ONTARIO POWER GENERATION

Pickering Nuclear Generating Station Power Reactor Operating Licence Amendment Application


BLEED CONDENSER
HIGH LEVEL SETBACK
PUMP 1
I-5-7
I-5-8
I-5-9
I-23
I-24
I-25
I-26
PRESSURIZING PUMPS
PUMP 1
PUMP 2
PUMP 5
PUMP 6
PUMP 7
PUMP 8
PUMP 13
PUMP 14
PUMP 15
N.W. QUADRANT
NORTH LOOP
SOUTH LOOP
N.E. QUADRANT
S.W. QUADRANT
S.E. QUADRANT

Executive *Summary*

Ontario Power Generation (OPG) requests authorization from the Canadian Nuclear Safety Commission (CNSC) to operate Pickering Nuclear Generating Station (NGS) Units 5 to 8 until December 31, 2026. The operation of these units beyond December 31, 2024 per the Power Reactor Operating Licence (PROL) 48.01/2028 constitutes a change to the Pickering NGS licensing basis.

This application demonstrates that the Pickering NGS will continue to meet all the legal requirements of the Nuclear Safety and Control Act and the associated Regulations, and that Pickering NGS will continue to operate safely and within the required margins for any operating nuclear plant. OPG will continue to carry on the licensed activities and make adequate provisions to protect the health, safety and security of persons and the environment, and maintain national security and measures required to implement international obligations.

OPG is proud of the strong performance and the many significant achievements at the Pickering NGS during the current licence term. Through ongoing investments and the efforts of our employees, Pickering NGS is exhibiting its strongest performance ever, including achieving its highest yearly production output and its best equipment reliability ratings. The station's strong operational and safety performance is also recognized by industry peers.

This 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. Every day, we demonstrate safety through our operations, with CNSC staff on site to confirm we are meeting rigorous requirements and standards. Our people live and work in Pickering and the surrounding communities. Public and environmental safety is more than a top priority; it is part of who we are.

Year over year, Pickering NGS continues to meet the expectations of the CNSC and demonstrates compliance to requirements through CNSC Compliance Verification activities. The evaluations of all findings for the safety and control areas show that, overall, Pickering NGS made adequate provisions for the protection of the health, safety and security of persons and the environment from the use of nuclear energy.

Following are some highlights of what has been accomplished at the Pickering NGS. These are just a few reasons why the CNSC and the public can be confident in the continued safe operation of Pickering NGS to the end of December 2026.

As required by the current Pickering NGS licence, a re-assessment of the continued validity of the Periodic Safety Review 2 (PSR2), called PSR2-B, was carried out to confirm that the design, condition and operation of Pickering NGS supports continuing commercial operation from 2024 to 2026. The PSR2-B re-assessed the time-dependent elements of PSR2 and the continuing applicability of the PSR2 basis. This included re-assessment of the global assessment results to identify any new findings required to maintain the validity of the PSR2 until the new proposed end of commercial operation date. The findings were consolidated into global issues, and appropriate actions have been proposed to resolve any outstanding issue. These actions, incorporated into the Integrated Implementation Plan (IIP), define the actions required to ensure the continued validity of the periodic safety review, until the evaluated date of December 2026. The 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.

OPG has comprehensive Probabilistic Safety Assessments (PSAs) in place for Pickering NGS Units 5 to 8. The PSAs demonstrate that the likelihood of public risk from a serious accident remains very low. The PSAs also confirm that the design of Pickering NGS is robust and very safe. Nonetheless, OPG continues to invest in further safety enhancements at its nuclear facilities, including:

- Completion of hydrogen passive autocatalytic recombiners installations in all Pickering NGS units;

- Provisions for Phase-1 emergency mitigation equipment (EME) to provide emergency make-up water and power for ensuring continuous fuel cooling and monitoring;

- Completion of Severe Accident Management Guidelines (SAMGs) to provide plant staff with guidance on prevention and mitigation of accident progression to a severe accident; and

- Completion of Phase-2 EME provisions that provide emergency back-up power to important containment equipment (boiler room air conditioning units and hydrogen ignitors on all units to protect containment integrity allowing the use of the existing emergency air filtered discharge system for controlled filtered post-accident venting of containment).

During the current licence term, Pickering NGS has continued to demonstrate strong conventional safety performance that is in the industry's top quartile. Pickering NGS reached 18 million hours without a lost time accident.

In 2018, Electricity Canada awarded OPG with the President's Award of Excellence for Employee Safety - Generation. OPG has since been recognized with this award every year from 2018 to 2022. The award recognizes OPG's achievement of being in the top quartile for both all injury/ illness frequency and lost time injury severity rates.

Station reliability has improved significantly due to investments and improvements made over the licensing period. As a result, in 2022 all six units at Pickering NGS had a record 109 day continuous run. This is strong evidence that the plant is being operated and maintained well. Pickering NGS is also using innovative technology such as mobile robots and drones to support operational excellence.

Combined with one of the best forced loss rate performances in OPG history in 2022, Pickering NGS is continuing to achieve improved and more reliable operation, which in turn improves nuclear safety at the station.

In 2020, a fleet-wide cross-functional EME Excellence Team was established, driving improvements to the Equipment Important to Emergency Response (EITER) program by improving EITER procedures, processes, teamwork, accountabilities and delegation of roles and responsibilities related to EME. The EITER program aligns with industry best practices. 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.

Through OPG's Integrated Aging Management Program, appropriate maintenance, testing and monitoring are ongoing at Pickering NGS, with particular attention to major components such as fuel channels, assuring that the plant is fit-for-service and safe throughout the continued operating period.

OPG is particularly mindful of its responsibility to ensure protection of the public and the environment. OPG has an extremely strong track record in this area. OPG continues to ensure that any radiological releases into air and water from Pickering NGS are at levels that are far below regulatory

limits and hence are protective of public health and the environment. The environmental monitoring program regularly samples water, air, and soil to ensure that both radiological and non-radiological emissions remain at safe levels. OPG posts the environmental monitoring results on its external website so that local communities and interested members of the public can be assured of the plant's safety. OPG will continue to show environmental stewardship in biodiversity and wildlife habitat programs. Pickering NGS performance will continue to improve, with the station priorities focusing on safety, reliability and human performance.

OPG is committed to engaging with Indigenous Nations and communities regarding nuclear operations and future projects. OPG's Indigenous Relations Policy provides a framework for engaging with Indigenous peoples and providing support for community programs and initiatives while respecting treaty and Aboriginal rights as per Section 35 of the 1982 Constitution Act. For example, in 2021 OPG signed a framework agreement with Curve Lake First Nation, with dedicated time and capacity support to better address subjects that are of importance to Curve Lake First Nation. As a result, regular monthly meetings were established with Curve Lake First Nation, with a focus on sharing information and updates related to OPG's nuclear and renewable generation operations. OPG and the Mississaugas of Scugog Island First Nation also entered into a framework agreement in the Fall of 2022 and work is progressing with Hiawatha First Nation to develop a similar agreement to support regular engagement.

OPG also maintains strong relationships with local communities and shares information on facility operations and performance with members of the public, to enable interested individuals to monitor the safety of the plant and OPG's management record. OPG also works to develop positive relationships with local communities, including those in the vicinity of the Pickering facility and Indigenous communities, as well as with stakeholder groups that have a longstanding interest in the safety of nuclear power.

As required by the current licence, Pickering NGS produces and implements a Sustainable Operations Plan (SOP), which describes the arrangements and activities that are planned to ensure continued safe and reliable operation of Pickering NGS during the transition to the end of commercial operation (ECO), as well as a Stabilization Activity Plan (SAP), which describes the activities that OPG will carry out to safely transition the station from commercial operation to Storage with Surveillance (SWS), with due regard for public and worker safety, and the environment.

This document provides a description of the Safety and Control Areas (SCA), highlights strengths and achievements in those areas and updates information since the last licence application, including improvements made or planned, to support operation to the end of December 2026.

Finally, further technical details on the assurance of fuel channel fitness for service (FFS) is provided for the fuel channel equivalent full power hours (EFPH) that is anticipated to be achieved at the end of December 2026.

The evidence contained in this application support the continued safe and reliable operation of the Pickering NGS Units 5 to 8 to December 2026 and asserts that:

- Nuclear safety will be assured such that plant personnel, the public and the environment are protected;
- Systems, structures and components at the plant are fit to continue commercial operation to December 31, 2026;
- Staff are qualified and competent to operate the plant, and this will be maintained through the licence period, including sufficient staffing numbers;
- Impacts of plant operation to the public, workers, and the environment will continue to be of low risk and adequately mitigated, while continuing to provide the various societal and environmental benefits of plant operation;
- Transparency and appropriate public and Indigenous engagement will continue; and
- OPG will continue to invest in Pickering to support the above objectives, including to improve equipment reliability, to assure fitness for service until the end of commercial operations, and to further enhance safety.

Continued operations of Pickering NGS Units 5 to 8 to the end of 2026 will have many benefits to the province, the economy and the environment, including:

- Reducing CO2 emissions by 2.1 megatonnes in 2026 – the equivalent of taking up to 643,000 cars off the road.
- Extending the need for 4,500 skilled jobs for approximately 2 years.
- Ensuring a stable supply of Cobalt-60, a critical medical isotope used in lifesaving medicine (Pickering provides 20% of the North American supply – and 10% of the world's supply).

In summary, OPG has demonstrated strong performance and many significant achievements at the Pickering NGS during the current licence term; OPG is confident that the Pickering NGS Units 5 to 8 can continue to operate to December 31, 2026 safely and reliably. OPG, therefore requests the CNSC to authorize operation of Pickering NGS Units 5 to 8 until December 31, 2026 and approve the new licence limit for operation of the pressure tubes up to 305,000 EFPH for the lead Pickering NGS unit (Unit 6).

Th

Table of *contents*

Table of *contents*

1.0 Land Acknowledgement

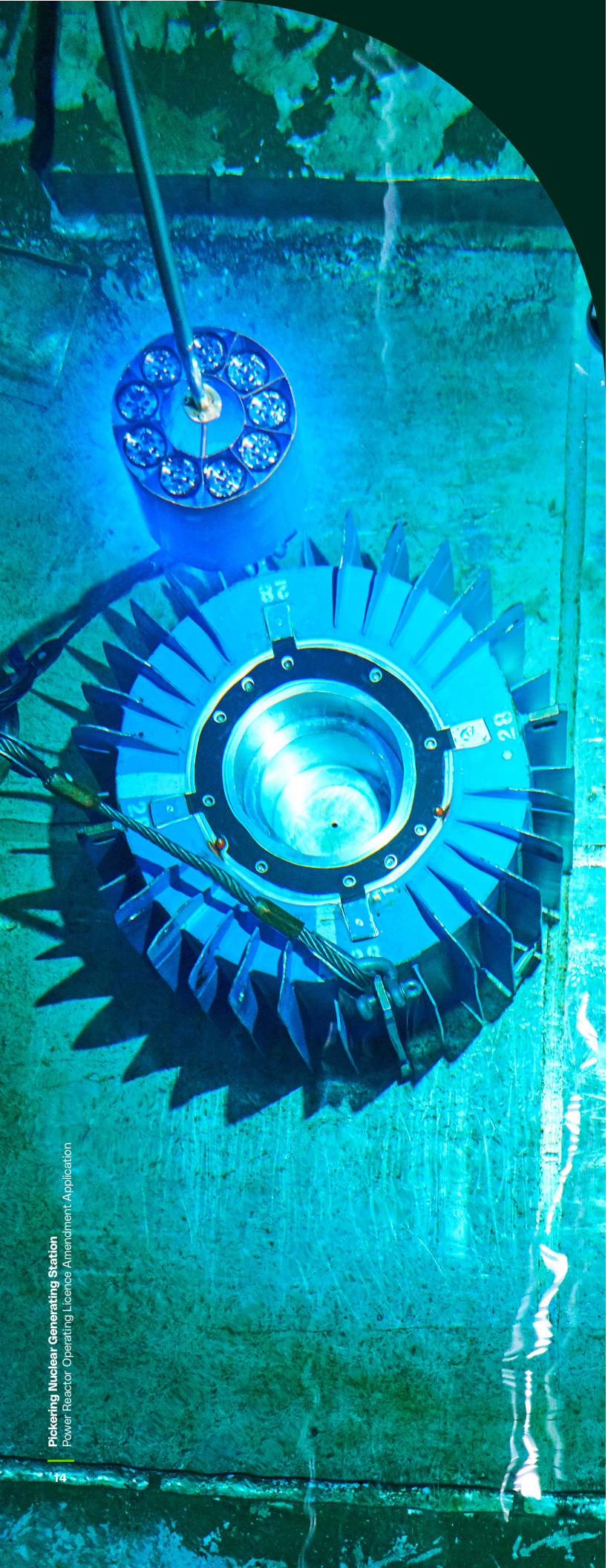
The lands and waters on which the Pickering Nuclear Generating Station (NGS) is situated are the treaty and traditional territory of the Michi Saagiig and Chippewa Nations, collectively known as the Williams Treaties First Nations.

Pickering NGS is 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 the stewards and caretakers of these lands and the waters that touch them, and that they continue to maintain this 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.

ALDERVILLE FIRST NATION
BEAUSOLEIL FIRST NATION
CURVE LAKE FIRST NATION
GEORGINA ISLAND FIRST NATION
HIAWATHA FIRST NATION
SCUGOG ISLAND FIRST NATION
RAMA FIRST NATION



2.0 Proposal to Operate Pickering Nuclear Generating Station Units 5 to 8 to September 2026

The current Pickering Power Reactor Operating Licence (PROL) 48.01/2028, includes continued commercial operation of all reactor units until December 2024 as well as post-shutdown activities associated with removal of fuel and water in preparation for the safe storage of all units.

OPG is seeking to amend the operating licence of the Pickering NGS Units 5 to 8 up to and no later than December 31, 2026. The ECO of Units 1 and 4 remains the end of 2024.

The Pickering NGS currently provides enough power to meet the needs of a city of 1.5 million people, which meets the planning requirements for the stability of the grid per the Independent Electricity System Operator.

Recent recognitions for Pickering NGS are as follows and other achievements are presented in Section 4.1.1.2.

- In 2020, the Institute of Nuclear Power Operations (INPO) recognized Pickering NGS with an Excellence Award.The award is presented to nuclear power plants that have achieved the top performance in the industry.

- In 2021, the City of Pickering recognized Pickering NGS with an Environmental Award in recognition of the more than one billion tonnes of climate change-causing greenhouse gas emissions that have been avoided due to its operations. Pickering NGS staff continue to work closely with the City of Pickering and surrounding homes and businesses on community environmental initiatives.

This application provides the information required to demonstrate that Pickering NGS meets all of the licence requirements for the approval of continued operation of Pickering NGS Units 5 to 8 to the end of December 2026.

OPG was granted a 10-year operating licence for Pickering NGS in 2018. At that time, a Periodic Safety Review (PSR) was completed for Pickering. That review was referred to as PSR2, as it was built on the previous integrated safety review. A PSR is a comprehensive assessment of Pickering's design and operation. Its purpose is to confirm that there is a high level of safety throughout the operating life and, through a review of current codes and standards and safety factors, and to determine what reasonable and practical enhancements can be made to further improve safety.

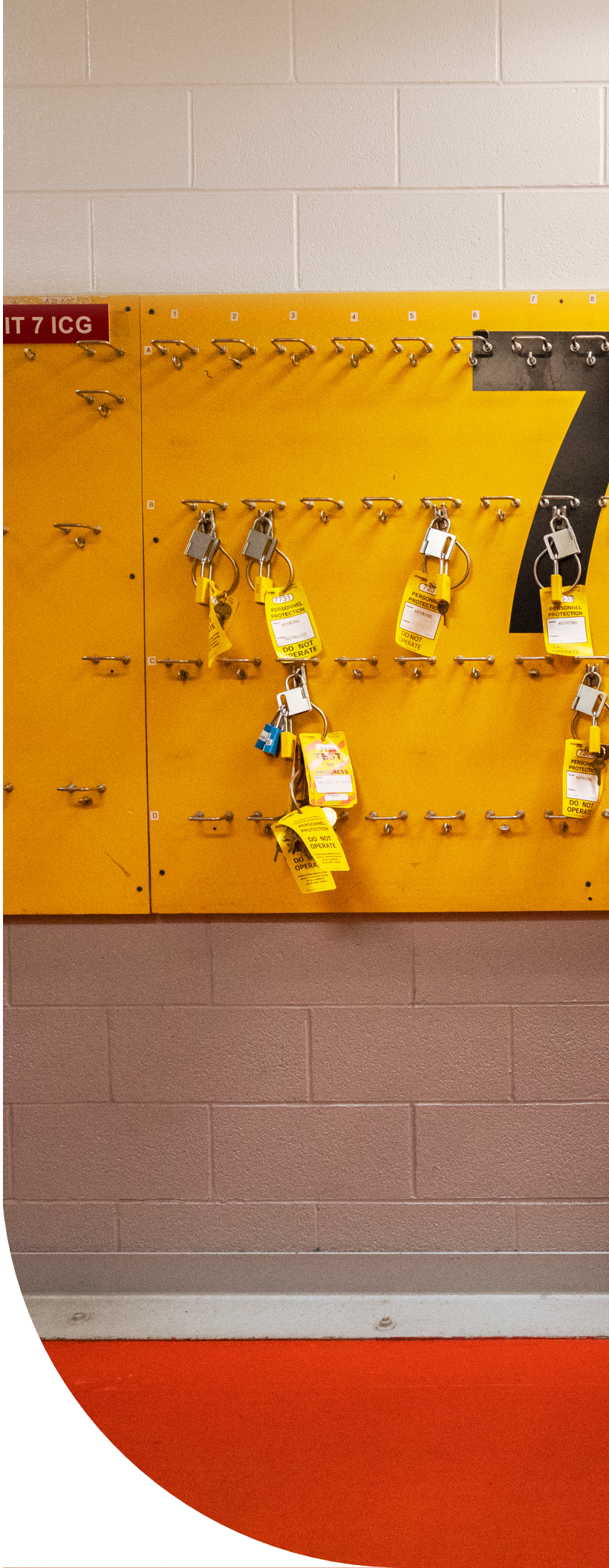
The PSR2 is a forward-looking assessment focusing on changes to requirements since the last assessment. The current operating licence for Pickering NGS requires that any request to operate beyond 2024 be supported by an assessment of the validity of the PSR2 results. This PSR amendment is referred to as PSR2-B throughout this application. PSR2-B was completed and confirmed that the design and operation of safety-significant structures, systems, and components (SSCs) supports continued safe operation of the Pickering NGS units to the end of 2026 and is valid until the end of 2028. The results of the review also confirmed that the condition of Pickering NGS is within the current licensing basis and identified practical safety enhancements to further improve the already low risk of plant operation.

Pickering NGS has an Environmental Risk Assessment (ERA) which evaluated and confirmed that the risk to human and ecological receptors from exposure to contaminants and physical stressors related to the Pickering NGS and its activities is very low. In addition, the 2022 Predictive Effects Assessment (PEA) Addendum was prepared to demonstrate that human health and the environment will continue to be protected during the transition of the station from operation to a safe storage state, based on updated baseline environmental conditions and continued operations assumed until 2026. These studies support the conclusion that the environmental protection in the vicinity of the Pickering NGS will be maintained.

3.0 Pickering Nuclear Generating Station Description

OPG is applying to the Canadian Nuclear Safety Commission (CNSC) for a licence amendment to operate the Pickering NGS Units 5 to 8 to December 31, 2026. OPG is confident that Pickering NGS will remain fit for service as presented in this application with supporting evidence.

For many years, Pickering NGS has proven to be a reliable and important source of energy for the province of Ontario and has played a vital role in meeting the growing energy needs of the community. The plant has undergone regular safety inspections and has been found to be in compliance with regulatory requirements. The dedicated team of professionals who operate and maintain the plant have consistently demonstrated their commitment to safety and excellence.




UNIT 8 ICG
ONTARIO POWER GENERATION
PERSONNEL PROTECTION
DO NOT OPERATE

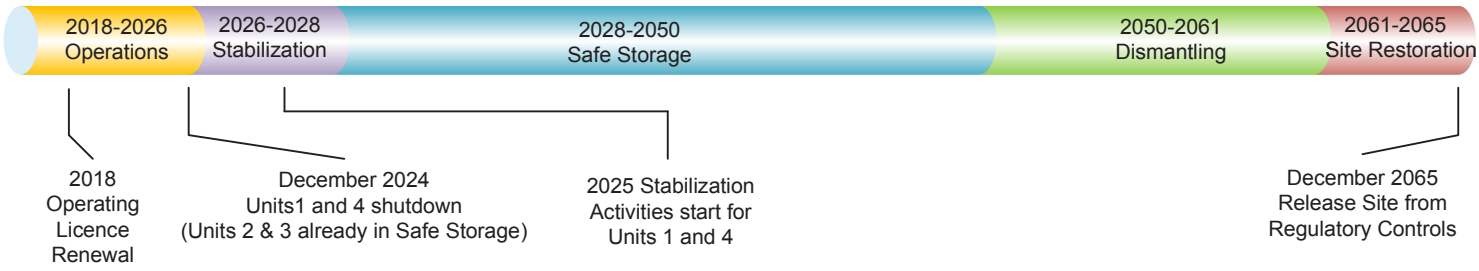


FIGURE 1 - PICKERING NGS TIMELINE

3.1 Pickering NGS Timeline

Figure 1 shows the current timeline for Pickering NGS, starting at the beginning of the current licence and ending at the release of the site from regulatory control.

Pickering NGS will continue commercial operation and shut down Units 1 and 4 by December 31, 2024 and proposes to shutdown Units 5 to 8 by December 31, 2026.

After shutdown of Units 1 and 4 by the end of December 2024 and Units 5 through 8 at the end of December 2026, stabilization activities will commence including removal of the fuel and the heavy water from the reactors. Activities which are required to place the units in the safe storage state, as described in the Stabilization Activity Plan (SAP), ensure a safe and efficient transition from the end of commercial operation (ECO) of Pickering NGS to the Storage with Surveillance (SWS) state of the facility. The SWS will be maintained until decommissioning (2028-2050). Decommissioning activities are addressed in the Preliminary Decommissioning Plan (PDP).

3.2 Site Description and Ownership

Pickering NGS has eight reactor units. Currently, six units are operating and two of the units (Pickering NGS Units 2 and 3) are in safe storage.

The facility is located on the north shore of Lake Ontario in the City of Pickering in the Regional Municipality of Durham, 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 site occupies a land area of 240 hectare in lots 17 to 22 inclusive in the Broken Front Concession. 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 and occupies part of lots 19 and 20 in the Broken Front Concession.

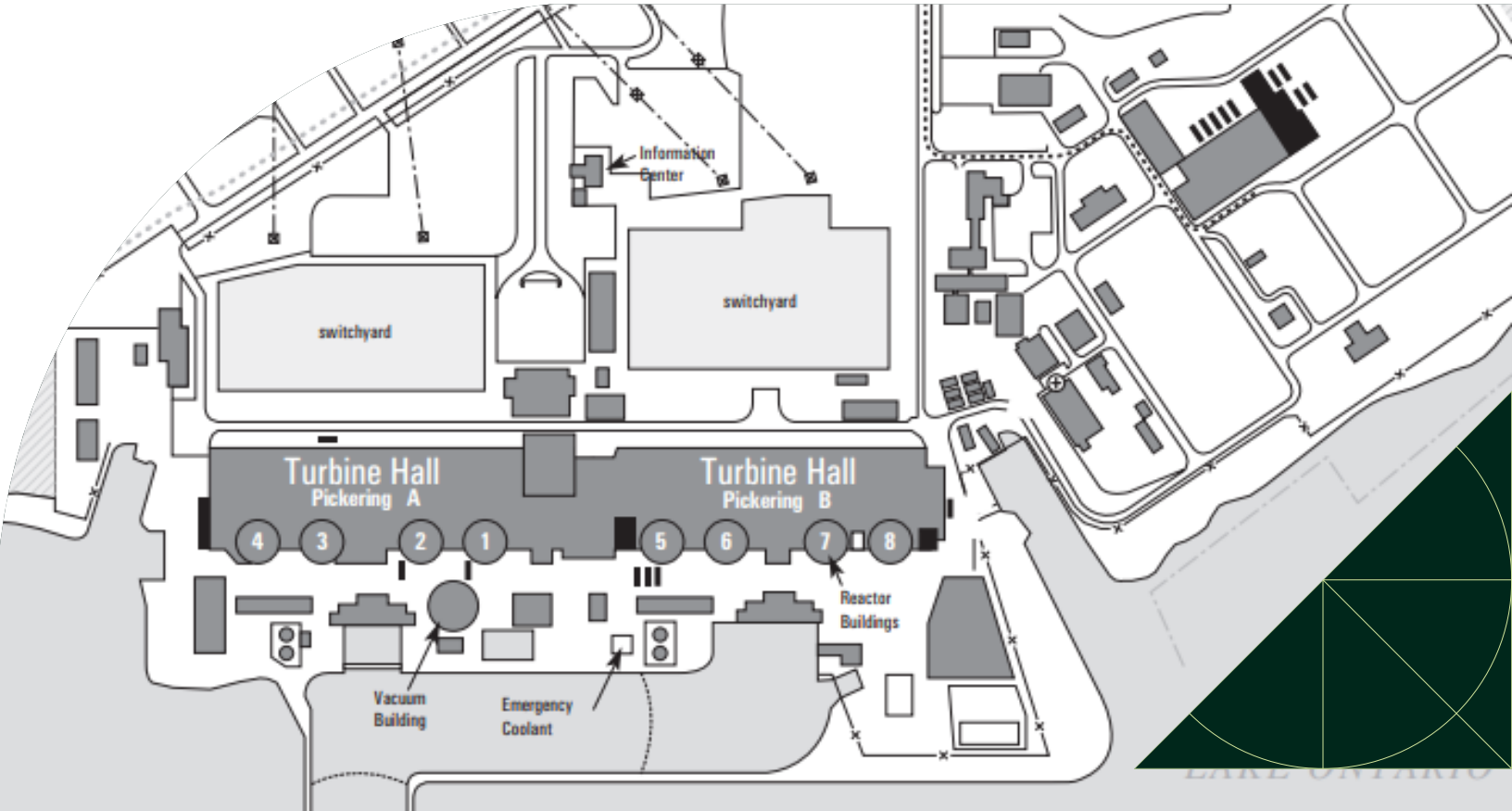
There are a number of watercourses in the vicinity of Pickering NGS. The two major ones closest to the site are Duffins Creek, 2.2 km to the east, and the Rouge River, 4 km to the west. The Pickering site is shown in Figure 2.

The Pickering NGS A (Units 1 and 4) and Pickering NGS B (Units 5 to 8) safety reports provide detailed and extensive information on the facility and the SSC design.

The reactor units are numbered 1 to 4, from east to west, and the other reactor units are numbered 5 to 8, from west to east starting from the center of the plant. The summary data for Pickering NGS is found in Table 1 and the in-service dates for each unit are found in Table 2.

The Pickering site is owned by Ontario Power Generation Inc. which is owned by the Province of Ontario.

FIGURE 2 – PICKERING SITE MAP



Summary Data - Pickering NGS	
Number of Units	8
Operational Units	6
Safe Storage Units	2 (Units 2 and 3)
Net Power Output (Electrical)	2 x 515 MWe (Units 1 and 4)
Net Power Output (Electrical)	4 x 516 MWe (Units 5,6,7, and 8)
Maximum Power (Thermal) per Unit	1744 MW(t) to yield 540 MWe (gross)
Nuclear Steam Supply System	CANDU Pressurized Heavy Water Reactor
Containment Structure	Reinforced Concrete

TABLE 1 - SUMMARY DATA FOR PICKERING NGS

Unit	In-Service Dates (Operational Units)
Unit 1	July 29, 1971
Unit 4	June 17, 1973
Unit 5	May 10, 1983
Unit 6	February 1, 1984
Unit 7	January 1, 1985
Unit 8	February 26, 1986

TABLE 2 - PICKERING IN-SERVICE DATES

4.0 Application and Associated Requests

The purpose of this application is to request Commission authorization for the continued operations of Pickering NGS Units 5 to 8 to December 31, 2026 and to request approval of the licence limit for operation of the pressure tubes up to 305,000 EFPH for the lead Pickering NGS unit (Unit 6).

This application provides the information for the following key considerations for continued operations and will demonstrate OPG's continuing commitment to safe and reliable operation of the station, as well as OPG's compliance to all applicable regulatory requirements.

One key consideration is Operational Excellence. Pickering NGS continues to make strides in equipment reliability, which has led to the station achieving its best operating performance in station history. Pickering NGS employees continue to be qualified and engaged and are considered Pickering NGS's most valuable asset. We continue to make strides in human performance to ensure that our safety record is maintained in the industry's top quartile.

Plant reliability is maintained by our maintenance programs and confirmed by the inspection and testing programs, utilizing advanced technologies to detect and address potential issues. Plant reliability is also supported by the asset management programs focused on system performance monitoring, preventative maintenance, risk management and comprehensive lifecycle management plans.

OPG can confidently state that its programs and processes will continue to assure FFS of the Unit 5 to 8 fuel channels up to 305,000 EFPH. This confidence is derived from a mature, well-defined life cycle management program that is based on years of operating experience and supporting research.

The PSR2-B did not identify any new gaps except to update those actions which were time dependent on the date for the end of commercial operation for major components, as well as, gaps that were identified to meet new versions of the standards that are not yet in the licence. These findings were consolidated, and appropriate actions have been established. These actions, incorporated into the Integrated Implementation Plan (IIP), define the actions required to ensure the continued validity of the PSR, until the evaluated date of December 2026.

The IIP and the assessments of FFS of Pickering NGS SSCs, comprise the basis for the regulatory requirement to operate Pickering NGS Units 5 to 8 beyond December 31, 2024. The methodology of the re-assessment is provided in Appendix A and a summary of the results of PSR2-B is discussed in Section 4.1.3.1.

OPG has assessed the operation of the fuel channels on all units and assures their FFS to the target service life to the end of 2026 on the basis of sound technical reviews, the established programmatic controls within OPG for managing fuel channel aging, and the availability of mitigating measures where required (Reference 1). A detailed discussion of fuel channel FFS is presented in Section 4.1.3.2.

In addition to addressing these items for operation beyond December 2024, as required by Pickering NGS's PROL, Section 6 of this application provides a brief description of the SCA, highlighting strengths and achievements in those areas and providing updated information since the most recent licence application.

4.1 Key Considerations for this Continued Operation Application

Excellence in station performance supports the continued operations of Pickering NGS Units 5 to 8 to December 2026. This section provides information related to topics that were key considerations for the current operating licence term and presents evidence to support operation through December 2026.

4.1.1 Station Performance and Operational Excellence

Due to OPG's continued investment in equipment, training and personnel, station reliability continues to trend positively; and, in some areas, performance has been industry leading.

During the current operating licence term, the station has achieved its best operating performance in station history in 2020. Other notable achievements include a record two-year run for Unit 4, which operated for 730 consecutive days before beginning scheduled preventative maintenance in 2021. Most recently, a major station operations milestone was achieved when all six units operated at high-power for a period of 109 days. This was the longest such run in the history of the 6 operating unit station.

Pickering Fuel Handling achieved an Equipment Reliability Index (ERI) score of 92 in the first quarter of 2023. That is the highest score in Pickering history

and was tied for first place among all CANDU stations that reported data in March 2023. It takes time for this metric to reflect the strength and effort of our team and our ERI has been steadily increasing since 2021.

4.1.1.1 Our People

OPG values the importance of a diverse, engaged workforce. In 2021, OPG launched its first ever Equity, Diversity and Inclusion strategy, a 10-year strategy to become a global leader in Equity, Diversity and Inclusion best practices. This ambitious strategy identifies nearly 100 initiatives and 15 strategic priorities to be carried out across the enterprise by 2030, including milestones such as establishing anti-racism training for all OPG employees (achieved in 2023), providing five million dollars in funding over 10 years to post-secondary programs to graduate and recruit students from historically under-represented communities, and partnering with the BlackNorth Initiative to launch a nationwide science, technology, engineering, and mathematics (STEM) recruitment platform to connect BlackNorth candidates with internship, mentorship and career opportunities across the sector. Also, notably, in 2022 Pickering NGS made history with an all-women led crew of CNSC-licenced Control Room Shift Supervisors and Shift Managers. This follows efforts by OPG and the regulator to remove gender-related barriers in the training required for licenced nuclear operator roles. 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 equity, diversity and inclusion programs.

During the pandemic, our staff remained committed to providing Ontarians with an uninterrupted 14 per cent supply of the province's electricity needs while working collectively to flatten the curve and support frontline workers. To support the OPG response and well-being of employees, as well as to implement safety protocols, OPG's Crisis Management and Communications Centre and Infections Disease Incident Response Team were active throughout the pandemic. OPG's efforts were recognized with the Essential Service Employer Pandemic Hero Award.

4.1.1.2 Excellence in Industry and Business Standards

In 2020, the Pickering Radiation Protection (RP) organization was recognized with the 2020 John S. Hewitt Team Achievement Award from the Canadian Nuclear Society and Canadian Nuclear Association. The award recognizes the efforts made in the development and implementation of an RP Excellence Index. The RP Excellence Index measures RP human performance at the department level, driving continuous improvement through targeted initiatives.

In 2019 and 2020, Pickering NGS was recognized with Business Excellence Awards by the Whitby Chamber of Commerce and the Ajax Pickering Board of Trade. Both awards were received for the station's continued commitment to innovation in governance and overall business excellence.

4.1.1.3 Innovation and Technology

OPG's focus on innovation and technology development is helping to drive both safety and performance.

In 2022, OPG's "Spot" robotic four-legged helper, completed several successful missions, including aiding inspections for Units 1 and 6. The robot has acquired a number of additional capabilities over the year, including the use of an infrared camera to detect thermal anomalies, radiation mapping and automated survey capabilities and has added a manipulator arm.

Innovative approaches and equipment were used to ensure the recent Vacuum Building Outage (VBO) was a success. These included using submersible remotely operated vehicles as well as trained dive staff to carry out inspections of the Emergency Water Storage Tank and the use of drones to perform inspections of the Vacuum Building structure.

4.1.2 Nuclear Safety

Nuclear safety is the primary and driving consideration for activities carried out by all personnel working at the Pickering NGS. The Senior Vice President and Chief Nuclear Officer are accountable to the CEO and the Board of Directors for establishing a management system that fosters the priority of nuclear safety throughout the entire organization. Guiding principles established in the Nuclear Safety Policy state that nuclear safety shall be the overriding priority in all activities performed in support of OPG nuclear facilities; nuclear safety shall have clear priority over schedule, cost and production; everyone must demonstrate respect for nuclear safety and conduct themselves in a manner that is consistent with the traits of a healthy nuclear safety culture. These principles are continually reinforced at Pickering NGS and are internalized by all personnel who support the operation of the plant.

OPG has demonstrated that Pickering is a safe plant through the following activities:

- Comprehensive safety analysis demonstrates likelihood of a serious accident remains very low.
- Probabilistic Safety Assessment (PSA) concludes low and continued reduction in public risk.
- Emergency Mitigating Equipment that was installed significantly reduces risk.
- Ongoing monitoring of the health of the Nuclear Safety and Security Culture.

The effects of Pickering NGS reactor aging and associated systems on safety margins were reviewed and confirmed that they are managed effectively. OPG is confident that safety analysis margins are maintained through to the ECO. Additional focus has been given to this aspect by updating analyses and/or addressing it in the PSR (Table 5 – PSR2-B Global issues and Resolution Description in Section 4.1.3.1.5 Integrated Implementation Plan). The PSA risk results for Pickering NGS Units 5 to 8 through to the ECO concluded that the risk is very low.

As confirmed by the Pickering PSR2-B (PSR2 Amendment), there are no safety issues that would preclude continued safe operation of Pickering NGS Units 5 to 8 until 2026. The actions within the PSR2-B IIP will maintain or further enhance safety and reliability.

The information in this application includes evidence that demonstrates that Pickering NGS has met the regulatory requirements related to each SCA, and that it is qualified and prepared to continue to do so throughout the licence period.

4.1.2.1 Defence-in-Depth

As part of the PSR2 Global Assessment, a defence-in-depth assessment was performed to support the licence renewal application in 2018. The assessment demonstrated the extent to which the safety requirements of defence-in-depth are fulfilled at Pickering NGS. The overall assessment was an important element in supporting the proposed enhancement plans and the planned operational strategy over the period of PSR2.

The PSR2 assessment of defence-in-depth and its conclusions in the PSR2 Global Assessment Report (GAR) (Reference 2) serve as the basis for the PSR2-B review. The approach taken in the assessment in PSR2 is based on the defence-in-depth requirements identified in CNSC REGDOC-2.3.3 (Reference 3), with specific assessment guidance provided by the International Atomic Energy Agency (IAEA) Safety Report Series No. 46, "Assessment of Defence in Depth for Nuclear Power Plants" (Reference 4). The approach analyzes the five independent levels of defence. All levels of defence-in-depth rely on multiple barriers of protection to prevent or limit equipment failures or human errors and mitigate the consequences should these failures or errors occur. The intent of the review was to confirm that for each of the five levels of defence, barriers are not unnecessarily challenged, and if they are, they do not all fail.

The five levels of defence, listed below are defined in IAEA International Nuclear Safety Advisory Group (INSAG) -10 Defence in Depth in Nuclear Safety (Reference 5):

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

The defence-in-depth assessment considered the overall plant, as well as the identified strengths, acceptable deviations, and the proposed resolutions to the Global Issues listed in the Global Assessment.

The defence-in-depth concept applied to the PSR2 Global Assessment was consistent with IAEA INSAG-10, Defence in Depth in Nuclear Safety (Reference 5). The assessment used elements of the process described in IAEA SRS-46, Assessment of Defence in Depth for Nuclear Power Plants (Reference 4).

The detailed review of provisions for each level of defence presented in Section 18 and Appendix D of PSR2 GAR (Reference 2) confirmed that Pickering NGS design and operation have adequate and effective barriers in all applicable levels of defence-in-depth and that significant improvements to barriers have been implemented.

It was confirmed that the applicable safety principles from IAEA SRS-46 (Reference 4) for the concept of defence-in-depth was applied at the Pickering NGS design stage and throughout its operation. At the design stage, the focus was on the first three levels of defence-in-depth: prevention of operation outside normal operating conditions, control of abnormal conditions, and provision of safety systems to effectively mitigate Design Basis Accidents. The capability of station systems and processes for responding to emergencies to mitigate the consequences of Beyond Design Basis Accidents (BDBAs), including severe accidents, was considered for defence-in-depth Levels 4 and 5.

The defence-in-depth assessment confirmed that at Pickering NGS, effective Level 1 barriers are ensured through the original conservative design, supplemented by design enhancements implemented since initial operation, comprehensive operating and maintenance programs in place, and ongoing continuous improvements based on national and international operating experience (OPEX). Given the focus and priority placed on equipment reliability to address the findings in the areas of the equipment condition, this level of defence will continue to be strong and effective for Pickering NGS.

The assessment of defence-in-depth Level 2 confirmed that the provisions in place at Pickering NGS are mature and robust. This is further enhanced by the completed implementation of the PSR2 Resolution Plans related to Level 2.

The defence-in-depth assessment confirms that the Pickering NGS has strong Level 3 barriers due to the high quality of the design that includes extensive mitigating provisions, comprehensive emergency operating procedures, and a robust set of safety analyses. The completed implementation of REGDOC-2.4.1 (Reference 6) and REGDOC-2.4.2 (Reference 7), and the planned safety analysis updates (Global Issue (GI)-24) for the extended operation beyond 2024 further sustain and enhance the safety requirements of Level 3.

The PSR2 assessments and the review of safety principles show that design features and procedural provisions are in place and are effective for defence-in-depth Level 4. The measures considered at the first three levels ensure maintenance of the structural integrity of the core and limit potential

radiation hazards to members of the public. The complete implementation of Fukushima Actions, Phase 2 EME and SAMG has further strengthened defence-in-depth Level 4.

The assessment of defence-in-depth Level 5 confirmed that the coordinated emergency response capability of the various response organizations and the implementation of OPEX from the Fukushima event supports the Level 5 defence-in-depth provisions. The enhancement to the Emergency Response Projection Software as part of the PSR2 IIP Action (G26-RS1-10-22) (Reference 8) has further enhanced the response for defence-in-depth Level 5.

The detailed review of provisions for each level of defence presented in Section 18 and Appendix D of PSR2 GAR (Reference 2) confirmed that Pickering NGS design and operation have adequate and effective barriers in all applicable levels of defence-in-depth and that significant improvements to barriers have been implemented.

The comprehensiveness of the assessment in PSR2 GAR (Reference 2) is assured by assessing each of the safety principles, which are supported by multiple and overlapping provisions for each level of defence-in-depth. Furthermore, each defence-in-depth level is supported by multiple safety principles providing a second layer of overlap of provisions across levels of defence-in-depth. The defence-in-depth has been further strengthened with the implementation of the PSR2 Resolution Plans and completion of associated IIP Actions (Reference 8).

The adequacy of these provisions has also been confirmed by the comprehensive PSAs. The Pickering NGS PSAs (References 9 and 10) demonstrate that the overall plant design has a Core Damage Frequency and Large Release Frequency within the OPG risk-based Safety Goals, indicating robustness in the design and reliable equipment that is capable of responding effectively to accident scenarios.

For the PSR2-B, the defence-in-depth assessment included consideration and confirmation that the conclusions of the assessment in PSR2 are not impacted by the Global Issues identified in PSR2-B. The PSR2-B assessment considered the following elements:

- The key physical improvements, analytical evaluations and programmatic enhancements that have been completed since PSR2, and how these improvements and enhancements support the baseline plant meeting the requirements of defence-in-depth.

- The positive impact on defence-in-depth of the enhancements associated with the proposed Resolution Plans for PSR2-B from the PSR2-B GAR (Reference 11).

- Confirmation that the PSR2-B Acceptable Deviations do not have a significant adverse effect on defence-in-depth, either individually or when aggregated.

Furthermore, the assessment confirms that the Global Issues identified by PSR2-B validates the conclusions of the assessment in the PSR2 GAR, and the defence-in-depth will be further strengthened with the implementation of the proposed Resolution Plans.

The PSR2-B GAR concludes that the current plant design, operation, processes and management system will ensure continued safe operation of Pickering NGS Units 5 to 8 to December 2026. Resolution of PSR2-B gaps will be addressed under the IIP as discussed in Section 4.1.3.1.5.

4.1.2.2 Nuclear Safety Analysis

Pickering NGS has a mature safety analysis program that meets or exceeds all applicable regulatory requirements and related objectives. OPG's safety analysis program plays a key role in supporting the plant safety provisions and the overall safety of the plant, as provided through the functions of controlling reactor power, cooling the fuel, and containing or limiting any releases from the plant. The basic types of safety analysis are deterministic and probabilistic. These serve different purposes but are complementary.

Deterministic Safety Analysis

The deterministic safety analysis (DSA) has been extensively used from the inception of the Pickering NGS design and is a key tool for supporting the adequacy of the plant safety provisions. It is also integral to supporting the defence-in-depth approach (through to Level 5). DSA uses validated scientific models and conservative assumptions to analyze the response of the reactor and other plant systems to hypothetical abnormal or accident conditions and assesses the potential consequences.

The DSAs documented in the Pickering Safety Reports demonstrate compliance with licensing limits and derived acceptance criteria. The Safety Reports are periodically updated and submitted to the CNSC in accordance with regulatory requirements.

As the aging of the heat transport system can have an impact on safety margins, additional focus has been given to this aspect by updating analyses or addressing it in the PSR, which is outlined in Table 5 – PSR2-B Global issues and Resolution Description in Section 4.1.3.1.5 Integrated Implementation Plan. The effects of aging of the Pickering NGS reactors are managed effectively and OPG is confident that safety analysis margins are maintained through to the ECO.

This safety analysis consists of a systematic evaluation of the potential hazards associated with the operation of Pickering NGS and considers the effectiveness of preventative measures and strategies in reducing the effects of these hazards. DSA demonstrates compliance with CNSC public dose limits for internal and external design basis events, such as piping failures and seismic events.

The DSA is being updated in compliance with REGDOC- 2.4.1, Deterministic Safety Analysis (Reference 12) which includes

updates to safety analyses that are the highest priority and provide benefit to the station. Common Cause Events safety analysis represented the single most significant Safety Report enhancement and has now been completed for both Pickering NGS Units 1 and 4 and Units 5 to 8 and are included in the station Safety Reports.

Probabilistic Safety Assessments

The Probabilistic Safety Assessment (PSA) is an important tool for assessing and managing nuclear power plant risk, and it is another key tool used to support the adequacy of the plant safety provisions.

It is also integral to supporting the defence-in-depth approach (up to Level 5).

PSA answers three questions:

- What can go wrong?
- How likely is it?
- What are the consequences?

This is accomplished through detailed modelling of a reactor and the various supporting plant systems and by conducting a systematic assessment of the possibility and consequences of incidents initiated by system failures or other events. In so doing, PSAs realistically simulate accident scenarios and potential system performance, and enable the identification of vulnerabilities in the plant so that nuclear safety can be enhanced through plant design modifications or changes to operating procedures, thereby further reducing the likelihood of an accident and its potential outcome. The PSA is a unique methodology that combines knowledge about plant behaviour from a wide range of sources into a unified risk model based on data drawn from observed plant performance.

PSAs are conducted separately for internal and external types of hazards, in particular, they are for internal events, internal fires, internal floods, seismic hazards, and high wind hazards. Many other hazards are also examined and addressed as part of the PSA hazard screening process (some hazards – meteorites, for example – are deemed to be of such low likelihood that they were screened out, and not developed into PSA models).

The PSAs also consider both 100% full-power operating conditions as well as outage conditions, in which a reactor is shut down. The PSA is an important tool used to support operational decisions, for example, to assess the consequences of taking equipment out of service for maintenance, during normal operation or planned maintenance outages (this assessment determines if modifications to scheduled work activities are required to reduce the risk levels of the work activities).

Additionally, the non-reactor sources PSA is performed to assess the risk of radioactive releases from sources other than the reactor core, for example, the irradiated fuel bays (IFB).

The Pickering NGS PSAs are governed by OPG's Risk and Reliability Program and are updated periodically and submitted to CNSC staff. In addition, OPG's PSA methodology is subject to CNSC staff acceptance. The 2022 Pickering NGS Units 5 to 8 PSA update was composed of 12 submissions in total and were submitted to the CNSC from January 2022 to December 2022.

The PSAs provide quantitative estimates of risk in the form of calculated risk metrics for each hazard type, for comparison to OPG's PSA safety goals. OPG's PSA safety goals are numerical safety criteria used to help ensure that the overarching objectives around protection of the public and the environment are met.

This is achieved by limiting the likelihood of certain undesired consequences, namely, severe core damage and large off-site releases. As such, the OPG PSA safety goals are expressed in terms of an annual frequency with which severe core damage or a large release might occur for an individual reactor unit due to a given hazard. That is, the safety goals are applied on a per-unit, per-hazard, per-year basis. To help manage risk, the safety goals are set at very low levels:

- Severe core damage frequency (SCDF) is less than 1 in 10,000 per reactor, per year;

- Large release frequency (LRF) is less than 1 in 100,000 per reactor, per year; and

- These safety goals are aligned with international norms and CNSC safety goal definitions.

The SCDF and LRF risk results for Pickering NGS Units 5 to 8 are presented below in Table 3. The risk values for all internal and external hazards are shown to be below the OPG safety goals. The overall conclusion is that the Pickering NGS Units 5 to 8 risk is very low.

Summary of 2022 Pickering NGS B Probabilistic Safety Assessment (PBRA) Update

The 2022 PBRA update was prepared to be compliant with the CNSC Regulatory Document REGDOC-2.4.2, accounting for operating experience and changes at the station. The 2022 PBRA update also included a detailed non-reactor sources PSA.

The SCDF and LRF values, shown in Table 3 below, are within the safety goals for each of the internal and external hazards considered in the 2022 PBRA update.

Severe Core Damage and Large Release Frequency (x 10-5 per reactor-year, per unit)		
PSA Hazards	2022 PBRA Baseline SCDF	2022 PBRA Baseline LRF
Internal Events At-Power	0.10	0.08
Internal Events Outage	0.10[1]	0.04
Internal Fires	0.08	0.04
Internal Floods	0.02	0.01
High Wind	0.99	0.59[2]
Seismic	0.01	0.01
Non-Reactor Sources: Internal Events[3]	-	0.03
Non-Reactor Sources: Seismic Events[3]	-	< 0.01
Safety Goal	10	1
Administrative Safety Goal	1	0.1

TABLE 3 - SEVERE CORE DAMAGE AND LARGE RELEASE FREQUENCY FOR PICKERING NGS B

[1] The 2022 PBRA Internal Events Outage SCDF represents the most limiting plant outage configuration.

[2] The LRF value for the 2022 PBRA High Wind events meets OPG Safety Goal, but exceeds Administrative Safety Goal. This exceedance is a result of the LRF increase from the 2017 PBRA High Wind study. The LRF increase is attributed primarily to the changes in the analysis methodology in response to the latest industry developments and use of the most up to date Environment Canada data. No immediate plant changes were identified to be required at this time.

[3] The LRF value for the 2022 PBRA Non-Reactor Sources was estimated based on the assessment of all non-reactor sources at the Pickering site.

Risk and Reliability Program

The Risk and Reliability Program establishes a framework for the development and use of PSA as a means to manage radiological risks and to contribute to safe reactor operation. The PSA is used to assess the magnitude and frequency of radiological risks to the public, and operational reliability monitoring and reporting ensures that systems important to safety are monitored and managed.

Under the Risk and Reliability Program, actual station specific component failure data are collected and added to generic industry component failure data to obtain component failure rates. This component failure rate information is updated in models to derive an annual result for system Predicted Future Unavailability (PFU) of the Systems Important to Safety. This information is reported in the Annual Report on Risk and Reliability which allows OPG to assess the performance of the Systems Important to Safety against their PFU targets, as well as to identify and take corrective actions in case the PFU results do not meet the targets.

A components important to safety list was created at Pickering that employs insights from both internal (At-Power, Outage, Fire, Flood) and external events (Seismic, High Wind) PSA. The complex results from all the PSA studies were integrated into this single list. The reliability and performance of these components important to safety are reported in the Annual Report on Risk and Reliability.

As confirmed by the Pickering PSR2-B (PSR2 Amendment), there are no safety issues that would preclude continued safe operation of Pickering NGS Units 5 to 8 until 2026. The actions within the PSR2-B IIP will maintain or further enhance safety and reliability.

4.1.2.3 Safety Enhancements

OPG is committed to continuous improvement in safety at all of its nuclear facilities and has robust comprehensive programs in place that are aligned with industry best practices for ensuring the condition of SSCs important to safety are well understood and well maintained.

Beyond Design Basis Accident Containment Protection

From an integrated public risk perspective, OPG concludes that the most effective means of protecting containment and minimizing large releases resulting from a Beyond Design Basis Accident (BDBA) is to prevent an accident from progressing to the point of challenging containment.

Specific safety enhancements included post-Fukushima actions that were intended to prevent an accident from progressing to a severe accident following a BDBA:

- Completion of hydrogen passive autocatalytic recombiners installations in all Pickering NGS units;
- Provisions for Phase-1 EME to provide emergency make-up water and power for ensuring continuous fuel cooling and monitoring;
- Completion of SAMGs to provide plant staff with guidance on prevention and mitigation of accident progression to a severe accident; and
- Completion of Phase-2 EME provisions that provide emergency back-up power to important containment equipment (boiler room air conditioning units and hydrogen ignitors on all units to protect containment integrity allowing the use of the existing emergency filtered air discharge system for controlled filtered post-accident venting of containment).

The comprehensive Periodic Inspection Program (PIP) has continued to be executed to ensure major reactor components are safe and reliable. In addition, further investment has been made to ensure the tooling required to support the PIP work is well maintained including the Universal Delivery Machine, Single Fuel Channel Replacement tooling, Advanced Non-Destructive Examination (ANDE) tool and Spacer Location and Repositioning tools. The projects that are planned, and currently underway, to improve major reactor component reliability include:

- Feeder Stress Analysis: Feeder stress analysis work and the replacement of three feeders spool pieces ensure FFS of Pickering NGS feeders until the end of 2026. Related inspections will be managed as per the Feeders Life Cycle Management Plan (LCMP).
- Calandria Tube-Liquid Injection Shutdown System (CT-LISS) De-

tensioning: The Unit 6 De-tensioning device installation project was completed to keep the CT and LISS nozzles within an allowable gap and Pickering NGS is committed to ensuring the required gap tolerance is maintained to support FFS. Detailed inspections of the CT and LISS nozzles were completed during the 2023 Unit 6 outage and the gaps between CT and LISS nozzles were adjusted. The need for reassessment in the next Pickering NGS Unit 6 planned maintenance outage will be confirmed once the assessment is complete.

- Steam Generator In Situ Pressure Test Rig: The pressure test rig will enable Pickering NGS to pressure test steam generators, to identify any potential leaks before putting them in service.

Pickering NGS is also contributing towards industry wide projects under the CANDU Owners Group through Fuel Channel Life Assurance/Fuel Channel Life Extension with an objective of ensuring fuel channel FFS at higher EFPH values. Extensive research and development work was performed under these projects, including pressure tube burst tests to measure fracture toughness.

A substantial investment was also made to ensure station Balance of Plant reliability until the end of 2026, including the replacement of three low pressure turbine spindles and the high-pressure turbine rotor in Units 5 and 7. Also, turbine electro-hydraulic governor modules, Class 2 battery bank and digital control computer power supplies have been refurbished.

Condenser debris filters and expansion joint replacements, as well as condenser polishing unit projects contributed to the health of Pickering NGS by improving condenser tube cleaning system availability and debris filter reliability. The Unit 8 main generator chemical clean project was completed in 2021 to improve its reliability until the ECO of Pickering NGS. The improvement project on emergency power generator 3 and standby generators increased reliability and lowered the probability of impairments.

To improve the reliability of the screen house intake, fishnet cleaning is continuously performed. An investment in an algae early warning system has provided the station with early information on algae conditions, allowing time for operators to take necessary mitigating actions to avoid unit trips on loss of the condenser cooling water (CCW).

Pickering NGS has further invested in modifications that help to reduce the worker radiation dose, environment releases and improve on radiation area monitoring. The Tritium Emission Reduction initiative remains one of Pickering's priorities and the station will continue to focus on tritium emission prevention and reduction, including through the purchase and installation of vapour recovery driers. Tritium emission prevention has also been achieved through the reduction of system tritium content and through improved monitoring. Collectively, these initiatives have resulted in decreased emissions, including in 2022.

4.1.2.4 Emergency Preparedness

The Nuclear Emergency Preparedness program is documented in OPG's Consolidated Nuclear Emergency Plan. This plan describes concepts, structures, roles and processes to implement and maintain an effective OPG response in the unlikely event of a nuclear emergency. The Consolidated Nuclear Emergency Plan provides a framework for interaction with external authorities and defines OPG commitments under the Provincial Nuclear Emergency Response Plan (PNERP).

OPG's Nuclear Emergency Preparedness program ensures OPG has adequate provisions for the preparedness and on-site response capability that would mitigate the releases of radioactive material.

To respond effectively to an emergency, Pickering NGS practices the response capability of staff through simulated emergencies, and maintains plans and procedures to ensure that this capability is sustained.

A summary of performance is provided in Table 4.

Performance Indicator 4 Quarter Average	2018	2019	2020	2021	2022
Radiological Emergencies Performance Index (%)	96.4%	94.4%	100%	99.6%	99.3%
Emergency Response Resources Completion Index (%)	100.0%	99.3%	98.7%	100.0%	100.0%

TABLE 4 – EMERGENCY RESPONSE PERFORMANCE INDICATORS

The Radiological Emergencies Performance Index provides an indication of Emergency Response Organization (ERO) timeliness and accuracy while executing emergency notifications during drills, exercises or real events as outlined in the PNERP. The results above demonstrate good performance for Pickering NGS.

The Emergency Response Resources Completion Index indicates the percentage of the completed maintenance, tests and checks of emergency facilities and equipment important to emergency response versus the scheduled work for the quarter. The results above indicate good performance for Pickering NGS.

In 2021, as part of an emergency preparedness excellence initiative, OPG introduced additional opportunities for key members of the Pickering ERO to demonstrate their skills and proficiency in executing Provincial emergency notification requirements in the main control room simulator. As a result, ERO proficiency has improved and OPG has qualified additional Pickering ERO members beyond program requirements.

Maintaining qualified ERO staff is an integral component to OPGs Emergency Preparedness Program. This ensures the ERO receives current training and has the experience and knowledge to respond to an event. Qualified ERO members are required to complete practical evaluations, as documented in OPG governance, to maintain their qualifications. These practical evaluations may be a drill, exercise, real event or procedural walkthrough with a qualified person. ERO qualifications are controlled through OPGs managed training system. Maintenance and monitoring of the ERO duty roster is performed by OPG Emergency Management.

Formalized self-assessments and industry benchmarking of OPG's Emergency Preparedness program elements are conducted every year to identify program improvement opportunities. In 2022, a self-assessment was conducted on the proficiency of the Emergency Shift Assistants (ESAs). The ESA proficiency plan has been successful at increasing the confidence and competence of this role at Pickering. Overall Performance (as measured by Drill and Exercise Performance) has increased from 94% to 99%, which is in line with industry top quartile. Each ESA will continue to be required to participate in at least 2 performance opportunities each year to maintain their qualification.

Drills and Exercises

To demonstrate OPG's emergency response capability, Pickering NGS maintains an extensive drill and exercise program. This program validates emergency plans and procedures and provides the emergency response organization with the opportunity to improve and sustain their emergency response capability.

In the unlikely event of an emergency at Pickering NGS, OPG would perform the appropriate notifications to the Province, CNSC, and local municipalities in accordance with established procedures. Pickering NGS takes actions to control and mitigate the emergency on-site and to minimize off-site effects. The Province under the PNERP takes actions to notify and protect the public, including recommending protective actions such as sheltering, potassium iodide ingestion, or evacuation, with support from local municipal emergency response organizations.

In October 2020, OPG executed a full-scale nuclear emergency response exercise at Pickering NGS. The exercise involved the participation of the OPG ERO, as well as organization and government agencies at the Municipal, Regional, Provincial, Federal and International levels. The overall purpose of the exercise was to demonstrate the collective response capability to a nuclear event in the Province of Ontario per requirements of CNSC REGDOC-2.10.1 Nuclear Emergency Preparedness and Response. The exercise and scenario were designed to test emergency plan arrangements less commonly demonstrated, including the ERO assuming their roles for multiple days into an incident. This exercise helped demonstrate the collective readiness of OPG and local response organizations to respond to a nuclear emergency at Pickering NGS.

The next full-scale nuclear emergency response exercise at Pickering NGS is planned for September 2023 and will continue every 3 years.

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-kilometres (km) of the Pickering site.

- 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 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.

- Alert Ready: Canada's National Public Alerting System provides public alerts through radio, television, and on long-term evolution connected and compatible wireless devices (i.e., cellular phones).

OPG provides support to the Regional Municipality of Durham who owns, operates, and routinely tests the public alerting system including sounding 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.

Evacuation Time Estimate

OPG provides updates to the Pickering Evacuation Time Estimates (ETE) every five years as new census data becomes available. An update to the Pickering ETE study using 2021 census data was completed in May 2023.

Using an industry-accepted methodology, the ETE study takes into consideration the time required to evacuate schools, hospitals, and other residential institutions, and is completed with support from the Province, local municipalities, police, and transit organizations.

The estimate provides off-site emergency planners with projections on how long it may take for sectors and the Detailed Planning Zone (DPZ) (10-km around the Nuclear Generating Stations) to evacuate if required. Variables such as time of day, day of week, road restrictions, special event assemblies and weather were assessed as to how those factors may impact the evacuation duration. As per the 2023 Pickering ETE study (Reference 13), the time required to evacuate 90% of the population from the Pickering DPZ (i.e., out to 10 km) ranges from 4 hours and 45 minutes to 8 hours and 25 minutes (e.g., wintertime, with heavy snow at mid-day on a weekday).

Offsite Support

In May 2022, OPG and Emergency Management Ontario (EMO) endorsed a new five (5) year agreement to support EMO in the planning, maintenance, and execution of the PNERP. This new agreement further supports the province who provide staff with expertise in emergency planning, nuclear and radiological science, hazard identification and risk assessment, drills, and exercises,

maintenance of 24/7 nuclear emergency response capability, and nuclear education and emergency preparedness materials.

OPG provides Monitoring and Decontamination Unit capability and readiness at emergency worker and reception centres. Enterprise Emergency Management maintains equipment inventory at the designated offsite centres with the support of the local facility staff.

OPG is continuously working with community partners and external stakeholders to improve off-site support. OPG, in conjunction with Bruce Power, has prepared Radiation Basics training to be provided to City of Toronto and Durham Region to support Emergency Worker training efforts.

Offsite centre exercises were conducted at Durham College Reception Centre in Oshawa in June 2018 and at Delpark Homes Centre in Oshawa in September 2019. During these exercises, the OPG Monitoring and Decontamination Unit was activated and processed members of the public and their vehicles. Full participation of community partners was present at all levels. Lessons learned from these exercises have been incorporated in the processes and procedures for OPG, Durham Region and other applicable participating organizations.

OPG also works closely with The Toronto Emergency Workers' Centre Working Group. The purpose of the Emergency Workers' Centre Working Group is to coordinate preparedness and response planning for nuclear emergencies with specific focus on Land and Marine Emergency Workers' Centres as required by the PNERP.

The offsite drill and exercise efforts are in addition to the routine work of OPG's Emergency Response and Fire Protection staff who work with key members of the Ajax-Pickering hospital to review and familiarize each other with procedures and training relevant to radiological emergency situations.

To ensure emergency plans continue to support a timely and safe evacuation in the event of a nuclear emergency, OPG monitors and engages with the Province, Durham Region, and the City of Pickering regarding land use policies and activities in associated emergency planning zones. This ensures that there is no adverse impact on implementation of nuclear emergency plans.

Equipment Important to Emergency Response

The EITER program identifies equipment that is allocated to Pickering NGS to support an emergency response and ensures contingency actions are taken when equipment is taken out of service or becomes unavailable. This includes procedures and processes which identify EITER systems, structures, and components, as well as essential tools and equipment, necessary to implement the Consolidated Nuclear Emergency Plan.

In 2020, a fleet-wide cross-functional EME Excellence Team was established, driving improvements to the EITER

program by improving procedures, processes, teamwork, accountabilities and delegation of roles and responsibilities related to EME.

OPGs EITER program aligns with industry best practices and in 2020, the program was recognized as a strength by international utility peers because of its innovative practices for tracking, managing, and maintaining this equipment. Enterprise Emergency Management works closely with station staff to ensure EITER unavailability is reduced and equipment is restored quickly.

The EITER program ensures that OPG has the capability to implement the emergency plan 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.

Potassium Iodide Pills

As required by CNSC regulatory document REGDOC-2.10.1, Nuclear Emergency Preparedness and Response, the pre-distribution of an iodine thyroid blocking agent or potassium iodide (KI) is required in the DPZ which is a 10 km radius around Pickering NGS. Pre-distribution ensures that KI is available for residents within 10 km of Pickering NGS. Ingestion of KI is one protective action that may be directed by authorities in the unlikely event of a nuclear emergency.

A provincial update of the PNERP Master Plan is expected in December 2023, after which OPG processes and programs will be revised if required to ensure compliance with any updated requirements.

Potassium Iodide (KI) tablets are pre-distributed by the Durham Region/City of Toronto to 10km DPZ institutions to allow for timely ingestion of KI tablets and should only be taken when instructed by public health authorities. These institutions include schools, childcare centres, health care facilities and municipal services. 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 (50km IPZ) by the Province of Ontario.

OPG continues to maintain a KI pill pre-distribution program for the communities, businesses, and residences in the 10km vicinity of the Pickering NGS. The KI pill inventory for the pre-distribution program is maintained separately from the inventory that is maintained by the Province of Ontario. OPG has also procured additional KI pill contingency supplies.

The Prepare to Be Safe website (preparetobesafe.ca) serves as a platform for KI pill Frequently Asked Questions and provides a means for businesses and residents within 50 km of Pickering NGS to request KI pills. Website Frequently Asked Questions are translated into the 9 most common languages spoken within 10 km (based on census data). New households and businesses in the 10 km DPZ are identified monthly by Canada Post and sent KI pills with supporting information included.

KI public awareness campaigns are held regularly (three times per year). The campaigns are focused on the 10km DPZ but they are also extended into the 50km 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 50km 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 participate and support the CNSC-led Potassium Iodide Working Group (KIWG). A Phase I report was prepared and published on the CNSC KIWG website. The purpose of the Phase I Report was to fulfill the commitment to the Commission to provide clarity on the existing plans and associated responsible authorities for distributing KI pills in the 50km IPZ for Pickering NGS. Phase II work, commenced in early 2022, is being led by the Province of Ontario, given its jurisdiction over offsite nuclear emergency management, including protective action response planning and decision making. This Phase is focused on the feasibility of pre-distribution of KI pills to all schools within the 50km IPZ and establishing clear and detailed plans for the distribution of KI pills throughout the 50km IPZ, if necessary. Any changes to the KIWG work will be reflected in PNERP updates, and OPG will maintain compliance.

OPG continues to offer support to the KIWG on Indigenous community outreach, including through the CNSC regular meetings and engagement opportunities with Indigenous communities, including Curve Lake First Nation, Mississaugas of Scugog Island First Nation, and Métis Nation of Ontario.

The Province of Ontario's EMO is updating the PNERP, which was last revised in 2017. The review and update of the PNERP began in 2021. The Province is conducting a public consultation process with the objective of finalizing the updated PNERP in 2023. The approved Pickering Implementing Plan will be completed following the approval of the PNERP Master Plan. OPG has reviewed and provided comments during the initial review period and will enhance its emergency plans to align with any revised PNERP requirements as required.

4.1.2.5 Protection of the Environment

OPG's Environmental Policy ensures that an environmental management system (EMS) registered to the International Organization for Standardization (ISO) 14001 Environmental Management System standard, is established.

OPG continues to improve the EMS and environmental performance. Pickering is managed in a manner which strives to maintain or enhance surrounding natural areas and associated species of concern. This is achieved through collaboration with community partners supporting regional ecosystems and biodiversity, and by taking reasonable steps to manage any residual impact to these areas and species.

As shown in Figure 3, the radiation dose to the public resulting from operations at Pickering NGS is a very small fraction of the estimated annual average natural background radiation dose.

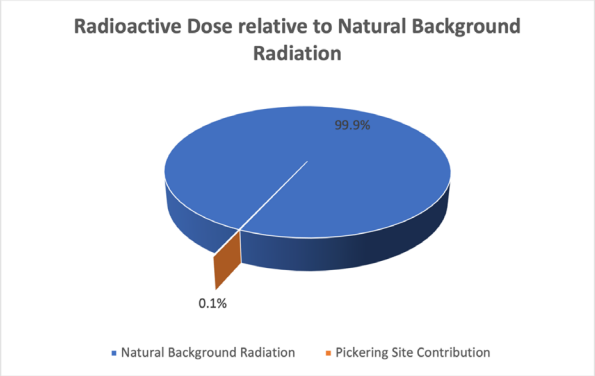


FIGURE 3 - RADIOACTIVE DOSE RELATIVE TO NATURAL BACKGROUND RADIATION 2022.

The dose to the public is generally equal to or less than 0.2% of the annual legal limit of 1000 µSv. The public dose for 2022 was 1.9 µSv and this dose was assigned to the "Urban Resident (Adult)" group, as shown in Figure 4.

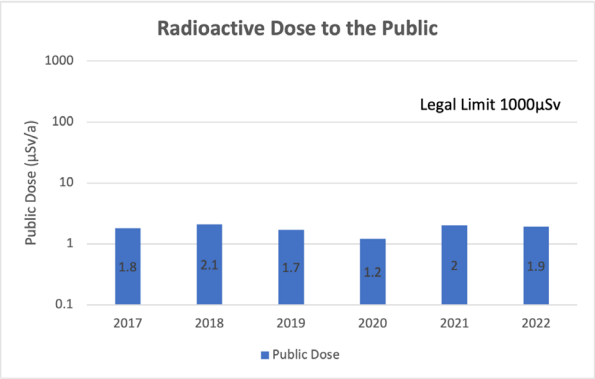


FIGURE 4 - RADIOACTIVE DOSE TO THE PUBLIC

4.1.2.5.1 Environmental Reporting

OPG tracks and reports environmental emissions data for Pickering NGS for each quarter and publishes the data publicly on OPG's website (opg.com).

Pickering NGS complies with regulatory requirements for controlling and monitoring releases of hazardous substances to the environment. Pickering reports releases of hazardous substances to Environment Canada's National Pollutant Release Inventory (NPRI). Tools and resources for accessing, analyzing and interpreting NPRI data are available on the NPRI website.

Pickering NGS's carbon dioxide emissions are well below the threshold for mandatory reporting to federal and provincial authorities. Greenhouse gas data and information for reporting facilities are available on the Greenhouse Gas Emissions Reporting Program website.

OPG has extensive programs to ensure the risk of spills to the environment is effectively assessed and managed. All spills are reported by OPG to the appropriate federal, provincial and municipal authorities as required. This information is also reported on the OPG website on a quarterly basis.

The Environmental Monitoring Program (EMP) identifies the contaminants and physical stressors to be monitored and conducts monitoring in the environment surrounding the site. The EMP design uses a risk-based approach and relies on the results of the site ERA to determine what locations and environmental media should be chosen for environmental monitoring. Locations considered to be outside the influence of Pickering NGS operations are also monitored to allow for a baseline comparison with background values. No major changes to the routine

sampling program were identified based on the 2022 EMP.

4.1.2.5.2 Environmental Risk Assessment (ERA)

OPG has completed an updated Environmental Risk Assessment (ERA) for Pickering NGS, focused on the years 2016 to 2020. The report was submitted to the CNSC in April 2023 (Reference 14) and is available on OPG.com.

The purpose of the Pickering NGS ERA is to assess potential human health and ecological risks from exposure to radiological contaminants, conventional contaminants, and physical stressors (eg. noise) present in the environment as a result of site operations. This is achieved through completion of a human health risk assessment and an ecological risk assessment (EcoRA).

A Human Health Risk Assessment identifies, quantifies, and characterizes the risks to human receptors from releases of radiological contaminants, conventional contaminants, and other stressors (i.e., noise) from a nuclear facility. The key to the assessment of the human health risk is the identification of potential critical groups; those most exposed individuals living or working within approximately 20 km of the Pickering NGS site. The potential critical groups used for annual dose calculations, include an urban resident, farm, dairy farm, sport fisher, correctional institution resident, and off-site industrial/commercial worker. Protection of the critical group indicates that all other members of the public are protected.

An EcoRA identifies, quantifies, and characterizes the risks to ecological receptors from releases of radiological contaminants, conventional contaminants, and other stressors (i.e., heat in water) from a nuclear facility. The 2022 Pickering NGS EcoRA focused on the nearshore Lake Ontario (the area surrounding the Pickering NGS outfall), the Pickering NGS site, and nearby Frenchman's Bay. Ecological receptors, also referred to as Valued Ecosystem Components, were chosen for dose and risk analysis because they are known to exist on-site, and/or represent major taxonomic/ecological groups, primary exposure pathways, or have a special importance/conservation concern, value, or interest to the public or Indigenous communities. Chemical and radiological contaminants were evaluated against conservative screening benchmarks (environmental quality guidelines) that are protective of ecological health to determine which required further detailed evaluation.

The 2022 Pickering NGS ERA meets the requirements of the Canadian Standards Association (CSA) N288.6-12 standard, Environmental risk assessments at Class I nuclear facilities and uranium mines and mills. The 2022 Pickering NGS ERA analyzed site and environment monitoring data from 2016 to 2020. Environment monitoring data is gathered by OPG annually and includes collection of air, water, food stuff (milk, vegetables, fruits, eggs, poultry), beach sand, and fish samples from farms and residences in the vicinity of Pickering NGS. The environment data is analyzed in a laboratory to understand the level of

radionuclides in all samples. The ERA results are intended to be conservative so as to not under-estimate any risk to the public and the environment.

The 2022 Pickering NGS ERA confirms that Pickering NGS is continuing to operate in a manner that is protective of the health of the public and the environment.

The ERA is reviewed and updated every five years based on ongoing environmental monitoring data, operational experience and advances in scientific knowledge. The ERA results are used to help identify what monitoring to include in the environmental monitoring programs or to recommend further assessment or action. The monitoring results are then used in future ERAs to confirm conclusions.

4.1.2.5.3 Predictive Effects Assessment

The purpose of the Predictive Effects Assessment (PEA) is to identify and assess the potential interactions with the environment as the result of future site activities and to determine whether or not adequate provision for the protection of the environment and health of persons has been made.

In 2017, OPG undertook a PEA as required under the Nuclear Safety and Control Act to support the Pickering NGS power reactor operating licence renewal application process and to evaluate the potential for adverse effects to human health and the environment from the activities associated with transitioning the station from end of commercial operation to a safe storage state. The 2017 PEA (Reference 15) focussed on the Stabilization Phase (transition to safe storage which includes defueling and dewatering reactor units) and the first ten years of Storage with Surveillance Phase (to allow for natural decay of radioactivity) after which the transfer of all used fuel to dry storage would be completed. The 2017 PEA concluded there would be no predicted potential adverse effects to public nor to the environment.

In 2022, OPG issued a PEA Addendum Report (Reference 16) to demonstrate continued protection of human health and the environment based on updated baseline environmental conditions and current operational assumptions after the ECO and safe storage period for the Stabilization and Storage with Surveillance Phases.

The 2022 PEA Addendum Report was updated in April 2023 (Reference 17) to address comments received from the CNSC and to reflect continued operation of Pickering NGS until 2026. Both the 2017 PEA and the 2022 PEA Addendum 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 Storage with Surveillance Phase activities.

4.1.3 Pickering NGS Fitness for Service

4.1.3.1 Periodic Safety Review

A Periodic Safety Review (PSR) is a systematic and comprehensive evaluation of the design, condition and operation of

the plant. It is a safety reassessment performed periodically, 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 a high level of safety throughout the plant's operating lifetime.

The objective of a PSR is to compare the plant against the requirements identified in 15 Safety Factor areas and against modern Laws, Regulations, Codes and Standards (LRCS), and to identify practicable safety enhancements of the facility based on the review. The PSR also assesses the overall acceptability of operation of the plant.

The Pickering PSR that was completed for the operating licence from 2018 – 2028 was called PSR2. It is valid for the period up to the end of August 2028 and included the prevailing planning assumption of operation of Pickering NGS units until the end of 2024.

The Global Assessment Report for PSR2 demonstrated that the Pickering NGS design, operation, processes and management system provides assurance of continued safe operation of the plant during the continued operating period to the end of 2028, with the commercial operation to the end of 2024.

An Integrated Implementation Plan (IIP) was approved in 2018 and consisted of those actions which translates the safety enhancements identified in the Global Assessment Report into specific actions with target completion dates. CNSC staff confirmed that the Integrated Implementation Plan fulfills regulatory requirements and met CNSC staff expectations and was subsequently accepted by the Commission and included as a regulatory requirement in the current Pickering operating licence.

All PSR2 IIP Actions were completed by OPG and the CNSC staff concurred that implementation and the results ensured the continued safe and reliable commercial operation of Pickering NGS to the end of 2024, as required by the PROL.

4.1.3.1.1 PSR2 Reassessment for Operation of Pickering NGS Units 5 to 8 to December 2026

In support of continued commercial operation for these units a re-assessment of PSR2, called PSR2-B was carried out to confirm that design, condition and operation of Pickering NGS supports continuing commercial operation from 2024 to 2026. The PSR2-B is an amendment that is being performed to reassess the time-dependent elements of PSR2 and the continuing applicability of the PSR2 basis.

4.1.3.1.2 Regulatory Requirements

The regulatory requirements for a PSR2 reassessment to ensure the continued validity of the PSR results are as follows:

- Identify new or revised requirements, expectations and practices which became available since the freeze date of the original PSR2.

- Consolidate, prioritize, and rank any newly identified findings to formulate new global issues and resolutions plans. Any new resolution plans should be incorporated into Integrated Implementation Plan (IIP) actions.

4.1.3.1.3 PSR2-B Assessment Methodology

PSR2 was assessed to be valid for the period of 2018-2028. The planning basis for PSR2 is an assumption of commercial operation of the Pickering NGS units until the end of 2024 and non-commercial operation until the end of 2028.

In conducting the PSR2 Global Assessment, consideration was given as to whether the resolution activities would be different for a scenario with commercial operation to 2024 (the nominal planning basis for the units), or for commercial operation beyond 2024 (extended planning basis). If the proposed Resolution Plan for a particular Global Issue was dependent on whether plant operation is assumed to continue beyond 2024, the Global Issue Resolution Plan was flagged under a category entitled "Reassessment Beyond 2024". In such cases, detailed resolution activities were only identified to address operation through 2024. In order to commercially operate beyond 2024, if necessary, the flagged Global Issue would need to be re-evaluated and updated resolution plans produced.

This reassessment, the PSR2-B, objective was to produce a supporting safety assessment of Pickering NGS Units 5 to 8 commercial operation from 2024 to 2026, to confirm that the design, condition and operation of Pickering NGS support operation to December 2026 and identify any additional safety enhancements not already achieved or committed. The reassessment revises the results of the PSR2 by evaluating the "Reassessment Beyond 2024" flagged Global Issues, revisits and updates the gaps that built the Global Issues and creates revised/new resolution plans and safety enhancing actions.

In parallel with the PSR2-B, OPG was undergoing a PSR review for the next operating cycle of the Darlington Nuclear Generating Station. The Darlington PSR (D-PSR) was performed in support of the Darlington licence renewal for operation from 2025 to 2035 and builds on the review basis of previous OPG work and other associated assessments. The PSR2-B has leveraged new or revised requirements, expectations and practices since the freeze date of PSR2. It has also leveraged the D-PSR Laws, Regulations, Codes & Standards (LRCS) reviews which were conducted with a freeze date of January 15, 2020.

The reassessment methodology used the following inputs:

- PSR2 Global Issues flagged "Reassessment Beyond 2024", identified as requiring reassessment for operation beyond 2024.

- Review of open regulatory commitments, regulatory action items, and regulatory obligations applicable to extending commercial operation to 2026.

- A review of the evaluations done for actual condition of the Pickering NGS Systems, Structures and Components (SSC) performed during PSR2. The result of this re-assessment confirms the validity of the PSR2 results in consideration of Pickering NGS Units 5 to 8 commercial operation to 2026.

- PSR2-B used the results from the D-PSR LRCS review and Safety Factor Reports for addressing the site-specific and programmatic aspects of the re-assessment covering any gaps, where applicable, that may have occurred since the Pickering PSR2 freeze date.

- A review of the Darlington PSR (D-PSR) gaps and enhancement opportunities in the D-PSR Global Assessment Report (populated from the D-PSR Safety Factor and LRCS reviews) of programmatic in nature and applicable to the Pickering NGS station.

The PSR2-B gaps were grouped into existing PSR2 Global Issues (GI)s or new GIs, based on topical similarities. Each GI was then prioritized with respect to nuclear safety and assigned a safety significance level, including the defence-in-depth assessment and Acceptable Deviation Aggregate impact. From this the Integrated Implementation Plan (IIP) that documents planned actions required to address the GIs was produced. This IIP was submitted (Reference 18) to CNSC staff for acceptance and form a substantial portion of the licensing basis for continued operation of Pickering.

4.1.3.1.4 Global Issues Gap Assessment and Global Assessment Report Results

The following are PSR2-B gaps based on two groupings:

Fitness-for-Service and Component Condition:

- FFS of Major Components (Fuel Channels, Feeders, Steam Generator, and Reactor Components and Structures, Inconel X-750 Pickering NGS Units 6 to 8 Spacers) for Pickering NGS Units 5 to 8 from 2024 to 2026.

- Update Station Condition Assessments (CA) Reviews and Validation for Pickering NGS Units 5 to 8 from 2024 to 2026.

- Assess the impact of the Heat Transport System component aging on various accident scenarios to demonstrate that adequate safety margins exist for Pickering NGS Units 5 to 8 operations from the end of 2025 to 2026.

- Assess and confirm the Environmental Qualification program includes operation from 2024 to 2026.

Assessment, Governance and Enhancements:

- Assessment of the recommendations from the CNSC Desktop compliance inspection report for Darlington Nuclear Generating Station Severe Accident Management Guidelines (SAMGs) for implementation at

Pickering NGS. The action to close this gap was completed in 2022.

- Assurance of FFS of Major Components and FFS of Containment for the Extended Operating Period from 2024-2026 has been completed. (Reference 1)

- Assessment of the impact of extended operation on CNSC concessions CSA N285.4, and N285.4 PIP and documentation revisions.

- Update of Governance.

- Installation of an enhanced Emergency Water Supply Reactor Building Water Level Measurement device for Pickering NGS Units 5 to 8.

- Apply National Building Code of Canada (NBCC) 2015 Part 3 for future construction or modification related to fire protection, occupant safety and accessibility. Update current applicable governance documents to include the new requirements, codes or standards identified in National Fire Code of Canada (NFCC) 2015.

The proposed resolutions for these PSR2-B gaps predominately address the aging management strategies for Pickering NGS Units 5 to 8 extended operation to the end of 2026, in addition to the equipment qualification and safety analysis to support this extended operation period, requirements of modern versions of LRCSs, and concessions against legacy versions of LRCSs. The PSR2-B gaps are used as the basis and input for the Pickering NGS PSR2-B GAR with updates and additions as applicable.

The report concluded that the acceptable deviations from the PSR2 Global Issues were not time sensitive and therefore did not require reassessment. Newly identified Acceptable Deviations deriving from the PSR2-B GAR and its sources were assessed and concluded no impact, either individually or in aggregate, to the defence-in-depth assessment.

The PSR2-B GAR 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. Resolution of PSR2-B gaps will be addressed under the IIP.

4.1.3.1.5 Integrated Implementation Plan

The Integrated Implementation Plan (IIP) defines resolution actions to address Global Issues. Each Resolution Action presents a set of IIP Action(s) with completion and success criteria to resolve the associated Resolution Statements from the PSR2-B GAR GI. The IIP actions are clear, distinct, achievable and executable activities to maintain and improve nuclear safety.

Globe Issue Title	Resolution Description
Fitness for Service for Fuel Channels	Update the Fuel Channels Pressure Tubes Periodic Inspection Plan (PIP) Plan for Pickering 5-8 to reflect an extended operating period up to the end of 2026.
	Establish the basis for continued demonstration of fitness for service of fuel channels for Pickering NGS Units 5 to 8 for the extended operating period up to the end of 2026. Fitness for service of fuel channels includes demonstration of sufficient margin on the FFS limits of the pressure tubes, calandria tubes and garter springs (annulus spacers) during the continued operational life of the plant.
	Demonstrate fitness for service for Zr-Nb-Cu and Inconel X-750 Pickering NGS Units 5 to 8 Spacers for the extended operation to the end of 2026.
	Develop and submit an implementation plan for developing inputs to satisfy the methodology in the Non-Mandatory Annex G of CSA N285.8-15, Update #1 to perform uncertainty analyses in probabilistic evaluations where the threshold requirement is met per CSA N285.8.
Fitness for Service for Feeders	Establish the basis for continued demonstration of fitness for service of feeders for Pickering NGS Units 5 to 8 for the extended operating period up to the end of 2026. Fitness for service of feeders includes demonstration that predicted feeder condition, with identified and planned mitigations, is acceptable for the intended operation.
Fitness for Service for Steam Generators	Establish the basis for continued demonstration of fitness for service of steam generators for Pickering NGS Units 5 to 8 for the extended operating period up to the end of 2026. Fitness for service of steam generators includes demonstration that predicted steam generator condition, with identified and planned mitigations, is acceptable for the intended operation.
Fitness for Service for Reactor Components and Structures	Establish the basis for continued demonstration of fitness for service of reactor components and structures for Pickering NGS Units 5 to 8 for the extended operating period up to the end of 2026. This includes demonstration that predicted reactor components and structures condition, with identified and planned mitigations, is acceptable for the intended operation. This also includes the required inspection activities to update the Calandria Tube – Liquid Injection Shutdown System (CT-LISS) nozzle gap assessments and identification of mitigation strategies if CT-LISS contact is predicted within the extended operating period.
Governance Implementation / Effectiveness Issues	Install an enhancement to the Emergency Water Supply Reactor Building Water Level Measurement to install 67138-LT566/LIA566 for Pickering NGS Units 5 to 8.
Safety Analysis to Support the Extended Operating Period	Update the Heat Transport System aging safety analysis models and perform the required safety analysis of events most impacted by aging (Small Break Loss of Coolant Accident, Loss of Flow and Neutron Overpower) to support continued operation for Pickering NGS Units 5 to 8 up to the end of 2026.
Safety-Related Structures (Non-Containment) for Nuclear Power Plants	Complete PSR2-B review of the aging management strategy for non-Containment safety-related structures. The purpose of the review is to confirm that the bases for the associated Aging Management Plan and PIP Program remain valid for the extended operation and to determine if any follow-up actions are necessary for extended operation of Pickering NGS Units 5 to 8 up to the end of 2026.
Fire Protection – National Building Code of Canada (NBCC) and National Fire Code of Canada (NFCC)	Apply NBCC 2015 Part 3 for future construction or modification related to fire protection, occupant safety and accessibility.
	Update current applicable governance documents to include, when appropriate, the new requirements, codes or standards identified in NFCC 2015 and develop strategy for appropriate and practicable operational and programmatic changes.
Safety-Related Structures (Non-Containment) for Nuclear Power Plants	Re-assess Pickering NGS EQAs to support extended operation of Pickering NGS Units 5 to 8 to the end of 2026.

The PSR2-B IIP resulted in 19 IIP actions associated with 13 Resolution Statements and 9 Global Issues. OPG will use existing action management infrastructure and processes to ensure that the IIP action completion progress is monitored and reported. The timely completion of the actions will support the extension of commercial operation of Pickering NGS Units 5 to 8 to December 2026.

4.1.3.2 Fuel Channel Fitness for Service

OPG can confidently state that its programs and processes will continue to assure fitness for service of the Unit 5 to 8 fuel channels up to 305,000 EFPH for the lead unit (Unit 6). This confidence is derived from a mature, well-defined life cycle management program that is based on years of operating experience and supporting research. The Major Components program produces fitness-for-service assessments that are aligned with licensing requirements. Based on the established programmatic controls for managing fuel channel aging, which include an extensive reactor inspection program, sound technical assessments, and the implementation of mitigating measures where required, OPG is confident that Pickering fuel channels will remain fit for service to the projected Units EFPHs. Refer to Section 4.1.3.2.7. for further detail on fuel channel integrity.

4.1.3.2.1 Fuel Channel EFPH

The projected EFPH for each Pickering NGS Units 5 to 8 is provided in Table 6.

Pickering Unit	Assessed Unit EFPH
Unit 5	297,500
Unit 6	305,000
Unit 7	298,000
Unit 8	283,000

TABLE 6 – PROJECTED EFPH FOR PICKERING NGS UNITS 5 TO 8

4.1.3.2.2 Fuel Channel Overview

Fuel channels support the fuel bundles inside the reactor and are an integral part of the heat transport system that removes heat from the fuel. The fuel channels are located inside the calandria vessel assembly, as shown in Figure 5.
At Pickering NGS, Units 5 to 8 each contain 380 fuel channels. All fuel channel pressure tubes (PT) at Pickering NGS units are made of a zirconium-niobium alloy.

Pressurized heavy water coolant is circulated through the fuel channels, transporting the heat produced by the nuclear fission process in the fuel to the boilers, in order to produce high-pressure steam. The PT forms the primary pressure boundary containing the fuel bundles and heat transport system coolant.

Fuel channels consist of two end fittings, four annulus spacers, a calandria tube (CT), and a PT as shown in Figure 6.
The fuel channels are surrounded by heavy water, which is used to moderate the fission process within the calandria vessel. Dry carbon dioxide gas flows in the annulus space between the PT and the calandria tube and provides a thermal barrier for the heat transport system and also moisture detection capability.

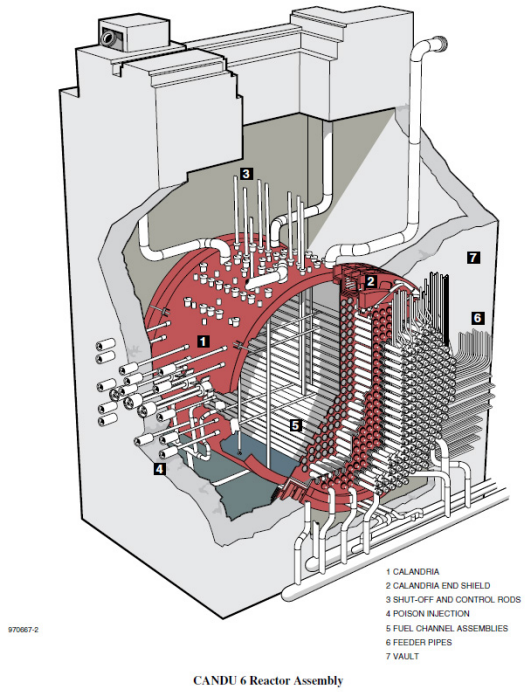


FIGURE 5 – SECTION VIEW OF FUEL CHANNEL ASSEMBLY

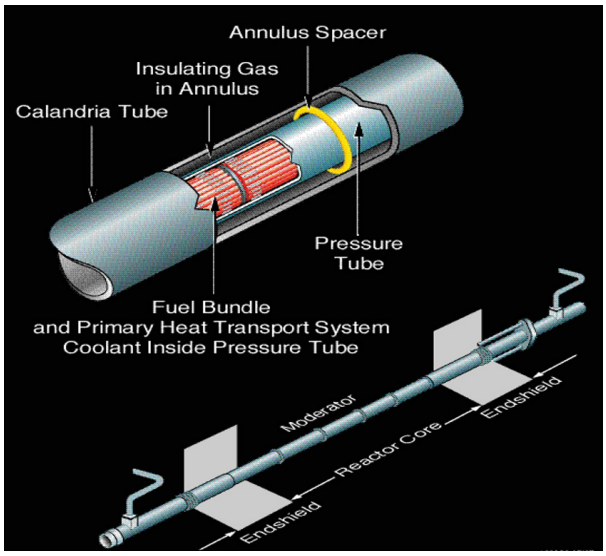


FIGURE 6 – SECTION VIEW OF FUEL CHANNEL ASSEMBLY

4.1.3.2.3 Defence-in-Depth – Fuel Channels

The approach to defence-in-depth and overlapping barriers is depicted in Figure 7.

Research and development (R&D) and testing is performed on pressure tubes to understand degradation, along with inspection and surveillance to monitor for progression of degradation; degradation assessment methods are employed to demonstrate retention of design margins; heat transport system operating procedures mitigate postulated degraded conditions; and leak detection enables safe reactor shutdown and depressurization to maintain fuel channel integrity.

As a final set of barriers, if required, alternative and diverse means of cooling the fuel are provided through safety systems (e.g. emergency coolant injection) and post-Fukushima modifications and emergency mitigation equipment. In the event all other measures fail, the containment system is available to limit radiation release and dose to the public and environment.

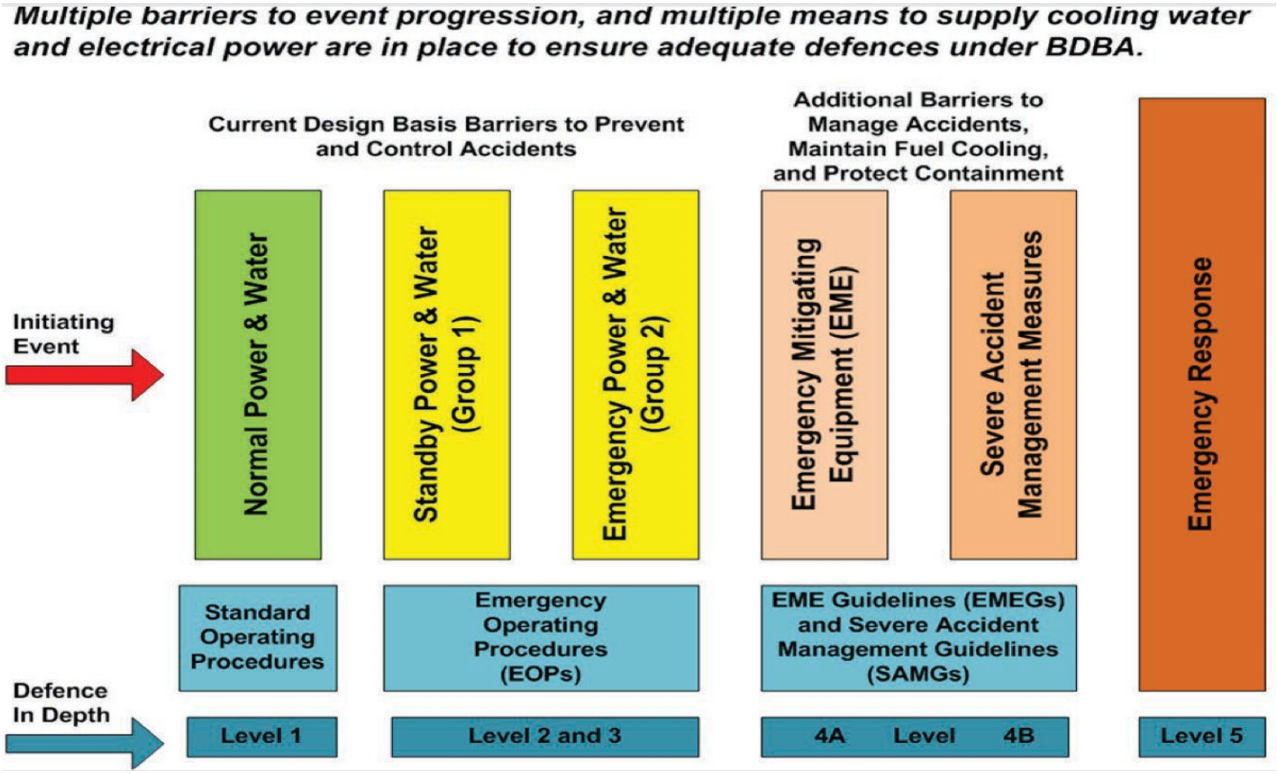


FIGURE 7 – DEFENSE IN DEPTH FRAMEWORK EMPLOYED BY OPG- BARRIERS TO FUEL CHANNEL FAILURE AND MITIGATION OF CONSEQUENCE IN EVENT OF PT FAILURE

4.1.3.2.4 Aging Management Programs

The fuel channels are a major component in CANDU reactors and OPG utilizes an Aging Management Program compliant with IAEA Safety Guide NS-G-2.12 and CNSC REGDOC 2.6.3 to ensure fuel channel integrity is well managed throughout the operational life of the plant. This is accomplished by establishing an integrated set of programs and activities that ensure fuel channel performance and fitness for service requirements are satisfied on an ongoing basis. This program also requires preparation of life cycle management plans and condition assessments, which are discussed in Sections 4.1.3.2.5 and 4.1.3.2.6 below.

Aging Management considerations are applicable throughout the plant life cycle, including design, construction, commissioning and operation. Critical aging management considerations are included and addressed in each of these phases. The basic framework for the Aging Management process is "Plan-Do-Check-Act". This framework (illustrated in Figure 8) ensures that planning is in place; the plant is operated in accordance with this plan; the plant condition is monitored; and that action is taken to manage the effects of aging.

The Aging Management Program and the activities it drives are key to ensuring critical equipment aging is managed such that operation of the nuclear power plant remains within the licensing basis of the facility and allows for station safety and operational goals to be met. OPG produces and regularly updates a Fuel Channels

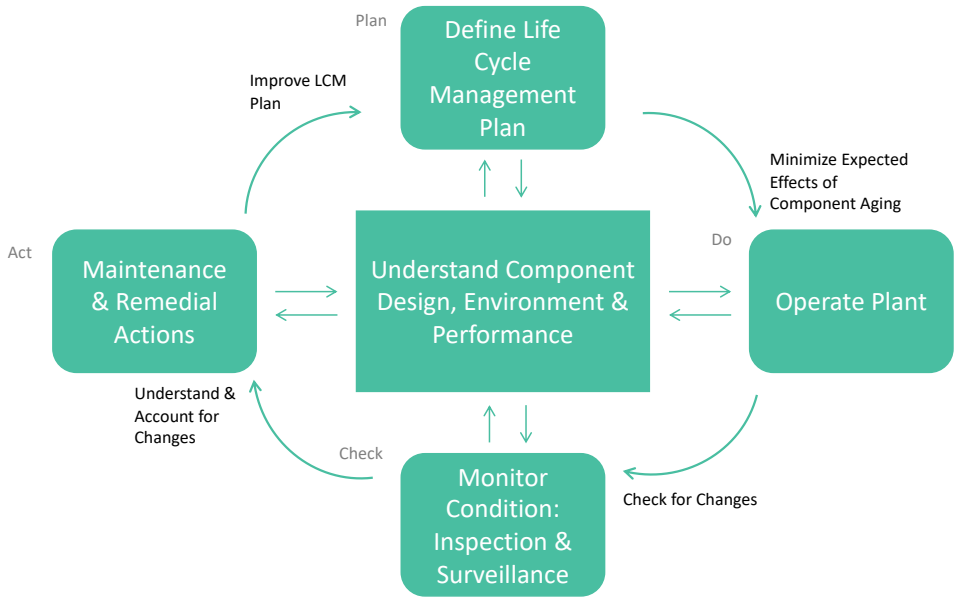


FIGURE 8 – INTEGRATED AGING MANAGEMENT PROCESS

Life Cycle Management Plan (FCLCMP) which ensures deliverables are well defined and that activities are planned and coordinated. The plan is optimized based on current understanding and routine assessment of component condition. Execution of the plan allows projections to be made regarding remaining life of the components. This process ensures the effects of component aging can be minimized allowing for the operation of the reactor to target end of life, with mitigating actions implemented as required.

4.1.3.2.5 Overview of Fuel Channel Fitness for Service (FFS)

To ensure safe operation and FFS of fuel channels, life cycle management activities are rigorously performed in accordance with industry standards.

The Canadian Standards Association (CSA) Standard N285.4 (Reference 19) prescribes requirements for monitoring fuel channel conditions via periodic inspections of multiple fuel channels. This standard also prescribes material surveillance which requires harvesting both small (thin scrape) and large (removal of entire PT) samples of PT material for subsequent destructive testing at a specialized laboratory facility to confirm material properties. The CSA Standard N285.4 standard defines acceptance criteria that must be met for given fuel channel conditions. If a fuel channel condition satisfies these acceptance criteria then that condition is considered unconditionally acceptable, as the fuel channel remains within the design basis.

To support continued operation of Pickering NGS Units 5 to 8 to December 31, 2026, a PSR has been completed as described in the previous section. Two gaps have been identified related to spacer integrity, and uncertainty analysis for core assessments, which

are discussed in Sections 4.1.3.1.4 and 4.1.3.1.5, respectively.

OPG produces and regularly updates a Fuel Channels Life Cycle Management Plan (FCLCMP) which documents planned inspection and surveillance activities for planned reactor inspection outages. The planned periodic inspections of PTs are conducted to assess degradation and monitor for change. These inspections typically exceed the minimum requirements in CSA Standard N285.4.

OPG utilizes specialized engineered tooling to perform fuel channel inspections; one example is the Advanced Non-Destructive Examination / Channel Inspection and Gauging Apparatus for Reactors (ANDE / CIGAR) hybrid inspection system tool. This inspection tool incorporates multiple non-destructive examination techniques, including ultrasonic testing and eddy current testing, and is deployed inside the PT after the channel has been defueled.

The tool is designed to inspect the full volume of the tube along the full length of the PT, including flaw detection, sizing and characterization; measurement of PT diameter and wall thickness; measurement of PT deflection (sag); measurement of the gap between the PT and calandria tube (CT); and confirmation of annulus spacer locations. An image of the ANDE / CIGAR hybrid inspection head and a schematic of PT characteristics are shown in Figure 9.

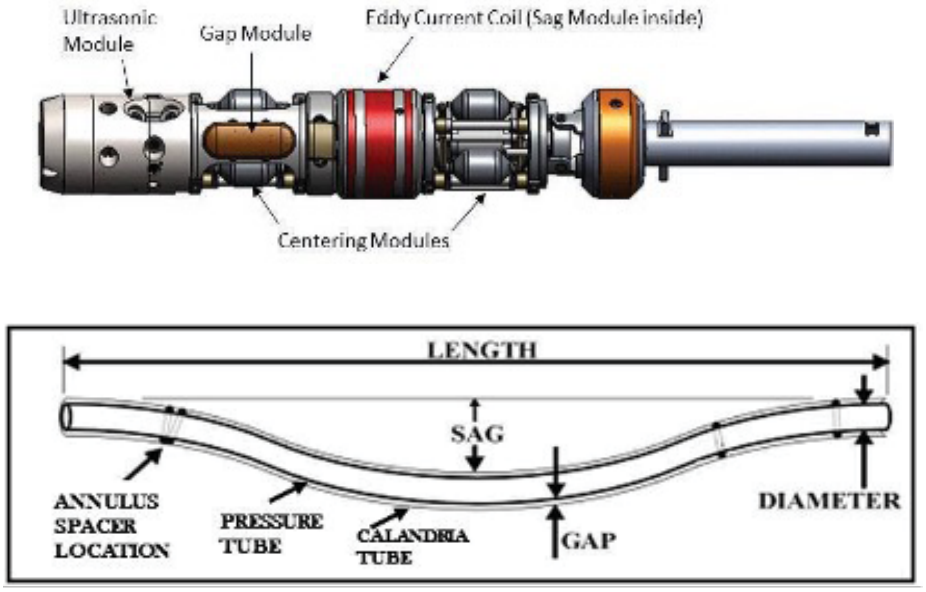


FIGURE 9 – ANDE / CIGAR HYBRID INSPECTION TOOL HEAD USED FOR INSPECTION OF CANDU FUEL CHANNELS (TOP IMAGE) AND SCHEMATIC OF FUEL CHANNEL CHARACTERISTICS (BOTTOM DIAGRAM NOT TO SCALE, CHANNEL CHARACTERISTICS SHOWN ARE FOR ILLUSTRATIVE PURPOSES)

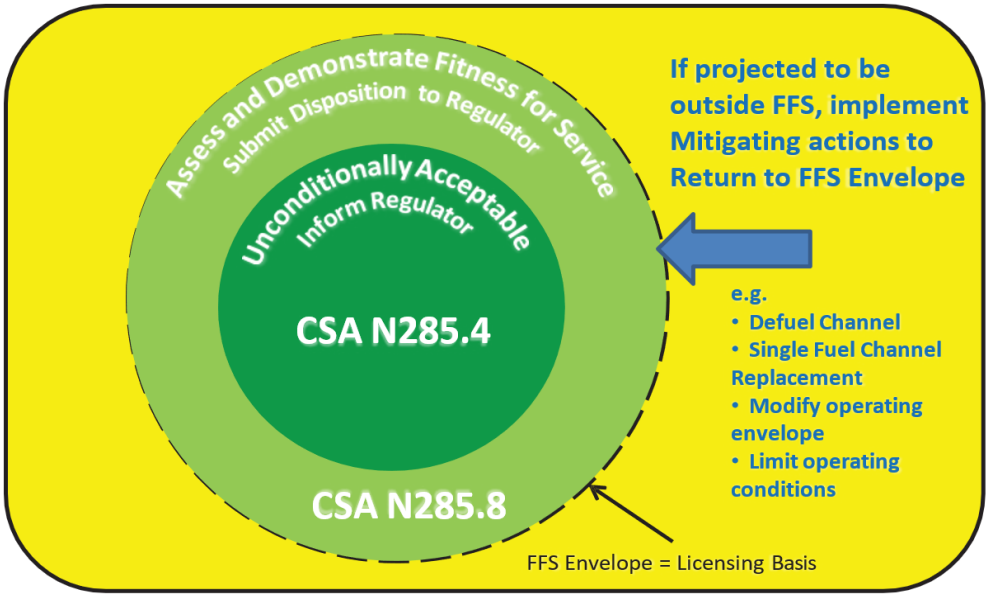


FIGURE 10 – FUEL CHANNEL FITNESS FOR SERVICE (FFS) ASSESSMENT APPROACH

When in-service inspection detects a condition (e.g. flaw, dimensional or material condition) that does not satisfy the acceptance criteria of CSA Standard N285.4 (Reference 19), OPG must comply with the technical requirements of CSA Standard N285.8 (Reference 20) to demonstrate continued fitness for service. CSA Standard N285.8 requires assessment of known as well as projected conditions, evaluation of material properties including any observed changes, and risk assessment of uninspected population of PTs in the reactor core. This process of evaluation requires a disposition that must be submitted to the CNSC for acceptance, as required by CSA Standard N285.4. The predictive models and assessment methodologies used to assess FFS are supported by accumulated knowledge obtained from continuing industry research and development activities, and they ensure predicted conditions remain acceptable.

The FFS assessment approach in Reference 19 ensures that PTs have adequate integrity for continued service and that OPG continues to operate its reactors safely and within the licensing basis. Figure 10 graphically depicts the FFS approach. The FFS framework also ensures that, through periodic inspection, OPG continually understands the condition of the fuel channels, and is able to predict fuel channel condition and ensure future operation remains within the acceptable FFS envelope.

If projections of fuel channel conditions suggest future departure from the FFS envelope, mitigating actions are available and would be implemented in order to remain within the envelope. For example, single fuel channel replacement may be employed in a postulated extreme case where assessment of a given PT flaw is unable to satisfy FFS criteria.

Following the Record of Decision in 2018 regarding the Licence renewal and authorization to operate Pickering NGS Units 5 to 8 up to a maximum

of 295,000 EFPH, there have been a significant number of inspections above the requirements of CSA Standard N285.4 to continue to confirm component conditions and completion of the associated FFS assessments. Examples of inspections include scrape sampling of pressure tube material, performing elongation measurements on a significant portion of the core, channel shifting to ensure channels remain in supported design condition, and ultrasonic testing inspections to monitor small surface flaws and deformation changes (additional information is provided in Section 4.1.3.2.7). OPG has confidence that the Pickering NGS Units 5 to 8 fuel channels will be fit for service to the projected Units EFPHs based on the ongoing inspection and maintenance program.

4.1.3.2.6 Condition Assessment of Fuel Channels

The condition assessment process is used to evaluate the health of critical components and establish actions necessary to maintain component health and assure continued fitness-for-service (FFS) for planned future operation. This process seeks to identify and understand aging mechanisms, collect data, conduct analyses, and evaluate component condition by comparison with defined acceptance criteria. The condition assessment of fuel channels is satisfied by several FFS assessments.

Condition assessments for PTs involve monitoring all of the aging mechanisms affecting fuel channels. As shown in Figure 11, fuel channel aging mechanisms are grouped into three main categories: PT deformation, changes to PT material properties, and PT flaws. As described above in Section 4.1.3.2.3, in the unlikely event of PT failure, mitigating systems are employed to provide necessary cooling to maintain integrity of the reactor core, and containment systems are in place.

A summary of aging mechanisms associated with Pickering fuel channels is provided in Section 4.1.3.2.7. OPG has assessed the effects of fuel channel aging

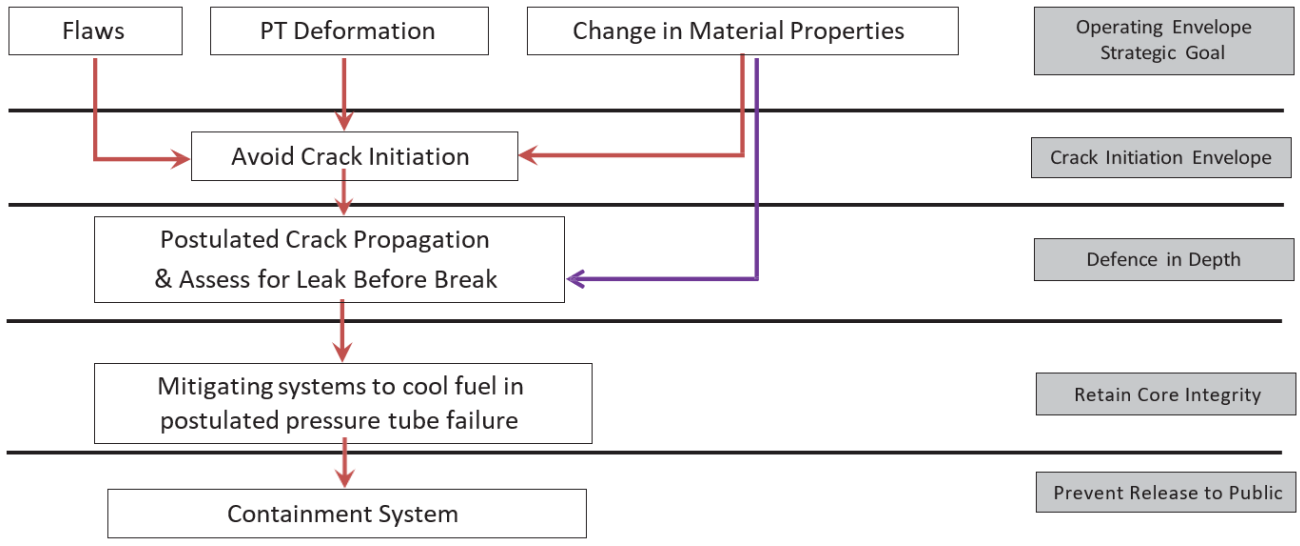


FIGURE 11 – MANAGEMENT OF FUEL CHANNEL AGING AND DEFENSE IN DEPTH

on all units, and confirmed that planned aging management strategies, including application of available mitigation options as required, will demonstrate margin on fuel channel fitness-for-service limits for operation of the Pickering NGS units to their projected Units EFPHs.

OPG will continue to perform in-service inspections in planned outages to verify the condition of the core and to confirm that the unit is fit for service for the planned operating period. If at any time emergent results, research findings, or industry operating experience challenges the validity of existing fitness for service assessments, OPG will evaluate the impact of these results in accordance with internal corrective action processes and licensing basis requirements.

4.1.3.2.7 A Review of Technical Degradation Related to Assurance of Fuel Channel Fitness for Service

OPG has a mature aging management program and tools in place to inspect and assess the condition of fuel channel components. A summary of the degradation mechanisms related to assurance of fuel channel FFS are provided in the following sections.

Wall Thinning

Wall thinning occurs as a result of irradiation effects from the fuel, coolant loading and temperature causing axial and diametral expansion of the PT. A reduced wall thickness results in an increase in stress which can impact the acceptability of small flaws in the PT inner wall. The location of maximum wall thinning typically coincides with the location of highest flux and temperature in the PT (Figure 12).

Based on extensive inspection data which is used to model and project into the future, wall thinning will not exceed the minimum wall thickness specified in the design. This ensures the PT will continue to perform its design function to contain the heat transport system and cool the fuel.

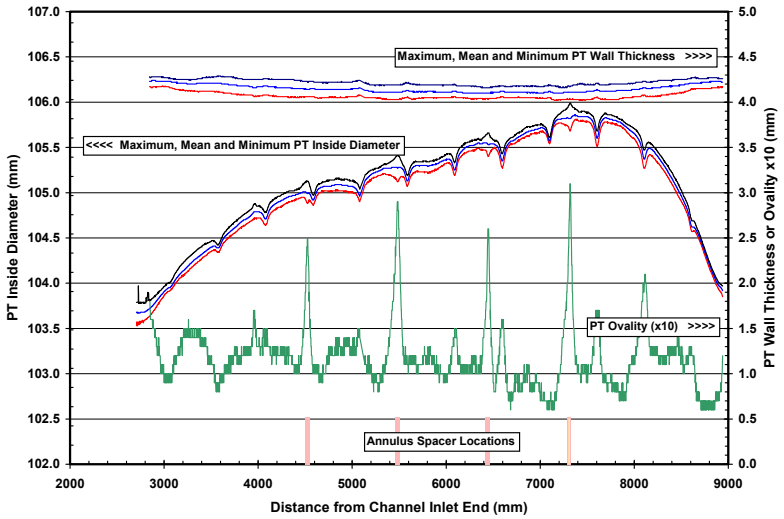


FIGURE 12 – EXAMPLE OF INNER DIAMETER, OVALITY AND WALL THICKNESS PROFILES ALONG THE LENGTH OF A TYPICAL CANDU PRESSURE TUBE

Diametral Expansion

Diametral expansion of the PT is caused by neutron fluence, coolant pressure and operating temperature. Diametral expansion can lead to reduced fuel cooling as the flow preferentially passes around and above the fuel bundles rather than through the center, spacer nip-up where the annulus spacer is loaded around the full circumference between the PT and CT and increases stresses on the CT and PT which can impact assessments of small flaws. The location of maximum diametral expansion typically coincides with the location of highest flux and temperature in the PT (Figure 12). Based on extensive inspection data which is used to model and project into the future, diametral expansion will remain within the maximum diametral limit specified in the design until the projected Units EFPHs.

Sag

PT sag occurs in the high temperature and high flux environment as a result of the weight loading of the PT, CT, fuel and coolant. Sag of the channel can affect passage of the fuel and inspection and maintenance tooling through the center of the core, and reduced gap between the PT and CT (Section 4.1.3.2.12). Sag of the fuel channel assembly (PT and CT) can also reduce the gap between the CT and other core reactor vessels internal components (eg. Liquid injection nozzles which inject large volumes of gadolinium nitrate in the unlikely case where a rapid shutdown of the reactor is required).

OPG has performed repeat inspections and maintenance to ensure there remains a gap between the CT and liquid injection nozzle. Further mitigating actions/maintenance through repeat gap inspections, increasing the gap between the components or removal of the affected fuel channel(s) are planned in the upcoming outages to support fitness-for-service to the projected Units EFPHs.

There continues to be extensive monitoring of the pressure tube sag measurements to provide indication of fuel or tooling passage concerns. Based on the measurements and projection EFPHs, there is no risk of exceeding the fuel or tool passage limits.

Axial Elongation

Pressure tube elongation involves the axial growth of the PT under the operating environment of elevated temperatures, pressures and neutron flux. Pressure tube elongation is accommodated by allowing the fuel channel assembly to slide axially on the journal bearings at each end of the calandria vessel (Figure 13). Generally, one side of the reactor face locks all fuel channels to prevent elongation (fixed end), while the second face remains free to allow fuel channel elongation and thermal expansion during operation and shutdowns in a single direction (free end). All Pickering NGS Units 5 to 8 fuel channels were "reconfigured" in the mid-2000s to allow growth in the opposite direction (i.e. switch the fixed and free ends). Fuel channels must remain on bearing which is the acceptable design configuration.

Each fuel channel may have a different elongation rate due to the differences

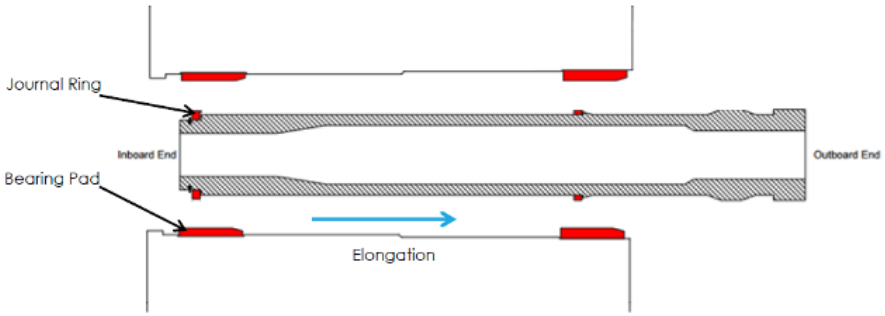


FIGURE 13 – FUEL CHANNEL ELONGATION BEARING AND JOURNAL RING

in channel power/flux as well as effects of microstructural variations between pressure tubes. To support understanding of each fuel channel's elongation rate, measurements are performed each outage to determine the growth of the channels over the operating period. These elongation rates also provide the projected time at which the fuel channel will remain on bearing. Maintenance activities include fuel channel shifting which either pushes or pulls the fuel channel to allow additional bearing travel on the free end. On-going maintenance and elongations measurements continue to be performed to ensure the fuel channels remain on bearing until the projected Units EFPH.

Flaws

Flaws can be created in the PT wall due to vibrations between the channel and fuel bundles, small debris in the coolant, local coolant concentrations or other sources. Flaws create sites for stress risers. The main source of PT flaws are small debris entrained in the heat transport system.

Ultrasonic inspections are performed regularly to monitor for new flaws or re-visit known flaws to ensure acceptable safety margins are maintained. Additional flaw geometry information, which could require a rubber replica, can be used in combination with finite element analysis methods to demonstrate acceptability of specific flaws.

Due to the high outlet rolled joint hydrogen isotope equivalent concentration ([Heq]) finding at Bruce Power, additional ultrasonic inspections have been targeted to demonstrate with a high degree of confidence that the flaw population density in the region of interest remains unchanged (Reference 21 and 22). Ongoing inspections, the results of which are submitted to the CNSC, continue to support this conclusion.

4.1.3.2.8 Deuterium Ingress and Hydrogen Isotope Concentration Measurement

The increase of hydrogen equivalent concentration ([Heq]) in the PT is a known aging mechanism that occurs over the operating life of the plant. During reactor operation the surfaces of PTs are subject to corrosion. This process results in the production of zirconium oxide and deuterium, with the primary source of deuterium being from the heavy water coolant of the heat transport system.

Some of the deuterium produced from corrosion is absorbed by the PT. The accumulation of deuterium in the PT impacts the resistance to crack initiation from in-service flaws and affects pressure tube material properties (such as fracture toughness, a measure of material resistance to propagation of a growing crack) over the life of the reactor.

Deuterium ingress has been extensively studied and characterized. The [Heq] level is higher at the rolled joint regions of the fuel channel as three sources of deuterium ingress are possible in addition to ingress across the inner surface of the PT. They are deuterium ingress from the stainless steel end fitting interacting with the pressure tube due to galvanic corrosion; general corrosion of the end fitting surface; and deuterium ingress from the galvanic cell that can establish in the crevice between the pressure tube and the end fitting. The locations of highest expected [Heq] represent a relatively small portion of the PT, at the rolled joint regions, and are shown in Figure 14.

The [Heq] within pressure tubes is routinely monitored by material surveillance activities which involve scraping a thin sample of the inside surface of the pressure tube in both the body of tube and rolled joint regions during inspection outages when the reactor is in a shutdown state. Hydrogen and deuterium concentrations are also measured in PTs periodically removed from the reactor. CSA Standard N285.4 (Reference 19) has established acceptance criteria, for measured hydrogen concentration, [Heq] in the form of maximum hydrogen concentration values and maximum allowable rate of change in hydrogen concentration.

In the body of tube region of the pressure tube, the CSA N285.4 requires the predicted concentration value of the next periodic measurement interval to be below the level at which hydrides are present at sustained operation conditions and the measured rate of change in [Heq] be within the acceptable range defined. All scrapes and removed PTs from Pickering NGS Units 5 to 8 meet this acceptance criteria or have been dispositioned.

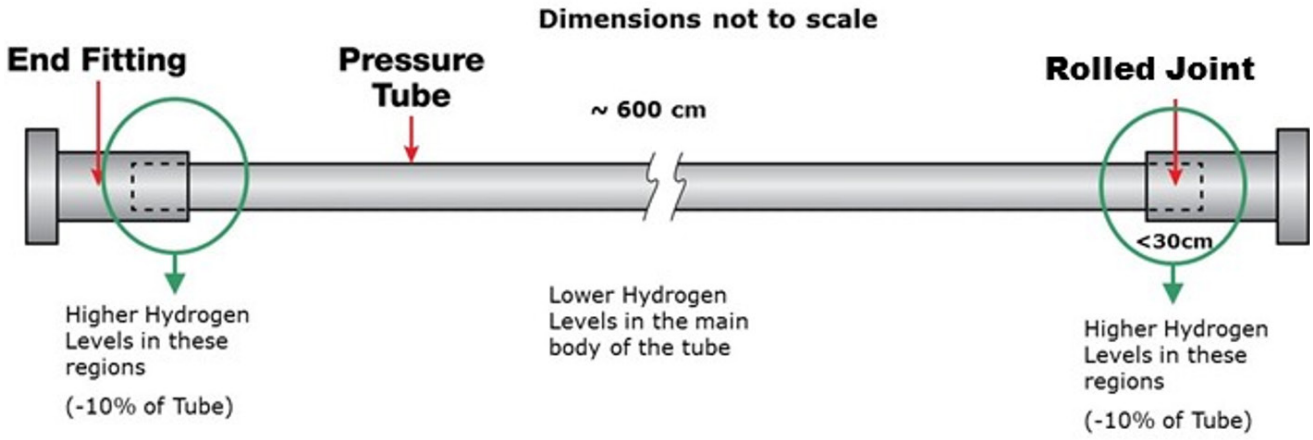


FIGURE 14 – FUEL CHANNEL SCHEMATIC DEPICTING RELATIVE LEVEL OF [HEQ] FOR GIVEN LOCATIONS ALONG A GIVEN PRESSURE TUBE

Following the high inlet and outlet rolled joint [Heq] findings at Bruce Power, there has been a significant review of the applicability and fitness-for-service impact on Pickering NGS Units 5 to 8. [Heq] of a similar magnitude to Bruce Power's measurement has not been observed at OPG units. In order to monitor for the OPEX finding, OPG has increased inspections to ensure that confidence in [Heq] predictions remains high, as outlined below.

The work completed since fall of 2021 and an industry [Heq] roadmap have been developed and submitted for Commission review (Reference 22) with an update provided in Reference 23. The [Heq] roadmap identifies key R&D activities, a target schedule and a summary of key deliverables to enhance existing [Heq] model predictions.

This review concludes that PTs installed in all OPG reactors remain safe for operation and continue to be fit for service even with postulated elevated [Heq] in these regions.

It was concluded that there are no active mechanisms for the formation of flaws that are at risk for crack initiation within the region of the pressure tube where elevated levels of [Heq] have been observed; therefore FFS is and will continue to be demonstrated at Pickering NGS Units 5 to 8 with sufficient inspection data (Reference 24).

OPG is confident that deuterium ingress is well managed by ongoing in-service and ex-service pressure tube material surveillance, R&D activities, execution of the Life Cycle Management Plan and related fitness for service assessments.

4.1.3.2.9 Fracture Toughness and the Predictive Models

Fracture toughness is the ability of a material to resist unstable crack propagation and fracture. Pressure tube fracture toughness reduces with PT operating time as a result of irradiation and accumulation of deuterium/hydrogen. Understanding the progression of reduction in fracture toughness properties is essential in the demonstration of FFS of pressure tubes as fracture toughness properties directly influence the ability to demonstrate pressure tube leak-before-break and protection against fracture.

OPG has continued to perform additional tests as part of the CANDU Owners Group (COG) Fuel Channel Life Management project, which is co-funded by Bruce Power, Point Lepreau and Canadian Nuclear Laboratories. The burst test program has performed over 50 pressure tube burst tests. The new results continue to further validate the current fracture toughness cohesive-zone model.

In light of the elevated [Heq] OPEX, burst tests in 2021-2023 have focused on higher [Heq] to validate the fracture toughness properties at these [Heq] levels (nominally targeting up to 300 ppm).

OPG is confident that planned activities provide for appropriate management of pressure tube fracture toughness in support of continuing demonstration of fuel channel FFS for the planned operating period of Pickering NGS Units.

4.1.3.2.10 Zr-Nb-Cu Spacers

In order to prevent the PT and the CT from coming into contact, each fuel channel has 4 spacers which maintains a gap to minimize coolant heat loss, allow for diametral expansion and permits circulation of the annulus gas for leak detection. These are of a loose-fitting design that can shift in location due to reactor vibrations and are regularly monitored to ensure maintenance of PT-CT gap (Section 4.1.3.2.12). The majority of spacers in Pickering NGS Units 5 to 8 are loose fitting Zr-Nb-Cu spacers with the exception of replaced channels following commissioning or those removed for PT sampling. Assessment of the Zr-Nb-Cu spacers integrity (i.e carry load of the PT, coolant and fuel, fatigue, wear and susceptibility to cracking) has been evaluated to 300,000 EFPH, although degradation of the spacer material is not considered life-limiting. There are no known degradation mechanisms for this type of spacer and therefore these spacers are not expected to be a FFS concern. As part of the monitoring of Zr-Nb-Cu spacer properties, a fuel channel was removed during the 2022 Unit 5 outage (spacers are currently being assessed) and another is planned for removal from Unit 7 in 2024. Results from the 2022 Unit 5 outage spacers are expected by Q4 2023. The removal and testing of these spacers is to continue to support our FFS understanding of these spacers and for confirmatory purposes. Examples of loose fitting Zr-Nb-Cu spacers are shown in Figure 15.

FIGURE 15 – LOOSE FITTING ZR-NB-CU SPACERS

4.1.3.2.11 Inconel X-750 Spacers

There are thirty-nine channels that have Inconel X-750 tight fitting spacers (31 in Pickering NGS Unit 8, 6 in Unit 7, 1 in Unit 6 and 1 in Unit 5). These spacers were installed as part of pre-service installation or during single fuel channel replacements throughout the life of the reactor. The tight fitting design has been shown to maintain its location after installation, but due to the nickel alloy composition experiences a degradation in strength properties due to a transmutation. OPG has performed in-service inspections (e.g. locate) and material surveillance to ensure Inconel X-750 spacer integrity, and continues to assess these spacers to demonstrate FFS up to the end of the commercial operation of the Units. Examples of Inconel X-750 tight fittings spacers are shown in Figure 16.

The program to monitor Inconel X-750 spacer strength properties required removal of a fuel channel Unit 8 in 2021. The Unit 8 spacers have experienced the longest operating time of Pickering NGS Units 5 to 8 spacers. Visual examination, hardness, crush/strength and fatigue testing were completed. Based on the 2021 Unit 8 test results, FFS of all Pickering NGS Units 5 to 8 Inconel X-750 spacers is demonstrated to 264,000 EFPH. With additional test

results and assessment from Darlington Unit 3 Inconel X-750 spacers, which is expected to be available by late 2023, OPG is confident the additional test data will provide confidence in spacer integrity to the units' projected end of commercial operations EFPH.

FIGURE 16 – INCONEL X-750 TIGHT FITTING SPACERS

4.1.3.2.12 Pressure Tube to Calandria Tube Contact

As part of CSA N285.4, PT to CT contact is an unacceptable condition and requires dispositioning per CSA N285.8 should this occur. If the [Heq] in the pressure tube is sufficiently high, PT to CT contact can lead to a locally high concentration of solid hydrides due to the temperature difference between the PT and CT. With enough hydrogen and time, this can result in the formation of brittle hydride blisters, which could crack and cause PT failure (Figure 17). In order to ensure that there is no PT to CT contact, inspections are performed and, if required, loose fittings spacers are re-positioned to increase the gap between the pressure tube and calandria tube.

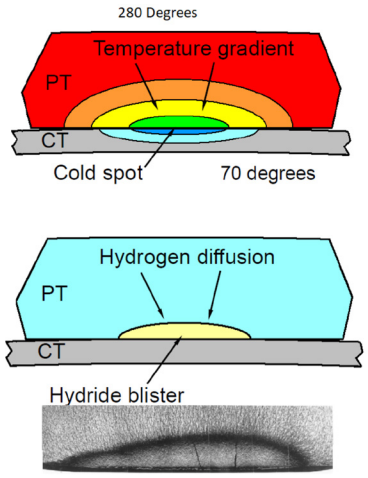


FIGURE 17 – PRESSURE TUBE TO CALANDRIA TUBE CONTACT

Due to the loose fitting spacers potential for mobility, assessments are performed for Pickering NGS Units 5 to 8 to determine the risk of pressure tube blister formation due to PT to CT contact. Based on the probabilistic assessments, the risk of blister formation in Pickering NGS Units 5 to 8 remains below the acceptable limit in CSA Standard N285.8. with use of the channel specific probabilistic blister susceptibility assessments. The program to assess the risk of blister formation and relocate loose fitting spacers as required will continue on Pickering NGS Units 5 to 8 until the new end of commercial operations.

4.1.3.2.13 Probabilistic Reactor Core Assessments and Uncertainty Analysis

To comply with CSA Standard N285.8 (Reference 20), OPG completes several FFS assessments to demonstrate that the risk of reactor operation remains low and within the station safety analyses. These include demonstration of protection against fracture of the PT, risk of flaws resulting in PT failure, analysis of leak-before-break and PT-CT contact. These assessments utilize

inspection data collected from the units to develop models and distributions to predict future conditions.

4.1.3.2.14 Fuel Channel LCMP Compliance with REGDOC-2.6.3 Aging Management

OPG's aging management program and the FCLCMP are compliant with REGDOC-2.6.3, Aging Management (Reference 25). REGDOC-2.6.3 sets out CNSC requirements for managing aging of structures, systems, and components of a power reactor facility, and also provides guidance as to how these requirements may be met. The REGDOC-2.6.3 document is built upon industry best practices, IAEA Safety Guide NS-G-2.12 (Reference 26) and supersedes CNSC regulatory document RD-344 (Reference 27) on aging management.

In order to support Pickering operation to the projected Units EFPHs, OPG updates the FCLCMP on an annual basis. This FCLCMP is also supported by the technical basis document for fuel channel and PT fitness-for-service.

4.1.3.2.15 Summary

The fuel channel program produces fitness-for-service assessments that are aligned with all licensing requirements. Based on the established programmatic controls for managing fuel channel aging, which include an extensive reactor inspection program, sound technical assessments, and the implementation of mitigating measures where required, OPG is confident that Pickering fuel channels will remain fit for service to the projected Units EFPHs.

4.1.3.3 Climate Change

For decades, OPG's world-class workforce has devised a blueprint for a carbon-free future. With clean coal closures, conversion of the Atikokan Generating Station to renewable biomass, the Darlington Nuclear Refurbishment, the expansion of hydro generating assets, and through clean power partnerships like the Gull Bay micro grid and the Nanticoke Solar facility, OPG is one of the most diverse, experienced generators in the world.

In 2020, OPG introduced a new climate change plan to create a cleaner environment to help tackle climate change, with the goal of becoming a net-zero carbon company by 2040 and helping the markets that OPG operates in achieve net-zero carbon economies by 2050. The guiding principle of this climate change plan is to be the catalyst that enables the transformation to clean economies, doing this in the most efficient and responsible way possible and respecting the best interests of the community.

Tackling climate change will take a combination of electricity generating technologies and innovative solutions. To reach these goals, OPG has implemented a four phase Climate Change Action Plan:

- Mitigate Carbon Emissions: OPG is working towards the electrification of the economy, addition of clean power (hydro, nuclear, and renewable), and reduction of emissions in natural gas generating stations through means such as carbon capture.

- Adapt to the Impacts of a Changing Climate: OPG will continue to invest towards all generating asset-based climate vulnerabilities to ensure continued production of clean and reliable power.

- Innovate and Deploy New Technologies: OPG will continue to innovate through investments such as small modular reactors, deploy nature-based climate solutions, and increase OPG's aggregate resource pool of distributed energy resources to meet changing electricity demands.

- Lead the Decarbonization of Ontario's Economy: OPG will continue to lead in and share the expertise to help decarbonization through small module reactors and hydro development, electrification infrastructure, and sustainably focused operational excellence.

Optimizing the shutdown of Pickering NGS is part of this climate change plan. Continuing to operate Pickering NGS Units 5 to 8 to the end of December 2026 safely and reliably will provide greenhouse-gas free power to the people of Ontario.

4.1.3.4 Innovation at Pickering NGS

With new and smarter technologies becoming part of our everyday lives, OPG is leading the industry in innovation. OPG's Enterprise Innovation Team, also known as X-Lab, is innovating with purpose and working to ensure OPG is at the forefront of technology in the energy industry. Examples are as follows:

- Usage of Remotely Piloted Aircraft Systems to assist with the structure, component or equipment inspections (Figure 18);

- Deployment of a state-of-the-art robot (as known as Spot to support activities such as teleoperation, remote operation of objects, remote and autonomous radiation surveys, thermal imaging and pan/tilt/zoom camera, thermal anomaly detection, etc. (Figure 19 and Figure 20); and

- Deployment of virtual tours (OPG Streetview) (Figure 21) and 3D scanning technology (Powerview).

FIGURE 18 – REMOTELY PILOTED AIRCRAFT SYSTEMS

FIGURE 19 – BOSTON DYNAMICS SPOT

FIGURE 20 – OPERATOR VIEW OF SPOT THERMAL IMAGING CAMERA

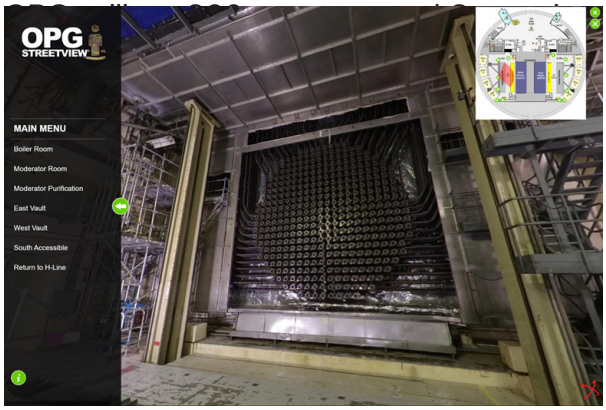


FIGURE 21 – OPG STREET VIEW APPLICATION

4.1.4 Public and Indigenous Communication

4.1.4.1 Public Information Program

OPG recognizes that members of the public, stakeholder groups, and local communities have a legitimate interest in the operations of the Pickering NGS. This includes the way it is operated and managed, the means by which OPG keeps the risks to human health, safety and the environment at a low level.

OPG believes in open and transparent communication in a timely manner to maintain positive and supportive relationships and confidence of key stakeholders. OPG's Corporate Relations and Communications organization adheres to the principles and process for external communications as governed by the nuclear standard N-STD-AS-0013, Nuclear Public Information and Disclosure. This document guides OPG's external community stakeholder activities, public response requirements for issues or significant events and OPG's standards for inquiries from the public.

OPG's community relations and public information program has been recognized as a strength by national and international utility peers. OPG benchmarks current practices amongst other industries to ensure continuous performance improvement.

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

Due to the COVID-19 pandemic, 2020 and 2021 were unique years for OPG's public information outreach program. However, OPG continued to provide community outreach in a number of ways. In 2022, OPG's public information outreach program gradually transitioned back to in person and hybrid programming, with modifications to follow corporate and public health and safety guidelines, as referenced in section 4.1.4.1.4.

The primary focus area for the engagement activities, in addition to the public at large, includes three municipalities proximate to the Pickering NGS site including the host community (City of Pickering) and adjacent

communities within 10 km of the project (the City of Toronto, the Town of Ajax, and the Town of Whitby). The 10 km radius is consistent with the Pickering NGS Detailed Planning Zone for nuclear emergency planning purposes, an area where residents are most familiar with nuclear plant operations and regularly receive information station and operational updates.

OPG ensures the public and stakeholders with a potential interest in Pickering NGS 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.

Pickering NGS Stakeholders and audiences may include but are not limited to:

- Indigenous Nations and communities;
- Residents in the vicinity of the Pickering NGS and the public;
- Established community committees such as the Pickering Community Advisory Committee 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

4.1.4.1.1 Communication Methods

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

Advertisements and Letters

Public notifications are prepared and distributed to announce upcoming hearings and other licencing activities, via a press release (as required), stakeholder letter(s), web communications, the PN community newsletter (Pickering Neighbours) and advertisements in local print media (as required).

Website

The OPG website for Pickering NGS is updated on a regular basis as new information becomes available. The web site 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 consultation program.

Pickering NGS Information Centre Phone Line

Our Pickering NGS Information Centre line continues to be maintained. Messages will be checked and responded to on weekdays and any required follow-up will be completed in a timely manner.

Media Relations

Ongoing liaison with respect to operations and licensing activities will be initiated and maintained by OPG with reporters and news editors for both electronic and print media.

OPG Employee Consultation Activities

The employee communication program will include articles written in OPG wide and Pickering NGS specific employee media. Staff presentations and information sessions will continue to be held. A specific intranet site will continue to be maintained to facilitate communication with employees.

Key Stakeholder Briefings and Interviews

Interviews and briefings will continue to be conducted to present information and provide an opportunity to have questions and comments addressed. Regular updates will be presented to municipal representatives, established community committees including the Darlington and Pickering Community Advisory Committees and Darlington Nuclear Health Committee and other key stakeholders on a frequency commensurate with key project activities and milestones. Feedback from these meetings will be recorded for response and issue management.

Workshops

Key stakeholders with a high level of interest in the operations and project activities may be invited to participate in workshops that will involve meaningful discussions and provide substantive input to various phases of the project.

Information Sessions

Information sessions (in person or virtual) advertised broadly and open to any participants will provide an opportunity to learn Pickering NGS and the licensing phases/activities and provided comments and/or have questions answered.

Information Centre

Pickering NGS continues to operate an information centre, as referenced in section 4.1.4.1.3.

Social Media

OPG maintains a presence on social media (Facebook, Twitter, Linked In and Instagram) and shares information through these media.

4.1.4.1.2 Station Reporting

OPG regularly and proactively provides information to the public on its facility activities. For operational status changes or unscheduled operations that may cause public concern or media interest, OPG follows a protocol to notify key community stakeholders in a timely manner. OPG maintains a duty on-call organization 24 hours a day, seven days a week.

In conjunction with the Durham Emergency Management Organization, OPG maintains a protocol to notify key community stakeholders when there are activities or

events that have the potential to garner public or media interest. The purpose of the protocol is to ensure contacts in the 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.

On a quarterly basis, OPG publicly posts performance reports on station operations on OPG's website and shares this document electronically with key stakeholders. Additionally, since 2014, OPG issues a quarterly Environment report in an easy to read and understandable format.

4.1.4.1.3 Welcoming Visitors

Pickering NGS maintains an Information Centre to host public, community groups and students. Visitors can find information on operations, technology, future plans and current issues, and staff are available to have conversations and answer questions. Students are offered curriculum-based educational presentations, introductions to CANDU technology and STEM-based activities.

OPG encourages community groups to use the Information Centre for events unrelated to the industry. This meeting room and event space were built and refreshed in 2023 to help build greater ties to the community. By creating a meeting space, organizations otherwise unrelated to the industry gain a comfort and familiarity with the technology.

4.1.4.1.4 Community Outreach

Outreach activities to interested groups and communities may include:

- Station tours, presentations, virtual tours and simulator tours to community groups, key stakeholders, industry partners and the general public.

FIGURE 22 – PICKERING NGS STATION TOUR – 2022

- Each quarter, OPG distributes Neighbours Newsletter for the Pickering NGS, which is distributed to about 120,000 residents and businesses within ten kilometers of Pickering and posted online.

- The Information Centre is available to community groups to host events related and unrelated to the industry.

- OPG's annual public open house, which is widely advertised with a focus on the nearby community. Staff from OPG and various industry partners are present to answer questions and provide information to participants. OPG hosted a community open house in 2022 following a two-year hiatus due to the COVID-19 pandemic. More than 2,400 people from across the Durham Region and the Province attended the event.

FIGURE 23 – OPEN HOUSE AT THE DEC – FALL 2022

FIGURE 24 – TUESDAYS ON THE TRAIL – SUMMER 2022

Pickering NGS's Stakeholder Relations and Communications continues to provide quality programs within our host community. Prior to the COVID-19 pandemic, our annual March Break Blitz and Tuesdays on the Trail programs reached thousands of community members throughout the winter and summer months. Since the start of the pandemic, OPG has pivoted to continue to provide free, educational and quality programs through virtual and curbside pickup platforms. Since 2021, OPG's Virtual Power Kids program reached over 120,000 participants. Although the pandemic has been challenging in many ways, OPG has developed alternative ways in which it can continue to engage, share information and build relationships within our host communities. In 2022, OPG returned to its in-person Tuesdays on the Trail program and has returned to in person March Break programming in 2023.

4.1.4.1.5 Community Committees

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

- The Pickering Community Advisory Committee 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 issues. This committee is chaired by the Durham Region Medical Officer of Health.

FIGURE 25 – PICKERING NGS COMMUNITY ADVISORY COMMITTEE TOUR MARCH 2023

FIGURE 26 – TAKING PRIDE IN PICKERING TREE PLANTING – FALL 2022

OPG meets often with stakeholder groups, elected officials and municipal representatives, as well as with stakeholder groups that have an interest in nuclear, safety, energy, climate change, and/or environmental issues.

4.1.4.1.6 Environmental Partnerships and Programs

Pickering NGS is committed to biodiversity work on OPG property and on public lands within the host community. Pickering NGS's biodiversity program continues to provide plantings, pollinator gardens, and numerous other initiatives. More than 2,700 native trees and shrubs have been planted in the vicinity of Pickering NGS since September 2018 by OPG staff and community volunteers.

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 NGS Information Center houses a hatchery and OPG partners with a local school for the program. During non-COVID years, OPG would host the students at the Info Centre and provide a presentation about Atlantic Salmon history in January, as well as organize the release of the fish in June with the school. Since 2021, the program has run virtually reaching thousands of students across the province. OPG supported the virtual classroom hatchery episodes with a segment on how OPG generates electricity. In 2023, OPG has returned to running the Bring Back the Salmon program in person.

FIGURE 27 – STUDENTS HELPING TO RAISE SALMON EGGS – JAN. 2023

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

In 2020, OPG's Pickering Nuclear Generating Station was recognized by the City of Pickering with an Environmental Civic Award for its contribution to conserving and enhancing its natural environment.

4.1.4.1.7 Employee Communications

The Corporate Relations and Communications (CRC) Department's Employee Communication division at Pickering NGS works to keep employees informed on station, fleet-wide company and industry issues in a timely, accurate and consistent manner by working collaboratively with station leadership and staff to develop and implement strategic station-wide communications programs.

These comprehensive programs support Pickering's vision of working together, as well as overall business objectives, work programs and goals to effectively drive improvements and support the safe and reliable operations of the plant. Additionally, the messages used within these communication programs help to foster alignment, engagement and teamwork amongst the intended audiences.

The internal CRC team develops annual communications strategies to support Pickering's business plans and vision, major on-site projects, initiatives and events. They include selected services and materials designed to achieve the communications goals. This ensures consistent communications have a positive, long-term impact on workforce alignment and engagement using a reliable two-way information exchange by way of the supervisory chain and meaningful face-to-face communication with direct reports, as well as more informal and formal online information channels. Pickering site communications anchor and reinforce key messages through multiple channels, including but not limited to face-to-face meetings, intranet websites, site-wide emails, posters and banners, in-station TV screens, and videos.

The CRC leads a number of initiatives throughout the year to measure and gauge the effectiveness of the strategies to promote a process of continual learning and improvement.

External evaluators and review teams continue to recognize the positive

contributions of internal communications on the culture at Pickering.

4.1.4.2 Indigenous Community Engagement

4.1.4.2.1 Indigenous Relations Policy

OPG is directed by a corporate wide Indigenous Relations policy that provides a framework for meaningful engagement with Indigenous Nations and communities and for the support of community programs and initiatives through its Corporate Citizenship Program.

The purpose of the policy is to work with Indigenous Nations and communities proximate to Pickering NGS and those that express interest in our operations at Pickering. Engagement includes dialogue on Pickering-related plans and activities, eliciting feedback and fostering opportunities through partnership and collaboration.

OPG is committed to engaging with Indigenous Nations and communities regarding nuclear operations and future projects. OPG's Indigenous Relations Policy provides a framework for engaging with Indigenous peoples and providing support for community programs and initiatives while respecting Aboriginal and Treaty rights which are recognized and affirmed under s.35 of Constitution Act, 1982.

Licence Amendment and Duty to Consult

The continued operation of Pickering NGS does not create any new adverse impacts on Aboriginal and/or treaty rights held by local Indigenous Nations and communities but does extend the known impacts and the ongoing mitigation efforts and OPG continues to engage with the local Indigenous Nations and communities to ensure awareness of impacts to rights. Further, OPG is committed, through this process, to meaningful engagement, building awareness of Indigenous perspectives and knowledge, and fulfilling the procedural aspects of the Duty to Consult while acknowledging the industry's legacy of the lack of meaningful engagement and consultation.

Engagement on Pickering NGS operations is focused on the Williams Treaties First Nations (WTFN) in whose treaty and traditional territory Pickering NGS is located. Over the course of OPG's engagement with the WTFN, the perspective that all life is connected has been shared and has helped frame OPG's approach to various plant and animal species – particularly those that are viewed as "invasive species" by the western world. Gleaning Indigenous Knowledge is a privilege that is earned through meaningful engagement, and it is gradually achieved as trust is developed. To that end, OPG continues to engage with the rights holders surrounding Pickering NGS to build an understanding of Indigenous Knowledge and values and how they can be incorporated into operational methodologies and practices. Through these engagements, OPG aims to not only share information on our operations but to develop awareness of the potential impacts on the Aboriginal and Treaty rights of the Nations and ways to mitigate those impacts or make accommodations for identified impacts.

Meaningful engagement takes time and effort and OPG is committed to working with the Indigenous Nations and communities to develop culturally appropriate frameworks and respectful protocols that incorporate their priorities and capacity needs.

On August 16, 2021, OPG established a Framework Agreement with the Curve Lake First Nation which allows for dedicated time and capacity funding to support ongoing, regular engagement on OPG's nuclear and renewable generation operations.

Regular monthly meetings were established in 2021 with Curve Lake First Nation through the Framework Agreement, which allowed meetings to occur on a regular basis with a focus on sharing information and updates related to OPG's nuclear and renewable generation operations.

OPG and the Mississaugas of Scugog Island First Nation also entered into a Framework Agreement in the fall of 2022 and work is progressing with Hiawatha First Nation to develop a similar agreement to support regular engagement.

In addition to the formal Agreements that support ongoing engagement, Pickering NGS invited Alderville First Nation, Rama First Nation, Beausoleil First Nation and Georgina Island First Nation, the Mohawks of the Bay of Quinte to engage on areas of interest including environmental monitoring, Pickering operations and economic and employment opportunities. Further, Pickering NGS has provided information to the Mississaugas of the Credit First Nation, the Métis Nation of Ontario Region 8 and Six Nations, who have all expressed interest in Pickering NGS continued operations and licensing activities.

Indigenous Community Meetings

OPG engages with these identified Indigenous Nations and communities on a regular basis to discuss plans such as end of commercial operation as well as station operations, environmental reporting, employment/procurement opportunities and other topics viewed as priorities by the communities. The Indigenous Nations and Communities are included in the external communication plan discussed in Section 4.1.4.

In 2021, the following areas of interest were discussed and addressed with local Indigenous Nations and communities (WTFN, Mohawks of the Bay of Quinte, Six Nations and Métis Nation of Ontario Region 8):

- Waste storage and transportation at Pickering NGS
- Thermal plume at Pickering NGS and potential impacts to fish and habitat
- Department of Fisheries and Oceans (DFO) authorization regarding fish impingement and entrainment
- Pickering End of Commercial Operations timeline
- Pickering Decommissioning timeline
- Environmental Monitoring Program

Some of the WTFNs have expressed specific interest in the DFO authorization, particularly as it relates to the Pickering NGS end of operations timeline and discussions are ongoing.

In 2022, engagement continued with the Métis Nation of Ontario (Region 8) on Pickering NGS, specifically related to the end of commercial operations process. In addition, OPG had discussions with Curve Lake, Scugog Island and Hiawatha regarding Pickering environmental initiatives such as monitoring of fish and groundwater and mitigation efforts in reducing impacts on endangered species.

Discussions were also held with Curve Lake, Scugog Island and Hiawatha on the plans for Pickering NGS with respect to the late-2022 announcement to seek CNSC authorization to operate Pickering NGS Units 5 to 8 to December 2026 and to conduct a feasibility study on potential refurbishment. In addition to in-depth discussions, personal phone calls were made to the Chiefs of the WTFN and the Saugeen Ojibway Nation in advance of the announcement to ensure they were informed ahead of time.

OPG will also respond to any questions, concerns or comments from Indigenous Nations and communities and peoples from elsewhere in the province as required. OPG intends to continue and improve upon its engagement activities by having more frequent and meaningful engagement supported by existing and future framework agreements with Indigenous Nations and communities.

4.1.4.2.2 Indigenous Advisory Council

All the local Indigenous Nations and communities are invited to participate in the Canadian Centre for Nuclear Sustainability and its Indigenous Advisory Council. The Canadian Centre for Nuclear Sustainability has Pickering NGS and its future at the forefront of its mandate and the Indigenous Advisory Council , launched in April 2021, serves as a body to both receive information about the site and offers advice and guidance to ensure Indigenous participation and perspectives are considered in relation to ongoing operations, projects, employment and business opportunities.

Indigenous Opportunities Network

The Indigenous Opportunities Network (ION) is a program aimed to increase the representation of Indigenous workers at OPG and within the broader energy sector.

To date, the ION program has placed over 100 Indigenous candidates in positions that match their career interests, qualification and skill sets, in the energy industry. Approximately 80-85% of candidates are in apprenticeships/skilled trades and 15-20% are employed with a professional skillset (such as project management)

4.1.4.2.3 Future Plans and Improvements

In the fall of 2021, OPG launched the Reconciliation Action Plan (RAP), which outlined the commitment to advancing reconciliation with Indigenous peoples through relationships, economic empowerment, employment, and leadership. The plan is a public document that includes

specific actions and commitments with clear deliverables and timelines and was developed to serve as a roadmap to reconciliation. Two key commitments within the RAP include growing OPG's economic impact to $1 billion within ten years and increasing Indigenous representation across OPG's workforce, at all levels of the organization, within ten years. An annual report was published in the fall of 2022 which noted that the first-year goals were achieved through much work, dedication and collaboration with communities. The Plan is being refreshed throughout 2023 to build on the existing targets and develop new, additional commitments.

Some highlights from the 2022 RAP include:

- Delivered approximately $77 million in economic benefits to Indigenous communities and businesses, with $56 million in Indigenous procurement and $21 million in distributions from our equity partnerships to our Indigenous partners.

- Issued 69 new purchase orders against a target of 30 Indigenous vendors and added a total of 27 new Indigenous vendors to our database.

- Hired and secured placements for 24 skilled Indigenous employees, against a commitment of 20, through our Indigenous Opportunities Network (ION).

- Established an internal RAP Working Group and Steering Committee to ensure tracking and reporting on commitments and actions.

For 2023 and beyond, an overarching Indigenous Engagement Plan is also being developed by OPG in collaboration with the Indigenous Nations and communities proximate to OPG's nuclear operations which will support the prioritization and resource allocation required to continue meaningful engagement on Pickering NGS's operations.

4.2 Other Considerations for Continued Operations

4.2.1 Cobalt-60 Production

Continued operations of Pickering NGS Units 5 to 8 will ensure additional supply of Cobalt-60, a critical medical isotope used in lifesaving medicine. Pickering provides 20% of the North American supply and 10% of the world's supply of Cobalt-60.

In 2021, the station's Cobalt team harvested and discharged 21 Cobalt-60 adjuster assemblies during each of the planned maintenance outages on Units 6, 7 and 8. There are an additional 21 adjuster assemblies being harvested in each future planned maintenance outage on Units 6 (in 2023 and 2025), Unit 7 (in 2024), and on Unit 8 (in 2023 and 2026). The Cobalt team then ships the Cobalt to Nordion Canada Inc., an Ottawa-based health sciences company. From there, the isotope is shipped across the globe to sterilize 40 percent of the world's single-use medical equipment, heart valves and other implants. Cobalt-60 is also used to sterilize medical equipment including swabs, gloves and gowns used in medical settings. The isotope is also used to irradiate food to remove pathogens and parasites, and to diagnose and treat cancers.

5.0 End of Commercial Operation and Safe Storage

As required by licence condition 15.4 of the Pickering NGS operating licence, plans for the end of commercial operation (ECO) for Pickering NGS are to be implemented and maintained. The Sustainable Operations Plan (SOP) identifies and plans for the anticipated unique challenges and changes as ECO approaches and describes the arrangements and activities that are planned to ensure continued safe and reliable operation of Pickering NGS during the transition to the end of commercial operation. The SOP covers the period starting 5 years prior to the final shutdown of the first of the six operating units and ending with the final shutdown of the last operating unit.

In the context of the SOP, the term "anticipated unique challenges and changes" refers to unique people, plant or process issues arising due to Pickering NGS's end of commercial operations. Specifically, a unique challenge or change refers to an activity, or activity frequency or extent, for a nuclear power plant that would not otherwise occur were it not for a specific event taking place (e.g. approach to ECO). The unique challenge or change may be addressed by existing measures (programs, processes, procedures, etc.) or it may require additional measures (e.g. revision to governance) or actions. The annual SOPs will continue to be consistent with the current Licence Conditions Handbook (LCH). In 2022, a SOP action was created to review all open and completed SOP actions to address the proposed change in operation of Pickering NGS Units 5 to 8 to December 2026 pending regulatory approvals. The results of this reassessment will be discussed in the 2023 SOP. If the continued operation of Pickering NGS Units 5 to 8 is approved (new ECO in December 2026), the 2023 and 2024 SOPs will include Pickering NGS Units 1 and 4 and Units 5 to 8, and the 2025 and 2026 SOPs will only include Pickering NGS Units 5 to 8.

As well, Pickering NGS is required to produce and implement a Stabilization Activity Plan (SAP), which includes planning for the ECO and for the subsequent lifecycle phases including decommissioning. The purpose of the SAP is to describe the arrangements and activities that ensure a safe and efficient transition from the end of commercial operation (permanent shutdown) to the SWS phase. SAP implementation activities commence when the first unit is permanently shut down and cease once the entire plant is declared to be in SWS. Stabilization will result in issues and activities that are unique by virtue of their frequency and/or scope.

It is expected that the scope and definition of the SAP will increase as ECO approaches and Stabilization planning progresses. Similarly, the SAP should be considered strategic as well as evolutionary, as strategies and plans will also evolve as planning progresses. The SAP describes management of the

transition to SWS, as required by Section 15.4 of the Pickering NGS LCH.

In addition to satisfying the regulatory requirement, the SAP also provides a valuable mechanism for OPG to summarize the physical changes that will be made to the plant as well as the process and programmatic updates that are required to transition the station safely and efficiently from commercial operations to SWS. The summary ensures that the various planning elements are aligned internally and that there is alignment with broader strategic goals, such as the decommissioning program outlined in the Preliminary Decommissioning Plan (PDP).

6.0 Safety and Control Areas

Pickering NGS continues to operate in a safe manner within the bounds of the operating policies and operational safety requirements. The following provides a brief description of the Safety and Control Areas (SCA), highlights strengths and achievements in those areas and updates information since the last licence application, including planned improvements to support operation until December 2026.

OPG has continued to transition to newer codes and standards and Appendix B contains a list of Compliance Verification Criteria Documents by SCA, that Pickering NGS is now in compliance with since the current licence was renewed in 2018.

6.1 Management System

OPG's mature and effective nuclear management system provides the framework for programs, standards and processes which collectively ensure that OPG's Pickering NGS operates safely and that safety is the foremost consideration in management decisions and actions.

Every employee in the organization is responsible and held accountable for complying with the expectations of the nuclear management system, 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.

There are no major changes required to the programs and processes for the operation of Pickering NGS Units 5 to 8 to December 2026 and this program continues to comply with the requirements of the licensing basis. The following sections provides a description of some current improvements and initiatives in this area.

6.1.1.1 Management System

OPG's Nuclear Management System is reviewed through inspections, self-assessments, benchmarking, and independent audits. Program performance is assessed in the areas of management and leadership, performance execution and continual improvement. Oversight ensures that problem areas are identified and corrective actions are established. In 2022, an internal audit was performed of the overall OPG program in support of nuclear operations. The audit team

assessed line performance through interviews with multiple program owners, meeting observations and documentation reviews. This performance-based audit of the Nuclear Management System Administration Program identified that the managed system controls are effective. Where opportunities for improvements were identified, action plans were developed and implementation is ongoing.

6.1.1.2 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's operating strategy.

Nuclear Staffing Plans at Pickering 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 adequate qualified staffing levels are maintained for safe reliable operation of Pickering NGS. This activity will continue to support operation of Pickering NGS Units 5 to 8 through the revised end of commercial operation dates.

OPG shares the confidential nuclear staffing plans annually with CNSC staff, in conjunction with CNSC staff's review of the SOP.

Recruitment and Onboarding

OPG has a number of internal and external recruiting programs that are administered through the Recruitment and Onboarding team within the Human Resources organization. The Recruitment and Onboarding organization works with hiring managers to source and attract a diverse and high performing workforce.

Sourcing strategies are multi-faceted and include partnerships with educational institutions, use of Building Trade hiring halls, internal and external job posting and career sites, recruitment advertising, direct sourcing, retained/contingent search recruitment agencies, augmented staff agencies and succession planning discussions.

Knowledge Management

Department Managers have implemented Knowledge Transfer and Retention Plans to ensure critical skills are retained in the event of departure of experienced staff and to increase proficiency of new workers more quickly.

The Knowledge Transfer and Retention plans use various techniques to measure staff proficiency levels, and they incorporate innovative means to transfer knowledge with a focus on job preparation and learning to maintain high levels of performance. The plans are continuously reviewed for both progress and effectiveness, with monitoring and oversight functions established within respective departments.

Succession Planning

OPG has a mature succession planning program and fully integrated succession planning process. Management uses common tools (e.g. 9 box rating scale) to ensure a standardized approach

across the organization when they conduct succession and talent reviews. To measure the effectiveness of our succession and development planning programs, OPG has implemented a Talent Health Dashboard to show progress on key focus areas and measures. This includes a measure on the percentage of roles with "Ready Now" candidates.

OPG's Nuclear fleet has well-defined career paths for critical senior leadership roles and manages succession planning through succession forecasting. Succession forecasts are prepared annually and are periodically reviewed throughout the year. Peer teams across the fleet are responsible for preparing a succession forecast for nuclear leadership roles. The Operations Leadership Team prepares the succession forecast for senior operations leadership positions, where they pro-actively focus on timing of leader transitions and targeted development to advance successor readiness.

OPG has a healthy pool of succession candidates for the critical senior nuclear leadership roles for the next 5 years and beyond and has targeted development plans to prepare candidates for the increased level of scope and accountability. Furthermore, the Nuclear Operations pipeline for licensed positions is healthy. OPG actively monitors attrition rates and has staffing plans and strategies in place to mitigate potential staffing risks as the organization approaches Pickering End of Commercial Operations (ECO). At Pickering, staffing risks are managed by each department and plans to mitigate any identified risks are monitored at the People Health Committee.

OPG is confident that its staffing management programs will ensure it has the required competent and qualified staff to support continued operations to December 2026.

6.1.1.3 Safety Culture

Nuclear Safety Culture is an organization's values and behaviours—modeled by its leaders and internalized by its members—that serve to make nuclear safety the overriding priority.

OPG has defined the elements that make up a healthy nuclear safety and security culture, and the operational and organizational components by which it is implemented. These are formally defined, with performance criteria for each, as the Traits of a Healthy Nuclear Safety and Security Culture.

In March 2022, Pickering NGS conducted a station wide nuclear safety and security culture assessment that consisted of a staff survey followed by an on-site evaluation by an assessment team who conducted document reviews, staff interviews, and focus group sessions. The assessment focused on perceptions, attitudes and behaviours of the organization.

The assessment concluded that Pickering NGS has a healthy nuclear safety and security culture, healthy respect for nuclear safety is evident in the organization, and that nuclear safety is not compromised by production priorities. Station personnel feel they can challenge

any decision if needed. Areas for improvement were documented following the assessment and actions taken to address the findings are tracked.

OPG will continue to conduct these station wide assessments periodically with the next assessment scheduled for 2025.

In addition, OPG has implemented a nuclear safety and security culture monitoring panel to monitor the process inputs that are indicative of the health of the organization's nuclear safety and security culture. The panel, made up of the senior plant leadership team, meets three times a year to discuss the 11 nuclear safety and security culture traits.

6.1.1.4 Operating Experience (OPEX)

The OPEX process is comprised of three elements: external OPEX, internal OPEX, and the use of OPEX. Combined, these elements meet the objectives by ensuring that lessons learned are reviewed and appropriate actions taken. In addition, the process ensures that lessons learned are incorporated into training and qualifications.

Over this licence period, Pickering NGS made improvements to its OPEX process and tools, use of OPEX and the sharing of lessons learned. The process and tool improvements include revision of the program governance as well as development of the OPEX database. The updates were made to simplify/clarify requirements, reflect organizational changes, and incorporate suggested improvements from internal/external assessments. Sharing of internal lessons learned with other OPG stations was improved by updating the recommended requirements for internal OPEX sharing for applicability of lessons learned.

In addition, the development of the OPEX database provides a central depository of external OPEX and facilitates access by all OPG staff to view dispositions of external OPEX as well as monitor how the external OPEX is being reviewed and implemented.

6.1.1.5 Materials Management

The Materials Management program ensures effective and efficient planning for, and procurement of, items and 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 site. Supply Chain confirms all the quality aspects for receipted materials based on designated quality requirements. Vendor quality is maintained through audits and receiving inspections.

All suppliers to OPG are required to have implemented a Counterfeit, Fraudulent and Suspect Items (CFSI) program and this is verified by supplier audits carried out by OPG. In addition, 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.

OPG's CFSI Program is aligned to industry best practices. It provides direction for the prevention, detection, and control of CFSI from entering Ontario Power Generation supply chain and Nuclear Power Plants

(NPP), and is applicable to all aspects of the Nuclear business including all equipment, systems, services, and activities.

6.1.1.6 Records management

The Records Management program establishes a set of standards and procedures for the management of OPG's information throughout its life-cycle and the advancement of electronic, digital, and mobility solutions that provide tools that effectively and efficiently capture, change, issue, and make content available. This program continues to be effective with the managed system controls.

OPG's software, Asset Suite (AS), was upgraded in 2022 to version AS-9, replacing the 10-year-old AS-7 software. The AS-9 upgrade addresses the technology obsolescence of AS-7 while bringing hundreds of functional and performance enhancements and changes to AS. These upgrades include an improved modern user interface, a global search bar, and simplified navigation. AS-9 is now hosted in OPG's Microsoft Azure Cloud, incorporating industry best practices used in the energy sector, and can be accessed through modern browsers (Edge/Chrome). The AS team is also working on performance improvements, which should be added shortly.

Additionally, the cybersecurity encryption upgrade to Microsoft dual key encryption is underway to improve records security and ease of operation across multiple Microsoft platforms, including Cloud solutions. These system improvements are expected to benefit ongoing OPG business operations.

6.1.1.7 Business Planning

OPG's business planning process directs the organization's resources to meet challenging but attainable operational and financial targets associated with meeting the strategic direction for the business.

A three-to-five-year horizon is assessed in detail and is supported by a complementary long term (20 years) outlook based on higher level information to better identify and react to emerging strategic shifts within the nuclear industry.

Pickering aims for continuous improvement and industry top quartile performance in all areas. Where gaps in performance are identified, improvement initiatives are developed to ensure the established targets are met. These initiatives, and their associated milestones, are monitored and discussed at various station oversight meetings on a routine basis. Plans address how initiatives will be implemented by the various station departments. Once implemented, results are monitored continuously through review of the station performance metrics, and if performance gaps still exist, initiative plans are revisited or further developed as required.

The Pickering Generation Plan specifies the major outage scope and durations as well as the operational performance targets, such as Forced Loss Rate, established during the business planning process. Additional scope has been added in future outages for Pickering NGS Units 5 to 8 to support operation to the end of 2026. Most recently in 2023, additional fuel channel, feeder and steam

generator scope was completed in the Unit 6 planned maintenance outage. The generation planning process is designed to incorporate outage scope requirements and changes based on major component life cycle management plans and up-to-date inspection results and unit conditions.

6.1.1.8 Business Continuity

The Business Continuity Program establishes a managed system for business continuity, and to provide direction related to business and operational continuity, and recovery planning. It ensures that approved response strategies and recovery priorities are in place for critical functions during incidents that may impact business continuity. The Business Continuity Program requirements defined in governance are met and are effectively implemented to support safe and reliable operation of Pickering NGS.

OPG Nuclear has continuity plans in place for Pickering NGS to address the potential of natural and technological hazards, as well as the infectious disease pandemic scenario. These plans were last revised in 2021 to incorporate learnings from the COVID-19 pandemic, such as the inclusion of a formalized contingency staffing plan and specific plan activation and deactivation criteria for identified risks. Plans will continue to be reviewed every other year for updates as required.

OPG has an enterprise-wide Infectious Disease Response Guideline. This response guideline documents OPG's strategic approach to respond to any infectious disease introduced into the workplace from a singular incident up to a full pandemic response. OPG successfully implemented the Nuclear Continuity Plan procedures and Infectious Disease Response Guideline throughout the COVID-19 pandemic. Sufficiency of the plans outside active implementation is assured through annual exercise requirements such as the execution of an exercise, tabletop, or drill. These scenarios must rotate through 4 different potential situations - (1) Staff Unavailability (including key staff and large numbers of staff); (2) Facility Impairment or Loss (this includes power disruptions, etc.); (3) IT, Communications, Computer Systems or other tools Unavailable/ Data Loss; (4) Unavailability of Critical Suppliers or Services. The lessons learned from the exercises must be submitted to the program owner (Enterprise Emergency Management) and incorporated in line of business document updates as required.

OPG conducted a review of the COVID-19 pandemic response to identify and address any adjustments needed for future business continuity.

6.2 Human Performance

The Human Performance (Hu) program establishes a systematic framework for Hu management across OPG, achieving higher levels of nuclear and industrial safety, unit reliability, and reduced operating costs. The Hu Program aims to minimize the frequency and severity of events through the systematic reduction of human error and the management of defences in pursuit of zero events of consequence. Human performance

management provides workers guidance to reduce the probability and consequences of human error associated with operating, maintaining and supporting the Pickering NGS.

There are no major changes required to the programs and processes for the operation of Pickering NGS Units 5 to 8 to December 2026 and this program continues to comply with the requirements of the licensing basis. The following sections provides a description of some current improvements and initiatives in this area.

6.2.1.1 Human Performance Management

The Pickering Human Performance department aims to improve human performance at every level of the organization. In this cross-functional approach, each line organization maintains accountability for their human performance (Hu), while the Pickering Hu Department provides performance analyses, recommendations, and develops initiatives to support continuous Hu improvement.

The Pickering Hu department develops Hu products and services to reduce the probability and consequences of human-error events. Some examples are observation feedback and field support, excellence planning input, workshops or training to drive proficiency, inputs on emerging risks or strengths, and station communications.

The station is committed to excellence standards, exemplary safety performance, and high reliability with a strong emphasis on quality observations and coaching, understanding and applying failsafe principles in work-planning, and leveraging leading indicators to correct gaps quickly. These priorities are supported by the human performance program with workshops, training, and analysis and communication. The station has a human performance working group, supported by the station advocate program, to cross-functionally influence change and engage workers and supervisors in developing their leadership skills, knowledge and reinforcement of standards.

As a learning organization, there is a process for event communication and analysis that is frequently used to identify individual or organizational factors that lead to undesirable outcomes. This analysis tool is leveraged across all work groups to learn from events to prevent event re-occurrence.

The measures used to evaluate overall health, reliability and robustness of the Human Performance strategic plan are Site Event Free Day Resets (SEFDR) 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.

As seen in Figure 28, Pickering NGS was challenged with 2 SEFDR in 2022 which was above the target of 1. One SEFDR occurred when a worker received an unplanned tritium uptake while working on an airlock on Unit 4. This resulted in an action level exceedance but

was well within the annual regulatory effective dose limit and OPG's annual administrative dose limit. Corrective actions included reinforcing expectations around quality pre-job briefs and tritium protection planning. The second SEFDR occurred as a result of operator error when performing an unplanned task, which caused the safety system to perform its intended function and shutdown the unit. Corrective actions were taken. Appropriate manuals and instructions were revised to reinforce expectations when performing unplanned tasks and the event was discussed extensively will all station personnel to prevent recurrence.

Currently, Pickering has a site error rate of 0.06 against a target of zero (0). Improvement plans are in place and Pickering is expected to improve the site error rate to 0.04 in June 2023. The June 2024 target is a site error rate of zero (0).

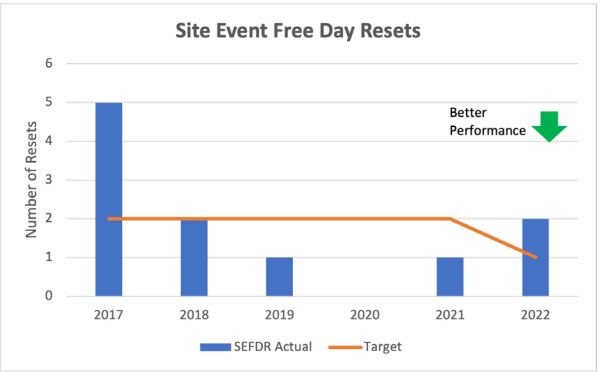


FIGURE 28 – PICKERING EVENT FREE DAY RESETS

In addition to regular programmatic oversight and support to improve human performance, Pickering NGS has prioritized a proactive approach called Fail Safe, when looking at safety and human performance.

Fail Safe identifies and strengthens our defenses so when an event does occur, there are enough strong defenses in place to ensure the event occurs safely. It shifts the focus to learning; and proactively applies those lessons to the work that is done in the future.

This approach assumes that no matter how much a person prepares and trains to avoid human error, errors will happen and should be planned for by having appropriate controls, barriers and safeguards in place to prevent injury and serious equipment damage when an error occurs.

As an organization, the culture of continuous improvement is driven through our Staying on Top culture, supported by our facilitative leadership initiatives. Staying on top culture consists of the following key principles:

- Setting Long Term Direction
- Leadership and Talent Development
- Excellence Standards
- Continuous Learning
- Self-Awareness and Self Correction

6.2.1.2 Personnel Training

The training program includes training for regular staff, contractors, temporary personnel and other staff assigned work at OPG. It 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.

The health of training is carefully monitored with a defined program to ensure that there is a Systematic Approach to Training 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 these plans are revised and reissued on a regular 5-year cycle.

Engineering Training
The engineering initial training covers the fundamentals of culture, conduct, and behaviours of working in the nuclear environment and associated processes.

As a result of the Covid-19 pandemic, all Engineering Training was converted to virtual training in May 2020 and remains virtual to date. Engineering Training, together with the line and vendors, have produced over 400 Video Learning On Demand sessions, demonstrating dedication to continuous learning and knowledge transfer.

The continuing training plan has the flexibility to focus on key performance issues tailored to the individual groups or needs.

Maintenance Training
The Maintenance Continuing Training Plan has the flexibility to focus on the key performance issues tailored to the individual groups or needs. Additionally, Maintenance utilizes Dynamic Learning Activities to reinforce learning and proficiency heat maps to formally document and assess proficiency of all Maintenance staff. This also allows Supervisors to review the overall proficiency and trajectory of their crews and to develop Knowledge Retention plans. Training and Line continue to collaborate when gaps in knowledge and/or performance exist to identify and implement training as required.

Operations Training
The Operations training plan is a comprehensive and integrated plan that provides an overview of the current status and planned improvements. This plan is aligned with industry best practice and integrated with the fleet plan.

Leadership Training
Since 2020, OPG Leadership Training has shifted towards an enterprise and performance-based approach to learning and development programs, integrating participants from across the enterprise to bring together diverse thoughts, ideas and perspectives. Many of these programs are supported by internal mentors to share experiences and enhance the transfer of learning to the participating leaders.

As a matter of continual improvement, several of OPGs foundational leadership training programs have been revised since 2020, based on learnings and best practices from international benchmarking, internal and external to the nuclear industry. For example, OPG's First Level Manager Program was redesigned in 2020 during the shift to virtual training delivery as a result of the COVID-19 pandemic, and the Middle

Manager Program was completely redesigned and piloted in 2021.

OPG, in partnership with UK Utility EDF Energy and World Association of Nuclear Operators (WANO), has offered the International Senior Nuclear Plant Manager program to senior leaders since 1996 with alumni being promoted to positions that include Chief Nuclear Officer, Chief Nuclear Engineer, Site Vice President and similar positions. Senior leaders from major contract suppliers have also attended to support the pursuit of nuclear excellence. In 2021, OPG and EDF UK partnered with an external leadership development firm to re-design the International Senior Nuclear Plant Manager program under the new name, the Leading Nuclear Development Program. The program spans nine months and provides an opportunity for participants to further develop their leadership and industry knowledge, apply learnings on-the-job and develop an international network of peers and mentors.

Emergency Response Organization (ERO) Training
OPG applies the Systematic Approach to Training guidelines to all ERO training development, revisions, and delivery. For example, in 2021, OPG improved the Emergency Shift Assistant (ESA) performance during evaluated drills by completing a Training Needs Analysis as per the Systematic Approach to Training. The revised training sessions now utilize control room simulators and include performance evaluations by a qualified Subject Matter Expert. Implementation of the new training has been successful in improving ESA proficiency.

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

One example of where innovative training techniques were developed include:

Virtual Reality Crane Simulators
Maintenance Training instructors improved crane operator performance by incorporating a virtual reality simulator into crane operator training. Virtual reality crane simulators allow crane operators to build crane operation proficiency in a zero-risk environment. Training material improvements include the incorporation of simulated scenarios such as precision lifts, crane failures, and risk management decision points. The virtual reality crane simulator offers a learning opportunity that is personalized, on-demand and realistic.

6.2.1.3 Certification

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

- Responsible Health Physicist;
- Authorized Nuclear Operator;
- Control Room Shift Supervisor; and
- Shift Manager.

Table 7 contains the number of Pickering certified staff, as of December 31, 2022. As shown, there are adequate numbers of individuals for each position that requires CNSC certification.

The associated training programs are compliant with CNSC regulatory document REGDOC 2.2.3 Personnel Certification, Vol III: Certifications of Persons Working at Nuclear Power Plants.

Certified Position	Pickering 5 to 8		
	# of Certified Staff	# of Trainees	Minimum Required
Shift Manager and Control Room Shift Supervisor	23	6	10
Authorized Nuclear Operator	57	8-12	30
Responsible Health Physicist	2		1

TABLE 7 – NUMBER OF PICKERING CERTIFIED STAFF (DECEMBER 31, 2022)

Continuing training includes refresher training of knowledge and skills required for the certified position, and updated training based on changes to the plant and procedures. Certified Operations staff complete 200 hours per year of continuing training.

6.2.1.4 Initial Certification and Requalification

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 position. Requalification tests are administered in a consistent manner and in accordance with the regulatory requirements as outlined by the CNSC.

OPG will continue to demonstrate its capability to administer examinations and requalification tests for Operations certified staff, and to ensure sufficient numbers of certified staff are available for the safe and reliable operation of the Pickering NGS. This includes having sufficient trained and qualified staff available to deliver the examination and testing programs throughout Pickering's continued operation.

6.2.1.5 Fitness for Duty

Pickering NGS continues to operate the facility in accordance with provincial and CNSC expectations to manage worker fatigue, until the end of commercial operations.

Supervisors are required to ensure that their employees are aware of their prescribed limits and are also responsible for monitoring their employees' hours of work. 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.

In addition, OPG has in place a Continuous Behaviour Observation Program which trains supervisors and managers to monitor workers for signs of fatigue or other factors which could adversely impact worker performance.

OPG Security monitors all personnel entering the protected area for indications of being unfit for duty or under the influence of intoxicants; if they suspect a worker is unfit, they will be denied access to the facility. OPG is using periodic canine drug monitoring at security entry points as an additional barrier to ensure the fitness for duty of all staff entering the protected area.

The Federal Court of Canada ordered that the implementation of pre-placement and random testing in REGDOC-2.2.4 Fitness for Duty, Volume II: Managing Alcohol and Drug Use, Version 3, be stayed pending final disposition of the employee union's Application for Judicial Review.

On June 6, 2023, the Federal Court of Canada reached a decision and concluded that random and pre-placement alcohol and drug testing for Safety Critical employees does not breach the Canadian Charter of Rights and Freedoms and that the process followed by the CNSC in the creation of the REGDOC was reasonable from an administrative law perspective.

Timing of the implementation regarding the random and pre-placement testing associated with this REGDOC will be determined with guidance from CNSC staff.

6.3 Operating Performance

The Operating Performance program continues to ensure, that plant operation is safe and secure, with adequate regard for safety of the public, environment, plant personnel and equipment and international obligations.

There are no major changes required to the programs and processes for the operation of Pickering NGS Units 5 to 8 to December 2026 and this program continues to comply with the requirements of the licensing basis. The following sections provide a description of some current improvements and initiatives in this area.

6.3.1.1 Operations

The Nuclear Operations Program implements a series of standards and procedures to ensure that the plant is operated safely and reliably. This program establishes safe, uniform, and efficient operating practices and processes that provide nuclear professionals the ability to ensure the facilities are operated in such a manner that the PROL, Operating Policies and Principles, and other applicable regulations and standards are followed. It also supports the alignment, prioritization and resolution of operational concerns, keeping reactor safety as an overriding priority.

6.3.1.2 Plant Status Control

Plant Status Control forms part of the managed process to operate the plant safely and within the approved design basis.

Nuclear Safety Configuration Management is the process of establishing and maintaining systems and equipment in the desired operating state to assure nuclear safety.

As a performance metric of plant status control, a misposition is declared when a component is found in a position off its baseline position without documented

approval, or a component is incorrectly operated, or the incorrect component is operated. There is an immediate follow-up to misposition events to gain an understanding of the organizational and individual drivers that contributed to the event and to establish compensatory actions to prevent reoccurrence. The human performance lessons learned process is then used to share the underlying contributors to the event to prevent other occurrences. The Plant Status Control Committee was established as an oversight body, to review and categorize all misposition occurrences, identify trends and review corrective action plans to ensure that adequate corrective actions are taken to prevent recurrences.

The results are a reduction in the number of department resets due to misposition events and fewer and less significant misposition events.

Figure 29 shows a reduction in significant misposition events which are categorized as Level 1 or 2. Misposition events categorized as Level 3 and Level 4 are not significant themselves but are tracked for trending purposes, and as a leading indicator to help inform activities to improve plant status control.

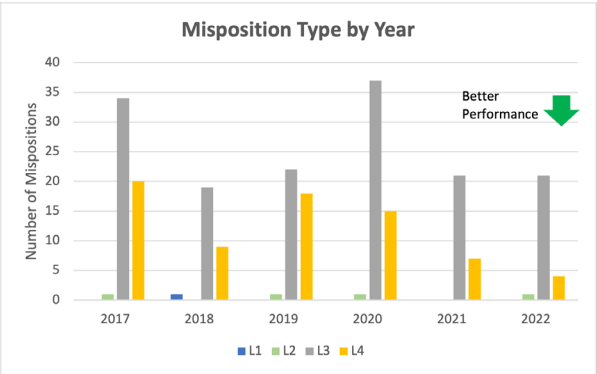


FIGURE 29 – MISPOSITION TYPE BY YEAR

6.3.1.3 Work Protection

The Work Protection program describes the management processes, corporate governance, and roles and responsibilities to ensure worker safety where work on equipment requires isolation and de-energization. Worker safety is achieved through the effective application of work protection standards and procedures which ensure physical and administrative barriers are established between the energy source and the worker.

Operations provides oversight to the work protection program as follows:

- Nuclear Work Protection Review Board - this group provides oversight of work protection performance at the nuclear or fleet level.
- Local Work Protection Review Board – this group provides oversight of the Work Protection Performance at the site level.
- Site Work Protection Working Group – this group is made up of individuals who execute work protection and provides oversight of work protection performance at the worker level.
- Nuclear Performance Area Trending, Prevention and Intervention Process – This guideline has been established to provide guidance to Site Functional Area Managers and Corporate Functional Area Managers in managing execution and oversight of performance.

- Corporate Oversight, Conduct of Nuclear Fleet Peer Teams and Programs – The purpose of this instruction is an oversight function to observe, critically monitor, assess and evaluate the conduct of Nuclear program(s) including review of action plans addressing gaps, independent analysis of trends, self-awareness and self-correction, performance information which provides assurance that functional outcomes are achieved, standards are met and policy boundaries are being respected.

- All groups and procedures work to review events, identify trends, develop actions to improve performance and ensure that operating experience is used to inform improvement strategies.

Planned improvements include the development and use of pre-prepared and checked work protection permits which improves efficiency and reduces potential human performance events due to increased interaction.

The Equipment Status Monitoring program has been updated to align all of OPG. The updated software includes interlocks to prevent previous human performance events from occurring.

In addition to the yearly proof of practice reviews of all levels of work protection qualifications, the work protection Oral Review Board has been established to assess knowledge and identify gaps that require corrective actions. The intent of the Oral Review Board is to provide managers with confidence that an individual is capable of performing in role, and to identify any potential areas for improvement.

6.3.1.4 Reactivity Management

Reactivity management practices at OPG are established through the Reactivity Management Standard, such that reactivity of the core is always respected and controlled. Plant operation and maintenance activities affecting reactivity are performed in a safe, controlled, conservative manner using approved procedures consistent with fuel design and operating limits.

Weekly Reactivity Management Plans are produced to provide a forward-looking schedule that integrates and optimizes the timing of required core fueling with prescribed unit testing and maintenance. This planning process is improved through frequent review of execution and compliance metrics.

All reactivity management events and conditions are systematically reviewed, assessed and tracked according to their significance level or category by the Reactivity Management Review Committee - a multi-disciplinary team comprised of all departments which impact reactivity management. This committee provides oversight in the area of reactivity management and quantifies any events or conditions into the Reactivity Management Index. This metric is consistent with industry standards and used to communicate overall program effectiveness and facilitate benchmarking comparisons between individual plants and utilities. Where deficiencies

are identified, corrective actions are established and tracked to completion via a managed process.

6.3.1.5 Outage Management Performance

Outage management ensures event free inspections, maintenance and modifications in a shutdown state are performed, such that plant safety and reliability are maintained at the desired levels during normal operation.

During the current licence term, Pickering NGS adopted a 30-month outage schedule which has been managed in a safe and effective manner and has resulted in the following successes:

- Established a new site record for a six-unit continuous run of 109 days.
- Earned one of the lowest forced loss rates in company history during 2022.
- Reduced dose rates to personnel, including use of dose reduction techniques.
- Human performance planning and Just In Time Training integration.

Pickering has an outage improvement initiative that focuses on unit shut down and start up efficiencies. These efficiencies will safely minimize the amount of time required to transition the unit into and out of the outage state, but also focus on additional planning, resources and oversight over critical evolutions to support safe operation. This will maximize the window for our outage maintenance program and maintain our commitment to supply electricity to the people of Ontario.

Additionally, the outage performance improvement plan continues 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.

6.4 Safety Analysis

OPG continues to maintain and routinely update the Safety Analysis to maintain the overall safety case and demonstrate the fundamental safety functions to control power, cool the fuel, and contain or limit any accidental releases from the plant.

There are no major changes required to the programs and processes for the operation of Pickering NGS Units 5 to 8 to December 2026 and this program continues to comply with the requirements of the licensing basis. The following sections provides a description of some current improvements and initiatives in this area.

6.4.1.1 Deterministic Safety Analysis

The deterministic safety analyses documented in the Pickering Safety Reports, demonstrate compliance with licensing limits and derived acceptance criteria. The analyses are used to identify limits on process parameters and safety system requirements and serve as a basis

to establish the safe operating envelope for the station.

The Analysis of Record is the set of documents that establishes the current reactor safety licensing basis. It consists of the latest revision of the safety report and all analyses that update or supersede analyses contained in the latest revision of the safety report. The safety reports are periodically updated and submitted to the CNSC in accordance with regulatory requirements.

The deterministic safety analysis was updated in compliance to REGDOC-2.4.1, Deterministic Safety Analysis by including an appendix for common cause events into the safety reports. The REGDOC-2.4.1 implementation plan was revised for 2021-2024 and submitted to the CNSC in December 2021.

6.4.1.2 Probabilistic Safety Assessment

Probabilistic Safety Assessment (PSA) is a tool used to help demonstrate that the design and operation of a nuclear power plant poses an acceptably low level of risk to the public. The main objective of PSA include the identification of risk insights that can be used to improve the safety of plant design and operation. The results of the PSAs are compared with OPG's safety goals as documented in the Risk and Reliability Program.

Hazard analysis is conducted as an initial step to probabilistic safety assessments. This involves the assessment and screening of various types of hazards: internal and external hazards, naturally occurring and human-induced.

Based on the hazard screening process, PSAs are developed for internal events, internal floods, internal fires, seismic events, and high winds. All other hazards identified were screened out and dispositioned to be of very low risk.

The overall conclusion of the Pickering NGS A and the Pickering NGS B PSA is that the public risk from Pickering NGS operation is low.

As per regulatory requirements, the PSAs for Pickering are routinely updated on a periodic basis. The updated PSA for Pickering NGS B was completed and submitted to the CNSC at the end of 2022, and the PSA for Pickering NGS A is due for submission at the end of 2023.

6.5 Physical Design

OPG's Physical Design program continues to maintain the design basis that assures that the structures, systems and components at Pickering remain available, reliable, effective and consistent with design, analysis and quality control measures.

There are no major changes required to the programs and processes under this SCA for the operation of Pickering NGS Units 5 to 8 to December 2026 and this program continues to comply with the requirements of the licensing basis. The following sections provide a description of some current improvements and initiatives in this area.

6.5.1.1 Fuel

The Fuel program establishes a formal and systematic process for ensuring the safe use of fuel in OPG's nuclear reactors. Continuous improvement is applied to the fuel defect management process by addressing the root cause, foreign material. The Reactor Fuelling and Physics team maintains an ongoing campaign of targeted training within pre-outage training, fuel defect infographics visible on station digital displays, and at active participation as quorum members of the Foreign Material Exclusion Committee; whose goal is to raise foreign material exclusion awareness among station managers, workers and contract partners.

Inspections of fuel discharged in the last five years of operation (post-discharge fuel inspections) indicate that the fuel condition remains within the design basis compliance envelope for wear and deformation.

6.5.1.2 Pressure Boundary Program

The Pressure Boundary Program manages the processes that control the quality of pressure boundary activities at OPG.

In March 2023, the Technical Standards and Safety Authority completed an assessment that determined OPG was successful in demonstrating pressure boundary processes to be in compliance with the applicable codes and standards. As a result, the Certificates of Authorization (C of A) for pressure boundary activities were renewed for three years, until April 15, 2026.

6.5.1.3 Environmental Qualification

The Environmental Qualification (EQ) program ensures that all required systems, equipment, components, protective barriers, and structures are qualified to perform their safety functions under the environmental conditions defined by the Pickering design-basis accidents. The program includes the procedures and processes to systematically identify the equipment to be environmentally qualified, the environmental conditions to be used for qualification and the required documentation.

EQ is an on-going program ensuring that aging is managed, obsolescence is taken into account and that qualification configurations are maintained.

An IIP action resulting from PSR2-B is to review the EQ assessments (EQAs) and update the EQAs if required to maintain component qualification for operation to December 2026.

6.6 Fitness for Service

OPG's fitness for service programs ensure all equipment is available to perform its intended design function when called upon to do so. The physical condition of structures, systems and components at Pickering remain available, reliable, effective and consistent with design, analysis and quality control measures.

There are no major changes required to the programs and processes under this SCA for the operation of Pickering NGS Units 5 to 8 to December 2026 and this program continues to comply with the requirements of the licensing basis. The

following sections provide a description of some current improvements and initiatives in this area.

6.6.1.1 Equipment Reliability

The Equipment Reliability Program improves station equipment reliability and reduces forced loss rate by ensuring high levels of reliable performance of components important to nuclear safety, production and environmental protection.

Pickering NGS has performed benchmarking against other plants through physical and virtual benchmarking of CANDU and non-CANDU station best practices as well as participation in the Equipment Reliability Working Group and Fuel Handling Equipment Reliability Working Group of the CANDU Owners Group (COG). COG has established the Equipment Reliability Index (ERI) which the industry uses to assess the health of a plant's reliability program and performance and enables benchmarking against other plants. This index provides an aggregate assessment of equipment reliability and the supporting programs. See Figure 30 for the ERI data.

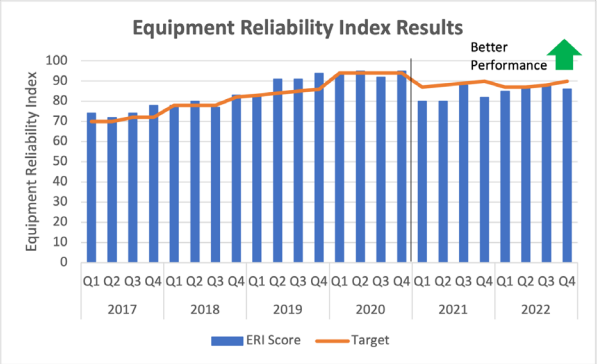


FIGURE 30 – EQUIPMENT RELIABILITY INDEX (ERI)

The ERI score is derived from 17 key weighted leading and lagging sub-indicators which add up to a maximum score of 100. COG members implemented a revision to the COG ERI metric at the start of 2021. The updated metric sets more challenging performance targets such that the same performance would result in a lower ERI score which is reflected by an apparent drop in performance in 2021 Q1.

Pickering's ERI score has significantly improved over the course of the current licence period as a result of various equipment reliability initiatives. Pickering continues to invest in equipment reliability improvements and has set increasingly challenging ERI targets through to End of Commercial Operations (ECO).

Over the current licence period, Pickering NGS has significantly reduced the backlog of corrective and deficient work orders (WOs) as discussed in section 6.6.1.8. This backlog reduction improves system and equipment availability and redundancy in support of safe and reliable operation.

Pickering has made a considerable investment in projects to support operations to 2026, including feeder and single fuel channel replacements, intake monitoring and algae reduction, tritium emissions reductions, and equipment reliability improvements across a range of systems including fuel handling, turbine generators, stand-by power, and digital control computers. Pickering is continuing to invest in reliability and performance improvements by continuing to progress

projects. Upcoming projects include improvements to the Irradiated Fuel Bay (IFB) cooling and purification system, chemistry analyzer and stack monitor improvements, system performance monitoring data acquisition upgrades, investments in Fuel Handling (FH) reliability, and further investments in equipment reliability across a number of systems.

Equipment Reliability Excellence Planning
Through 2023, Pickering NGS is driving continuous improvement in equipment reliability with a focus on cross-functional participation in risk identification and elimination, Single Point Vulnerability and Conditional Single Point Vulnerability elimination, and continued improvements in system performance monitoring. Also, dedicated action plans were developed to improve performance in Fuel Handling (FH) and Turbine Generator equipment reliability (ER). These two technical areas have driven the majority of plant challenges in recent years, although continuous improvements have been seen in the performance of Fuel handling systems since 2021.

The FH reliability plan includes continued improvements in risk identification and elimination supported by FH Data infrastructure enhancements, installation of sensors to enable detection and response to consequential failures, and continued execution of priority work documented in the FH Equipment Reliability plan.

The Turbine Generator excellence plan is focused on improving subject matter proficiency with a focus on cross-functional collaboration between workgroups and industry peers as well as improved incorporation of Operating Experience (OPEX) and Original Equipment Manufacturer information on effective aging management and proactive/ predictive maintenance implementation. OPG, and Pickering NGS specifically, continue to engage with industry peers to ensure our action plans incorporate industry best practices to ensure safe and reliable operation of our station.

Equipment Reliability and Climate Change
Strengthening the resilience of Pickering NGS is another piece to the climate change plan. One of the possible consequences of climate change is an increase in the volume of algae in Lake Ontario. The increased algae risk is due to the rise in seasonal temperatures, increased algae in Lake Ontario due to run off into the lake, and storm events directing algae toward the shoreline. Entrainment of significant volumes of algae can impact the station's ability to condense steam from the turbines, which could necessitate unit shutdowns.

Pickering NGS has installed an Advanced Algae Warning System, which is used to forecast the amount of algae that could enter the Pickering NGS forebay. This allows staff to take precautionary measures, rather than reacting to algae ingress as it happens.

OPG worked with the Michigan Technological University to develop an algorithm to predict the likelihood that algae events will occur. This tool is based on physical conditions such as wave

height and current direction. Using an early warning system, operators are now well-prepared to plan maintenance operations and manage screenhouse activity while receiving an elevated inflow of algae debris.

Pickering NGS has demonstrated an innovative and industry leading approach to look beyond and proactively plan to deal with such risks to ensure the safe and reliable operations of the station. Since 2019, the Advanced Algae Warning System has been proven to reliably forecast algae conditions.

6.6.1.2 Major Components

The Major Components Program establishes an integrated set of processes and activities to demonstrate fitness for service of Fuel Channels, Feeders, Steam Generators and Reactor Components and Structures, and develops long term life cycle management strategies for continued operation.

This program ensures that major components will perform safely and reliably until the end of commercial operation, maintaining design and licensing bases and operational safety requirements while optimizing production and cost- effectiveness.

Fuel Channels

The fuel channel life cycle management program facilitates the safe operation of the fuel channels to the Pickering specified targeted operating life and is based on many years of inspections, monitoring, and mitigation of known degradation mechanisms. With the implementation of the Fuel Channel LCMP, OPG will continue to demonstrate that component condition remains acceptable via monitoring and inspection.

OPG's planned research and development activities continue to support the demonstration of understanding of key degradation mechanisms, material properties and component fitness for service. Research and development findings, as well as inspection results and industry operating experience are incorporated into the fuel channel program to maintain adequate margins on fitness for service for the station operational life. Enhancements and improvements in engineering assessments have provided margin and incorporation of new models from the applicable standards.

Steam Generators

The primary goal of the Steam Generator LCMP is to operate all units safely and reliably with the existing SGs over the life of the station. The SG LCMP ensures this critical equipment is understood and the required activities are in place to support safe, reliable component and overall system performance, while maintaining the design and licensing basis. Another key goal of the SG LCMP is to maintain thermal performance.

Steam Generators are closely monitored by an inspection program to manage active and plausible degradation mechanisms. The inspection results demonstrate that life-limiting degradation mechanisms are being monitored and mitigated. The sound inspection and

maintenance strategies assist in ensuring compliance with standard CSA N285.4.

Feeders
The goal of the feeder piping life cycle management program is to maintain the integrity of the feeder piping system until the end of commercial operation through the implementation of the LCMP.

The Pickering feeder piping fitness for service is demonstrated by inspection and assessment activities. Advanced stress analysis methodologies have been used to demonstrate that the required minimum wall thickness can be safely reduced in order to minimize or eliminate feeder replacement resulting from flow accelerated corrosion. Feeder fretting and contact with other components will continue to be closely monitored with visual inspections and with the incorporation of operating experience.

The COG Feeder Joint Integrity Project has produced Fitness For Service Guidelines, which are used in addition to ASME codes, providing analysis methodologies as well as acceptance criteria for various feeder degradation assessments. A feeder replacement schedule is developed from the most recent feeder thinning inspections and assessments of remaining life based on minimum required wall thickness, to demonstrate fitness for continued service.

Feeder replacements will continue to be assessed and implemented as needed for Pickering to the end of commercial operation.

Reactor Components and Structures
The Reactor Components and Structures LCMP, is intended to establish the strategy or identify necessary actions to ensure that the effects of aging on reactor components and structures are appropriately managed for the plant operating life. The plan is updated annually and assessments are incorporated into the life cycle management strategies.

Reactor component and structures inspections and assessments continue to demonstrate fitness for service of these components.

6.6.1.3 Aging Management
The Integrated Aging Management Program, ensures that the condition of Structures Systems and Components (SSC) and critical station equipment is understood and that required activities are in place to assure the health of the SSC's, through plant aging.

Integrated aging management is implemented with the following programs:

Major Components develops long-term life cycle management strategies that support continued fitness for service for major components. These life cycle management programs are maintained and updated based on internal and external OPEX, the results of predictive maintenance and analysis, and expected service life of the system and station. The station continues to invest in major projects to manage the long-term life cycle of major components.

Component and Equipment Surveillance defines the requirements for the surveillance of a select set of components including inspection, maintenance, certification, and testing. Heat exchangers, check valves and power operated valves are examples of the defined component programs. Pipe wall thickness, pressure relief valves and buried piping are examples of equipment undergoing inspection and testing programs.

The Equipment Reliability program establishes the process for Equipment Reliability (ER) for critical components. The ER Program and its implementing procedures ensure that critical components meet their defined or desired level of reliability for the lifespan of the station.

Life cycle plans are established by a comprehensive Condition Assessment (CA) process. Condition assessments supplement the ongoing engineering surveillance activities in place to monitor and optimize system performance. These CAs focus on the aging mechanisms, current condition and recommended actions required to maintain the health of the component. The CAs and Periodic Safety Review (PSR2) continue to be reviewed to ensure that life cycle plans remain current with the planned and projected end of component, system, and station operations up to and beyond 2024 and through safe storage and storage with surveillance.

In addition, aging management is supported by a range of strategies including preventative maintenance plans, one time component replacements, predictive maintenance programs, and component and system health surveillance. Each of these programs is being maintained and continuously supported by qualified staff to support ongoing system health improvements and initiatives.

6.6.1.4 Periodic Inspection and Testing

The periodic inspection programs provide assurance of structural integrity of pressure retaining and containment systems and components in the Pickering NGS in accordance with regulatory requirements and applicable codes and standards.

The periodic inspection programs are documented in specific periodic inspection plans and associated inspection schedules. These inspections are administered under nuclear governing documents.

The periodic inspection program for CSA Standard N285.4, Periodic Inspection of CANDU Nuclear Power Plant Components, consists of approximately 1600 inspection items across six operating units (200 to 400 per unit). Inspected components include piping and vessel welds, pumps, valves, pipe and component supports, heat exchangers, and mechanical couplings.

For containment components, the periodic inspection program for CSA Standard N285.5, Periodic Inspection of CANDU Nuclear Power Plant Containment Components, consists of approximately 2500 inspection items across six operating units (200 to 700 per unit) and approximately 1100 inspection items in Unit 0. Each item is inspected once within unit 10-year inspection interval.

Inspected components include containment penetrations (including seal welds), piping, piping components (e.g. valves), pipe and component supports, bellows, containment dampers, etc.

Baseline and inaugural inspections are performed for newly installed items and components that are subject to inspection under CSA Standards N285.4 and N285.5 as required by the programs. These inspections are used to establish the condition of the components at the time it was placed into service, allowing for comparative analysis between inspection results.

The in-service examination and testing of Pickering concrete containment structures are performed in accordance with CSA Standard N287.7, In-Service Examination and Testing Requirement for Concrete Containment Structures for CANDU Nuclear Power Plants.

The reactor building undergoes inspection for integrity during every planned unit outage. These inspections are covered under the Periodic Inspection Plan (PIP) which is overseen by the Components Engineering group. A reactor building pressure test is performed every 6 years to check for reactor building leak tightness.

Inspections and testing of Vacuum Building and Pressure Relief Duct containment structures were last performed during the 2022 Vacuum Building Outage (VBO) under CSA N287.7. The inspection activities were conducted on the concrete components, vacuum building joint sealant, vacuum building roof seal and pressure relief duct joint seals.

6.6.1.5 Chemistry Control

The chemistry program covers activities associated with overall objectives of controlling plant chemistry in order to ensure safe plant operation and to protect the long-term life of SSC's.

The Chemistry Performance Index (CPI) compares the concentration of selected impurities and corrosion products to corresponding limiting values, with focus on secondary system chemistry. The limiting values are periodically reviewed against industry best practices to ensure they continue to represent challenging targets. The measure is reported as a twenty-four-month rolling average (MRA). Quarterly values are also used to depict more recent trends in performance.

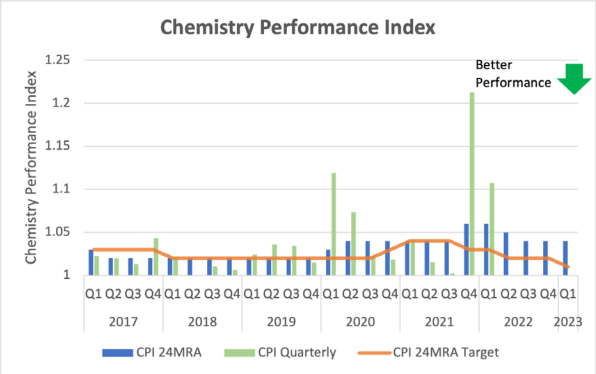


FIGURE 31 – CHEMISTRY PERFORMANCE INDEX (CPI)

The decline in 2021 Q4 trends are attributed to boiler blow down adherence issues, two condenser tube leaks, and outage and start-up chemistry issues. The most recent trends 2022 Q2 to 2022 Q4 indicate improving and exemplary performance for the last year. OPG Pickering achieved its first ever year of straight exemplary performance having

four straight quarters of perfect (1.00) CPI in station history. This is a reflection of combined efforts to improve start-up chemistry and outage practices. Based on current performance, projection is to remain with perfect CPI until end of commercial operation.

6.6.1.6 Maintenance

Maintenance is a key component in equipment reliability. The maintenance program ensures safe and reliable operation of plant equipment within the Pickering NGS. This is accomplished through corrective and preventive maintenance activities as well as routine inspections of system components to ensure they continue to operate as expected.

OPG's Maintenance organization is empowering their workers and leaders to achieve industry best performance by implementing 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 within each section based on leading indicators (e.g., field observations), inputs such as rework events, and interventions in place to correct shortfalls in performance. This forum has enabled the Maintenance Leadership team, including First Line Managers, 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 forums (e.g., Confined Space, Foreign Material Exclusion) fall under the Pickering NGS governance oversight framework to ensure clear ownership and oversight for station programs are in place.

Rework is the unexpected and unplanned repeat of work to repair or maintain a component or system that was related to a maintenance activity within the last 12 months. Cause categories include gaps in application of maintenance fundamentals and technical skills, human performance shortfalls, work instruction deficiencies, and preventative maintenance implementation.

Rework events that result in higher consequential potential are categorized as level 1 events. Events with lower consequential potential are categorized as level 2.

Figure 32 below demonstrates a reduction in level 1 and 2 maintenance rework events in 2021 compared to 2020, with a slight increase in 2022 compared to 2021 results. Level 1 and 2 maintenance rework target was 0 for 2022.

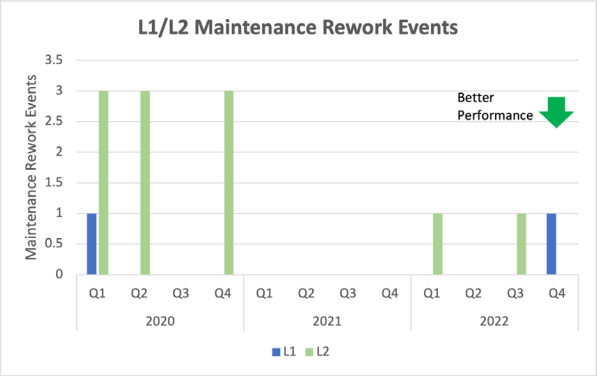


FIGURE 32 – L1/L2 MAINTENANCE REWORK EVENTS

6.6.1.7 Fuel Handling Reliability

The Fuel Handling (FH) Equipment Reliability Index (ERI) measures performance based on a number of metrics including machine availability, fueling compliance, failure rates, work management performance and completion of important projects. Pickering NGS has taken the lead on various changes to the FH ERI metric indicators in order to improve its ability to accurately reflect ER condition in the station. In 2021 the COG FH ERI Metric was revised based on collaboration with Pickering FH and peer stations. The new guide defines stricter and harder to achieve targets in order to drive continuous improvement in equipment reliability.

Pickering NGS FH performs monthly and annual reviews on equipment reliability performance with a focus on failures resulting in unplanned unavailability. Based on this ongoing trending, the equipment reliability team develops annual reliability plans of the most important projects and maintenance to improve FH Equipment reliability. This plan is reviewed and endorsed cross functionally to ensure it is comprehensive and best reflects the station's needs. FH ERI at Pickering has improved by over 25% since 2018 and has seen steady and improving performance in the current licence period and is now industry leading. A key performance indicator, Forced Loss Rate (FLR) has seen substantial year over year performance improvement in 2022 which has continued through the first quarter of 2023. Three of the station's best years in terms of FH FLR have occurred in the past 5 years, demonstrating the continuous improvement of FH Equipment Reliability.

The Fuel Handling team is continuing to implement a large portfolio of equipment reliability improvements to improve performance and get the station ready for Safe Storage and the defueling activities. Recently, the FH team has completed a year's long project to redesign the station's fueling machine ram ball screw seals through collaboration with COG and international partners. The new seals have reduced unplanned unavailability and FLR while increasing fueling system reliability and predictable performance. Additionally, Pickering NGS FH has recently replaced 5 of 8 Irradiated Fuel Bay (IFB) heat exchangers as part of our lifecycle management strategy. Replacement is in progress for the remaining 3 heat exchangers. This project will increase the bay cooling margin to prepare for defuelling as well as long term storage of irradiated fuel after the end

of commercial operations. Other notable projects include the Auxiliary IFB and IFB-B Supertool replacement projects, the module loader logic controller project, IFB-B liner repairs, fuel transfer elevator and conveyor component replacement projects, and fueling machine magazine position potentiometer interlock logic improvements across all units. Each of these projects has been driven to readiness and execution thanks to cross-functional support of the FH Equipment Reliability plan.

Looking toward safe storage, the fuel handling organization is continuing to progress a number of projects including redesign of the C-Ram spirator, reliability improvements for the Y-Drive bridge motors, improvements to purification and cooling across all three IFBs, module loader improvements and improvements to the Fueling Machine D2O supply system through accumulator bladder and pump packing redesigns. In addition, the FH organization is progressing a large scope of proactive component replacements to prepare for the increased system demands during defuel.

Beyond the Equipment Reliability Plan, Fuel Handling Performance Engineering has redefined their approach to effective system performance monitoring. Since 2018, the Operations and Engineering departments have collaborated on the development of innovative tools which provide previously unavailable parameters which are used to monitor equipment performance and perform maintenance before degrading trends impact equipment reliability. An example would be the development of the Cancel Analysis Database and Data Acquisition and Review Tool which allows System Engineers to monitor automatic program cancel rate and component actuation times to identify signs of equipment degradation. Throughout 2022 and 2023, the station is improving access to Fuel Handling equipment performance surveillance data to advance the capacity of the FH Equipment Reliability team to identify degrading equipment condition.

Based on completed and planned projects and initiatives, the station has set continuously increasing targets for FH ERI through the remaining operating life for all units as well as through the defueling campaign. As of 2023 Q1, the Pickering NGS fuel handling ERI is the highest of all COG stations, which reflects the stations ongoing commitment to equipment reliability improvements, as shown in Figure 33. The mechanisms in place to monitor for degrading trends in performance are maintained on an ongoing basis and supported by adequate qualified staff to maintain an improving trajectory and meet increasingly challenging performance targets.

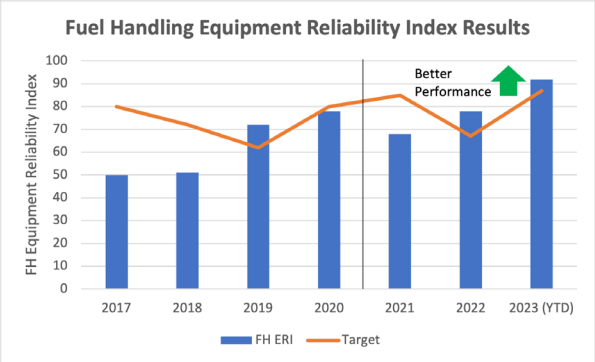


FIGURE 33 – FUEL HANDLING EQUIPMENT RELIABILITY INDEX (FH ERI)

6.6.1.8 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 risk ranking.

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.

As shown in the Figure 34, the volume of corrective and deficient maintenance backlog work orders continues to steadily decrease since 2017. As of 2022 Quarter 4, the backlog of Corrective Critical and Corrective non-critical (CC/CN) WOs was reduced by 97% since 2017. Over the same period, the Deficient Critical and Deficient Non-Critical (DC/DN) WO backlog was reduced by 88%.

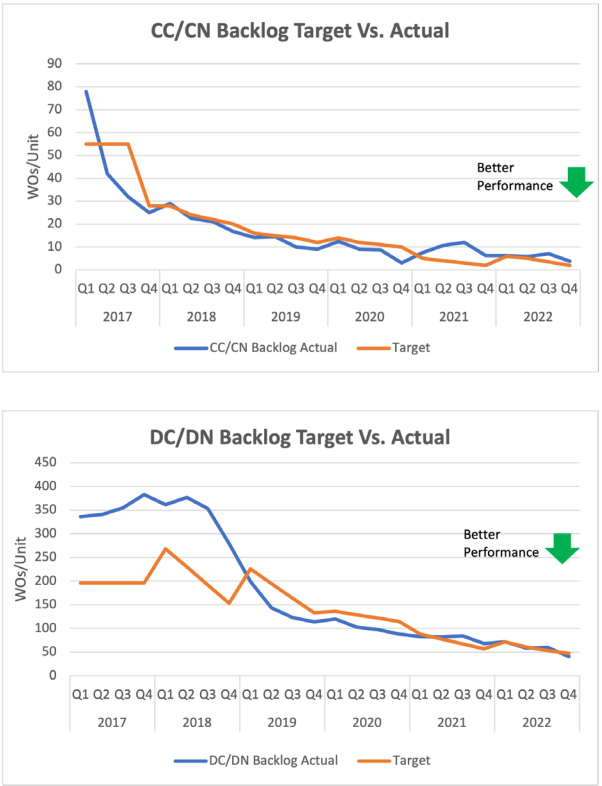


FIGURE 34 – CORRECTIVE CRITICAL AND NON-CRITICAL (CC/CN) MAINTENANCE BACKLOG (TOP) AND DEFICIENT CRITICAL AND NON-CRITICAL (DC/DN) MAINTENANCE BACKLOG (BOTTOM)

6.7 Radiation Protection

The Radiation Protection (RP) program controls occupational and public exposure as low as reasonably achievable 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.

There are no major changes required to the programs and processes under this SCA for the operation of Pickering NGS Units 5 to 8 to December 2026 and this program continues to comply with the requirements of the licensing basis. The

following sections provide a description of some current improvements and initiatives in this area.

6.7.1.1 Application of As Low as Reasonably Achievable

As Low As Reasonably Achievable (ALARA) is a foundational principle in radiation protection. 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 radiation protection 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 performance targets for Site Collective Dose which is the total radiation dose for individuals working at the Pickering NGS, are established annually. Actual performance against targets is reviewed and corrective actions are taken where expectations are not met. Figure 35 below shows Pickering NGS Collective Radiation Exposure is better than the yearly targets. This was achieved through the implementation of increased line accountability for dose and improvements driven through lessons learned and OPEX. Improved tooling and training also played an important role in major outage campaigns, as is evidenced by continued dose performance improvement during evolutions such as fuel channel shift, feeder replacement, single fuel channel replacement, and use of the Circumferential Wet Scrape Tool.

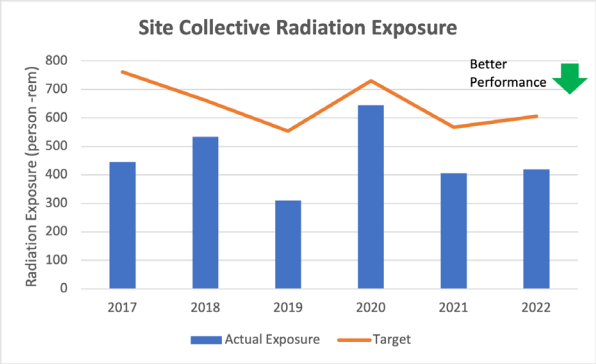


FIGURE 35 – SITE COLLECTIVE RADIATION EXPOSURE

Pickering ALARA strategy initiatives that contributed to improved dose performance include improved shielding and specialized dose reducing resin in heat transport ion exchange columns to reduce dose rates from system equipment.

6.7.1.2 Worker Dose Control

Worker exposures are planned and managed to ensure doses are kept well below regulatory limits and to ensure unplanned exposures are avoided.

During the current licence period from 2018 to date, there were no worker doses at Pickering which exceeded regulatory or OPG administrative dose limits.

Pickering monitors performance of precursor indicators related to worker dose control such as the number of Electronic Personal Dosimeter (EPD) dose alarms and precursor-level tritium uptakes (tritium uptakes greater than 10 uCi/L above planned) (see Figure 36). These precursor indicators are the tracking of low-level events used to identify and correct behaviors, or improve related work plans.

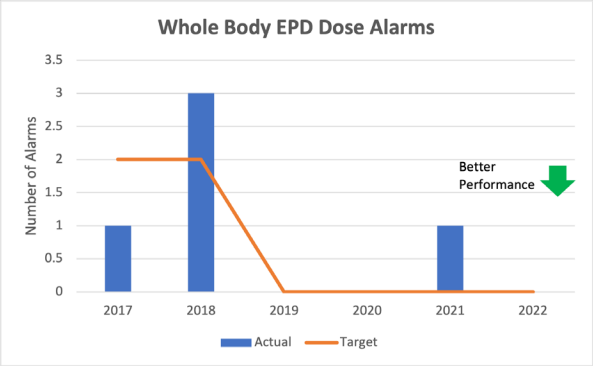


FIGURE 36 – WHOLE BODY EPD DOSE ALARMS

Enhancement to worker's dose control tools include the increased use of teledosimetry, a system of RP equipment which transmits information from video camera feeds, voice communications, and instrument data over a WIFI signal. Teledosimetry allows RP staff to monitor radioactive work remotely. RP staff can observe workers using the cameras while monitoring their accumulated radiation dose and dose rate information via a computer interface. Continuous monitoring of hazard levels and remote monitoring of worker dose reduce the risk of workers working in changing hazard conditions and ensure dose is kept ALARA.

Furthermore, specialized shielding, tooling and training has been utilized for several years for fuel channel and boiler inspection outage work programs which has contributed to lower collective radiation exposures. In addition, dose goals have been implemented for several years for work executed in the field. These dose goals provide a platform for workers and supervisors to set challenging targets for their daily work program (that are below the limits of their radiation exposure permit).

6.7.1.3 Radiological Hazard Control

Radiological hazard surveys are performed using approved instruments on both a routine basis and prior to performance of radioactive work. Remote instrumentation is used to provide real-time hazard information to staff. Robotic equipment is used by Operations staff to reduce exposure during on-power entries and allow for searches in areas previously inaccessible. Robotic entries are planned the same way as all radiological work activities by following planning processes. Some examples of areas that are inaccessible while the unit is online include the moderator room and steam generators room. Robotics have been used multiple times in these inaccessible areas to rule out potential leak sources. Remote tritium monitoring using sampling ports to monitor tritium has also been used in areas which normally cannot be accessed on power such as the vaults and feeder cabinets. This remote

instrumentation and use of robotics has reduced exposure to staff.

6.8 Conventional Health and Safety

Conventional health and safety work practices and conditions at the station result in a high degree of personnel safety.

There are no major changes required to the programs and processes under this SCA for the operation of Pickering NGS Units 5 to 8 to December 2026 and this program continues to comply with the requirements of the licensing basis. The following sections provide a description of some current improvements and initiatives in this area.

6.8.1.1 Conventional Health and Safety Program

The Environment, Health and Safety Management Systems program and supporting governing documents establish process requirements that protect employees by ensuring they are working safely in a healthy and injury-free workplace.

During the current licensing period, Pickering NGS has demonstrated strong safety performance throughout its operations.

Over the last 4.6 years Pickering NGS reached 18 million hours without a lost time accident. 2021 represented the best Accident Injury Rate (AIR)/Total Recordable Injury Frequency (TRIF) performance with an AIR/TRIF of 0.1 with approximately 4 million hours worked.

In 2018, Electricity Canada awarded OPG with the President's Award of Excellence for Employee Safety - Generation. OPG has since been recognized with this award every year from 2018 to 2022. The award recognizes OPG's achievement of being in the top quartile for both all injury/ illness frequency and lost time injury severity rates.

Annual Total Injury Frequency Comparison

Previously, OPG measured safety performance using Accident Injury Rate (AIR) as a metric. In 2018 this was changed to measuring Total Recordable Injury Frequency (TRIF) to align with Canadian industry benchmarks. From 2018 to 2021 Pickering NGS has shown strong performance for both AIR and TRIF. Pickering NGS AIR/TRIF performance was better than the target in 2019 through 2021. In 2018 the AIR/TRIF was above target due to 6 medically treated injuries impacting the AIR/TRIF for that one year. As of the first quarter of 2023, Pickering AIR/TRIF rate is below target as shown in Figure 37 below. The AIR/TRIF rate is expected to continue to trend downwards 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 defences and barriers in place to prevent consequential events.

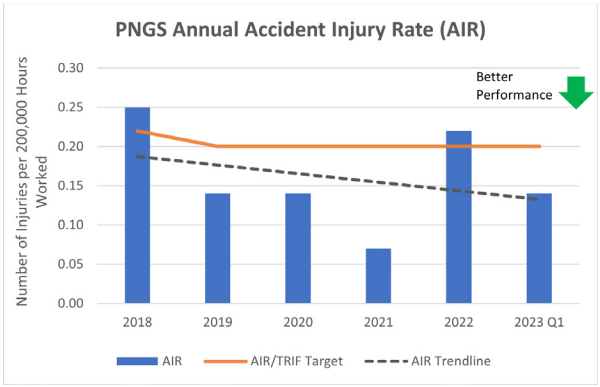


FIGURE 37 – PICKERING NGS ANNUAL ACCIDENT INJURY RATE

Accident Severity Rate (ASR)

Pickering's Accident Severity Rate performance over the current licensing period was overall strong. However, in 2018, a slip and fall injury due to ice resulted in 180 days of lost time. All incidents were reviewed, and lessons learned were reinforced. From 2019 to 2022, Pickering achieved 4 consecutive years with no lost time injuries resulting in top quartile performance in the Canadian utility generation sector for ASR. From 2019 to 2022, Pickering achieved 4 consecutive years with no lost time injuries resulting in top quartile performance in the Canadian utility generation sector for ASR.

Safety Enhancements

A number of health and safety enhancements have been made to the program, equipment and systems at Pickering NGS, during the current licensing period.

As part of our continuous improvement plan, OPG has launched the Fail Safe initiative in 2020/2021. OPG has demonstrated excellent safety performance record over the years, however, potential risk areas need mitigation. Fail Safe 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.

In 2020, OPG also started an initiative to adopt the Safety Classification and Learning Model (SCL). SCL was developed by the Edison Electrical institute to develop a new way of classifying incidents within the electric power sector. OPG is currently in the process of piloting this SCL model across multiple sites including Pickering NGS. 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 failsafe dashboard to analyze and interpret SCL learnings.
- Classifying events using SCL model as they occur in real time.
- Training for staff on the SCL model.
- Updating safety event investigation process to include SCL classifications.

The Timely Completion of Safety Corrective Actions (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 (zero extensions). TCSCA encourages positive behaviours and outcomes desired in OPG employees and work programs. This supports building the safety culture in OPG, where employees can work to create positive TCSCA results. Since the introduction of the TCSCA, Pickering NGS has maintained performance at 100%.

With the challenges of COVID-19, OPG has put increased focused on cultivating and strengthening the importance of mental health by:

- Continuing to provide Mental Health First Aid Training
- Reducing stigma surrounding mental health through various mechanisms.
- Continued encouragement of our employees to access our Telus Health Program (previously Employee Family Assistance Program).
- Enhancement of our mental health focus in our return-to-work program.
- Offering a Remote Health Care Provider service through Maple to all employees. This allows for employees who don't have a family physician to access medical services faster.
- Collaboration with Human Performance department to support the Mental Health Advocates program.

6.9 Environmental Protection

OPG's comprehensive environmental protection program aims to continually minimize impacts from the station operation to 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.

There are no major changes required to the programs and processes for the operation of Pickering NGS Units 5 to 8 to December 2026 and this program continues to comply with the requirements of the licensing basis. The following sections provides a description of some current improvements and initiatives in this area.

6.9.1.1 Environmental Management System (ISO 14001)

OPG's Environmental Policy states that OPG shall maintain an Environmental Management System (EMS) which is registered to the ISO 14001 system. OPG's EMS requires assessment of environmental risks and opportunities associated with station activities, and assurance that any potential adverse impacts to the natural environment are minimized. The EMS program includes OPG's approach to ensuring compliance with applicable environmental regulatory requirements and other compliance obligations.

The Environmental Monitoring Program (EMP), which is a component of the EMS, identifies the contaminants and physical stressors to be monitored and conducts monitoring in the environment surrounding the site. The EMP design uses a risk-based approach and relies on the results of site Environmental Risk Assessment (ERA) to determine what locations and environment media should be chosen for environmental monitoring. Locations considered to be outside the influence of Pickering site operations are also monitored to allow for a baseline comparison with background values. No major changes to the routine sampling program were identified based on the 2022 EMP.

To enhance operational transparency, since 2018, the Pickering NGS ERA report, the EMP report, the fish impingement report and the groundwater monitoring report have been posted on OPG's website. OPG has also added a Geographic Information System Map to display the groundwater monitoring wells and the data collected over the last 10 years. OPG tracks and reports environmental emissions data for Pickering NGS for each quarter which is also published publicly on OPG's website.

A robust auditing program is maintained as part of OPG's EMS, which includes annual internal environmental compliance audits on ISO 14001 requirements. Adverse conditions or opportunities for improvement are addressed in accordance with OPG's corrective action program.

6.9.1.2 Effluent

Waterborne

During the period from 2018 to 2022, there were no Derived Release Limit (DRL) exceedances for Tritium, Gross Beta/ Gamma, Carbon-14, or Alpha emissions to water, with loadings no more than 6.5% of the annual DRL.

See Table 8 below for the performance of each monitored parameter over the licence period.

Year	Tritium (% DRL)	Gross Beta/ Gamma (%DRL)	Carbon-14 (%DRL)	Alpha (%DRL)
2018	0.053	2.344	0.003	0.005
2019	0.055	4.183	0.009	0.007
2020	0.054	1.895	0.005	0.010
2021	0.061	6.155	0.011	0.010
2022	0.063	1.087	0.004	0.010

TABLE 8 – SUMMARY OF DATA OF WATERBORNE EMISSIONS

Airborne

During the period from 2018 to 2022, Pickering NGS has not exceeded the Derived Release Limit (DRL) or the Action Level for any radiological emission to air. Details of the emissions can be found in Table 9 below which shows that emissions were well below the DRLs. OPG strives to ensure that its emissions are as low as reasonably achievable (ALARA).

In October 2020, a micro scrubber column was installed on the U4 stack to manage airborne tritium emissions. The micro scrubber has performed very well in reducing tritium releases to air.

Pickering NGS tracks daily tritium emissions and focuses on improving equipment reliability and performance for further emission reductions. This is a station focus area and efforts have been effectively reducing tritium emissions.

Non-Radiological Emissions

Pickering NGS controls and monitors certain waterborne discharge streams under Environmental Compliance Approvals (ECA). During the current licence period, all effluent streams that are monitored under the ECA were discharged to the environment via approved pathways. There have been eight (8) exceedances during the period from 2018 to 2022, which were reported to Ministry of Environment, Conservation and Parks. Three of these were related to effluent temperature exceedances and the remaining five were as a result of chemical discharge parameters exceedances above the ECA limit. Appropriate actions have been taken to minimize recurrence.

Cumulative Emissions	Particulate (uCi)	Iodine (uCi)	Tritium (Ci)	Noble gases (Ci-Mev)	Carbon 14 (Ci)	Gross Alpha (uCi)
2018	207.034	316.69	16629.765	3259.62	101.9125126	32.11
2019	154.301	375.22	15102.456	3487.67	70.5992614	29.12
2020	157.636	276.33	17509.594	1203.95	61.3019459	27.43
2021	306.142	262.66	13985.706	3894.06	71.3182344	26.91
2022	290.800	289.17	13,371.227	2,689.70	64.6004529	27.00

%DRL	Particulate	Iodine	Tritium	Noble gases	Carbon 14	Gross Alpha
2018	0.0006331%	0.0000627%	0.1984843%	0.1526657%	0.0897801%	0.0005739%
2019	0.0013339%	0.0004923%	0.5478342%	0.4851270%	0.0971068%	0.0014385%
2020	0.0013627%	0.0003626%	0.6351519%	0.1674667%	0.0843187%	0.0013550%
2021	0.0026466%	0.0003446%	0.5073246%	0.5416550%	0.0980957%	0.0013293%
2022	0.002507761%	0.0003783%	0.4870056%	0.3748188%	0.08873689%	0.0013348%

TABLE 9 – RADIOLOGICAL AIRBORNE EMISSIONS

	ECA Exceedance
2018	• Sep 10/18, CCW-058 Effluent Temperature was 38C, exceeding the limit of 37C • Sep 12/18, CCW-058 morpholine was 0.059 ppm, exceeding the limit of 0.02ppm
2019	• May 22/19, CCW-014 unionized ammonia of 0.06 mg/L, exceeded limit of 0.02 mg/L • Dec 25/19, CCW-014 morpholine of 0.135 mg/L, exceeded limit of 0.02 mg/L
2020	• January 14/20, CCW-024 morpholine of 0.135mg/L, exceeded limit of 0.02 mg/L
2021	• May 29/21, CCW-058 Differential Temperature was 14.9C, exceeding the limit of 11C • Aug 28/21, CCW 058 Effluent temp was 40C, exceeding the limit of 37C
2022	• Oct 5/22, CCW 014 unionized ammonia of 0.071 mg/L, exceeded limit of 0.02 mg/L

TABLE 10 – ECA EXCEEDANCES 2018-2022

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 contaminants in groundwater. In 2020, OPG implemented the requirements of CSA N288.7, 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.

As part of Pickering NGS's annual groundwater monitoring program, samples are collected from the site-perimeter monitoring wells and analyzed statistically to identify any trends. From 2018 to 2022, the groundwater data collected from many of the key areas at Pickering NGS indicate that tritium 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.

Additionally, as part of the program, groundwater samples are collected 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.

6.9.1.3 Spill Management Program

Pickering NGS has extensive programs to ensure the risk of spills to the environment is effectively assessed and managed.

Any spill that causes or is likely to cause an adverse effect must be reported to the Ministry of Environment, Conservation and Parks. Reportable spills have been classified as Category A (major), Category B (moderate), and Category C (minor) depending on specified criteria such as the environmental impact and the quantity of substance released.

During the current licence period (2018-2022), there were no Category A or B spills, and there were five (5) Category C spills.

The following spill mitigation initiatives have been completed or are scheduled for completion and are driven by OPG's adherence to continuous improvement:

- The Pickering 012 sewage sump pumps were replaced with more robust grinder style pumps for improved availability. An additional level switch was installed to prevent sump overflows (Completed in 2019).
- The Units 1-3 System Service Transformer and Units 1-4 Generator Service Transformer heat exchanger bundles are being replaced. This will help with prevention of spill events from equipment that has a potential release pathway to the natural environment.

6.9.1.4 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 Fisheries and Oceans Canada (DFO). The FAA approved OPG to impinge and entrain a fixed number of fish and counterbalance these losses by undertaking an approved offsetting plan, in addition to monitoring of avoidance, mitigation and offsetting measures. The FAA period extends from 2018 to December 31, 2028.

In April 2023, OPG submitted an application for an administrative amendment to the FAA to DFO, to reflect operation beyond December 31, 2024 subject to Commission approval. (Reference 28).

FIGURE 38 - FISH DIVERSION SYSTEM

During the winter period, when the Fish Diversion System is removed and relocated to its storage facility, the net components are inspected and repaired as necessary and made ready for deployment the following year.

Routine monitoring of fish impingement is conducted weekly throughout the year. Fish from the screen house are collected in bins and trained staff identify the fish species, count them and measure the size and weight of the fish sampled. The estimated biomass of impinged fish is reported annually to the CNSC and DFO and reports are posted to OPG's website. Over the period 2018-2022, combined biomass of all species and ages impinged were below the two- year consecutive threshold of 3619 kg 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, impingement 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 other environmental phenomena.

The Pickering NGS FAA has created three offsetting measures to counterbalance fish impingement or entrainment losses such that a net benefit in fisheries productivity is achieved. 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 / 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.

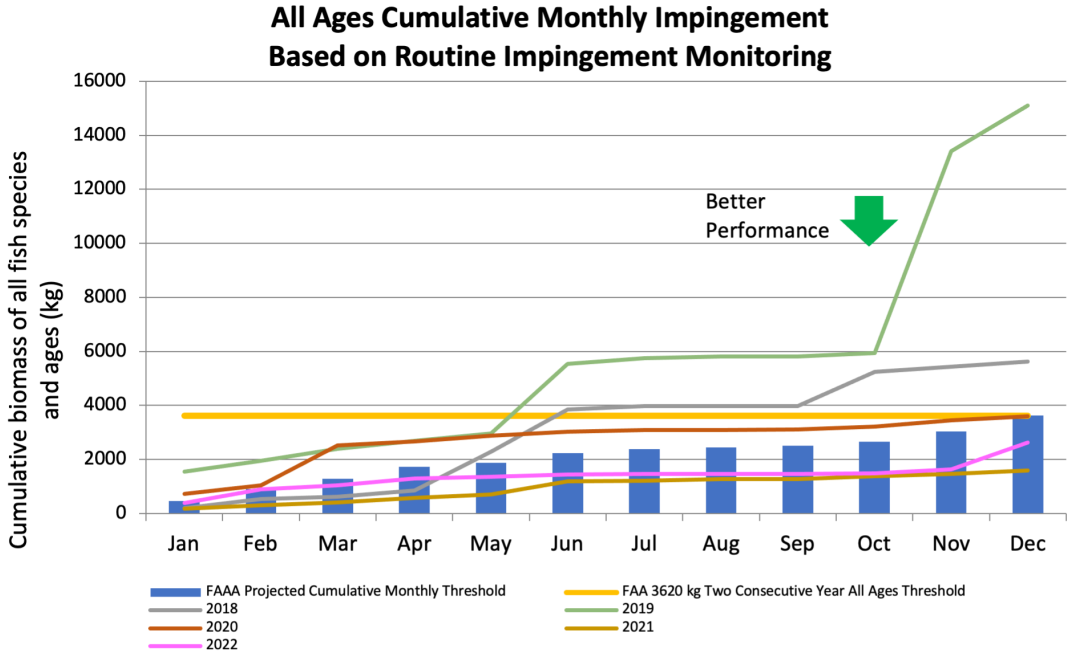


FIGURE 39 – CUMULATIVE MONTHLY IMPINGEMENT BASED ON ROUTINE IMPINGEMENT MONITORING BETWEEN 2018 AND 2022

Thermal Plume

The 2018 ERA Report for Pickering NGS concluded that the thermal plume was not having an adverse effect on Round Whitefish embryo survival but recommended one additional year of monitoring. The CNSC and Environment Climate Change Canada requested OPG to increase this to two (2) years of additional monitoring and to incorporate the findings in the next revision of the Pickering NGS ERA. The embryo survival study was repeated in December 2018 to April 2019 and December 2019 to April 2020. The largest relative survival loss in 2018-2019 was 3.8% and in 2019-2020 was 1.5%. These values are well below the CNSC threshold of concern of 10% relative survival loss.

The 2018-2019 and 2019-2020 studies support the 2018 Pickering NGS ERA conclusion that there is no chronic or likely acute adverse effects on round whitefish egg survival. These findings have been incorporated in the 2022 Pickering NGS ERA that was submitted to the CNSC (Reference 14).

6.9.1.5 Environmental Risk Assessment

The Pickering NGS ERA is discussed in Section 4.1.2.5.2.

6.9.1.6 Predictive Effects Assessment

The Pickering NGS PEA is discussed in Section 4.1.2.5.3.

6.9.1.7 Biodiversity and Wildlife Habitat Council

Pickering NGS has a 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.

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 (Figure 40).

FIGURE 40 – HYDRO MARSH PHRAGMITES REMOVAL

Since 2018, approximately 2700 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 off site through the ongoing partnership with Environmental Stewardship Pickering (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. ESP also hosts educational workshops for community members on gardening, habitat creation and environmental stewardship.

OPG submits applications for Wildlife Habitat Council certification 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 2020-2022, which is the top tier certification.

6.10 Emergency Management and Fire Protection

Pickering NGS has effective emergency preparedness measures and fire protection response capabilities in place to prevent and mitigate the effects of nuclear and hazardous substances releases, as well as, fire hazards, both onsite and offsite, in order to protect the workers, the public and the environment.

There are no major changes required to the programs and processes under this SCA for the operation of Pickering NGS Units 5 to 8 to December 2026 and this program continues to comply with the requirements of the licensing basis. The following sections provide a description of some current improvements and initiatives in this area.

6.10.1.1 Fire Protection and Conventional Preparedness and Response

The OPG Fire Protection program ensures that all reasonable measures are taken to prevent fires, and to promptly detect and suppress any fires that may occur on-site. The overall program is based on CSA N293, Fire Protection for Nuclear Power Plants and industry best practices.

New self-contained breathing apparatus were purchased in Q4 2021 with training delivered in the spring of 2022. These new devices provide better comfort, weigh less, offer better communication capabilities and notification of breathing air reserves which all contribute to better and more informed fire response capability.

The continuing training program at OPG requires ERMs to participate in annual continuing training and practice sessions where response skills are demonstrated and assessed. These skills require the ability to respond safely and effectively to physically demanding scenarios. ERT drills documenting team and individual performance are also evaluated annually and have demonstrated the capability of the ERT to respond effectively to realistic scenarios at the station and at the Wesleyville live fire training facility.

OPG fire protection has sought new and different ways to innovate with the use of technology. Many software solutions have been purchased and/or developed to integrate into existing processes to help improve reliability and efficiencies within the overall program, these include but are not limited to:

- Radio Frequency Identification tags for fire equipment inspections, testing and maintenance - These present more resilient tags and a more intelligent back-end database to track inspection, testing, and maintenance activities for fire protection equipment (e.g. fire extinguishers, exit signs, etc).

- Ignition source permit Software – streamlines communication between field staff and approvers for ignition source permits to help ensure procedural compliance is maintained.

- Software based Fire Drill evaluations – paperless solution to streamline consolidation and logging of drill events noted by evaluators and controllers with synchronized time stamps.

OPG has also further improved and upgraded its fire protection infrastructure and systems. Upgrading the fire alarm visual display workstations in the central alarm control supports expeditious identification of the fire alarm location. Another significant upgrade was to mechanically connect the fire water systems for Pickering NGS Units 1 to 4 and Pickering NGS Units 5 to 8 sites together to form one consolidated fire water system. This improves the fire water systems reliability by introducing additional alternate flow paths.

Lastly, OPG has issued, and submitted to CNSC, the re-affirmed Pickering NGS Fire Safe Shutdown Analysis and the Fire Hazard Assessment in 2022. No new findings were identified through this evaluation.

6.11 Waste Management

Pickering NGS implements a waste management program that includes strategies to minimize the production of all wastes taking into consideration the health and safety of workers and the environment. Pickering NGS continually strives to improve on safely managing and reducing the amount of Low- and Intermediate-Level Waste (L&ILW) produced, to reduce both the amount and the types of materials that enter the waste stream.

There are no major changes required to the programs and processes under this SCA for the operation of Pickering NGS Units 5 to 8 to December 2026 and this program continues to comply with the requirements of the licensing basis. The following sections provide a description of some current improvements and initiatives in this area.

6.11.1.1 Waste Minimization, Segregation and Characterization

Waste is generated at Pickering as a result of daily operations and maintenance activities and during planned and unplanned outages. Waste is characterized as either radiological or conventional depending on the radiological zone of its origin and from radiological surveys and analysis.

Pickering NGS continues to meet federal and provincial requirements in processing and disposing of hazardous and chemical wastes.

OPG employes stringent waste minimization and segregation practices

to ensure that the volumes of waste processed, transported to and stored at licenced waste facilities is minimized.

Polychlorinated Biphenyl (PCB) Waste
PCB Regulation SOR/2008-273 requires the removal of PCBs on site by December 31, 2025. OPG is developing a phase-out plan on PCB management (including radioactive PCBs), after the end of commercial operations at Pickering. Currently, Pickering is mid-cycle on its program to remove all accessible fluorescent light fixtures for replacement with LED lighting, as a high proportion of the fixtures' ballasts have been identified as containing PCBs.

6.11.1.2 Decommissioning Plans

Pickering NGS Decommissioning aspects are captured in the Preliminary Decommissioning Plan (PDP) which demonstrates the technical and financial feasibility of decommissioning Pickering NGS safely.

The decommissioning activities outlined in the PDP are planned in accordance with the requirements of the Canadian Standards Association (CSA) standard N294:19, Decommissioning of Facilities Containing Nuclear Substances, CNSC guides G-206, Financial Guarantees for the Decommissioning of Licensed Activities, and CNSC G-219, Decommissioning Planning for Licensed Activities.

The scope of the PDP includes all of the associated buildings and structures located inside the Pickering NGS Protected Area, not including decommissioning of the Pickering Waste Management Facility. There is a separate PDP for the decommissioning of the Pickering Waste Management Facility, which is licensed separately from Pickering NGS.

The PDP accounts for the removal of all structures on site and of all radioactive and other (conventional) hazardous materials, their disposal at licensed facilities, and eventual restoration of the site to an end state in agreement with the CNSC. As per the PDP, upon completion of the decommissioning program, the site will be in a condition that will support an application to remove the site from regulatory control.

The Pickering NGS PDP demonstrates that, through the process of decommissioning, the licensed facilities can be permanently retired from service and the site restored to a predetermined end state in a manner that will ensure that the health, safety and security of workers, the public and the environment are protected. The Pickering NGS PDP was updated and submitted to the CNSC in January 2022 (Reference 29). The PDP will be updated and submitted every five years or as requested by the CNSC. The next scheduled update of PDP will be in compliance with the CNSC REGDOC-2.11.2 Decommissioning.

6.12 Security

The Nuclear Security Program ensures the safe and secure operation of the station, maximizing protection against threats to security through the use of equipment, personnel and procedures.

There are no major changes required to the programs and processes under this SCA for the operation of Pickering NGS Units 5 to 8. The following sections provide a description of some current improvements and initiatives in this area.

6.12.1.1 Nuclear Security Program

The elements of the Pickering NGS security program include response to threats and maintaining compliance with legislative requirements, while minimizing the adverse impact on staff and plant operations. It ensures security readiness and maximizes response capability to, contain, mitigate, and terminate security events.

While several facets of OPG's security programs are regarded as best practices among private sector organizations, OPG continues to build strength in identifying areas for improvement by tackling adverse trends and processes to drive continuous improvement efforts.

On an annual basis, OPG reviews its Memorandum of Understanding with Durham Region Police Service. This memorandum defines mutual responsibilities and provides a strong foundation for continued productive and integrated working relationships between Durham Region Police Service and OPG. As well, Nuclear Security continues to maintain excellent working relationships with off-site emergency response organizations.

Improvements include several strategic initiatives aimed at implementing innovation and technology opportunities. These include, mitigating security impairments with the use of portable camera systems, patrol vehicle fleet electrification pilot, and security clearance system electronic application upgrade. The Security Monitoring System and Entry Control System life cycle project upgrades are actively in progress. Pickering NGS is expecting implementation by early 2024.

Other improvements include a Security Excellence plan focused on enhancing human performance and improving regulatory compliance.

OPG believes that these improvements will better serve the industry and the program to maintain safe conditions to mitigate security risk to the station.

The security training hiring team typically consists of Managers and Supervisors that reflect the diversity of Security employees and demonstrate OPG's commitment to Equity, Diversity and Inclusion. The Security process is lengthy, is consistent with nuclear industry peers and is aligned with municipal policing hiring practices. As a result, in 2022, thirty six new employees were selected including women and visible minorities. All candidates successfully completed training and were qualified as Nuclear Security Officers pursuant to the standards of the CNSC. Additionally, Security Training demonstrated our adaptability by adjusting to fluid COVID-19 conditions and delivering all portions of the Security Training program including the new hire class.

6.12.1.2 Cyber Security

The purpose of the Cyber Security Program is to define the key program

elements, objectives, and roles and responsibilities, with the overall goal to protect the cybercritical assets for nuclear safety, safeguards, physical protection, and emergency preparedness functions from cyber-attacks.

The program objectives are to establish and maintain processes, procedures, and controls to ensure OPG meets or exceeds legal and regulatory requirements for Cyber Security, ensuring effective implementation of a cyber security management system for information technology and industrial control systems across OPG's operating units. Appropriate steps are taken to monitor information and operational technologies on an ongoing basis in order to detect, and respond to threats that impact the confidentiality, integrity, and availability of OPG's assets.

Cyber security related updates have been made to the Engineering Change Control (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 the commencement of work efforts towards meeting the requirements identified in the recently issued CSA N290.7-21, Cyber Security for Nuclear Facilities, along with cyber security best practices.

6.13 Safeguards and Non-Proliferation

Pickering NGS has an effective safeguards and non-proliferation program that takes adequate measures to meet Canada's international safeguards obligations arising from the Canada/International Atomic Energy Agency (IAEA) safeguards agreements as well as other measures arising from the Treaty on the Non-Proliferation of Nuclear Weapons.

During the current licence period, Pickering 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. Pickering staff has fully cooperated with the IAEA and facilitated achievement of IAEA Safeguards goals.

There are no major changes required to the programs and processes for the operation of Pickering NGS Units 5 to to 8 to December 2026 and this program continues to comply with the requirements of the licensing basis.

6.14 Packaging and Transport

Pickering NGS has an effective packaging and transport program that ensures the safe, compliant, and efficient transportation of radioactive material.

There are no major changes required to the programs and processes for the operation of Pickering NGS Units 5 to to 8 to December 2026 and this program continues to comply with the requirements of the licensing basis.

7.0 OPG is Qualified to Operate Pickering NGS Units 5 to 8 to December 2026

OPG clearly demonstrates in this application that:

- OPG continues to meet the applicable regulatory requirements;
- Pickering NGS Units 5 to 8 are fit-for-service to December 31, 2026;
- OPG is qualified to operate the Pickering NGS Units 5 to 8 to December 31, 2026; and
- OPG is committed to safe and reliable operation of the station by providing adequate provisions to protect the health, safety and security of persons and the environment.

This will allow OPG to meet the growing energy needs expected in 2025 and 2026 for the province of Ontario. In addition to providing reliable, low-cost electricity, continued operation of the Pickering NGS benefits the economy and the environment.

Pickering NGS is committed to operational excellence, as evidenced by its efforts to improve equipment reliability and achieve its best operating performance in station history. The station's workforce is highly qualified and engaged, and Pickering NGS considers its employees to be its most valuable asset. To maintain its safety record in the industry's top quartile, continued efforts are made towards improving diversity and human performance.

Pickering NGS prioritizes nuclear safety and assures the public that risk analysis demonstrates very low risk for the continued operation of Pickering NGS Units 5 to 8, with regular updates to the analysis as required. The station maintains plant reliability through robust maintenance programs, advanced inspection and testing technologies, and asset management programs that focus on performance monitoring, preventative maintenance, risk management, and comprehensive lifecycle management plans.

A re-assessment of the Periodic Safety Review reaffirmed that the design and operation of safety-significant structures, systems, and components support safe operation until the end of 2026, with additional practical safety enhancements identified to further reduce risk. The review did not identify any new gaps, and appropriate actions have been proposed to resolve any outstanding issues.

OPG has assessed the operation of fuel channels on Pickering NGS Units 5 to 8 and assures their fitness for service to the end of 2026 based on sound technical reviews, programmatic controls, and availability of mitigating measures where required.

To promote engagement and transparency, Pickering NGS has fostered communication with its neighbors and the Indigenous communities that have a vested interest in the station's safe operation.

With over 50 years of experience operating nuclear stations in Ontario, OPG has built a reputation of safe operations, providing carbon free electricity to the province and has gained the trust of our communities. Based on this strong track record for safety and performance, OPG requests CNSC's authorization to operate Pickering NGS Units 5 to 8 to December 31, 2026 and to revise the operating limit for Units 5 to 8 pressure tubes up to 305,000 EFPH.

8.0 Acronyms

Acronym	Description
AIR	Accident Injury Rate
ALARA	As Low as Reasonably Achievable
ANDE	Advanced Non-Destructive Evaluation
ASR	Accident Severity Rate
BDBA	Beyond Design Basis Accident
CANDU	CANada Deuterium Uranium
CC	Corrective Critical
CC/CN	Corrective Critical and Non-Critical
CCW	Condenser Cooling Water
CFSI	Counterfeit, Fraudulent and Suspect Items
CIGAR	Channel Inspection and Gauging Apparatus for Reactors
CN	Corrective Non-Critical
CNSC	Canadian Nuclear Safety Commission
COG	CANDU Owners Group
CPI	Chemistry Performance Index
CRC	Corporate Relations and Communications
CSA	Canadian Standards Association
CT	Calandria Tube
CT-LISS	Calandria Tube-Liquid Injection Shutdown System
DC	Deficient Critical
DC/DN	Deficient Critical and Non-Critical
DFO	Department of Fisheries and Oceans
DN	Deficient Non-Critical
DPZ	Detailed Planning Zone
DRL	Derived Release Limit
DSA	Deterministic Safety Analysis
ECA	Environmental Compliance Approvals
ECC	Engineering Change Control
ECO	End of Commercial Operation
EFPH	Equivalent Full Power Hours
EITER	Equipment Important to Emergency Response
EME	Emergency Mitigation Equipment
EMO	Emergency Management Ontario
EMP	Environmental Monitoring Program
EMS	Environmental Management System
EPD	Electronic Personal Dosimeter
EQ	Environmental Qualification
EQA	Environmental Qualification Assessment
ER	Equipment Reliability
ERA	Environmental Risk Assessment
ERI	Equipment Reliability Index
ERO	Emergency Response Organization
ESA	Emergency Shift Assistant
ESP	Environmental Stewardship Pickering
ETE	Evacuation Time Estimates
FAA	Fisheries Act Authorization

Acronym	Description
FCLCMP	Fuel Channels Life Cycle Management Plan
FFS	Fitness for Service
FH	Fuel Handling
FH ERI	Fuel Handling Equipment Reliability Index
FLR	Forced Loss Rate
GAR	Global Assessment Report
GI	Global Issue
IAEA	International Atomic Energy Agency
IFB	Irradiated Fuel Bay
IIP	Integrated Implementation Plan
INPO	Institute of Nuclear Power Operations
INSAG	International Nuclear Safety Advisory Group
ION	Indigenous Opportunities Network
IPZ	Ingestion Planning Zone
ISO	International Organization for Standardization
KI	Potassium Iodide
KIWG	Potassium Iodide Working Group
LCH	Licence Conditions Handbook
LCMP	Life Cycle Management Plan
LISS	Liquid Injection Shutdown System
LRCS	Laws, Regulations, Codes and Standards
LRF	Large Release Frequency
MRA	Month Rolling Average
NBCC	National Building Code of Canada
NFCC	National Fire Code of Canada
NGS	Nuclear Generating Station
NPP	Nuclear Power Plant
NPRI	National Pollutant Release Inventory
OPEX	Operating Experience
OPG	Ontario Power Generation
PBRA	Pickering NGS B Probabilistic Safety Assessment
PCB	Polychlorinated Biphenyl

Acronym	Description
PDP	Preliminary Decommissioning Plan
PEA	Predictive Effects Assessment
PEXT	Pickering Life Extension
PFU	Predicted Future Unavailability
PIP	Periodic Inspection Program
PNERP	Provincial Nuclear Emergency Response Plan
POSD	Pickering Optimization
PROL	Power Reactor Operating Licence
PSA	Probabilistic Safety Assessment
PSR	Periodic Safety Review
PSR2	Periodic Safety Review 2
PSR2-B	Periodic Safety Review 2 - B
PT	Pressure Tube
RAP	Reconciliation Action Plan
RP	Radiation Protection
SAMG	Severe Accident Management Guidelines
SAP	Stabilization Activity Plan
SCA	Safety and Control Area
SCDF	Severe Core Damage Frequency
SCL	Safety Classification and Learning Model
SEFDR	Site Event Free Day Resets
SOP	Sustainable Operations Plan
SSC	Systems, Structures and Component
STEM	Science, Technology, Engineering, and Mathematics
SWS	Storage with Surveillance
TCSCA	Timely Completion of Safety Corrective Actions
TRIF	Total Recordable Injury Frequency
VBO	Vacuum Building Outage
WANO	World Association of Nuclear Operators
WHC	Wildlife Habitat Council
WO	Work Order
WTFN	Williams Treaties First Nations

9.0 References

1. OPG Letter, J. Franke to R. Richardson, "Pickering NGS - Assurance of Major Components Fitness-for-Service for the Conservative Projected Operating Hours of Pickering Units 5-8", April 19, 2023, CD# NK30-CORR-00531-08660.

2. OPG Report, "Pickering NGS Global Assessment Report", February 8, 2018, CD# P-REP-03680-00032 R001.

3. CNSC Regulatory Document, "Operating Performance: Periodic Safety Reviews", April 2015, REGDOC-2.3.3.

4. IAEA Report, "Assessment of Defence in Depth for Nuclear Power Plants", Safety Report Series No. 46, February 2005.

5. IAEA Report, "Defence in Depth in Nuclear Safety", INSAG-10, June 1996.

6. CNSC Regulatory Document, "Deterministic Safety Analysis", REGDOC-2.4.1, May 2014.

7. CNSC Regulatory Document, "Probabilistic Safety Assessment (PSA) for Nuclear Power Plants", REGDOC-2.4.2, May 2014.

8. OPG Report, "Pickering Periodic Safety Review 2 (PSR2) Integrated Implementation Plan", P-REP-03680-00031 R001, February 28, 2018.

9. OPG Report, "Pickering Nuclear Generating Station A Probabilistic Safety Assessment Summary Report", NA44-REP-03611-00036 R001, September 28, 2018.

10. OPG Report, "Pickering Nuclear Generating Station B Probabilistic Safety Assessment Summary Report", NK30-REP-03611-00021 R001, January 10, 2018.

11. OPG Report, "Pickering NGS Periodic Safety Review 2-B (PSR2-B): Global Assessment Report", CD# P-REP-03680-00048 R000, April 28, 2023.

12. OPG Letter, M. R. Knutson to K. Campbell and J. Burta, "Status Update on REGDOC-2.4.1 Deterministic Safety Analysis Implementation," December 13, 2021, CD# N-CORR-00531-22934.

13. OPG Report, "Pickering NGS Development of Evacuation Time Estimates", CD# P-REP-03490-00080-R002, March 24, 2023.

14. OPG Report, "Environmental Risk Assessment Report for Pickering Nuclear", CD# P-REP-07701-00007 R001, March 31, 2023.

15. OPG Letter, R. Lockwood to A. Viktorov, "Environmental Risk Assessment Report for Pickering Nuclear and Predictive Effects Assessment for Pickering Nuclear Safe Storage", April 28, 2017, CD# P-CORR-00531-04982.

16. OPG Report, “Predictive Effects Assessment for Pickering Nuclear Safe Storage – 2022 Addendum Report”, CD# P-REP-07701-00006 R000, May 10, 2022.

17. OPG Report, “Predictive Effects Assessment for Nuclear Safe Storage - 2022 Addendum Report”, April 17, 2023, CD# P-REP-07701-00006, March 31, 2023

18. OPG Letter, J. Franke to R. Richardson, “Pickering NGS: Periodic Safety Review 2-B (PSR2-B) Integrated Implementation Plan”, May 30, 2023, CD# P-CORR-00531-23259.

19. CSA Standard, “Periodic Inspection of CANDU Nuclear Power Plant Components”, CAN/CSA Standard No. N285.4-05, Update No.1 June 2007.

20. CSA Standard, Technical Requirements for In-Service Evaluation of Zirconium Alloy Pressure Tubes in CANDU Reactors”, CAN/CSA Standard No. N285.8-15, Update No.1, October 2019.

21. CNSC Record of Decision,“Request for Authorization to Restart Pickering Nuclear Generating Station B Unit 5 following a forced outage”, DEC 21-H111, October 12, 2021.

22. CNSC CMD, “Approval to Restart”, CMD 21-H112, 21-H114, October 27, 2021.

23. OPG Letter, M. R. Knutson to D. Saumure and A. Viktorov, “OPG Response – Darlington and Pickering NGS – Request for an Update to the Commission on Activities Related to the Discovery of Elevated Hydrogen Equivalent Concentration (Heq) – New Action Item 2022-OPG-23135”, CD# N-CORR-00531-08536, July 19, 2022.

24. OPG Letter, M. R. Knutson to A. Mathai and R. Richardson, “OPG Response – Darlington and Pickering NGS – Request for an Update to the Commission on Activities Related to the Discovery of Elevated Hydrogen Equivalent Concentration (Heq) – New Action Item 2022-OPG-23135”, CD# N-CORR-00531-23603, March 27, 2023.

25. CNSC Publication, “Aging Management”, CNSC Regulatory Document REGDOC-2.6.3, March 2014.

26. IAEA Publication, “Ageing Management for Nuclear Power Plants”, International Atomic Energy Agency (IAEA), Safety Standards Series, Safety Guide NS-G-2.12, 2009.

27. CNSC publication, “Aging Management for Nuclear Power Plants”, CNSC Regulatory Document RD-334, 2011.

28. OPG Letter, R. McCalla to E. Morton, “Submission of an Application for Amendment to Authorization 16-HCAA-00256”, April 6, 2023, CD# P-CORR-00539.4-00031.

29. OPG Letter, C. Carmichael to N. Greencorn, K. Campbell, J. Burta, L. Sigouin, “Submission of Preliminary Decommissioning Plans”, January 25,2022, CD# N-CORR-00531-23047.

Appendix A: Basis of the Periodic Safety Review

A1. Periodic Safety Review and Licensing requirements

CNSC Regulatory document REGDOC-2.3.3, Periodic Safety Reviews, sets out the CNSC's requirements for the conduct of a periodic safety review (PSR) for a nuclear power plant (NPP). It is consistent with the International Atomic Energy Agency's Safety Standards Series, Specific Safety Guide No. SSG-25, Periodic Safety Review for Nuclear Power Plants.

The objectives of a PSR are to determine:

1. The extent to which the facility conforms to modern codes, standards and practices;

2. The extent to which the licensing basis remains valid for the next licensing period;

3. The adequacy and effectiveness of the programs and the structures, systems and components (SSCs) in place to ensure plant safety until the next PSR or, where appropriate, until the end of commercial operation; and

4. The improvements to be implemented to resolve any gaps identified in the review and timelines for their implementation.

The scope of the periodic safety review is to:

1. Address all safety factors of the NPP including any interdependencies;

2. Identify all facilities and associated SSCs to be covered by the PSR;

3. Address unit-specific and site-specific issues;

4. For multi-unit NPPs, address interdependencies on common SSCs not covered by item 1;

5. Consider all expected modes of operation; for a multi-unit facility, taking into consideration the operational state of each unit; and

6. Include a comprehensive review of current licensing issues applicable to the safety factor.

The methodology for the following must be specified:

1. Conducting assessments that confirm that the plant will continue to meet its licensing basis; until the next PSR cycle or, where appropriate, the end of commercial operation;

2. Conducting assessments against applicable modern codes, standards and practices;

3. Conducting a global assessment of facility safety in view of all PSR gaps and strengths; and

4. Identifying any corrective actions and safety improvements that are necessary to address PSR findings to improve the level of safety.

A PSR is comprised of the following four key elements:

1. PSR2 Basis Document

2. Safety Factor Reviews

3. Global Assessment

4. Integrated Implementation Plan

Safety Factor Review

Safety factors cover all aspects important to safety of an operating nuclear power plant. These safety factors are shown in Table A1.

A2. Pickering NGS PSR2 Methodology

PSR2 Methodology Overview

The PSR2 basis document defines the assessment basis, scope and methodology. Safety factor reviews are conducted in accordance with the assessment basis, which will identify gaps and compliances. The compliance and groups of compliances are used in the Global Assessment as strengths. The gaps are consolidated into like issues, called Global Issues. These Global Issues are assessed, prioritized and ranked. Resolutions are proposed for the global issues and undergo reviews and approvals and are documented in the Global Assessment Report (GAR). The resolutions from the GAR are further

Subject Area	Safety Factor	
The Plant	1	Plant Design
	2	Actual Conditions of Structures, Systems and Components Important to Safety
	3	Equipment Qualification (Environmental and Seismic)
	4	Aging
Safety Analysis	5	Deterministic Safety Assessment
	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 Protection	15	Radiation Protection

TABLE A1: PICKERING NGS PSR2 SAFETY FACTORS

defined with implementation timelines and are documented in the Integrated Implementation Plan (IIP).

Safety Factor Reviews

As a subsequent PSR, the PSR2 Safety Factor review will focus on changes in requirements (Laws, Regulations, Codes and Standards), updated plant condition, operating experience and information from research.

Development of Global Issues

Global Issues are developed by the consolidation and grouping of all the gaps that were identified in the safety factor reviews and other any review that was considered as part of the original PSR. Consolidation of gaps into these Global Issues facilitate the assessment of the safety impact and the assessment of practical and effective resolutions. The global issues are then assessed and documented in the Global Assessment Report (GAR).

Prioritization of Global Issues

Global Issues are then prioritized with respect to their importance to nuclear safety. The safety significance considers deterministic and probabilistic safety analysis impact and is shown in Table A2.

Safety Significance Level	Impact on Nuclear Safety
1	High
2	Medium
3	Low
4	Very Low

TABLE A2: SAFETY SIGNIFICANCE LEVELS

The basis for prioritization of each Global Issue comprises Deterministic and Probabilistic considerations are as follows:

The Deterministic considerations are:

- Defence-in-Depth (E1)
- Safety Significance Levels (E2)

A Safety Significance Level of 1, 2, 3 or 4 is assigned to each Deterministic consideration based on whether the Global Issue has a high, medium, low or very low impact on nuclear safety for the consideration being evaluated. A Safety Significance Level of 1, 2, 3 or 4 is then assigned to the overall Deterministic consideration based on the most safety significant result. For Deterministic considerations that are not relevant to the Global Issue, the prioritization is recorded as “N/A” or “Not Applicable”.

There are 7 Probabilistic considerations, as follows:

- Reactor Safety Core Damage Frequency (F1)
- Reactor Safety Defence-in-Depth (F2)
- Public Radiation Safety (F3)
- Plant Operability (F4)
- Occupational Radiation Safety (F5)
- Emergency Preparedness (F6)
- Environment (F7)

A Safety Significance Level of 1, 2, 3 or 4 is assigned to each Probabilistic consideration based on whether the Global Issue has a high, medium, low or very low impact

on nuclear safety for the consideration being evaluated. A Safety Significance Level of 1, 2, 3 or 4 is then assigned to the overall Probabilistic consideration based on the most safety significant result. For Probabilistic considerations that are not relevant to the Global Issue, the prioritization is recorded as "N/A" or "Not Applicable".

The overall Safety Significance Level for the Global Issue is then assigned based on the Safety Significance Level of whichever overall consideration, Deterministic or Probabilistic, has the highest nuclear safety impact. The overall Safety Significance Level for each Global Issue corresponds to the highest impact on nuclear safety (smallest Safety Significance Level number) of the individual considerations.

Development of Resolution Plans

Proposed Resolution Plans for Global Issues are formulated with consideration of interfaces between the various Gaps to ensure that the proposed Resolution Plans complement each other. Proposed Resolution Plans are developed for all Global Issues and consider safety benefits and practicability. Insights from available site Probabilistic Safety Assessments may be used in evaluating the benefit/practicality of potential options, where appropriate.

Proposed Resolution Plans may include proposed Resolution Statements which are actions defined to address a Gap. Proposed Resolution Statements are primarily proposed for Global Issues that have been prioritized with a Safety Significance Level of 1 or 2 (i.e., high or medium impact on nuclear safety), and for Global Issues with Safety Significance Level 3 if a practicable solution is readily evident.

Consistent with the PSR2 Basis Document, Resolution Statements are not proposed for all PSR2 Gaps. Gaps with Safety Significance Level 4 (i.e., very low impact on nuclear safety) are generally assessed as Acceptable Deviations. Gaps with Safety Significance Level 3 (i.e., low impact on nuclear safety) for which a practicable solution is not readily evident are also assessed as Acceptable Deviations. Acceptable Deviations are not tracked beyond the Global Assessment phase of PSR2. However, the impacts of Acceptable Deviations are considered in the defence-in-depth assessment to determine the aggregate impact on the defence-in-depth capability of the plant.

Resolution Plans of the PSR2 consist of the following statement types:

- Resolution Statements: An activity is defined to address the Gap(s).
- No Further Action: Work is already completed or is underway outside of PSR2 to address the related Gap(s), or information has been found to obviate the Gap(s).
- Acceptable Deviation: The Gap(s) have been assessed to have a Very Low Safety Significance Level or are Low Safety Significance Level items and a practicable resolution is not readily evident.
- Cross Reference: An action that addresses the Gap(s) is covered by another Resolution Statement.

To facilitate binning of potential work, proposed Resolution Plans are categorized as one or more of the following types of enhancements:

- Programmatic (changes to governing programs and procedures)
- Engineering (repair/replacement or design changes)
- Analytical (engineering analysis, deterministic safety analysis, probabilistic safety assessment or hazard analysis)

The Global Issues and the Resolution Plans undergo several reviews during the Global Assessment process. These reviews consider factors such as the priority previously determined (Safety Significance Level), the contribution to defence-in-depth and the significance of the source (e.g., the type of document that generated the Gap(s) leading to the Global Issue). The proposed resolutions identified in this report are also presented to OPG Senior Management for their review and acceptance.

Ranking of Resolution Statements

The purpose of ranking proposed Resolution Statements is to determine the activities that will be most effective in enhancing safety.

All Global Issue Resolution Statements with identified actions are ranked from 1 to N in decreasing importance such that 1 is the most important and N, which is the total number of Resolution Statements, is the least important.

The ranking is determined through the application of a value-tree method for solving multi-attribute decision problems. The ranking of each proposed Resolution Statement is based on the weight and a two-variable utility function that accounts for impact and time attributes. The impact attribute is a measure of how directly or strongly the issue impacts the objective, while the time attribute accounts for how long it would take to implement and realize the associated objective. The two variable utility function is used to generate a utility matrix, and the time and impact ratings for each proposed Resolution Statement are used together with the utility matrix to obtain a numerical value that represents the utility score for resolving the proposed Resolution Statement. The Ranking Number of the proposed Resolution Statement is then calculated by multiplying its utility score by its weight.

Acceptable Deviations and No Further Action statements do not go through the ranking process; only proposed Resolution Statements with identified actions are ranked.

Defence-in-Depth Assessment

As part of the PSR2 Global Assessment, a defence-in-depth assessment was performed which supported extended operation at Pickering NGS by demonstrating the extent to which the safety requirements of defence-in-depth are fulfilled at Pickering NGS. The overall assessment was an important element in supporting the proposed enhancement plans and the planned operational strategy over the period of PSR2.

The PSR2 assessment of defence-in-depth and its conclusions serve as the basis for the PSR2-B review. The assessment of defence-in-depth included a detailed review and confirmation of the adequacy of the provisions for each level of defence. This was based on the assessment of plant design, procedures and processes for the operation and maintenance activities at the plant, and an organizational structure and management system that provides the requisite processes, tools, resources, and oversight to ensure continued safe operation. The PSR2 established that Pickering NGS has multiple and overlapping provisions that are adequate and effective barriers in all levels of defence-in-depth.

The following five levels of defence, listed below are defined in IAEA INSAG-10 Defence in Depth in Nuclear Safety:

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

Integrated Implementation Plan

The Integrated Implementation Plan (IIP) captures the proposed enhancements developed in the GAR. Each resolution action from the GAR is developed into one or more IIP Actions. Each IIP action is developed to be achievable, manageable and executable with completion criteria and success criteria. Each action is developed with OPG programs owners and subject matter experts, with approval from OPG Senior Management for the contents, completion dates and owners of the actions. Each action has been assessed to the appropriate level of the organization for accountability to ensure commitment.

The IIP plan is reviewed and accepted by the CNSC, and a completed action is documented as having met the closure criteria and a closure request sent to the CNSC. IIP actions are closed when CNSC is satisfied that their corresponding success criteria has been met.

Furthermore, OPG has established IIP change control process and reporting arrangements – as part of OPG's governance document framework, and as agreed to by the CNSC.

A3. Pickering NGS PSR2 Results

Pickering NGS underwent a Periodic Safety Review, referred to as "PSR2", from 2016 to 2018, in support of operation extension to 2024. OPG was granted a 10-year Power Reactor Operating Licence (PROL) for Pickering NGS for the period of August 31, 2018, to August 31, 2028.

The PSR for the 2018 Pickering licence renewal was called "PSR2", and was conducted as a subsequent PSR, building on the review basis of earlier OPG PSR work and other associated assessments (termed as "PSR1"), consisting of:

- The Pickering NGS B Integrated Safety Review, completed in 2009 and performed in support of refurbishment and continued operation (for another 30 years) of the Pickering 5 to 8 units;

- Pickering 1,4 integrated safety assessments performed during the Pickering NGS A Return to Service work (circa 2000), in support of approval to restart the Pickering 1,4 units; and

- The Darlington Integrated Safety Review, completed in 2011 with a "code refresh review" performed in December 2013, in support of refurbishment and continued operation of the Darlington.

PSR2 is valid for the period up to the expiry of the Power Reactor Operating Licence (PROL) in 2028. The current planning basis for Pickering NGS is an assumption of operation until the end of 2024. PSR2 is focussed on operating units. When units are permanently shutdown, some Structures, Systems and Components will continue to be operated while the units are place in the safe storage and surveillance state. Description and management of the activities and program changes associated with the transition period for this safe storage and surveillance state are addressed outside of the PSR process.

The Safety Factor reviews conducted under PSR2 assessed a period of extended operation to the end of 2028. In conducting the PSR2 Global Assessment, the development of Resolution Plans considered whether the resolution activities would be dependant on commercial operation to 2024 (the nominal planning basis for the units), or for operation beyond 2024. In cases where detailed resolution activities were only identified to address commercial operations to 2024, the Global Issue (GI) Resolution Plan was identified as requiring "Reassessment Beyond 2024".

The GI Resolution Plans not requiring reassessment for beyond 2024 were evaluated for the period of extended operation of Pickering NGS units to the end of 2028, and therefore, are not time-sensitive to the end of the licensing period.

Hence, the PSR2 fully assessed the safe operation of Pickering NGS to 2024, with the understanding that an extension of the commercial operation of certain units beyond 2024 would be possible, if supported by a reassessment of the impact of such extended operation on the licensing basis and continued plant safety.

Pickering NGS PSR2-B

The overall objective of PSR2-B is to confirm that the design, condition and operation of Pickering NGS support two additional years of commercial operation to the end of 2026 and to identify any necessary improvements beyond those that have already been achieved or committed.

The elements of PSR2-B consist of the following three phases:

i. An assessment to identify gaps for consideration in the Pickering PSR2-B, including a review of the Pickering PSR2 GIs to evaluate the impact of commercial operations beyond 2024, a review of open regulatory actions and an assessment of Darlington NGS D-PSR gaps and Enhancement Opportunities for applicability to Pickering NGS. Documented in the Global Issue Gap Assessment Report.

ii. An amendment to the Pickering PSR2 Global Assessment Report (Reference A-1) to assess the acceptability of Pickering NGS Units 5 to 8 for continued operation over the extended period, and to identify the necessary improvements.

iii. An amendment to the Pickering PSR2 IIP (Reference A-2) to reflect the results of the PSR2-B Global Assessment Report (GAR).

For the PSR2-B, the defence-in-depth assessment included consideration and confirmation that the conclusions of the assessment in PSR2 are not impacted by the Global Issues identified in PSR2-B. The PSR2-B assessment considered the following elements:

- The key physical improvements, analytical evaluations and programmatic enhancements that have been completed since PSR2, and how these improvements and enhancements supports the baseline plant meeting the requirements of defence-in-depth.

- The positive impact on defence-in-depth of the enhancements associated with the proposed Resolution Plans for PSR2-B from the PSR2-B GAR (Reference A-3).

- Confirmation that the PSR2-B Acceptable Deviations do not have a significant adverse effect on defence-in-depth, either individually or when aggregated.

Evaluation of Acceptability of Operation of Pickering NGS Units 5 to 8 to 2026

As a final step, the results of the previous steps of the PSR2-B assessment were used to evaluate the overall acceptability of continuing Pickering NGS Units 5 to 8 operation to 2026. The PSR2-B Global Assessment considers the PSR2 Global Assessment conclusions, the improvements implemented since the PSR2 assessment, the proposed enhancements identified, and the defence-in-depth assessment.

The PSR2-B amendment to the Global Assessment reassessed the time-dependent elements in PSR2 GAR and the new or revised requirements since PSR2, to confirm the validity of the PSR2 conclusions for continued commercial operation for Units 5 to 8 to the end of 2026.

Furthermore, by including the results from the on-going Darlington-PSR, the PSR2-B assessment takes into account any safety significant changes in requirements since the PSR2 was completed, and effectiveness issues

related to programs and practices common to the OPG nuclear fleet.

Finally, the assessment confirms that the Global Issues identified by PSR2-B do not invalidate the conclusions of the assessment in the PSR2 GAR, and the defence-in-depth will be further strengthened with the implementation of the proposed Resolution Plans.

OPG is committed to continuous improvement in safety at all of its nuclear facilities and has robust comprehensive programs in place that are aligned with industry best practices for ensuring the condition of important SSCs important to safety are well understood and well maintained.

A4. References

A-1 OPG Report, “Pickering NGS Global Assessment Report”, CD# P-REP-03680-00032 R001, February 8, 2018.

A-2 OPG Report, “Pickering Periodic Safety Review 2 (PSR2) Integrated Implementation Plan”, CD# P-REP-03680-00031 R001, February 28, 2018.

A-3 OPG Report, “Pickering NGS Periodic Safety Review 2-B (PSR2-B): Global Assessment Report”, CD# P-REP-03680-00048 R000, April 28, 2023.

Appendix B: List of New CSA and Regulatory Documents since September 2018

Licensing Basis Publications				
Licence Condition	**Org Document #**	**Title**	**Version**	**Effective Date**
G.5 Financial Guarantees	CSA N294	Decommissioning of facilities containing nuclear substances	2019	2021-12-31
	CNSC REGDOC-3.3.1	Financial Guarantees for Decommissioning of Nuclear Facilities and Termination of Licensed Activities	2021	2024-01-12
	CNSC REGDOC-2.11.2	Decommissioning	2021	2024-01-12
G.6 Public Information and Disclosure	CNSC REGDOC-3.2.1	Public Information and Disclosure	2018	2020-12-11
1.1 Management System	CNSC REGDOC-2.1.2	Safety Culture * With the exception of nuclear security culture **Including nuclear security culture	2018	2019-05-24* 2020-11-26**
2.1 Human Performance Program	CNSC REGDOC-2.2.4	Fitness for Duty: Managing Worker Fatigue	2017	2019-01-01
	CNSC REGDOC-2.2.4	Fitness for Duty, Volume II: Managing Alcohol and Drug Use, Version 3 * For all requirements other than random and pre-placement alcohol and drug testing ** For Sections 5.1 and 5.5	2021	2021-07-22*. TBD**
	CNSC REGDOC-2.2.4	Fitness for Duty, Volume III Nuclear Security Officer Medical, Physical, Psychological Fitness	2018	2020-04-17
2.4 Certification Programs	CNSC REGDOC-2.2.3	Personnel Certification, Volume III: Certification of Persons Working at Nuclear Power Plants	2019	2020-04-09
4.1 Safety Analysis Program	CNSC REGDOC-2.4.2	Probabilistic Safety Assessment. (PSA) for Nuclear Power Plants	2014	2020-12-31
5.1 Design Program	CSA N290.14	Qualification of Digital Hardware and Software for Use in Instrumentation and Control Applications for Nuclear Power Plants	2015 (R2020)	2022-11-01

Licensing Basis Publications				
Licence Condition	**Org Document #**	**Title**	**Version**	**Effective Date**
6.1 Fitness for Service Program	CNSC REGDOC-2.6.1	Reliability Programs for Nuclear Power Plants	2017	2020-10-23
	CNSC REGDOC-2.6.2	Maintenance Programs for Nuclear Power Plants	2017	2020-10-23
	CSA N285.5	Periodic Inspection of CANDU Nuclear Power Plant Containment Components *** Compliance with the 2018 edition is only for the clauses specified under "CVC Related to CSA N285.5" in the LCH	2008 and Update No. 1 (January 2011) (2018)***	2013-09-01 2019-02-19
	CSA N287.7	In-service Examination and Testing Requirements for Concrete Containment Structures for CANDU Nuclear Power Plants	2017	2021-10-08
9.1 Environmental Protection Program	CNSC REGDOC-2.9.1	Environmental Protection: Environmental Principles, Assessments and Protection Measures, Version 1.1	2017	2020-12-31
	CSA N288.8	Establishing and implementing action levels for releases to the environment from nuclear facilities	2017	2023-12-31
	CSA N288.7	Groundwater protection programs at Class I nuclear facilities and uranium mines and mills	2015	2020-12-31
	CSA N288.1	Guidelines for calculating derived release limits for radioactive material in airborne and liquid effluents for normal operation of nuclear facilities	2014 and Update No. 1 & 2 (May & November 2017)	2019-01-01
10.1 Emergency Preparedness Program	CNSC REGDOC-2.10.1	Nuclear Emergency Preparedness and Response, Version 2	2016	2020-04-17
10.2 Fire Protection Program	CSA N293	Fire protection for CANDU nuclear power plants	2012 and Update No. 1 (R2017)	2023-06-30
11.2 Decommissioning Plan	CNSC REGDOC-2.11.2	Decommissioning	2021	2024-01-12
12.1 Nuclear Security Program	CNSC REGDOC-2.12.1	High-Security Sites, Volume I: Nuclear Response Force, Version 2	2018	202-04-17
	CSA N290.7	Cyber security for nuclear power plants and small reactor facilities	2014	2019-11-30
13.1 Safeguards Program	CNSC REGDOC-2.13.1	Safeguards and Nuclear Material Accountancy * except for non-fuel nuclear material inventory requirements ** for non-fuel nuclear material inventory requirements	2018	2020-03-31* 2021-10-29 **

TABLE B1 – LIST OF NEW CSA AND REGULATORY DOCUMENTS SINCE 2018

Ontario Power Generation Inc.
Head Office
700 University Avenue,
Toronto, Ontario M5G 1X6
Telephone (416) 592-2555 or (877) 592-2555

ONTARIO POWER GENERATION