity removal, the point of discharge is downstream of the ion exchangers to simplify waste treatment.

3. Sewage System

The sewage system collects waste throughout the Pickering NGS Units 1 to 4 and Pickering NGS Units 5 to 8 and discharges it into the Regional Municipality of Durham sewage mains. Sewage is collected from Pickering NGS Units 1 to 4 and Pickering NGS Units 5 to 8, the Information Centre, the Engineering Services Buildings ESB1 and ESB2, the Projects and Modifications Complex, Nuclear Sustainability Services – Pickering, the Administration Building and extension, and the Service Wing and extension. All sewage is directed by either gravity or is pumped to a final sewage lift station, located in the yard. Two 100% centrifugal pumps, rated at 50 L/s each, transfer the sewage to the mains.

Contamination of sewage from personnel showers is extremely low and the activity levels are well below the International Commission on Radiological Protection recommended limits for drinking water. About 25 L of representative samples per week are analyzed for radionuclides.

B.25 Plant Auxiliary Systems – Heavy Water Management System

The primary objectives of the heavy water management system are:

- To limit the release of tritium and other radioactivity to the environment to as low as practical below regulatory limits.
- To minimize exposure of station staff to both tritium in the station atmosphere and radionuclides in the heavy water management system.
- To segregate recovered heavy water into a number of isotopic ranges to minimize upgrading costs.
- To segregate recovered water into high-tritium from the moderator system and low-tritium from the heat transport system to avoid adding high-tritium heavy water to the heat transport system.

All the heavy water management systems, with the exception of the heavy water upgrading system, are classified as Class 3 under Section III of the ASME Code. The heavy water upgrading system is designed in accordance with the ASME Code, Section VIII and additional OPG requirements. The systems used to recover, transfer, store, and treat the downgraded heavy water and to store reactor grade heavy water.

There are seven stainless steel headers in the reactor auxiliary bay for Units 5 to 8 for heavy water transfer with a minimum of drum handling. Some of these lines are interconnected with the existing transfer lines in Units 1 to 4. The transfer headers are used to transfer heavy water between reactor units and among the following systems:

- Moderator system.
- Heat transport system.
- Deuteration and de-deuteration systems.
- Heavy water supply system.
- Heavy water ion exchange cleanup system.
- Heavy water upgrading systems.
- Incoming/outgoing tritiated heavy water system.

It is anticipated that the following system will undergo changes during the upcoming licensing period:

- USI 34600, Upgrader Plant Pickering (UPP)

B.26 Plant Auxiliary Systems – Heating, Ventilation and Air Conditioning

1. Heating System

The heating systems serve two purposes:

- Provide comfort to people working inside the plant.
- Prevent equipment and line freezing during plant shutdown in the winter.

Steam, electricity, and hot water are used for heating. During operation, heating steam comes from the turbine. During plant shutdown and before turbine operation, steam can be taken from Pickering NGS Units 1 to 4 extraction header.

One heating steam header at 227.7 kPa(g) (33 psig) runs the entire length of the powerhouse of all four units in an east-to-west direction. The steam header is supplied with extraction steam from each unit through a pressure-reducing valve. All the steam heating equipment receives steam only from this header.

The heating steam header has a relief valve downstream of each pressure reducing valve set to open at 276 kPa(g) (40 psig).

Where the use of steam heaters is not desirable (Zone 1 areas), electric heaters or hot water heating systems are used. Hot water from the domestic water system is used for humidification.

2. Ventilation and Air Conditioning Systems

The primary objectives of the ventilation and air conditioning systems are:

- To provide a controlled atmosphere (within specific temperature limits) for instrumentation and control equipment.
- To provide year-round comfort to people working inside the plant.
- To remove the heat released by the thermal cycle.
- To remove moisture entering the air, to reduce the downgrading of recovered heavy water.
- To remove or dilute obnoxious, toxic, or radioactive contaminants and thus prevent personnel radiation doses from exceeding acceptable limits.
- To supply clean air in work areas.
- To isolate the reactor building in case of an emergency.

The reactor building contains systems and equipment, which may be sources of contamination and is classified as Zone 3.

The reactor auxiliary bay is heated by two identical hot water systems, one for Units 5 and 6, the other for Units 7 and 8. Each consists of a steam-to-water heat exchanger, hot water circulating pumps, hot water heaters, and piping systems. Each system supplies two heating coils, one in each of the respective unit's ventilation inlet air plenum.

The irradiated fuel storage bay is heated by two heaters located at the south wall of the bay. They provide 58.6 kW (200,000 Btu/h) each.

The irradiated fuel storage bay ventilation is similar in concept to the reactor building ventilation system. Air is exhausted from the irradiated fuel storage bay to induce inflow of outside air. The air is exhausted from the water level of the fuel storage bay, from the decontamination room in the basement, and several other locations. Before being exhausted to the stack of Unit 7, the air passes through a filter assembly consisting of a demister, heater, prefilter, HEPA filter, and High Efficiency Carbon Absorber (HECA) filters. There are two bypass systems. One bypasses the filter assembly for maintenance or replacement of filter components. The other is a bypass of the HECA filter only to provide the bypass option to prolong HECA filter life.

Heating is by a single heater of 58.6 kW (200,000 Btu/h) capacity. The vehicle loading area has a 2.1×10^5 L/min (7500 scfm) supply unit and two roof ventilators, one of 1.54×10^5 L/min (5500 scfm) capacity connected to a hood above the vehicle, and the other of 5.6 x 10^4 L/min (2000 scfm) covering the rest of the area.

An electric eye mechanism starts the ventilation of the area. The ventilation starts when a vehicle enters and stops some time after the vehicle has left.

The turbine hall and turbine auxiliary bay are heated by two separate steam heating systems, one steam heater system and two perimeter heating and ventilating units which have steam heating coils.

There are five separate air-conditioning systems serving the control room and the control equipment rooms. Air-Conditioning Units (ACU) 1 to 4 serve Units 5 to 8, while ACU 5 serves the control room. All mechanical equipment is located in the air-conditioning equipment room. Each air-conditioning unit consists of an electronic air cleaner, a sprayed coil dehumidifier, a supply fan, and a hot water reheater.

It is anticipated that the following system will undergo changes during the upcoming licence period:

- USI 73110, Reactor Building Heating & Cooling
- USI 34230, Filtered Air Discharge System (FADS)

B.27 Plant Auxiliary Systems – Low Pressure Service Water

Each unit has a low-pressure service water (LPSW) system supplied by three vertical low-pressure service water pumps powered from the Class IV buses. The pumps are located in the powerhouse and each pump has a capacity of 2210 L/s (35,000 USgpm) at 42.7 m (140 ft) total head. Normally two pumps operate in parallel with the third pump on standby. These pumps supply a common header.

A fourth emergency pump, of identical rating, supplies cooling water to the recirculation heat exchanger of the emergency coolant injection system. Each heat exchanger is supplied by two pumps, one from each of the units associated with the recirculation circuit. If a pump fails or is being maintained, water can be supplied from the other low-pressure emergency pumps.

It is anticipated that the following systems will undergo changes during the upcoming licence period:

- USI 71300, Service Water Systems

B.28 Plant Auxiliary Systems – High-Pressure Service Water System

The high-pressure service water is taken from the unit low-pressure header in the powerhouse and supplies cooling lake water raised in head by a minimum of about 414 kPa (139 ft). High pressure water is delivered by two vertically-mounted 567.7 L/s (9000 USgpm) pumps (7134-P3 and P4) operating on Class IV power and two vertically-mounted 378.5 L/s (6000 USgpm) pumps (7134-P1 and P2) operating on Class III power.

These loads fall into two categories:

- Loads at an elevation too high to be supplied by the LPSW system.

- Fire protection system.

If Class IV power fails, one emergency high pressure service water pump powered from the Class III bus meets the demand for essential equipment excluding fire protection system. Two emergency high pressure service water pumps are required to include supply to the fire protection system.

B.29 Plant Auxiliary Systems – Recirculated Cooling Water System

The recirculated cooling water system provides clean demineralized water at 29°C (85°F) to equipment which might become fouled or plugged by impurities from raw lake water. The provision of recirculated cooling water to equipment containing heavy water, such as the bleed cooler, eliminates the possibility of accidental freezing of the heavy water because the cooling water is maintained at 29°C (85°F), which is well above the winter service water temperatures.

The recirculated cooling water is provided by three, 50%, 88 L/s (1400 USgpm) capacity pumps. The suction head of the pumps is about 331 kPa(g) (48 psig) and the discharge pressure is about 772 kPa(g) (112 psig). The pumps operate on Class III power.

The recirculated cooling water heat exchangers are each rated at 50% capacity and are cooled by LPSW. If the LPSW fails due to a loss of Class IV power, firewater can be used as a backup.

Makeup to the system comes from the high-pressure demineralized water system. The pH of the water is kept above 10 and dissolved oxygen is removed for corrosion control. This is done by the addition of lithium hydroxide. Periodic sampling and chemical addition maintain the desired conditions. In addition, a small bypass flow of 3.8 L/s (60 USgpm) flows through a filtering arrangement (71320-FR501) which continuously cleans the closed water system. Large particles are taken out by the full flow strainer 71320-STR501.

B.30 Civil Structures

It is anticipated that the following systems will undergo changes during the upcoming licence period:

- USI 22000, Powerhouse (Civil Structures)
- USI 21000, Reactor Building & Auxiliary Bay (Civil Structures/H-Piles)

B.31 Miscellaneous

It is anticipated that the following systems will undergo changes during the upcoming licence period:

- USI 04916, Buried Piping
- USI 57000, Cable, Conduit & Cable Pans (Cable Program)USI 71400, Fire Protection Systems

Appendix C: Activities and Nuclear Substances to be Encompassed by the Licence

The information below is provided to satisfy the requirements of Section 3(1)(b) of the *General Nuclear Safety and Control Regulations*.

Activities to be Licensed:

The application for renewal of PROL 48.03/2028 contains information for the activities to be licensed. These activities include those currently licensed in PROL 48.03/2028 and WFOL-W4-350.00/2028:

i. operate the Pickering Nuclear Generating Station Units 5 to 8 (hereinafter “the nuclear facility”) and the Pickering Waste Management Facility (“the waste storage facility”) at a site located in the City of Pickering, in the Regional Municipality of Durham, in the Province of Ontario;

ii. decommission the Pickering Nuclear Generating Station Units 1 to 4 located at the site described in (i); possess, transfer, use, package, manage and store the nuclear substances that are required for, associated with, or arise from the activities described in (i) and (ii);

iii. import and export the nuclear substances, except controlled nuclear substances, that are required for, associated with, or arise from the activities described in (i) and (ii);

iv. possess, transfer, produce, package, manage, and store Cobalt-60;

v. possess, transfer, manage and store heavy water from other nuclear facilities;

vi. transport Category II nuclear materials that are associated with the activities described in (i) and (ii) by road vehicle on the site of the Pickering Nuclear Generating Station;

vii. possess, transfer, export, package, manage and store nuclear substances, except controlled nuclear substances, from the Western Waste Management Facility;

viii. possess and use prescribed equipment and prescribed information that are required for, associated with, or arise from the activities described in (i), (ii), (iii), (vii) and (xi);

ix. possess, use, manage and store enriched uranium as required for fission chambers for the Pickering Nuclear Generating Station Units 1 and 4 Shutdown System Enhancement, including spares;

x. carry out the site preparation, construction, or construction modifications at the onsite waste storage facility associated with the authorized additional processing and storage buildings, when on completion will result in a total of no more than 1 dry storage container processing building and no more than 6 used fuel dry storage buildings; and

xi. carry out the site preparation, construction, or construction modifications and operate the Pickering Component Storage Structure for interim storage of Low and Intermediate Level Waste from Pickering Nuclear Generating Station.*

*Application currently pending Commission decision (CMD 25-H101)

List of Nuclear Substances:

Table 54. List of Nuclear Substances

Nuclear Substance	Form and Location	Maximum Quantity
Natural Uranium	Solid as Fuel Bundles: New Fuel Inventory, New Fuel Transfer Mechanisms, Fueling Machine Heads, Service Area Rehearsal Facility, Pressure Testing Facility.	12,600 bundles *
Irradiated Uranium	Solid as Spent Fuel bundles: All Bays – Storage Bays, Reception Bays, Wet Cask Bays, All Reactor cores – Units 1,2,3,4 DSC Storage Buildings: • SB1 – 185 DSCs • SB2 – 469 DSCs • SB3 – 480 DSCs • SB4 – 624 DSCs • SB5 – up to 1410 DSCs	(436,360) bundles[5] * 18,240 bundles 1,216,512 bundles (3168 DSCs x maximum 384 bundles per DSC)
Depleted Uranium	Solid as Fuel Bundles: New Fuel Inventory, Spent Fuel Discharged to Bays.	*Included in above totals marked with asterisk
Depleted Uranium in components (e.g. shielding)	Solid. Located within the Pickering protected area for use as needed.	7,451.1 kg
Depleted Uranium in Cobalt components (e.g. shielding)	Stationary shielding located inside the boiler room within the reactivity deck/mechanism in Units 6, 7 and 8	Material: Depleted Uranium Weight: 143 lbs (65 kg) per shielding Quantity: 21 shielding per unit Total weight: 143 lbs x 21 x 3 = 9,009 lbs (4,086 kg)
Cobalt-60	Solid (Unit 6,7 &8)	6.3 MCi
	Solid (AIFB)	0 MCi
Heavy Water	Liquid (D_2O) Units 5, 6, 7, and 8	1,828 Mg
	Liquid (D_2O) Storage	1,101 Mg

[5] Full storage bay and reception/Wet Cask Handling Bay (WCHB) floor based on bay and module dimensions.

Nuclear Substance	Form and Location	Maximum Quantity
Enriched Uranium in Components (e.g. fission chambers)	Solid. Located within the Pickering protected area for use as needed	39.16 g
Intermediate Level Waste	Solid as retube components in DSMs at PWMF.	34 DSMs
Low and Intermediate Level Waste *(Pending Commission approval of the PCSS at PWMF)*	Solid as L&ILW from refurbishment of Pickering NGS Units 5 to 8 and decommissioning activities in the PCSS.	The quantity of waste will include **but is not limited to:** • 140 RWCs (for ILW) • 48 Steam Generators (for LLW)

Appendix D: List of Hazardous Substances

The purpose of this Appendix is to document a list of hazardous materials at the Pickering NGS and PWMF with respect to a licence application requirement under *Class I Nuclear Facilities Regulations* SOR/2000-204.

Under *Class I Nuclear Facilities Regulations* SOR/2000-204, Licence Applications, General Requirements, Section 3,

An application for a licence in respect of a Class I Nuclear Facility, other than a licence to abandon, shall contain the following information in addition to the information required by Section 3 of the *General Nuclear Safety and Control Regulations*.

> (e) the name, form, characteristics and quantity of any hazardous substances that may be on the site while the activity to be licensed is carried on.

Table 55 contains a list of the hazardous substances at Pickering NGS.

Table 55. List of Hazardous Substances

Name	Form	Characteristics	Quantity (inventory)	Quantity (in system)
Carbon dioxide gas	Compressed Gas	Mildly toxic, asphyxiant in high concentrations, heavier than air.	33 Pieces of 12 pack cylinders (K size containers)	Annulus Gas: Pickering 014 and Pickering 058 combined: ~120 ft^3 (~3.4 m^3)
Ethylene Glycol	Liquid	Toxic	~2 drums, 205 L	~1000 L
Gadolinium Nitrate	Solid, Made into solution for addition	Toxic, severe irritant	~36 pieces of 5 kg each	Pickering 058: LISS: ~19,000 L Moderator: ~1,700 L
Helium gas	Compressed Gas	Compressed gas, simple asphyxiant, lighter than air	~80 Cylinders, 291 ft^3/Cylinder (8.2 m^3/Cylinder)	Moderator Cover Gas: ~6000 ft^3 (~170 m^3) (P014 and P058 combined) Liquid Zone Control: 7000 ft^3 (198.2 m^3) (P014 and P058 combined)
Hydrazine (35% solution)	Liquid	Corrosive base, Toxic	Pickering 014 uses drums. ~12 drums at 208.65 kg per drum as	Pickering 014: Typically, 1 drum (205 L)

Name	Form	Characteristics	Quantity (inventory)	Quantity (in system)
			Hydrazine Hydrate Pickering 058 uses totes. ~1,800 L (2x 900 L totes) as Hydrazine Hydrate	connected to the system Pickering 058: ~1,800 L tote connected to the system
Hydrogen gas	Compressed Gas	Flammable Compressed Gas, lighter than air	2 Cylinders at 196 ft^3 (5.6 m^3) 5 Cylinder at 2.77 m^3	HTS: Pickering 058 and Pickering 014 combined 6500 ft^3 (184 m^3) Moderator Cover Gas: Pickering 058 and Pickering 014 combined 115,000 ft^3 (3256.4 m^3) in a Mobile trailer hooked up directly to the system
IX resin Cation	Solid	Toxic, irritant	~ 50 Pieces of 1 ft^3 Package (28.32 L/bag)	Moderator (Pickering 058 Only) ~1 ft^3 (~0.03 m^3)
IX resin: De-oxygenating Resin	Solid	Toxic, irritant	4 pieces of 1 ft^3 (0.03 m^3) packages	Pickering 058 and Pickering 014 combined: ~14 ft^3 (~0.4 m^3)
IX resin: Lithiated Mixed Bed Resin	Solid	Toxic, irritant	~ 243 pieces of 0.5 ft^3 (0.01 m^3) bags	Pickering 058 and Pickering 014 combined: HTS ~30 ft^3 (~0.85 m^3) RCW ~4 ft^3 (~0.1 m^3) ESC ~23 ft^3 (~0.7 m^3)
IX resin: Neutral Mixed Bed Resin	Solid	Toxic, irritant	~ 45 pieces of 1 ft^3 (0.03 m^3) package	Pickering 014 and Pickering 058 Combined: Moderator: ~55 ft^3 (~1.6 m^3)

Name	Form	Characteristics	Quantity (inventory)	Quantity (in system)
			2 Pieces of 35 ft^3 package (1 m^3)	IFB: ~240 ft^3 (~6.8 m^3) AFIB: ~200 ft^3 (~5.7 m^3) SCW: ~14 ft^3 (~0.4 m^3)
Lithium Hydroxide	Solid, made into solution for addition	Corrosive base	~ 14 pieces of 0.5 kg bags	Combined Pickering 058 and Pickering 014: HTS: ~240 g (in solution) RCW: ~2.7 kg (in solution)
Lubricating oil and seal oil Teresso #46	Liquid	Non-toxic during normal use	~570 drums at 205 L each	Pickering 014 and Pickering 058 Combined: ~375,000 L
Morpholine	Liquid	Combustible liquid, toxic, corrosive base	Pickering 014 uses drums ~45 drums at 441 lb/drum (200 kg/drum) of 50% solution, Pickering 058 uses totes ~1800 L of 45% solution	Pickering 014: Typically, 1 drum (250 L) connected to the System Pickering 058: ~1800 L, this is in totes connected directly to the system
Oxygen gas	Compressed Gas	Strong oxidizer - increases flammability of flammable or combustible Material	~2 cylinders, 335 ft^3 (9.5 m^3) per cylinder	Moderator Cover Gas: Pickering 058: ~2600 ft^3 (~73.6 m^3) Pickering 014: None Annulus Gas: Pickering 014 and Pickering 058 combined ~1000 ft^3 (~28.3 m^3)

Name	Form	Characteristics	Quantity (inventory)	Quantity (in system)
Reolube Turbofluid 46XC Fire Resistant Fluid	Liquid	Mildly toxic	~3,400 L	
Sodium Hypochlorite 7%	Liquid	Corrosive acid, oxidizer – increases flammability of flammable or combustible material	Pickering 014: ~52,000 L Pickering 058: ~54,000 L	Tank connected to the system directly
Sodium Meta-bisulphite 38% aqueous	Liquid	Corrosive acid, toxic	Pickering 014: ~32,000 L Pickering 058: ~40,000 L	Tank connected to the system directly
Sodium Hydroxide	Liquid	Corrosive	Not Available	Dilute 2%
Sulphur Hexafluoride	Compressed Gas	Compressed Gas, mildly Toxic	2 cylinders, 350 ft^3 (10 m^3) (size 30 cylinder)	Pickering 014 and Pickering 058 Combined: ~1,800 ft^3 (~51 m^3)
Transformer Fluid - Oil	Liquid	Non-toxic during normal use	20 kg/pail	As required
Transformer Fluid - Xiameter PMX-561	Liquid	Non-toxic during normal use	20 kg/pail	As Required

Hazardous Substances at PWMF

The PWMF contains a small amount of a variety of non-radiological hazardous materials which are typically found in industrial buildings, including the following:

- *Paint:* Touch-up paint is applied to areas on the DSC that have been affected by the scrapes or scuffs that may have resulted from handling. The total amount of paint stored at PWMF in "purpose-built" storage lockers is approximately 100 L.
- *Consumables for maintenance:* These include items such as adhesives, abrasives, various solvents, lubricants for operations and maintenance equipment as required, and janitorial and cleaning supplies. The total amount of these materials that may be stored on-site in "purpose-built" storage lockers is approximately 400 L, primarily janitorial cleaning supplies. Flammable materials are stored in appropriate cabinets.

- *Fuel:* A small amount of fuel for snow blowers and maintenance equipment is stored on-site. The quantity stored on-site in flammable material storage cabinets is less than 20 L.

Appendix E: Permits, Certificates, and Other Licences

The following are CNSC licences that control other nuclear substances at Pickering NGS and PWMF.

Nuclear Substance and Radiation Devices Licences

Industrial Radiography (812), 12861-1-25.5

Consolidated Use (815), 12861-2-25.3

Basic Servicing (822), 12861-17-25.2

Dosimetry Service Licence

Dosimetry Service, 12861-11-25.9

Class II Nuclear Facilities and Prescribed Equipment Licences

Class II Irradiator (635), 12861-18-26.8

Import/Export Licences

Import:	**Export:**
Import Licence, IL-A2-29788.0/2028	Export Licence, EL-A4-30515.0 2026
Import Licence, IL-A4-29770.0/2028	Export Licence, EL-A4-31107.0/2030

Summary of Regulatory Commitments, Regulatory Obligations and Regulatory Management Actions Made/Concurrence Requested

CD# P-CORR-00531-23980 P

Submission Title: **Renewal Application for Pickering Nuclear Generating Station Power Reactor Operating Licence and Pickering Waste Facility Operating Licence**

Regulatory Commitments (REGC):

No.	Description	Date to be Completed
	None	

Regulatory Management Action (REGM):

No.	Description	Date to be Completed
	None	

Regulatory Obligation Action (REGO):

No.	Description	Date to be Completed
	None	

Concurrence Requested: None