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Annual Program Report

Rapport annuel sur les programmes

**Regulatory Oversight
Report for Canadian
Nuclear Power
Generating Sites for 2022**

**Rapport de surveillance
réglementaire des sites
de centrales nucléaires
au Canada pour 2022**

Public Meeting

Réunion publique

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Prévue pour :

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Submitted by:

CNSC Staff

Soumise par :

Le personnel de la CCSN

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Summary

This CMD presents the Regulatory Oversight Report for Canadian Nuclear Power Generating Sites for 2022.

The following summarizes the regulatory oversight report:

- Through compliance verification activities, CNSC staff concluded that nuclear power plants (NPPs) and the waste management facilities (WMFs) on their sites in Canada operated safely during 2022. The evaluations of all findings for the safety and control areas show that, overall, NPP and WMF licensees made adequate provision for the protection of the health, safety, and security of persons and the environment and took the measures required to implement Canada's international obligations.
- The following observations support the conclusions:
 - Radiation doses to members of the public were well below the regulatory limit.
 - Radiation doses to workers were below the regulatory limits.
 - The frequency and severity of non-radiological injuries to workers were low.
 - Radiological releases to the environment from the NPPs and WMFs were below regulatory limits.
 - No serious process failures occurred at the NPPs.
 - Licensees met applicable requirements related to Canada's international obligations.

Résumé

Ce CMD présente le Rapport de surveillance réglementaire des sites de centrales nucléaires au Canada pour 2022.

Ce qui suit résume le rapport de surveillance réglementaire :

- En se basant sur des activités de vérification de la conformité, le personnel de la CCSN a conclu que les centrales nucléaires et les installations de gestion des déchets sur leurs sites ont été exploitées de manière sûre en 2022. Les évaluations de toutes les constatations relatives aux domaines de sûreté et de réglementation montrent que, dans l'ensemble, les titulaires de permis de centrale nucléaire et d'installation de gestion des déchets ont pris les mesures voulues pour préserver la santé, la sûreté et la sécurité des personnes, protéger l'environnement et respecter les obligations internationales que le Canada a doit assumer.
- Les observations suivantes appuient les conclusions:
 - Les doses de rayonnement reçues par le public étaient bien en deçà de la limite réglementaire.
 - Les doses de rayonnement reçues par les travailleurs étaient en deçà des limites réglementaires.
 - La fréquence et la gravité des blessures non radiologiques subies par les travailleurs étaient faibles.
 - Les rejets radiologiques dans l'environnement par les titulaires de permis de centrale nucléaire et d'installation de gestion des

déchets étaient sous les limites réglementaires.

- Aucune défaillance grave des systèmes fonctionnels n'est survenue dans les centrales nucléaires.
- Les titulaires de permis se sont conformés aux exigences applicables en rapport avec les obligations internationale du Canada.

There are no actions requested of the Commission. This CMD is for information only.

Aucune mesure n'est requise de la Commission. Ce CMD est fourni à titre d'information seulement.

Signed/signé le
31 August 2023



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Executive summary

The Canadian Nuclear Safety Commission acknowledges that nuclear power generating stations are located on the traditional territories and homelands of many Indigenous Nations and communities and are covered by several treaties.

The regulatory oversight report describes the oversight activities by the CNSC and safety performance of nuclear power generating sites, consisting of nuclear power plants (NPPs) and their associated waste management facilities (WMFs), in Canada in 2022. For certain topics, updates on developments in 2023 are also described.

The following list identifies the facilities for each site covered by this report. Each line in the list identifies facilities that are governed by a single CNSC licence; for this reason, they are assessed together in this report:

- [Darlington Nuclear Generating Station](#), which includes the Tritium Removal Facility and Retube Waste Processing Building
- [Darlington Waste Management Facility](#), which includes the Retube Waste Storage Building
- [Pickering Nuclear Generating Station](#)
- [Pickering Waste Management Facility](#)
- [Bruce A Nuclear Generating Station and Bruce B Nuclear Generating Station](#)
- [Western Waste Management Facility](#)
- [Radioactive Waste Operations Site-1](#)
- [Point Lepreau Nuclear Generating Station](#), which includes the Solid Radioactive Waste Management Facility
- [Gentilly-2](#) Facilities

CNSC staff concluded that the NPPs and WMFs operated safely in 2022. This conclusion was based on CNSC staff assessments of findings from compliance verification activities for each facility in the 14 CNSC safety and control areas (SCAs).

The conclusion was further supported by other observations, including the following:

- No serious process failures occurred at the NPPs. The number of unplanned power reductions, transients and trips in the reactors was low and acceptable to CNSC staff. All unplanned power reductions and transients in the reactors were controlled per design and safely managed.
- Radiation doses to the public and to workers at the NPPs and WMFs were below the regulatory limits.
- The frequency and severity of non-radiological injuries to workers were low.
- Radiological releases to the environment from the NPPs and WMFs were below regulatory limits.

- Licensees met the applicable requirements related to Canada’s international obligations; safeguards inspection results were acceptable to the IAEA.

The SCAs at all NPPs and WMFs were rated as “satisfactory” with two exceptions. Specifically, the Security SCA was assessed as being “below expectations” at the Darlington and Pickering NPPs.

Referenced documents in this Commission member document are available to the public upon request.

1 Introduction

1.1 About the regulatory oversight report

The Regulatory Oversight Report (ROR) for Canadian Nuclear Power Generating Sites: 2022 provides Canadian Nuclear Safety Commission (CNSC) staff's assessment of the overall performance of Canadian nuclear power plants (NPPs) and their associated waste management facilities (WMFs) for 2022.

Section 1 provides introductory material that explains this report, identifies the facilities covered therein, and describes the CNSC regulatory framework and practices. In particular, the CNSC's approach to the safety assessments of the NPPs and WMFs is described in section 1.4.5.

Section 2 provides background information that serves as context for the assessments. While the assessments specific for each site are provided in section 3, section 2 contains some assessments of groups of licensees. For example, section 2 compares safety performance data for multiple licensees.

Section 3 contains highlights from the individual assessments for each facility.

Sections 2 and 3 are organized according to the CNSC safety and control area (SCA) framework as per [General Description of Regulatory Framework for Nuclear Power Generating Sites](#) [2].

Section 4 contains CNSC staff's overall conclusions.

Some of the terms used in this document are defined in CNSC [REGDOC-3.6, Glossary of CNSC Terminology](#).

This report also includes information requested by the Commission from previous regulatory oversight reports and licensing hearings. These requests are tracked through the CNSC Regulatory Information Bank (RIB) system. Table 1 provides the RIB tracking number, a description of the request, and where the request is addressed by CNSC staff in this report.

Table 1: Details on RIB requests from the Commission

RIB #	Request	Report section
14757	Inform the Commission of updates relating to Bruce Power’s pressure tube fracture toughness model, and report on the maximum [Heq] of the pressure tubes as part of the NPP Status Report during each Commission Meeting through the NPP Status Report, as well as in the NPP ROR.	Appendix I
14761	Monitor Bruce Power's continuing efforts to bring internal fire risk to below the safety goal target for the Bruce A Units, and report on the Bruce Power's progress regarding internal fire risk improvements at the Bruce A station in the annual NPP ROR.	Section 3.5.4
22116	(v) Report on OPG's review and revision of the PNGS Public Information and Disclosure Program (PIDP) in regard to emergency preparedness and the provision of information to populations beyond the detailed planning zone.	Section 2.16
25788	Update the Commission on licensees' response to the Heq discovery at Bruce NGS.	Appendix Appendix I
26782	Update the Commission on the concerns raised by several intervenors whose comments and recommendations made on previous RORs were not addressed by CNSC staff. The Commission directed CNSC staff to work towards the transparent resolution of intervenor recommendations.	Appendix G

1.2 Scope of the regulatory oversight report

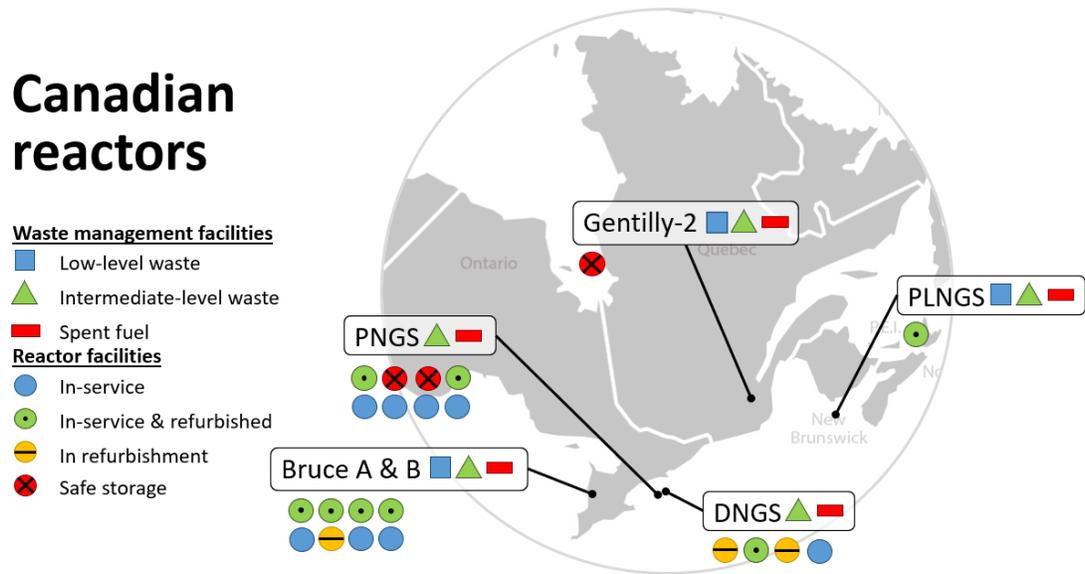
The Regulatory Oversight Report for Canadian Nuclear Power Generating Sites: 2022 covers the NPPs in Canada, including Gentilly-2. General statements in the report that refer to “NPPs” are intended to apply to Gentilly-2, while the phrase “operating NPPs” is used for statements that do not apply to Gentilly-2. The report also covers the WMFs located at the same sites, whether they are regulated under the same licence as the NPP or licensed separately.

Generally speaking, the information provided in this regulatory oversight report is pertinent to 2022, and the status that is described is valid as of December 2022. The word “UPDATE” is used to identify topics where more up-to-date information (up to June 1, 2023) is included (for example, progress on corrective actions, descriptions of significant events, and updates that the Commission specifically requested).

1.3 Nuclear facilities covered by this regulatory oversight report

Figure 1 shows the geographic location in Canada of the NPPs and WMFs covered by this report. It also indicates the type of waste stored at each WMF and the status of each reactor on a site.

Figure 1: Locations of nuclear power generating sites in Canada



1.3.1 Nuclear power generating sites and associated waste management facilities in Canada

The [Darlington site](#) is located in Clarington, Ontario, and consists of the Darlington Nuclear Generating Station (DNGS) and the Darlington Waste Management Facility (DWMF). The operation of the DNGS and DWMF are authorized under separate licences. The site also includes the Darlington New Nuclear Project (DNNP), which is at the licence-to-prepare-site stage of licensing.

The [Pickering site](#) is located in Pickering, Ontario, and consists of the Pickering Nuclear Generating Station (PNGS) and the Pickering Waste Management Facility (PWMF). The operation of the PNGS and PWMF are authorized under separate licences.

The [Bruce site](#) is located in Tiverton, Ontario, and consists of the Bruce A and B nuclear generating stations; OPG's Western Waste Management Facility (WWMF) and Radioactive Waste Operations Site-1 (RWOS-1); and Canadian Nuclear Laboratory's (CNL's) Douglas Point Waste Facility. The operation of Bruce A and B are authorized under a single licence. The operation of the WWMF, RWOS-1 and Douglas Point Waste Facility are authorized under separate licences. Note that the Douglas Point Waste Facility is not covered in this

report, but rather, in the Regulatory Oversight Report for Canadian Nuclear Laboratories Sites: 2022.

The [Point Lepreau site](#) is located on the Lepreau Peninsula in New Brunswick and consists of the Point Lepreau Nuclear Generating Station (PLNGS) and the Solid Radioactive Waste Management Facility (SRWMF). The operation of the PLNGS and SRWMF are authorized under a single licence. See section 3.7 for details.

The [Gentilly nuclear site](#) is located in Bécancour, Québec, and consists of CNL’s Gentilly-1 Waste Facility and Hydro-Québec’s Gentilly-2 Facilities. The operation of the Gentilly-1 and Gentilly-2 facilities are authorized under separate licences. See section 3.8 for details. Note that the Gentilly-1 Waste Facility is not covered in this report, but rather, in the Regulatory Oversight Report for Canadian Nuclear Laboratories Sites: 2022.

Throughout the report, all NPPs refer to all four nuclear generating stations, DNGS, PNGS, BNGS and PLNGS, while the term NPP is sometimes interchanged with one of them.

1.3.2 Nuclear power plants

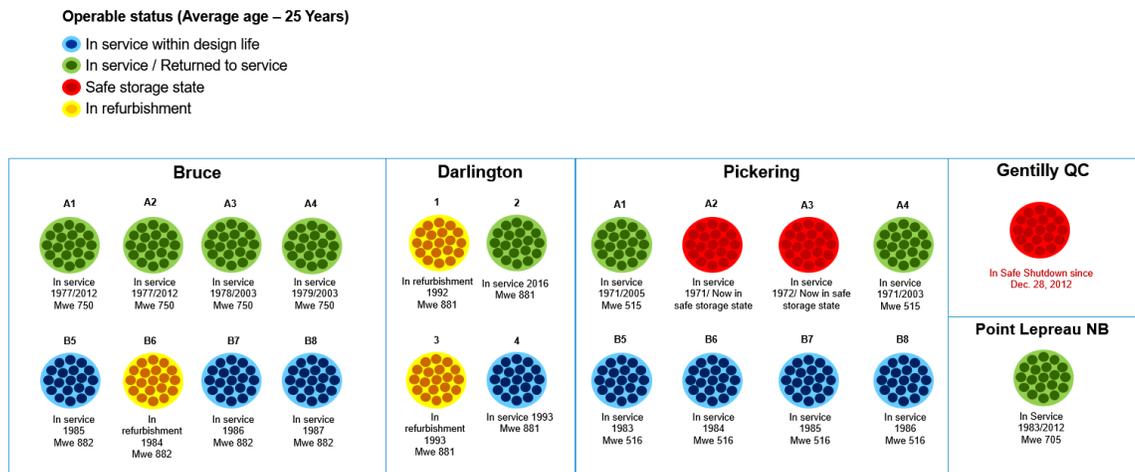
Operating NPPs

There were 17 reactors that continued to operate in Canada throughout 2022. They are located in two provinces (Ontario and New Brunswick – see figure 1) and are operated by three separate licensees (OPG, Bruce Power and NB Power). These NPPs range in size from 1 to 8 power reactors, all of which are of the CANDU (CANada Deuterium Uranium) design.

Figure 2 provides data for each NPP, including the generating capacity of the reactor units, their initial start-up dates, and reactor status in 2022. Additional information on the NPPs and licences is provided in section 3.

Figure 2: Basic information for all NPPs, as of December 31, 2022

Operating Performance of the Canadian Nuclear Fleet



Non-operating reactors

As indicated in figure 2, Bruce Nuclear Generating Station (BNGS) Unit 6 and DNGS Unit 3 were offline for refurbishment in 2022. DNGS Unit 1 was shut down in February 2022 to begin the refurbishment. The PNGS also includes Units 2 and 3, which remained defueled and in safe storage. The non-operating reactors are included in the same power reactor operating licence (PROL) as the operating units.

In addition, the NPP at Gentilly-2 is shut down and is governed by a power reactor decommissioning licence.

New NPPs

In 2012, the Commission issued a nuclear power reactor site preparation licence (PRSL) to Ontario Power Generation (OPG) for the DNNP at the Darlington site for a period of 10 years. The PRSL requires OPG to continue follow-up work on the environmental assessment (EA) conducted in conjunction with the licence application.

In June 2021, a Commission hearing was held to consider an application by OPG to renew its licence (PRSL 18.00/2022). On October 12, 2021, the [Commission renewed](#) the site preparation licence for a period of 10 years. On December 2, 2021, [OPG announced](#) the selection of the [GE Hitachi BWRX-300](#) as the new reactor technology for the DNNP. OPG submitted its application for the licence to construct a reactor facility in October 2022 which is currently under review by CNSC staff.

1.3.3 Waste Management Facilities

The WMFs that are included in this regulatory oversight report are licensed independently from the associated NPP with the exception of the Solid Radioactive Waste Management Facility (SRWMF) at the Point Lepreau site. They include the DWMF, PWMF and WWMF, each of which is owned and operated by OPG under a waste facility operating licence (WFOL). The RWOS-1 facility is licensed under a waste nuclear substance licence (WNSL).

Table 2 provides data for each WMF, including the name of the licensee, the initial start-up date, the expiry date of the licence, and the type of waste managed (for example, low- and intermediate-level waste (L&ILW), intermediate-level waste (ILW) and high-level waste (HLW)). Additional information on the facilities and licences is provided in section 3. As noted in section 1.3.1, both the Point Lepreau and Gentilly-2 sites also have WMFs; they are further discussed in sections 3.7 and 3.8, respectively.

Table 2: Basic information on WMFs

Facility	Licensee	Location	Operation start	WFOL expiry	Type of waste managed
DWMF	OPG	Clarington, ON	2008	Apr. 30, 2033	- HLW from DNGS - ILW from DNGS refurbishment
PWMF	OPG	Pickering, ON	1996	Aug. 31, 2028	- HLW from PNGS - ILW from PNGS Units 1–4 refurbishment
WWMF	OPG	Tiverton, ON	1974	May 31, 2027	- HLW from Bruce A and B NPPs - ILW from Bruce Units 1 and 2 refurbishments - L&ILW from DNGS, PNGS, and Bruce A and B NPP operations
RWOS-1*	OPG	Tiverton, ON	Mid-1960	Oct. 31, 2029	- L&ILW from Douglas Point and PNGS

*The RWOS-1 site is no longer receiving waste and is in a state of storage with surveillance by OPG.

1.4 Regulatory framework and oversight

The CNSC regulates the nuclear sector in Canada, including NPPs and WMFs, through licensing, reporting, compliance verification, and enforcement. The CNSC uses a mature regulatory approach, applying resources and focusing regulatory oversight in accordance with the risk associated with the regulated facility and activity.

Additional information on the CNSC's regulatory framework and oversight is provided in this section and in [General Description of Regulatory Framework for Nuclear Power Generating Sites](#) [2].

1.4.1 CNSC requirements

All licensees are required to operate in accordance with the applicable requirements. When a licence is issued, CNSC staff develop a licence conditions handbook (LCH) to identify the specific requirements that apply to that licence. All NPPs and WMFs covered by this report have LCHs.

Each licensee implements new CNSC regulatory documents and Canadian Standards Association (CSA) Group standards in a staged, risk-informed manner that takes into consideration the timing of licence renewals, operational needs, and other concurrent changes. Although differences exist in applicable requirements between similar facilities at any given time, the requirements nevertheless are comprehensive, and updated requirements are implemented in a systematic way.

1.4.2 Licensing

Each of the operating NPPs and WMFs described in this report has been granted a licence by the Commission. In 2015, the [Commission granted](#) OPG a 10-year licence for the DNGS. In 2018, the [Commission granted](#) Bruce Power a 10-year licence for the BNGS, and OPG a 10-year licence for the PNGS. In 2022 the [Commission granted](#) NB Power a 10-year licence for the PLNGS. For operating NPPs, licences are issued in conjunction with the implementation of a periodic safety review (PSR) process in preparation for the licence renewal.

The PSR is a comprehensive evaluation of the design, condition, and operation of an NPP. As outlined in CNSC [REGDOC-2.3.3, Periodic Safety Reviews](#), a PSR involves an assessment of the current state of the NPP and plant performance to determine the extent to which the NPP conforms to modern codes, standards and practices, and to identify any factors that would limit safe, long-term operation. It provides the licensee with a framework to systematically identify practicable safety enhancements, which are documented in an integrated implementation plan (IIP). A PSR is not a requirement for the Gentilly-2 Facilities and the WMFs because, relative to operating NPPs, the associated hazards are fewer and smaller, and the requirements change on a less frequent basis, such that the regular licensing process and implementation of updated CNSC regulatory documents and CSA Group standards are sufficient to ensure safe operation.

The status of the PSR for each operating NPP is described in section 3.

Fisheries Act authorization

In addition to CNSC licences, this regulatory oversight report describes developments related to *Fisheries Act* authorizations (FAAs). The [Fisheries Act](#) requires mitigation measures to prevent harm caused to fish and fish habitats as well as the establishment of offsets to compensate for any residual harm after mitigation measures have been put in place. The CNSC has a [memorandum of understanding](#) with Fisheries and Oceans Canada whereby CNSC staff are responsible for monitoring activities and verifying compliance for FAA. The [Minister of Fisheries and Oceans](#) is responsible for enforcing the authorizations in the event of non-compliance.

The status of the *Fisheries Act* authorization for each operating NPP is described in section 3.

1.4.3 Reporting

Licensees are required to provide various reports and notices to the CNSC in accordance with regulations made under the [Nuclear Safety and Control Act](#).

In addition to, and in conjunction with, the reporting requirements in the regulations, a licence condition requires NPP licensees to report to the CNSC in accordance with CNSC [REGDOC-3.1.1, Reporting Requirements for Nuclear Power Plants](#). REGDOC-3.1.1 requires licensees to submit quarterly and annual reports on various subjects, including the safety performance indicators that are discussed in this report.

For the Gentilly-2 Facilities, the requirements in REGDOC-3.1.1 have been adjusted in accordance with its current state and the associated risks [3].

For WMFs, OPG is required to submit annual compliance reports as described in [REGDOC-3.1.2, Reporting Requirements, Volume I: Non-Power Reactor Class I Facilities and Uranium Mines and Mills](#). In addition, OPG is required to provide quarterly operations reports for all 3 WMFs as part of the conditions listed in the LCH.

In 2022, NPP licensees reported to CNSC staff on 151 events and submitted 90 scheduled reports. In accordance with the [General Nuclear Safety and Control Regulations](#), the WMF licensee, OPG, also submitted 2 reportable events to CNSC staff that occurred at the DWMF and PWMF.

1.4.4 Compliance verification program

The CNSC staff conclusions presented in this report were based on the results of activities planned through the CNSC compliance verification program (CVP). In 2022, these activities included Type I inspections that evaluate licensee programs, Type II inspections that evaluate the outputs and outcomes of licensee programs, field inspections, which are flexible, conducted onsite and have focussed scope to collect data on the outputs and outcomes of licensee programs, desktop inspections, that are similar to Type II inspections but do not involve onsite activities, technical assessments, and surveillance. The total number of inspections by type is provided in Table 3 below.

Table 3: Total Number of Each Type of Inspection and Findings per NPP

Site	# of Type I inspections	# of Type II Inspections	# of Desktop Inspections	# of Field Inspections	# of Findings
Darlington	0	17	4	76	348
DWMF	0	3	0	0	51
Pickering	0	9	4	63	308
PWMF	0	5	0	0	64

Bruce	0	19	7	61	466
WWMF	0	3	0	0	67
RWOS-1	0	1	0	0	9
Point Lepreau	2	11	1	99	391
Gentilly-2	0	2	0	2	43
Total	2	70	16	301	1,747

Additional reactive compliance verification activities for NPPs and WMFs were added as needed. These reactive activities focused on site-specific matters and known or potential licensee challenges. The CVPs for NPPs and WMFs are intended to be risk-informed, performance-based, and responsive to developments.

The CVPs for NPPs also include technical assessments of safety performance indicators submitted quarterly to the CNSC in accordance with [REGDOC-3.1.1](#). Some of these indicators are reproduced in this report. No regulatory limits or thresholds are associated with this data, but CNSC staff monitor these indicators, observing for trends over time and deviations from the data typically provided by other licensees with similar operations or facilities.

Any unfavourable trend or comparison is followed by increased regulatory scrutiny, which can range from increased surveillance to increased focus during field inspections, adjustment of the timing or scope of a baseline inspection, focused technical assessment, or a reactive inspection, depending on the safety significance of the trend or deviation.

1.4.5 Safety assessment ratings

This report presents safety performance ratings for each SCA at each NPP and WMF based on findings generated during CVP activities. All findings are categorized into appropriate specific areas within the SCAs and are assessed against a set of high-level performance objectives and detailed regulatory requirements. Since the CVP consists of a rolling (typically 5-year) cycle of regulatory activities, not all specific areas are directly evaluated every year.

The SCAs and their associated specific areas are described in more detail in [General Description of Regulatory Framework for Nuclear Power Generating Sites](#) [2]. See Appendix A for a description of the rating methodology used for this regulatory oversight report.

In generating the ratings, CNSC staff considered over 1,700 findings for NPPs and WMFs.

All findings were assessed as being either compliant or, if not compliant, of negligible, low, or medium safety significance. There were no non-compliance findings of high significance in 2022.

For the Bruce A and B, Darlington, and Pickering sites, the NPP and WMF are assessed separately because they are regulated under separate licences and have facility-specific licensing bases. The WMFs at Point Lepreau and Gentilly-2 are governed by the NPP licences and are subject to the same regulatory requirements, so they are assessed together with their respective NPPs (as was done in previous regulatory oversight reports).

2 General and supporting information

This section provides information, organized by [safety and control area](#) (SCA), that serves as background for the assessments in section 3. In some cases, it describes data and issues that are applicable to more than one facility.

2.1 Management system

Prior to the COVID-19 pandemic, all licensees of operating NPPs had business continuity plans (BCPs) in place, which proved valuable during the crisis. These plans were effectively implemented in accordance with the requirements of CSA N286-12, *Management system requirements for nuclear facilities*. The experience gained from using these BCPs during the pandemic led to valuable lessons learned and improvements. These same BCPs ensure the safe operation of NPPs in case of future disruptions. Overall, the proactive measures taken by licensees have demonstrated that they are effectively prepared for events involving pandemics and labor relations actions.

The CNSC published [REGDOC-2.1.2, Safety Culture](#), in April 2018. This document sets out requirements and guidance for fostering a healthy safety culture and conducting periodic safety culture assessments.

CNSC staff are developing an oversight strategy to assess compliance with REGDOC-2.1.2 and monitor efforts to foster a healthy safety culture by all licensees.

NB Power conducted safety culture self-assessments (SCSA) at PLNGS in 2021. OPG performed such an assessment at DNGS in 2021 and at PNGS and Nuclear Sustainability Services (NSS), an OPG division focused on nuclear material and radioactive waste management, in 2022. Bruce Power also conducted its Nuclear Safety and Security Culture Assessment (NSSCA) at BNGS in late 2022. CNSC staff will continue to monitor the implementation of the actions resulting from these assessments.

CNSC staff confirmed Hydro-Québec's compliance with Section 2 of REGDOC-2.1.2, which requires licensees to document their commitment to fostering a safety culture. The requirement to conduct an SCSA described in Section 3 is no longer applicable to the Gentilly-2 NGS.

2.2 Human performance management

The CNSC requires NPP licensees to employ certified control room shift supervisors, plant shift supervisors, reactor operators and senior health physicists. Due to the design of BNGS A, BNGS B and DNGS, the CNSC requires these licensees to also employ certified Unit 0 operators. It should be noted that Gentilly-2 no longer employs certified shift workers, and therefore senior health physicists (“responsables techniques de radioprotection”) are the only remaining certified workers at the Gentilly-2 NPP. There are no certified staff at the WMFs.

Table 4 below shows the number of certified personnel who are available in the certified positions at each NPP, as of December 31, 2022. The table also shows the minimum required number of personnel for each position, which is the minimum number of certified personnel that must be present at all times multiplied by the total number of crews.

Table 4: Number of available certifications per NPP and certified positions for 2022

Station	Reactor operator	Unit 0 control room operators ^a	Shift supervisor ^b	Senior health physicist ^f	Total
Darlington Nuclear Generating Station					
Actual	60	21	26 (18 SM + 8 CRSS)	6	113
Minimum	30	10	10	1	51
Pickering Nuclear Generating Station 1, 4 ^c					
Actual	37		23 (18 SM + 5 CRSS)	2	62
Minimum	20		10	1	31
Pickering Nuclear Generating Station 5-8					
Actual	60		26 (20 SM + 6 CRSS)	2	88
Minimum	30		10	1	41
Bruce Nuclear Generating Station A ^d					
Actual	53	24	28 (22 SM + 6 CRSS)	3	108
Minimum	30	10	10	1	51
Bruce Nuclear Generating Station B					
Actual	59	25	32 (24 SM + 8 CRSS)	3	119
Minimum	30	10	10	1	51
Point Lepreau Nuclear Generating Station					
Actual	19		8	2	29
Minimum	6		6	1	13
Gentilly-2 ^e					
Actual				1	1
Minimum				1	1

- a. There are no Unit 0 positions at PNGS Units 1 and 4 and Units 5–8, or at PLNGS.
- b. At multi-unit NPPs, the shift supervisor number is the total of certified shift managers (SM) plus certified control room shift supervisors (CRSS).
- c. There are two certified health physicists in all at Pickering, who cover both PNGS Units 1 and 4 and Units 5–8.
- d. There are three certified health physicists in all at Bruce, who cover both BNGS A and BNGS B.
- e. There are no reactor operators, Unit 0 CROs or shift supervisors at Gentilly-2.
- f. Senior Health Physicists do not require a 24h/7day week onsite presence. Should emerging work require Senior Health Physicist approval, there is an on-call system.

Inspections conducted by CNSC staff during 2022 confirmed that the licensees met the requirements set for personnel certification, with few minor non-compliances.

All NPP licensees have a documented minimum shift complement (MSC), qualified staff who must be always present onsite, which forms part of its licensing basis. MSC is monitored each shift and is managed through face-to-face turnover, the use of electronic minimum complement monitoring systems, or the use of manual tracking mechanisms to record the availability of staff as they enter and exit the facility.

Licensees reported 2 MSC violation at the DNGS, two violations at PNGS, three violations at BNGS A and B, and 2 violations at PLNGS that happened during 2022. All violations were of a short duration and the licensees took appropriate actions, e.g., calling in relief staff, holding over staff already present and operating in quiet mode.

All NPP and WMF licensees have procedures to manage worker fatigue that include limits on hours of work. CNSC REGDOC-2.2.4, Fitness for Duty: Managing Worker Fatigue specifies requirements and guidance for managing worker fatigue at all high-security sites (HSS), which include NPPs and WMFs, with the aim of minimizing the potential for errors that could affect nuclear safety and security.

REGDOC-2.2.4, Fitness for Duty, Volume II: Managing Alcohol and Drug Use sets out requirements and guidance for managing fitness for duty of workers occupying safety-sensitive and safety-critical positions in relation to alcohol and drug use at all HSS. Version 3 of the regulatory document was published on January 22, 2021. OPG, Bruce Power and NB Power confirmed that they had implemented version 3 as planned by July 2021, with the exception of random testing, which they had committed to implement by January 22, 2022. Hydro-Québec implemented version 2 of REGDOC-2.2.4 Volume II in July 2019, and in June 2021 provided a gap analysis indicating that their current program was compliant with version 3.

On January 21, 2022, the Federal Court granted an injunction putting on hold the implementation of pre-placement and random alcohol and drug testing pending the results of the Federal Court's judicial review.

UPDATE: On June 6, 2023, the Federal Court released its decision dismissing the judicial review and upholding the validity of sections 5.1 and 5.5 of REGDOC-2.2.4, which are the sections that create the pre-placement and random testing requirements. The Federal Court found that sections 5.1 and 5.5 do not infringe the *Charter*, and the CNSC's decision to require pre-placement and random testing was reasonable. The CNSC has been informed that the applicants in the case intend to appeal the decision to the Federal Court of Appeal and will be seeking another injunction until the appeal is decided.

Licenses are required to ensure that all nuclear security officers have medical, physical and psychological certificates that meet CNSC's requirements, as outlined in [REGDOC-2.2.4, Fitness for Duty, Volume III: Nuclear Security Officer Medical, Physical and Psychological Fitness](#). While PLNGS's compliance with the standard was verified during a Type II inspection in 2021, compliance verification for all other licenses was being planned, as of the end of 2022.

2.3 Operating performance

There were 16 reactors and associated waste management facilities that continued to operate in Canada throughout 2022. DNGS Units 1 and 3 and BNGS Unit 6 were undergoing refurbishment during this time. DNGS Unit 1 was shutdown in February 2022 to commence its refurbishment.

All operating NPPs licenses are required to report serious process failures to the CNSC, in accordance with CNSC [REGDOC-3.1.1, Reporting Requirements for Nuclear Power Plants](#). Among other performance indicators, REGDOC-3.1.1 requires operating NPP licenses to submit quarterly reports on the "Number of unplanned transients", which tracks unplanned transients (unexpected reactor power changes) for each reactor that is not in a guaranteed shutdown state. These unplanned transients indicate problems within a plant, and place strain on its systems.

Table 5 summarizes the number of unplanned transients for the operating NPPs caused by step backs, setbacks, and reactor trips. Step backs and setbacks are power changes intended to eliminate risks to plant operations. Reactor trips are power reductions initiated by any of a reactor’s safety systems to rapidly shutdown the reactor. “Industry total” provides the data for the operating Canadian NPPs. In 2022, all unplanned transients were properly controlled by the reactor control systems. CNSC staff also determined that no serious process failures occurred at any NPP.

Table 5: Number of unplanned transients

NPPs	Number of operating reactors ³	Number of hours of operation	Un-planned reactor trips ¹	Step-backs	Set-backs	Total unplanned transients	Number of trips per 7,000 operating hours
DNGS	3	18,529	1	0	2	3	0.38
PNGS 1, 4	2	12,181	1	n/a ²	0	1	0.57
PNGS 5–8	4	29,137	2	0	0	2	0.48
BNGS A	4	39,981	0	1	2	3	0.00
BNGS B	3	17,697	0	0	1	1	0.00
PLNGS	1	5,667	2	0	0	2	2.47
Industry total	17	119,192	6	1	5	12	0.35

Notes:

- 1 This includes automatic reactor trips only; it does not include manual reactor trips or trips during commissioning testing.
- 2 Step backs are not a design feature at PNGS Units 1 and 4.
- 3 DNGS Units 1 (for part of the year) and 3 were down for refurbishment in 2022.

Figure 3 shows the total number of unplanned transients from 2018 to 2022 for the operating NPPs.

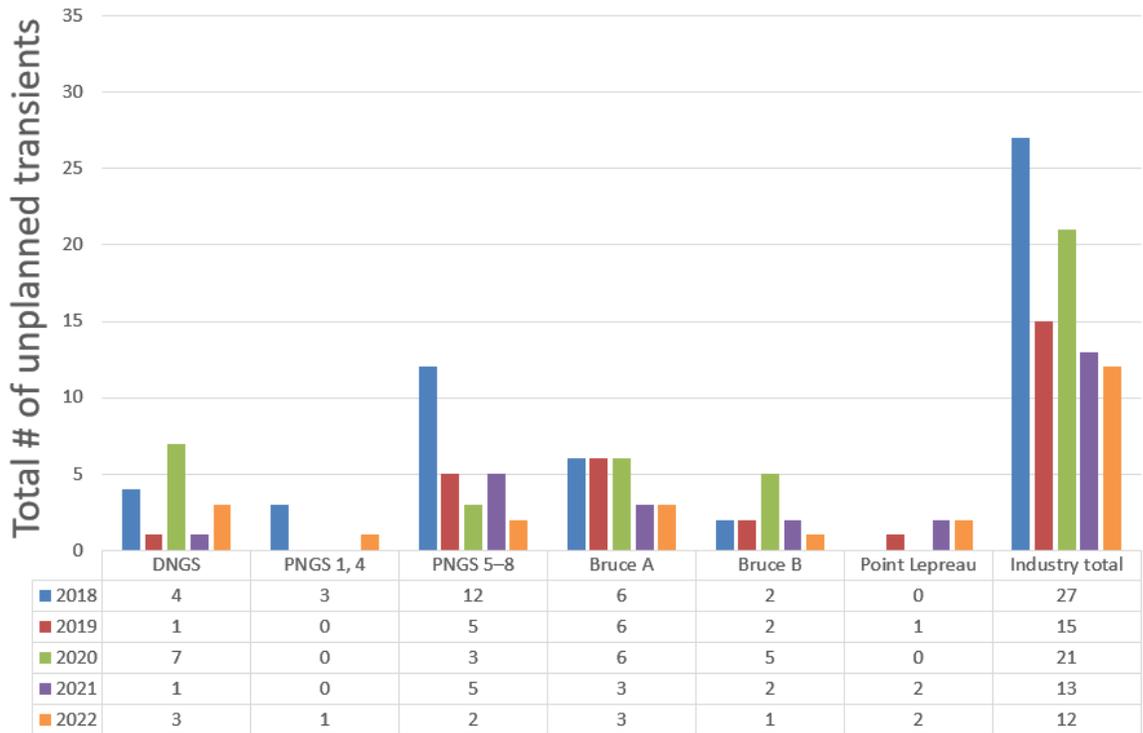
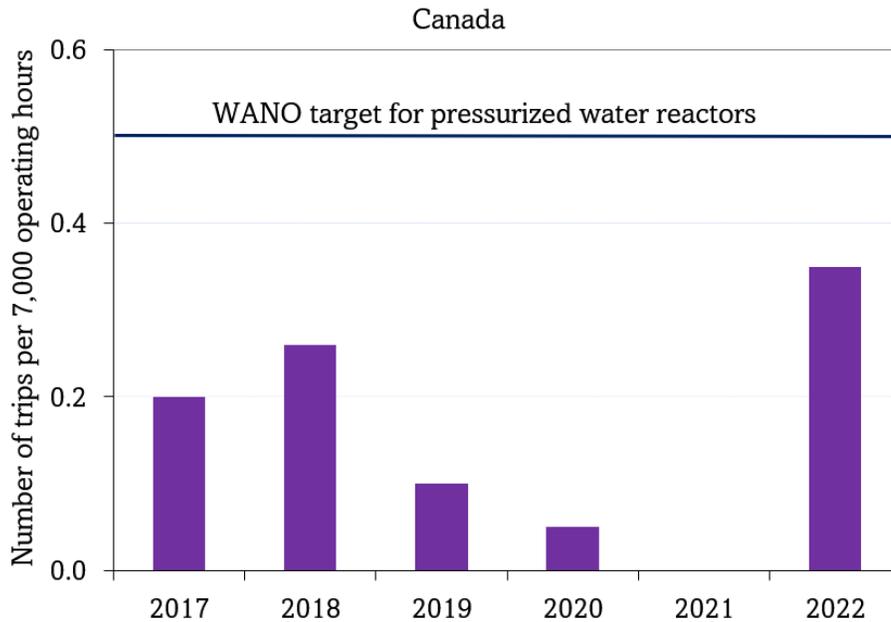
Figure 3: Trend of unplanned transients for stations and industry

Figure 4 compares the number of unplanned reactor trips for Canada's operating NPPs per 7,000 hours of operation, which is a measure used by the [World Association of Nuclear Operators](#) (WANO). This WANO indicator is defined as the number of unplanned automatic scrams (reactor protection system logic actuations) that occur per 7,000 hours of critical operation (which is approximately 1 year of operation). WANO targets include the following:

- The target for each of the individual operational units for pressurized heavy water reactors (PHWR) is 1.5 trips per 7,000 hours critical. In 2022, all units in Canada met this target, except for PLNGS. See section 3.7.3 for more details.
- The PHWR industry target, which is the equivalent industry total trips per 7,000 hours critical, is 1.0. Although the WANO target for PHWR is the appropriate benchmark for the CANDU reactors at Canadian NPPs, figure 4 superimposes a line at the more challenging target (0.5) for pressurized water reactors, which Canadian NPPs continue to use as the more conservative target.

Figure 4: Trend of unplanned reactor trips per 7,000 operating hours

CNSC staff informed the Commission of unplanned outages resulting from reactor trips and their outcomes via status reports on NPPs in 2022. CNSC staff confirmed that unplanned outages were managed safely and in accordance with the applicable regulatory requirements.

During each unit's planned outage in 2022, CNSC staff conducted compliance verification activities and determined that regulatory requirements were met, and outages were executed safely.

For all Canadian nuclear power plants, the 10-year trend for unplanned transients has been stable or slightly improving, and the unplanned reactor trips are well below the World Association of Nuclear Operators (WANO) target of one trip per 7,000 hours of critical operation.

CNSC staff determined that all licensees had adequate safe operating envelope (SOE) programs in 2022 that were based on the requirements of CSA N290.15-10, *Requirements for the safe operating envelope of nuclear power plants*. All licensees have implemented a hierarchy of governance, standards, processes, and procedures to support producing, updating, and maintaining SOE-related documentation. Additionally, CNSC staff also concluded that all licensees operated within the SOE in 2022, with the exception of one area at DNGS that was being addressed at the end of 2022 (refer to Section 3.1.3).

2.4 Safety analysis

In 2022, NPP licensees continued to improve their safety analysis programs in line with REGDOC-2.4.1, Deterministic Safety Analysis. All licensees submitted implementation plans, which were accepted by CNSC staff. These plans identify gaps between existing safety analyses and REGDOC-2.4.1 requirements and

prioritize tasks to address these gaps based on their relevance to risk. Re-analyzing accident scenarios takes time and effort, but licensees are performing it according to their plans with no significant delays.

Licensees implement aging management programs to monitor important parameters related to reactor aging, and compensatory measures are taken when needed to maintain safety margins. CNSC staff oversee these programs to ensure their effectiveness. Details for each facility are provided in section 3.

2.5 Physical design

CNSC staff concluded that the licensees met the applicable regulatory requirements and the expectations of CNSC staff for the SCA Physical Design in 2022. Site specific details are elaborated in Section 3.

2.6 Fitness for service

Overall, the special safety systems (SSSs) performed well in 2022 and met their unavailability targets, with a few exceptions described in sections 3.5.6 and 3.7.6.

The number of total missed safety system tests remained very low in 2022. In all, 40,609 tests were performed, and the percentage of missed tests was 0.002%. The impact of missing a single test is negligible because the NPP designs have sufficiently high redundancy to ensure continuous availability of the safety systems.

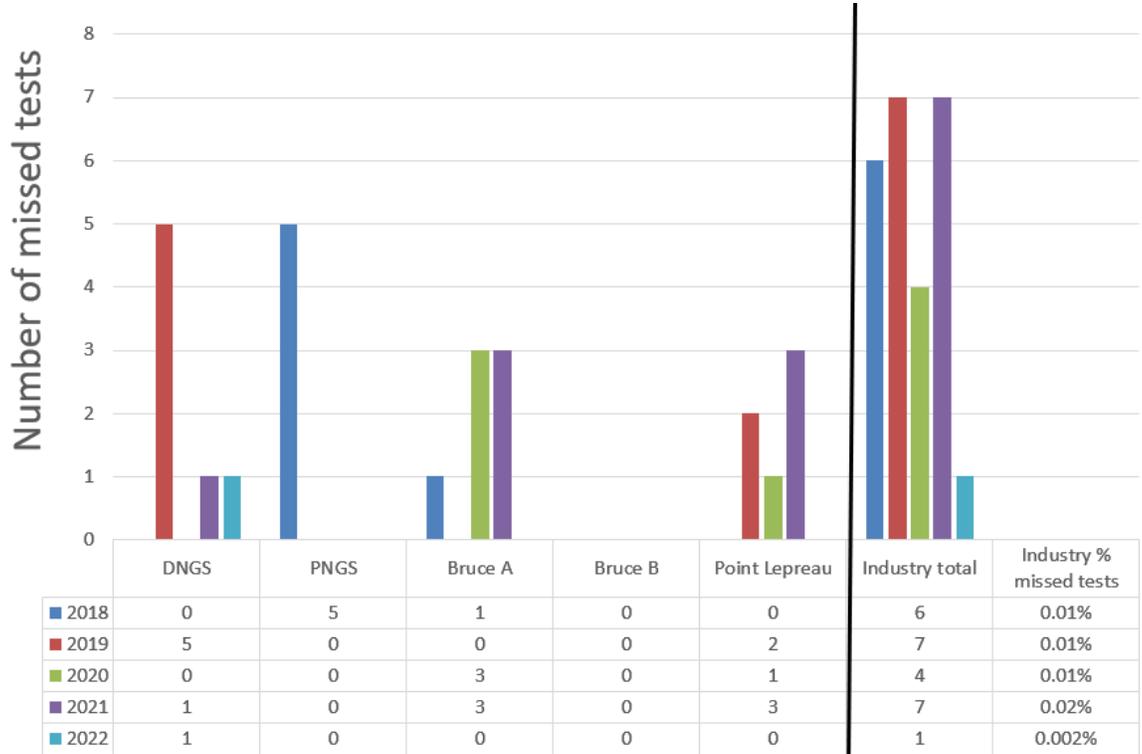
Table 6 provides the number of planned tests versus the number of tests not completed.

Table 6: Safety system test performance for 2022

Nuclear power plant	Number of annual planned tests	Not completed: Special safety systems	Not completed: Standby safety systems	Not completed: Safety related process systems	Not completed: Total	Percent not completed
DNGS	6,035	1	0	0	1	0.02%
PNGS	13,283	0	0	0	0	0.00%
BNGS A	7,833	0	0	0	0	0.00%
BNGS B	6,832	0	0	0	0	0.00%
PLNGS	4,313	0	0	0	0	0.00%
Industry	38,296	1	0	0	1	0.002%

total						
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Figure 5: Trend of safety system test performance for NPPs and industry



The preventative maintenance completion ratio (PMCR) quantifies the effectiveness of the preventive maintenance program in minimizing the need for corrective maintenance activities for safety-related systems. The average PMCR value for operating NPPs was 95% in 2022. CNSC staff were satisfied with the effectiveness of the licensees' preventive maintenance program.

The maintenance backlogs and deferrals for the industry are provided in Table 7. The industry average of these three performance indicators were low in 2022. Overall, CNSC staff were satisfied with the progress in 2022.

Table 7: Trend of industry maintenance backlogs and deferrals for critical components of NPPs

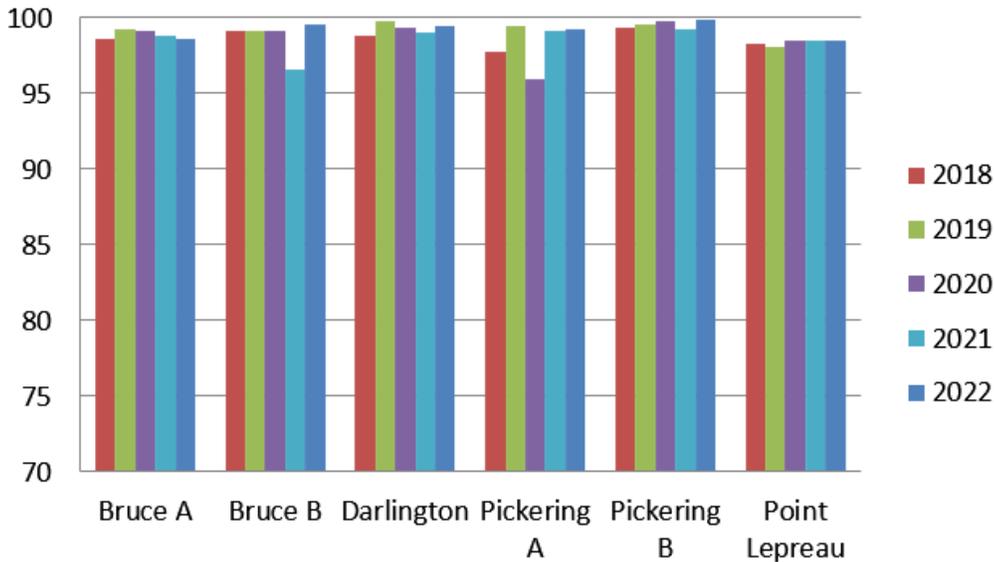
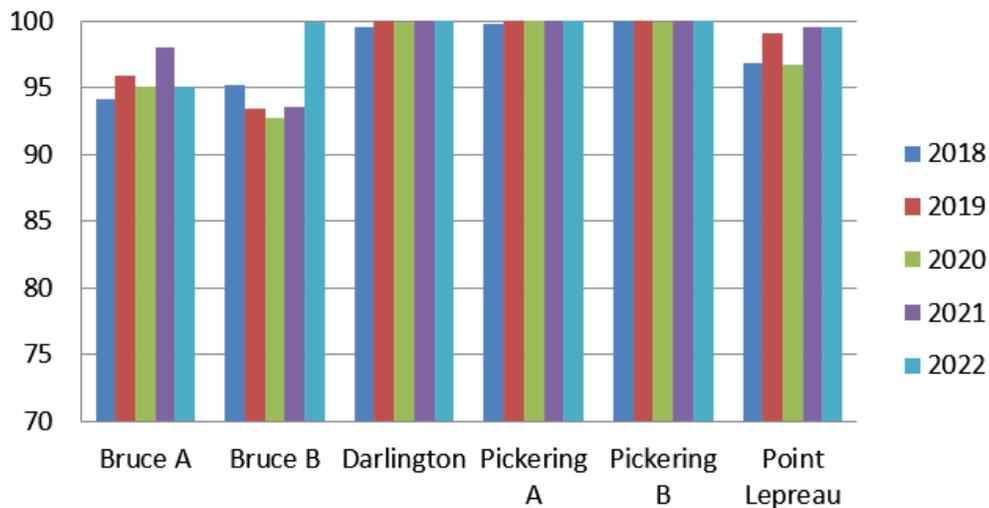
Performance indicator	Average quarterly work orders per unit in 2020	Average quarterly work orders per unit in 2021	Average quarterly work orders per unit in 2022	3-year trending
Corrective maintenance backlog	1	1	1	Steady
Deficient maintenance backlog	4	4	4	Steady
Deferrals of preventive maintenance	2	3	1	Improving

Appendix I contains an update on industry's response to the elevated hydrogen equivalent concentration (Heq) findings near the rolled joint burnish marks of BNGS Unit 3 and Unit 6 pressure tubes.

The licensees completed the scheduled inspection activities for pressure boundary systems and containment components and structures required for compliance with the periodic inspection programs referenced in their LCHs. Findings were of minor safety significance, and all findings were dispositioned to confirm required safe operating margins continue to be met.

Figures 6 and 7 show the values of both chemistry control indices for operating NPPs from 2018 to 2022. The chemistry index (CI) is the percentage of time that the selected chemical parameters are within specification. It quantifies the long-term control of important chemical parameters. The CI is used to determine long-term impacts of various issues, such as corrosion, on safety-related systems. The chemistry compliance index (CCI) is the percentage of time that the selected chemical parameters are within the licensees' specifications for guaranteed shutdown state (GSS) and non- GSS conditions. The CCI parameters are selected based on potential immediate risks if these parameters are out of specification.

Based on these values, CNSC staff concluded that chemistry control was acceptable for all licensees.

Figure 6: Trend of chemistry index for industry (in percentage)**Figure 7: Trend of chemistry compliance index for industry (in percentage)**

2.7 Radiation protection

The safety performance indicator for the Application of ALARA is the “collective radiation exposure” also known as collective dose. In 2022, the total collective dose for monitored individuals at all Canadian NPPs and WMFs was 30.0 person-sieverts (p-Sv), approximately 15% lower than the industry-wide collective dose reported for the previous year (35.5 p-Sv). The number of non-zero doses reported for all operating NPP’s in 2022 (11,196) was slightly higher than 2021 values (10,855). The decrease in total collective dose was mainly due to a decrease in collective dose from outage activities at Bruce A and B and DNGS. The routine operations dose remained relatively constant between 2022 and 2021.

The collective doses for the individual NPPs are dominated by doses from outages (including refurbishment activities) rather than from routine operations. It should also be noted that external dose is, collectively, much greater than internal dose. The primary component of worker internal doses at Canadian NPPs is airborne tritium. Some of the current initiatives used at NPPs to protect workers and lower tritium levels include better respiratory protection, ensuring the use of fully operational driers prior to outages and the use of local ventilation and temporary ventilated enclosures.

NPPs with units undergoing refurbishment incur significantly more collective dose. The magnitude of the doses received during refurbishment also changes depending upon the work being performed; a higher radiation exposure is experienced when a reactor core is dismantled compared to when it is being reconstructed. Table 8 shows the total collective dose for operating NPPs, as well as a breakdown of the collective dose into different work categories.

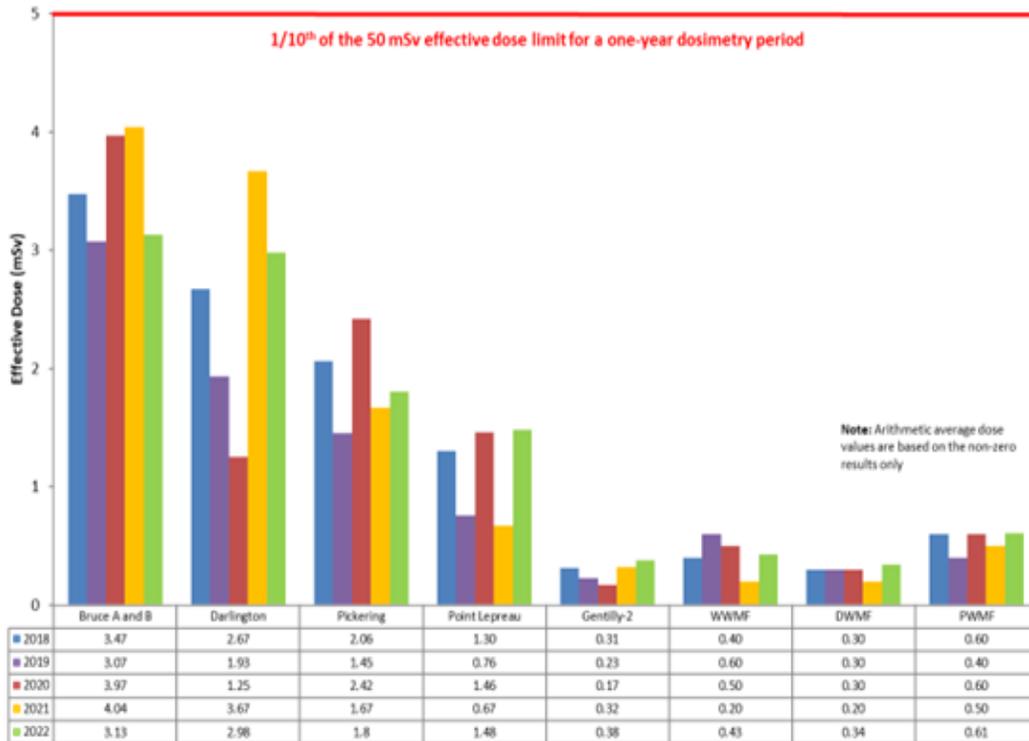
Table 8: Breakdown of collective dose for operating NPPs in 2022 (person mSv)

NPP	Number of operating units	Routine operations	Outages	Refurbishment	Total
DNGS*	4	259	383	10,311	10,953
PNGS	6	885	3,148	0	4,033
BNGS A	4	500	6,077	0	6,577
BNGS B**	4	486	2,339	4,355	7,180
PLNGS	1	176	1,207	0	1,383

* DNGS Unit 3 was in refurbishment for all of 2022, while Unit 1 was in refurbishment from mid-February through December 2022.

** BNGS Unit 6 was in refurbishment for all of 2022.

The annual average effective dose in 2022 for all operating Canadian NPPs was 2.68 millisieverts (mSv). Figure 8 shows the average effective doses to monitored persons with non-zero dose at each NPP and WMF for the period 2018 to 2022. This figure shows that, for 2022, the average effective dose at each facility ranged from 0.34 to 3.13 mSv per year. In general, the fluctuations in average dose observed from year to year reflect the type and scope of work being performed at each facility. No negative trends were identified in 2022.

Figure 8: Trend of average effective doses of monitored persons

The maximum annual individual effective doses, as reported by each NPP and WMF for 2018 to 2022, are presented in figure 9. In 2022, the maximum individual effective dose received at a single site was 21.29 mSv, received by a worker who participated in maintenance outages that included fuel channel and feeder inspection programs at BNGS. In 2022, no radiation exposures received by persons at any NPP or WMF exceeded the regulatory dose limit of 50 mSv/year for nuclear energy workers, as established in the [Radiation Protection Regulations](#).

Figure 9: Trend of maximum individual effective doses

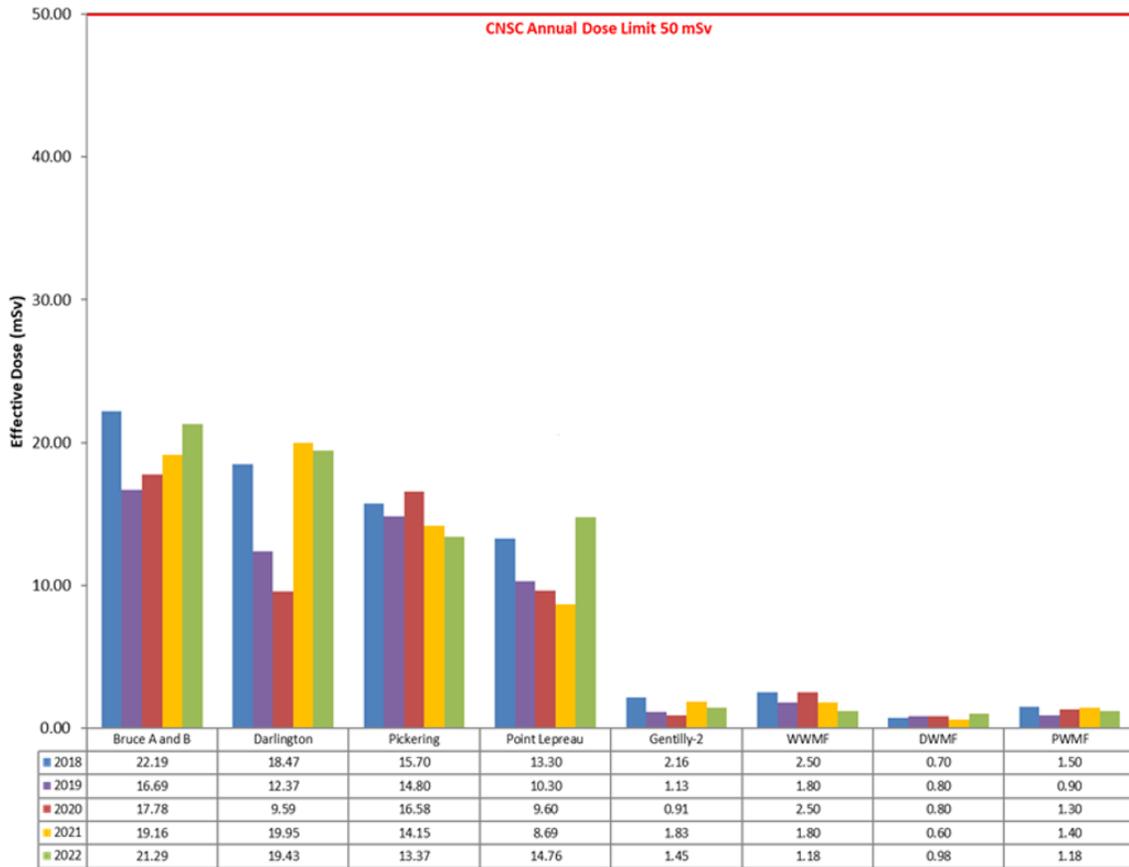
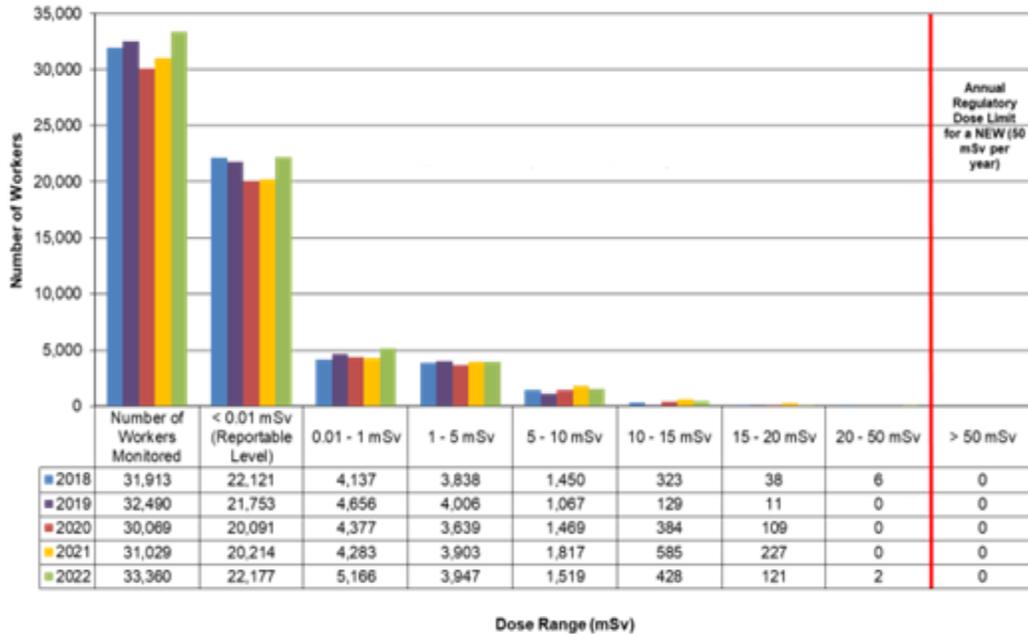


Figure 10 provides the distribution of annual effective doses to all monitored persons at all Canadian NPPs from 2018 to 2022. All doses reported over those years were below the annual regulatory dose limit of 50 mSv for nuclear energy workers. In fact, approximately 82% of the doses reported were at or below the much lower annual regulatory dose limit of 1 mSv for members of the public.

Overall, CNSC staff were satisfied with the licensees’ control of worker doses in 2022 and concluded that workers’ radiation protection was appropriately planned and managed.

Figure 10: Trend of distribution of annual effective doses received by all monitored persons at Canadian NPPs



NPPs continued to employ performance metrics and perform self-assessments to monitor and control performance in all aspects of the RP program. Operating experience and benchmarking with industry was used to improve performance.

CNSC staff did not observe any failures of RP programs in 2022 and are satisfied with the industry's performance.

2.8 Conventional health and safety

The performance indicator consists of Accident Severity Rate (ASR), Accident Frequency (AF), and Industrial Safety Accident Rate (ISAR). The ASR measures the total number of days lost due to work-related injuries for every 200,000 person-hours (approximately 100 person-years) worked at an NPP. The AF is a measure of the number of fatalities and injuries (lost-time and medically treated) due to accidents for every 200,000 person-hours worked at NPPs. The ISAR is a measure of the number of lost-time injuries for every 200,000 hours worked by NPP personnel.

The ASR, AF and ISAR values for the NPPs and industry average are presented in figures 11, 12 and 13, respectively. The data in these figures indicate continuing low rates of accidents and lost time due to accidents.

In addition, the values for ASR and ISAR for WMFs were zero in 2022 with no lost-time injuries. CNSC staff observed that no work-related fatalities occurred at Canadian NPPs and WMFs in 2022.

All licensees continue to implement and maintain a safe conventional health and safety program in accordance with provincial and federal regulatory requirements. Regulatory requirements for conventional health and safety are found in the

relevant provisions of provincial and/or federal laws ([Occupational Health and Safety Act](#) (Ontario), the [Ontario Labour Relations Act](#), [Occupational Health and Safety Act](#) (New Brunswick), Quebec’s [Loi sur la Santé et la Sécurité au Travail](#) (Québec), and the [Canada Labour Code, Part II: Occupational Health and Safety](#)). CSA N286-12, *Management system requirements for nuclear facilities* also contains regulatory requirements that are directly applicable to conventional health and safety. The CNSC has a [memorandum of understanding](#) with the Ontario Ministry of Labour, Immigration, Training and Skills Development, which establishes a formal mechanism for cooperation and exchange of information between the Ministry and the CNSC.

Figure 11: Trend of accident severity rate for NPPs and Canadian industry
(Covers all employees, not including third-party contractors)

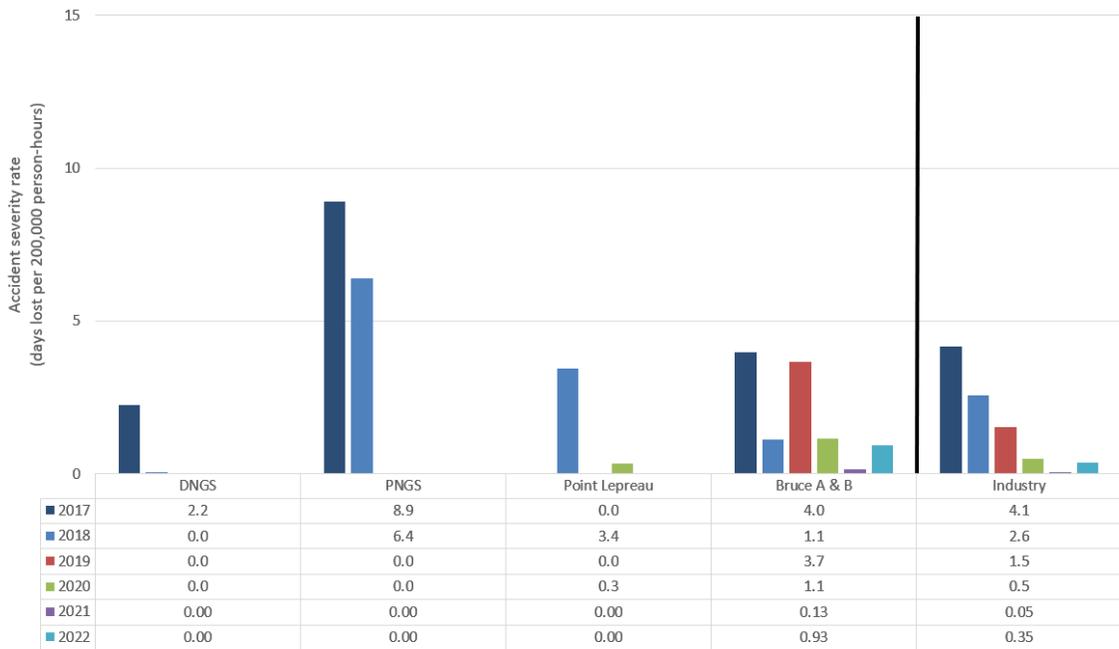


Figure 12: Trend of accident frequency for NPPs and Canadian industry
(Covers all employees, not including third-party contractors)

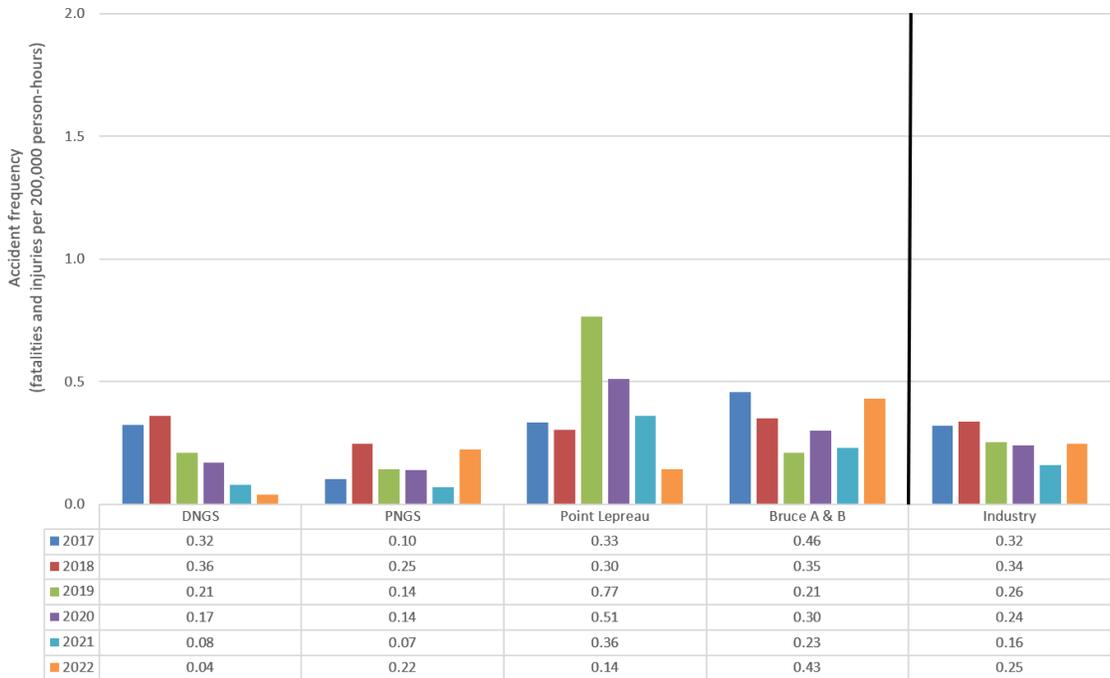
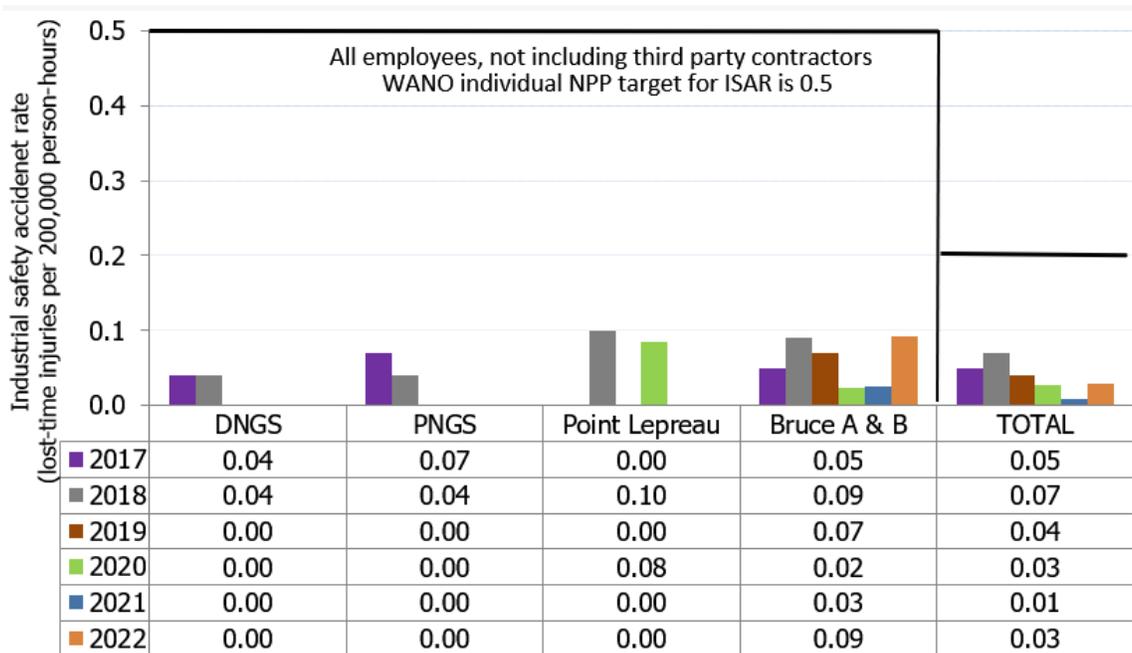


Figure 13: Trend of industrial safety accident rate for NPPs and Canadian Industry (covers all employees, not including third-party contractors)



2.9 Environmental protection

Derived release limits (DRLs) are quantities of radionuclides (released as an airborne emission or waterborne effluent) that are calculated based on the regulatory dose limit for the public of 1 mSv per year. The DWMF and PDMF fall under the DRLs for the DNGS and the PNGS, respectively. The WDMF has its own facility specific DRLs for airborne and liquid releases.

The CNSC publishes annual radionuclide loadings to the environment from nuclear facilities on the CNSC [Open Government Portal](#) [4]

The estimated doses to the public for airborne emissions and liquid releases from 2018 to 2022 are provided in Table 9. Note that the data for the DWMF, PDMF and WDMF is included in that of the DNGS, PNGS and BNGS sites, respectively.

The table shows that the doses were well below the annual regulatory dose limit of 1 mSv for members of the public. A comparison of the 2022 data with that of previous years indicates that the values remained within the same general range (<0.01 mSv) as the values for 2018 to 2022.

Table 9: Trend of estimated dose to the public from Canadian nuclear power generating sites (mSv)

Year	Darlington	Pickering	Point Lepreau	Bruce	Gentilly-2*
2018	0.0008	0.0021	0.0007	0.0017	0.0090
2019	0.0004	0.0017	0.0012	0.0015	0.0030
2020	0.0004	0.0012	0.0013	0.0018	0.0010
2021	0.0006	0.0020	0.0013	0.0016	0.0010
2022	0.0006	0.0019	0.0011	0.0024	0.0010

* Gentilly-2 data is presented for completeness, but this facility is no longer considered an NPP

Environmental Protection Reviews

CNSC staff conduct environmental protection reviews (EPRs) for all licence applications with potential environmental interactions, in accordance with CNSC's mandate under the NSCA and its regulations. An EPR is a science-based environmental technical assessment conducted by CNSC staff. The fulfillment of other aspects of the CNSC's mandate, such as regulating safety and security, are met through other oversight activities.

Starting in 2021, the CNSC began a new approach for publishing stand-alone EPR reports online. These reports are separate from a specific licensing decision to allow interested Indigenous Nations and communities and members of the public additional time to review information related to environmental protection and engage with CNSC staff on any areas of interest or concern. All available

EPR reports can be found on the [CNSC website](#). EPR reports are typically conducted to align with the facility's ERA cycle, which is approximately every five years or whenever there is a major change to the facility. CNSC staff have posted the following two EPR reports for NPPs and WMFs:

- [Environmental Protection Review Report: Darlington Waste Management Facility](#)
- [Environmental Protection Review Report: Point Lepreau Nuclear Generating Station](#)

The information in EPR reports support staff's recommendations to the Commission in future licensing and regulatory decisions on whether the proposal provides adequate protection of the environment and the health of people.

2.10 Emergency management and fire protection

Note that OPG has a single, consolidated nuclear emergency plan that governs both the DNGS and PNGS sites and that includes the Darlington and Pickering WMFs. The WWMF is under the Bruce Power nuclear emergency response plan and fire response plan.

In support of the province's jurisdiction over off-site public safety, Emergency Management Ontario in January 2023 initiated a three-year Nuclear Emergency Management Program Enhancement Project. A new technical study and planning basis is being prepared with the aim of producing a revised/updated Provincial Nuclear Emergency Response Plan (PNERP) for Ontario. The updated PNERP is expected to be completed by 2026.

CNSC staff continue to engage with the provinces and are satisfied with the support being provided by the utilities to ensure that provinces are poised and ready to respond in case of a nuclear emergency.

2.11 Waste management

Through on-going compliance activities, CNSC staff confirmed that all licensees continued to employ effective programs for the radioactive and hazardous wastes during 2022.

In 2022 the Commission accepted the preliminary decommissioning plans (PDPs) and revised financial guarantees submitted by NB Power.

On January 25, 2022, OPG submitted preliminary decommissioning plans (PDPs) for all its nuclear facilities, which include sites licensed by Bruce Power. CNSC staff completed their review and confirmed that the PDPs met the applicable regulatory requirements and guidance.

OPG maintains a consolidated planning and Financial Guarantee for decommissioning of its owned nuclear facilities including BNGS A and BNGS B on the base of a 5-year cycle. In August 2022, OPG submitted an application for the acceptance of its revised consolidated financial guarantee for the future decommissioning of OPG's nuclear facilities. OPG's consolidated financial

guarantee was due to expire on December 31, 2022. The Commission concluded in December 2022 that OPG's proposed revised financial guarantee will continue to provide for the future decommissioning of OPG's owned nuclear facilities and accepted OPG's proposed revised financial guarantee for 2023-2027.

2.12 Security

Throughout 2022, all licensees maintained security effectiveness in the Facilities and Equipment area despite the challenges posed by the COVID-19 pandemic. Licensees managed their security-related equipment through lifecycle management programs, and with the exception noted below, only minor equipment failures were reported to the CNSC.

However, findings identified in 2021 in security Facilities and Equipment area indicated that OPGs performance at both DNGS and PNGS deviated from the applicable requirements and CNSC staff's expectations. These findings had not been fully addressed in 2022. Additionally, CNSC staff inspections at DNGS in 2022 identified non-compliances related to underground pathways and lighting.

Licensees successfully managed their Business Continuity Plans in relation to Security Practices throughout 2022. The COVID-19 pandemic did not significantly impact the regulatory compliance of licensees in this area.

In the Response Arrangements area, regulatory compliance of licensees was not significantly impacted by COVID-19 throughout 2022. Non-compliances were identified at DNGS for Nuclear Response Force (NRF) Response Vehicle Verification and Nuclear Security Officer (NSO) Equipment and Asset Verification, as well as Public Agent Requirements. These non compliances also impacted PNGS. Additionally, OPG was also issued a warning letter in relation to a security event. These non-compliant findings and the follow up of the security event are described in a supplemental CMD as the details are confidential.

In the area of Drills and Exercises, licensees met the CNSC's regulatory expectations in 2022. Although no Performance Testing Exercises were conducted by the CNSC at NPGS sites in 2022, the Performance Testing Program has commenced to follow the schedule of deferred security exercises as directed by the Commission.

UPDATE: In early 2023, the CNSC initiated a new regulator and industry advisory group, the Nuclear Security Advisory Group (NUSAG), with participants from the CNSC and all NPGS licensees. The advisory group serves as a forum for collaboration between industry and the CNSC on matters related to nuclear security.

Throughout the reporting period, licensees collaborated through the CANDU Owners Group (COG) cyber security peer group program, sharing lessons learned and implementing best industry practices. Licensees remain committed to maintaining their cyber security programs to safeguard their cyber essential assets from potential threats.

2.13 Safeguards and non-proliferation

CNSC staff confirmed that the accountancy and control of nuclear material at WMFs and NPPs complied with the applicable regulatory requirements in 2022. The licensees submitted their required monthly general ledgers on time.

In 2022, the International Atomic Energy Agency (IAEA) conducted 20 announced, 5 short-notice and 32 unannounced inspections, and 1 complementary access at the NPPs and WMFs. The numbers of activities conducted by the IAEA at each NPP and WMF in 2022 are provided in Table 10.

Table 10: IAEA safeguards activities for 2022

Activity	DNGS	DWMF	PNGS	PWMF	BNGS A	BNGS B	WWMF	PLNGS	Gentilly -2	Totals
Physical inventory verifications	1	1	1	1	1	1	1	1	1	9
Design information verifications	2	1	1	1	1	2	1	1	1	11
Short-notice random inspections	1	N/A	1	N/A	1	1	N/A	1	N/A	5
Unannounced inspections	3	3	4	3	4	4	5	6	N/A	32
Complementary accesses	0	0	0	0	0	0	0	1	0	1

CNSC staff verified that the licensees met the applicable regulatory requirements for access and assistance at the NPPs and WMFs in 2022. Pursuant to the Canada/IAEA safeguards agreements and the facilities' licence conditions, the licensees granted timely access and provided adequate assistance to the IAEA for safeguards activities at the facilities. The IAEA considered most of the inspection results to be satisfactory.

The licensees submitted their annual updates for the additional protocol to the CNSC on time, enabling CNSC staff to draft and submit Canada's additional protocol declarations to the IAEA.

CNSC staff confirmed that the licensees met the applicable regulatory requirements for safeguards equipment, containment, and surveillance for the NPPs and WMFs in 2022. The licensees supported IAEA equipment operation and maintenance activities, including maintenance and installation of surveillance and containment equipment to ensure the effective implementation of safeguards measures at each facility.

During 2022, the CNSC and licensees continued to engage with the IAEA on a revised equipment-based approach for the verification of spent fuel loadings and transfers at the CANDU sites as part of the IAEA's revised State-level approach for Canada.

2.14 Packaging and transport

In 2022, four packaging and transport events were reported. All four events were of negligible safety significance.

2.15 Indigenous Consultation and Engagement

2.15.1 CNSC Engagement Activities

The nuclear power generating sites fall within the traditional and treaty territories of many Indigenous Nations and communities, as listed in Appendix D. The CNSC is committed to building long-term relationships and conducting ongoing engagement with Indigenous Nations and communities who have an interest in CNSC-regulated facilities within their traditional and/or treaty territories. The CNSC's ongoing Indigenous engagement practices include:

- Sharing information and discussing topics of interest with Indigenous Nations and communities
- Seeking feedback and input on CNSC processes
- Responding to issues and concerns
- Collaborating and maintaining dialogue on ongoing basis
- Seeking input when drafting relevant sections of CNSC reports
- Providing opportunities to participate in environmental monitoring through the CNSC's IEMP
- Funding opportunities through the CNSC's Participant Funding Program (PFP) to support participation in Commission proceedings and ongoing regulatory activities

CNSC staff continued to work with Indigenous Nations, communities, and organizations to identify opportunities for formalized and regular engagement throughout the lifecycle of these facilities and welcomed the opportunity to meet with Indigenous Nations and communities to discuss and address topics of interest or concern.

NPGS ROR Virtual Engagement Session

The CNSC held an annual NPGS ROR virtual engagement session with Indigenous Nations and communities in September 2022. The goal of the engagement session was to provide an overview of the ROR, CNSC staff's findings with regards to licensees' performance in 2021 as well as discuss and address feedback, concerns, comments, and recommendations submitted by interested Nations and communities in relation to the 2022 NPGS ROR. CNSC staff appreciated the feedback and discussions and worked to include and reflect a number of the recommendations in the 2022 NPGS ROR. Based on the continued success of these virtual engagement sessions, CNSC staff plan to host another NPGS ROR engagement session for the 2022 ROR in September 2023.

CNSC Communications with Indigenous Nations and Communities

In addition to the outreach and engagement sessions, CNSC staff ensure that all interested Indigenous Nations and communities are made aware of the opportunities to review the ROR and submit interventions to the Commission, including the opportunity to intervene orally, as well as opportunities to receive funding through the CNSC's PFP to support their participation in the process. As well, in 2022, CNSC staff continued to keep Indigenous Nations and communities up to date and informed with regards to CNSC staff's regulatory oversight activities at nuclear power generating sites including specific meetings on topics of interest, ongoing discussions with regards to responding to and addressing issues, concerns and recommendations raised in their interventions to the Commission. In 2022, CNSC staff followed up with each Indigenous Nation and community who intervened with regards to the 2021 NPGS ROR and offered to have specific meetings and discussions to address their concerns, comments, and recommendations. In response to concerns raised by Indigenous Nations and Communities, CNSC staff has taken the following actions to continue to improve the NPGS ROR:

- Included an annex summarizing the issues, concerns and requests, and the status of the CNSC's responses/work to address them from interveners from last year's ROR, including Indigenous Nations and Communities.
- Continued working with Indigenous Nations and Communities to address their recommendations in their interventions on the 2021 NPGS ROR.
- Collaborated with Indigenous Nations and communities whom the CNSC has a ToR for long-term engagement with on drafting summaries of engagement activities.
- Collaborated with Indigenous Nations and communities on summarizing their feedback and perspectives on engagement with licensees in 2022.

For more information on the ToR engagement summaries and each Nation's perspective on the Licensee's engagement during 2022, please see Appendix E and the section on Licensee's engagement activities in 2022 below.

Tracking of ROR Issues, Concerns and Recommendations

In order to effectively track and respond to requests and recommendations from Indigenous Nations and communities, CNSC staff has established an issue tracking process to capture the requests, concerns and comments included in the interventions in relation to each ROR, or other Commission proceedings as appropriate, from each Indigenous Nation and community. The tracking tables also include CNSC staff's responses and proposed actions as appropriate. The tracking tables are shared with each Indigenous Nation and community for validation and discussion in order to make progress on addressing their requests and concerns collaboratively.

Therefore, in response to the Commission's request for information on issues and concerns tracking, from interventions received specifically in relation to the RORs, CNSC staff have included an additional Appendix (see Appendix G) in this year's ROR. This appendix provides key information about the number of issues, concerns and recommendations submitted by each Indigenous Nation and community in relation to the 2021 NPGS ROR. Additionally, the Appendix presents the number of issues and concerns that the CNSC has responded to or provided an approach to meaningfully address and close out specific requests, concerns, and comments, where possible.

CNSC staff have reached out to all Indigenous Nations and communities who intervened in the 2021 ROR, offering to meet and discuss the requests, concerns, and comments from their interventions. For Indigenous Nations and communities that have a ToR with CNSC, requests, concerns and comments raised in the ROR will be further discussed in agreed-upon regular meetings, and CNSC staff will work with the Indigenous Nation or community to share and verify the data in their respective issues tracking table.

Overall, the interventions in relation to the 2021 ROR were categorized in 12 different themes including consultation and engagement, improvements to ROR process and ROR content, and CNSC oversight activities.

CNSC Terms of Reference for Long-Term Engagement with Indigenous Nations and communities

CNSC staff have formalized several long-term engagement relationships with interested Indigenous Nations and communities through ToR collaboratively developed with each interested Indigenous Nation or community. A summary of the engagement activities that occurred in 2022 in relation to each of the existing ToRs for long-term engagement is included in Appendix E. These summaries were collaboratively drafted by CNSC staff and each respective Indigenous Nation or community.

In 2022, the CNSC developed and finalized a ToR for long-term engagement with the Mississaugas of Scugog Island First Nation. This is in addition to existing ToRs with Indigenous Nations and communities with an interest in NPGS sites and activities which include: Curve Lake First Nation, the Saugeen Ojibway Nation, the Metis Nation of Ontario, and the Historic Saugeen Metis. CNSC staff are developing a number of others in the coming years with interested Indigenous Nations and communities. CNSC staff remain open to developing ToRs for long-term engagement with other interested Indigenous Nations and communities with nuclear facilities in their traditional and/or treaty territories.

Pickering and Darlington sites

CNSC staff's engagement with Indigenous Nations and communities in 2022 related to the Pickering and Darlington nuclear power generating sites included activities specific to relevant licensing and Commission hearing processes, including OPG's DWMF licence renewal request. CNSC staff's engagement included notifying identified Indigenous Nations and communities about the

application, sharing information about opportunities to participate, making funding available through the CNSC's Participant Funding Program, providing regular updates, and offering to meet to discuss any questions or concerns. CNSC staff also conducted early engagement related to OPG's expected application for a licence to construct for the Darlington New Nuclear Project.

In 2022, CNSC staff were grateful for the opportunity to visit culturally important and sacred sites, such as the Petroglyphs Provincial Park with Curve Lake First Nation and Serpent Mounds site with Hiawatha First Nation. These activities were invaluable for building relationships, understanding and enhancing CNSC staff's cultural awareness.

In 2022, CNSC staff worked collaboratively with Curve Lake First Nation to develop communication products (such as a Potassium iodide (KI) Pill information sheet) to improve means of information sharing with CLFN community members.

Bruce Site

CNSC staff engages with Saugeen Ojibway Nation, Métis Nation of Ontario, and the Historic Saugeen Métis on areas of interest to them through a combination of virtual forums and in-person meetings. CNSC staff also engaged through community information events and the CNSC's IEMP. Additional details can be found in the Appendix E, which were prepared in collaboration with their representatives.

Point Lepreau Site

CNSC staff regularly engages and communicates with the interested First Nations and their representative organizations on areas of interest to them.

In 2022, a major focus of CNSC's engagement activities was the Point Lepreau NGS licence renewal hearings and to continue to strengthen the relationships between the interested First Nations and CNSC staff. CNSC staff provided information and updates to Mi'gma'we'l Tplu'taqnn Inc (MTI), Wolastoqey Nation in New Brunswick (WNNB), Kopit Lodge and Passamaquoddy Recognition Group Inc and met with them individually to discuss topics of interest. Topics included the Point Lepreau NGS licence renewal application and the related regulatory review process, the CNSC's IEMP, the gathering and inclusion of Indigenous Knowledge, and further information on the CNSC's role with regards to regulating potential SMR projects in New Brunswick. In 2022, MTI, Kopit Lodge and WNNB expressed an interest in working with the CNSC to draft a ToR for long-term and routine engagement that is meaningful. CNSC staff remain willing and continue to offer the opportunity to develop similar TOR with any interested Indigenous Nations and communities.

Gentilly-2 site

In 2022, CNSC staff continued to keep Indigenous Nations and communities informed through the 2021 NPGS ROR, which was reviewed by Le Grand Conseil de la Nation Waban-Aki (GCNWA).

2.15.2 Licensee Indigenous Engagement Activities

In 2022, CNSC staff continued to monitor the engagement work conducted by the NPGS licensees to ensure that there was active engagement and communication with Indigenous Nations and communities interested in their facilities, and that there were also activities in relation to relevant licensing and Commission hearing processes that occurred in 2022.

CNSC staff confirmed that the licensees have Indigenous engagement and outreach programs. The CNSC encourages licensees to continue to develop relationships and engage with Indigenous Nations and communities who have expressed an interest in the licensee's activities.

Feedback received by Indigenous Nations and communities on engagement with Licensees

In their 2021 ROR interventions, Indigenous Nations and communities raised the concern that their views on licensees' engagement were not reflected in the RORs. In response to this concern, CNSC staff sought feedback from the Indigenous Nations and communities with regards to their perspectives on the Licensees engagement with them in 2022. Of the Indigenous Nations and communities that the CNSC's requested feedback from, the Historic Saugeen Metis and Curve Lake First Nation responded.

Ontario Power Generation

Throughout 2022, OPG met and shared information with interested Indigenous Nations, communities and organizations including the Williams Treaties First Nations, the Métis Nation of Ontario, and the Mohawks of the Bay of Quinte. Topics of discussion included the DWMF licence renewal, environmental monitoring activities, fish impingement and entrainment at the DNGS and PNGS, OPG's intent to apply for a licence to construct for the Darlington New Nuclear Project, and the proposed DNGS isotope project.

CNSC staff continue to be satisfied with OPG's engagement efforts and activities in 2022.

Feedback on OPG's Engagement from Curve Lake First Nation:

Note: This section was drafted by CLFN representatives.

In 2022, OPG provided support for CLFN consultation staff, archaeological, and environmental capacity. This support to participate allows for overall participation and provides a framework and a consistent approach on how both parties will work together. OPG provided CLFN opportunities to visit the DNNP site and existing facilities. CLFN has reciprocally invited OPG and CNSC staff to visit Curve Lake First Nation.

In 2022, OPG and CLFN continued having routine meetings as part of a wider forum including other members of the Williams Treaties First Nations. Through these routine meetings, OPG shared information about the DNNP, such as the Endangered Species Act permit, archeological work, bank swallow assessment, early works on the site, Sulphur Hexafluoride (SF6) Draining, EIS review report,

and the condenser cooling water. CLFN also had the opportunity to comment on OPG's Indigenous engagement plan and Indigenous scorecards, and to have discussions on how to improve energy literacy at the community level. All the information exchanged has been reviewed by CLFN and comments will be integrated by OPG as part of their ongoing programs and improvement initiatives.

An issue that has arisen from these multiple matters of importance to CLFN is the communication of feedback in a timely manner and then to translate these reviews and feedback to community members, along with all other competing demands on CLFN's time and resources. Through this issue, OPG has demonstrated the willingness to work within the constraints while seeking ways to demonstrate flexibility with the process since this can lead to more fruitful outcomes. The overarching goal is overall relationship building and this is not driven only by the completion of project deadlines and milestones but also by the need to foster meaningful interactions.

Bruce Power Site

Throughout 2022, both Bruce Power and OPG met and shared information with interested Indigenous communities and organizations, including the SON, MNO and HSM.

For Bruce Power, information and discussion topics included their operations at the BNGS site, the pressure tube finding, their *Fisheries Act* authorization (FAA) application, inclusion in the development of the mitigation measure study as well as information on environmental impacts, including impacts to fish.

Bruce Power continued to engage the SON, MNO and HSM on the FAA to adequately address their information requests and concerns raised throughout the process in its final application that was previously submitted to Fisheries and Oceans Canada in November 2018.

In cooperation with Bruce Power, the SON completed another year of the Coastal Waters Monitoring Program (CWMP), which is an initiative funded by Bruce Power, but designed, led, and implemented by the SON to monitor environmental conditions in the nearshore areas of the Saugeen Peninsula. SON has recently shared with CNSC the 2022 Annual CWMP Report, as has been done in previous years.

In 2022, OPG continued its regular updates and meetings with Indigenous Nations and communities who have an interest in their operations and projects at the Bruce site.

CNSC staff continue to be satisfied with Bruce Power's Indigenous engagement efforts and activities in 2022.

Feedback on Bruce Power's and OPG's Engagement from the Historic Saugeen Métis (HSM):

HSM conducts regular quarterly meetings with Bruce Power and OPG with additional working group meetings to discuss special projects and initiatives.

HSM Council and staff toured the OPG's Western Waste Management Facility in 2022 to view and discuss new storage facilities for intermediate and used fuel.

NB Power

In 2022, NB Power worked with several First Nation communities and organizations, including the WNNB, MTI, Passamaquoddy Recognition Group Inc., Kopit Lodge, Sipekne'katik First Nation, the Union of New Brunswick Indian TI, and Mawiw Council. NB Power maintains on-going dialogue with First Nations consultative bodies and representatives through scheduled monthly meetings and technical workshops.

Information and discussion topics included NB Power's operations at Point Lepreau, its application for a *Fisheries Act* authorization, waste management, SMRs, environmental monitoring, environmental and regulatory approval processes, emergency preparedness, emergency services, education, archeology, cultural awareness, and sensitivity.

First Nations field monitors from MTI, WNNB and Passamaquoddy Recognition Group Inc. participate in field related activities related to the radiological and conventional monitoring of the Point Lepreau NGS site and continue to implement a number of activities supporting the gathering, sharing of Indigenous Knowledge, and establishing more awareness and sensitivity among its workers and local communities. Members of New Brunswick First Nation communities are invited to lead medicine walks, participate in regular activities at the site including collaborative environmental and safety monitoring and deliver presentations to NB Power leadership. NB Power works with Indigenous Nations and communities and members of the public in their host community, through regular community liaison committee meetings, open houses, regular newsletters, website updates and regular engagement activities with local fishing communities. NB Power's regular engagement activities are an effort to build capacity within their communities to better understand nuclear technology and its use in New Brunswick, waste management principles and procedures, new opportunities in nuclear development, and its role in New Brunswick's electricity mix.

CNSC staff continue to be satisfied with NB Power's engagement efforts and activities in 2022.

Hydro-Québec

In 2022, Hydro-Québec continued its engagement with Indigenous Nations and communities interested in its operations and sites and met and shared information with interested First Nations communities and organizations, in particular the GCNWA. Discussions with the Waban-Aki Nation take place on a regular basis and affect current and future projects.

In 2022, discussions focused on conducting archaeological work by the GCNWA on land belonging to Hydro-Québec near the Gently-2 facilities.

CNSC continue to be satisfied with Hydro-Québec's engagement efforts and activities in 2022.

CNSC Conclusions on Licensee Engagement

CNSC staff are satisfied with the level and quality of Indigenous engagement conducted by Licensees with regards to their operations and proposed projects at its different nuclear power generating sites in 2022. CNSC staff encourages the licensees to continue to remain flexible and responsive to the requests and needs of the Indigenous Nations and communities that have an interest in their sites, facilities, and proposed projects.

2.16 Other matters of regulatory interest

2.16.1 Public information and disclosure programs

The CNSC requires licensees to maintain and implement public information and disclosure programs, in accordance with CNSC's [REGDOC-3.2.1, *Public Information and Disclosure*](#). These programs are supported by disclosure protocols that outline the type of information to be shared with the public as well as details on how that information is to be disseminated by the licensee. This ensures that timely information about the health, safety and security of persons and the environment, and other issues associated with the lifecycle of nuclear facilities, is effectively communicated to the public in a meaningful, transparent, effective, and appropriate way.

In 2022, CNSC staff determined that the public information and disclosure programs for the Nuclear Power Plants (NPP) and Waste Management Facilities (WMF) complied with REGDOC-3.2.1. Despite the lingering impact of the COVID-19 pandemic, all NPP and WMF operators were able to adjust their public information programs to successfully engage and inform their stakeholders while adapting to the evolving restrictions and respecting all necessary protocols of the pandemic.

CNSC staff encouraged all licensees to review and update their PIDP annually. If updates are made, licensees must send revisions of their public disclosure protocols to the CNSC, indicating the changes and the reasons for them, as per section 2.3.1 of REGDOC-3.2.1. It would be good practice for licensees to provide this information to CNSC before any Commission proceedings.

In addition to all licensees providing regular updates throughout the year, Ontario Power Generation (OPG), Bruce Power and NB Power presented the highlights of their communications programs to CNSC staff.

The following are some features noted by CNSC staff during their review in 2022:

Ontario Power Generation (OPG)

OPG's Public Information and Disclosure Program (PIDP) is a fleet-wide program which covers all licenced nuclear facilities including WMF and NPPs. In 2022, OPG continued to engage regularly with their local community members and elected officials in the region of Durham, and the areas surrounding Western WMF. Programs began to transition back to in-person while respecting current

health and safety guidelines. Site-related activities included, but not limited to station tours (54 NPP tours, 34 WMF tours), 45 bus tours, 41 mock-up facility/simulator tours, hybrid Take our Kids to Work Day (>300 participants), public information sessions and an annual open house (2,400 participants). Virtual events and activities in the communities included Tuesdays on the Trail (1,500 participants), webinars, Virtual Power Kids which saw 63,000 participants from around the world, and several educational, environmental, and charitable initiatives. Social media campaigns generated awareness and engagement, while OPG's "Neighbours Newsletter" was delivered to more than 250,000 homes and businesses. OPG continued their educational and youth outreach program. OPG shared information about its nuclear fleet operations and projects including the Darlington refurbishment, small modular reactors, new nuclear projects, and Pickering decommissioning. Over the course of the year, OPG undertook several public opinion surveys and provided information to the community via public interest notifications. OPG participated in Municipal Council meetings, and Community Advisory Committees (Darlington, Pickering, and Joint meetings). OPG conducted 11 emergency preparedness drills in 2022.

The rebrand of Waste Management Facilities to Nuclear Sustainability Services was implemented across all communications and business platforms however, as noted in the January 2023 Commission hearing, this name change was met with opposition from intervenors and the Commission. OPG has initiated a self-assessment to identify areas of improvement related to this global name change which will be completed Q4 2023.

As part of the ongoing compliance reviews conducted by CNSC staff, a fleet-wide desk top inspection OPG's PIDP was conducted in 2023. The outcome will be included in the 2023 NPGS Regulatory Oversight Report. [RIB 22116]

Bruce Power

In 2022, Bruce Power welcomed over 10,000 public visitors, hosted 53 stakeholder and government in-plant tours. Public polling conducted by Bruce Power indicated strong public support for refurbishment and positive overall impression. Social media grew in reach and engagement while digital newsletters (11), proactive media relations (100+ releases and op-eds) contributed to a primarily positive and balanced outreach campaign. Bruce Power continues to be engaged in the community overall, via sponsorship funds and active promotion of its Environment, Social and Governance commitments. An open house mid-year drew 50 attendees and gave Bruce Power an opportunity to speak about isotope production. When CNSC issued an Administrative Monetary Penalty (AMP) in September, Bruce Power posted the information on their website. Following a significant number of noise complaints from the community in 2020, Bruce Power installed noise reducers resulting in zero (0) noise complaints being filed in 2022.

NB Power

Throughout 2022, NB Power regularly shared operational updates, project updates and exchanged information, knowledge and experiences with First

Nations and local communities. NB Power continued to provide regular station updates and information on upcoming projects to multiple audiences through web updates, news releases, virtual meetings, an ongoing presence on social media and traditional media coverage. NB Power communicated appropriately and in a timely manner about the unplanned outage at PLNGS in December 2022 as well as its annual planned outage. NB Power adjusted its communications from traditional print or online newsletters to more face-to-face forums to ensure community stakeholders were directly informed of the process and their topics of interest addressed. NB Power hosted six public information sessions and sponsored or participated in several other technical briefings, open houses, or community events. NB Power conducted a PLNGS public opinion telephone survey of 600 residents in March 2022 which indicated nearly all residents expect to be closely informed about PLNGS, 77% had a favourable opinion of NB Power and that the majority agree that PLNGS operates efficiently and safely.

Hydro-Québec

2022 marked the 10th anniversary of the official end of reactor operation at Gentilly-2 (G2). As such, there was significant impact on communications and interest from media and the public increased compared to previous years. Hydro-Québec (HQ) effectively gathered feedback and analyzed media coverage to inform their outreach and responses. An annual survey of official representatives of regional authorities indicated a stable satisfaction rating. Acting on a recommendation from CNSC, a survey of local communities was conducted in 2023. The results will be included in the 2023 NPGS ROR. Initial results indicate a notable interest in receiving information about G2. Social media was an effective mode of communications this anniversary year and the number of followers continues to increase. Public comments focused on nuclear fusion, waste management, environment, and energy supply. Hydro-Québec's website was redesigned to enable easier access to information. Reportable events were posted quarterly, the Environmental Monitoring Plan Annual report was added, and the timeline for decommissioning was updated. For the second year in a row, web traffic increased. HQ continues to communicate effectively and appropriately with local community, officials and employees with information addressing the key areas of interest such as decommissioning, waste and the environment and has taken action to address the recommendations received from CNSC.

2.16.2 Nuclear liability insurance

The [Nuclear Liability and Compensation Act](#) (NLCA) requires designated nuclear installations to provide annual proof of the requisite financial security in accordance with their classification. The NLCA is administered by Natural Resources Canada (NRCan). CNSC staff confirmed with NRCan that all the licensees subject to the NLCA complied with their financial security obligations under the act as of December 31, 2022.

2.16.3 Financial guarantees

CNSC staff reviewed the annual reports for licensees' financial guarantees (FGs). CNSC staff were able to confirm that the FG cost estimates were still valid and were able to confirm that the licensees had sufficient funds to meet decommissioning liabilities in 2022. Note: The Bruce Power FG is covered under OPG's FG.

OPG maintains a consolidated planning and Financial Guarantee for decommissioning of its facilities including Bruce Power. In August 2022, OPG submitted an application for the acceptance of its revised consolidated financial guarantee for the future decommissioning of OPG's nuclear facilities and Bruce Power's BNGS for the 2023-2027 period. OPG's consolidated financial guarantee was due to expire on December 31, 2022. The Commission concluded in December 2022 that OPG's proposed revised financial guarantee will continue to provide for the future decommissioning of OPG's and Bruce Power's nuclear facilities and accepted OPG's proposed revised financial guarantee for 2023-2027.

NB Power holds the liability for the PLNGS site and is responsible for preliminary decommissioning plans (PDPs) and associated financial guarantees. The PDPs and associated 5-year financial guarantees were revised in 2020 and accepted by the Commission in 2022.

2.16.4 Prohibition of Asbestos and Products Containing Asbestos Regulations

The [Prohibition of Asbestos and Products Containing Asbestos Regulations](#) came into force in December 2018. The Regulations include a 4-year exemption for nuclear facilities to ensure that licensees have enough time to identify all products containing asbestos and determine whether technically or economically feasible asbestos-free alternatives are available. During this 4-year exemption, NPP licensees will still have to report annually to [Environment and Climate Change Canada](#) (ECCC) on their use, and prepare the appropriate asbestos management plans in accordance with Schedule 1 of the Regulations.

In 2022, two NPP licensees used asbestos or asbestos-containing products to service equipment. Both Bruce Power and NB Power reported their use of product containing processed asbestos fibers in accordance with Section 11 of the regulations.

The following summarizes the equipment that was serviced using asbestos containing products at all NPP sites:

- PNGS and DNGS: No products containing asbestos were used.
- BNGS A and BNGS B: Three valves were serviced using gaskets containing double jacketed asbestos (in one case) and spiral wound asbestos filler (in two cases) where no technically or economically feasible alternative existed.
- PLNGS: Two bonnet gaskets for the Emergency Core Cooling check valves were serviced using products containing asbestos where no technically or economically feasible alternative existed.

Licensees continue to identify technically and economically feasible alternatives to asbestos and asbestos-containing products. Where they are unable to do so, they must continue to use these products in accordance with the regulations. There were no non-compliances with the regulations in 2022.

Beginning January 1, 2023, NPP licensees will need to apply to ECCC for a permit to use asbestos and asbestos-containing products. As part of this permitting process, NPP licensees must demonstrate that there are no technically or economically feasible alternatives.

UPDATE: Bruce Power's request to extend the exemption for another 3-year period was approved by ECC Canada in April 2023.

2.16.5 Forum between the CNSC and Canadian Environmental Non-Governmental Organizations

Note: This section was collaboratively drafted by CNSC staff and ENGO representatives.

The CNSC and members of environmental non-governmental organizations (ENGOS) have established a forum to exchange information and ideas and consider substantive and procedural issues of interest or concern (especially structural aspects related to Canadian nuclear regulatory matters). Forum meetings maintain a separate line of engagement from narrower project- or policy-specific opportunities for ENGOS to intervene before the Commission on specific project licences, Regulatory Oversight Reports, or reviews of draft regulatory documents or regulations. The Forum is meant to promote constructive dialogue, discussion, and debate in a respectful, open, and transparent setting.

There is a [dedicated page](#) on the CNSC website where the Forum's Terms of Reference are posted, along with meeting agendas.

The Forum is distinct from project or policy-specific opportunities for ENGOS to intervene before the Commission and does not constitute ENGO endorsement of the CNSC. ENGO participation in the forum is supported through the CNSC's Participant Funding Program.

Since its establishment in 2020, the Forum continues to meet virtually on a quarterly basis and is co-chaired by the CNSC's Regulatory Affairs Branch Vice-President and Chief Communications Officer and the Nuclear Transparency

Project Director. There are currently five organizations that make up Forum membership:

- Canadian Environmental Law Association
- Northwatch
- Nuclear Transparency Project
- Ottawa Riverkeeper
- Saskatchewan Environmental Society

While this update is being provided in the NPGS ROR, the matters discussed at the Forum extend beyond Power Generating Stations. Throughout 2022, the Forum explored some common procedural themes that were presented by ENGOs before the Commission including their need for early engagement on regulatory processes and guidance, robust and proactive public access to nuclear-related data, and publicly accessible information on Commission decisions and nuclear activities. The Forum also engaged on the following substantive topics:

- April 7th, 2022 – Access to Environmental Data, Regulatory Oversight Reports Presentation and Questionnaire
- June 30th, 2022 – Discussion with President Velshi, Access to Information and Privacy Presentation, and Paul Daly Report
- October 28th, 2022 – Introduction of new CNSC Co-Chair and Vice President Regulatory Affairs Branch, Michael DeJong, and the CNSC’s Approach to Licensing
- December 13th, 2022 – Update on the Commission Modernization Discussion Paper and the Participant Funding Program Independent Funding Review Process

ENGO members feel strongly that meetings between CNSC staff and industry representatives and licensees should exhibit similar transparency, with meetings and their topics similarly publicly reported for each calendar year. Discussions on transparency are very important, and the CNSC is ensuring that they continue to be a priority for ENGO forum discussions in the future.

Through these exchanges, CNSC staff gain an understanding of the barriers and challenges that ENGOs face when participating in Commission proceedings, and in accessing information required to provide informed interventions and commentary about nuclear-related activities and the CNSC’s role as a regulator. ENGOs are able to gain a better understanding of CNSC regulatory approaches and ongoing Commission modernization activities. As the Forum evolves, the membership can agree to invite other ENGOs and individuals with a demonstrated interest in nuclear issues as observers or full members.

Some of the topics to be collectively explored throughout 2023 include:

- Future activities to modernize the Commission.
- How the Participant Funding Program and other new funding programs are managed.
- Transparency of nuclear-related sampling data and compliance verification activities.
- Access to information and documents.
- The Independent Environmental Monitoring Program.

CNSC staff's intent is to continue to gain important insights and various perspectives from ENGOs and Civil Society Organizations on regulatory processes, practices and policies as the nuclear industry evolves. CNSC staff and ENGO forum members hope that their discussions can increase mutual understanding on issues of shared importance.

2.16.6 Independent Environmental Monitoring Program

The CNSC conducts its Independent Environmental Monitoring Program (IEMP), which is a technical environmental sampling program independent from licensees. The program operates in publicly accessible areas around nuclear facilities, using CNSC resources effectively and efficiently. The CNSC strives to build Indigenous and public trust in its regulation of the nuclear industry and implements the IEMP to confirm the effectiveness of a licensee's monitoring program and to promote awareness and information sharing of the CNSC's work in protecting people and the environment.

Further information on the CNSC's IEMP, including sampling results and associated standards, can be found on the [CNSC's Website](#) [5].

In 2022, the CNSC Laboratory conducted an analysis of the samples collected from Pickering locations as part of the IEMP. The samples included air, soil, water, and vegetation and were collected in 2021. The IEMP results were consistent with the results submitted by OPG PNGS, indicating that the licensee's environmental protection program is effective.

In July 2022, CNSC staff had conducted an IEMP sampling campaign around the BNGS site. The IEMP measurements found levels of radioactivity in the environment to be low, and well within the range of natural background radiation levels. As a result, no effects on human health are expected.

[IEMP results](#) from previous years (available on [CNSC's Website](#)) are consistent with the results submitted by licensees. This supports CNSC's assessment that the public and the environment in the vicinity of nuclear power generating stations are protected and that the licensees' environmental protection programs are effective.

3 Nuclear power plant and waste management facility safety performance and regulatory developments

3.1 Darlington Nuclear Generating Station

3.1.0 Introduction

The [Darlington site](#) is located on the north shore of Lake Ontario in Clarington, Ontario, 5 kilometres outside the town of Bowmanville and 10 kilometres southeast of Oshawa. The Darlington site lies within the traditional territory of the Michi Saagiig Anishinaabe people. These lands are covered by the Williams Treaty between Canada and the Mississauga and Chippewa Nations.



The Darlington site includes the Darlington Nuclear Generating Station (DNGS), the Tritium Removal Facility (TRF) and the Darlington Waste Management Facility (DWMF). The CNSC regulates the DNGS and the TRF under a power reactor operating licence (PROL), and the DWMF separately under a waste facility operating licence (WFOL).

The DNGS consists of 4 Canada Deuterium Uranium (CANDU) reactors that are rated at 881 MWe (megawatts electrical) each. The TRF, which is housed in the Heavy Water Management Building, is used to remove tritium that builds up gradually in heavy water contained in some plant systems as a result of day-to-day operations. Removing the tritium minimizes the amount released into the environment and reduces the potential radiation exposure of workers. The tritium is extracted from the reactor's heavy water and stored safely in stainless steel containers as titanium tritide within a concrete vault.

In 2015 the Commission authorized OPG to undertake the refurbishment of all 4 units at the Darlington NGS. The refurbishment project began in 2016 with Unit 2 and is expected to be complete with Unit 4 being returned to service in early 2026. OPG continues to operate the Retube Waste Processing Building, where removed reactor core components are volume-reduced before being sent to onsite storage facilities.

Licensing

The Commission renewed the PROL for the DNGS, which also governs the TRF, in December 2015, with an expiry date of November 30, 2025.

Fisheries Act authorization

[Fisheries and Oceans Canada](#) (DFO) issued a *Fisheries Act* authorization (FAA) to OPG for the DNGS on June 24, 2015. The FAA includes a second condition requiring OPG to report to the staff of DFO and the CNSC on the offset plan (compensation for residual harm to fish and fish habitats).

Note: There are two conditions (C1 and C2) in the Darlington FAA for 2022:

- C1 is an ongoing condition: “The current location of the Cooling Water System intake and the design features (e.g., porous veneer intake) shall be maintained in proper working order”. There were no reportable events related to the Cooling Water System intake that occurred at DNGS in 2022.
- C2 Monitoring report on vegetation encroachment (perimeter assessment): UPDATE: On March 1st, 2023, OPG requested an extension to submit its vegetation encroachment report. DFO has granted this extension and OPG plans to submit this report on October 31, 2023. At that time, DFO will conduct a technical review of the report.

Integrated implementation plan

CNSC [RD-360, Life Extension of Nuclear Power Plants](#), set out requirements applicable to the Darlington Refurbishment Project. In preparation for a life extension or refurbishment project, RD-360 required that a licensee conduct an integrated safety review (ISR) to address the safety factors identified in the International Atomic Energy Agency Safety Standards Series, as well as the CNSC safety areas and programs. RD-360 also required that the licensee participated in an environmental assessment (EA) and that the results of the ISR and EA be compiled into a global assessment report (GAR) and an integrated implementation plan (IIP).

The DNGS ISR consisted of an assessment of the plant design; systems, structures, and component (SSCs) condition; and plant performance, to determine the extent to which the DNGS conforms to modern standards and practices. From the ISR, OPG identified reasonable and practical modifications to SSCs and to the management of the station to enhance the safety of the plant to a level approaching that of modern nuclear power plants and to allow for long-term operation. The results of the EA, and ISR assessments were incorporated into the DNGS GAR and IIP. In 2015, the IIP was presented to the Commission and, implementation of the IIP became a requirement of the Darlington PROL.

The DNGS IIP consisted of 625 items, with three IIP items removed from its scope as approved by the Commission in 2019. In 2022, OPG submitted a request to the Commission to approve scope changes for seven additional IIP items. As documented in CMD-23-H102, staff assessed these items. It was determined that the changes were reasonable and CNSC staff recommended that the Commission approve the changes, as requested. The record of decision, DEC 23-H102, stated

that the Commission accepted the revisions to the 7 Darlington NGS IIP items. To date, OPG has completed 471 IIP items; they are progressing according to the schedule for each IIP item. CNSC staff are satisfied with the progress on the IIP.

Refurbishment

The refurbishment project has four phases for each reactor:

1. Lead-in – preparation activities such as defueling and dewatering the reactor.
2. Component removal – removal of key components, in particular pressure tubes, calandria tubes and feeder pipes.
3. Installation – installation of reactor components and the associated testing / quality control verifications to demonstrate fitness for service.
4. Lead-out – transition from the end of the installation phase to full-power operation.

DNGS Unit 3 began its refurbishment outage in September 2020. Throughout the first half of 2022, the Unit 3 refurbishment project focused on the installation phase, which progressed to the Lead Out, or Return to Service phase towards the middle of the same year. In February 2022, OPG also began defueling the Unit 1 core, marking the beginning of that unit's refurbishment and a 2-units refurbishment overlap. CNSC staff conducted compliance verification activities as established in the Darlington Refurbishment Project Multi-Unit Compliance Plan and confirmed that OPG was in compliance with regulatory requirements. There were no inspection findings with a medium or high safety significance identified during the refurbishment.

In November of 2022, following confirmation that all pre-requisites had been completed to staff's satisfaction, the Executive Vice President, and Chief Regulatory Operations Officer (EVP-CROO) of the CNSC removed the first Regulatory Hold Point (RHP-1), which allowed OPG to begin loading fuel in Unit 3. For the remainder of the year, OPG continued with return to service activities with the expectation of Unit 3 returning to service by the middle of 2023. The refurbishment of Unit 1 began in February 2022, with removal of reactor component progressing well into 2023. OPG continues to operate the Retube Waste Processing Building, where removed reactor core components are volume-reduced before being sent to onsite storage facilities.

In 2022, the IIP was progressing according to schedule, and CNSC staff were satisfied with this progress. Table 11 indicates the overall planned, completed, and closed IIP commitments. It also indicates IIP tasks planned for completion in 2022, completed by the licensee in 2022 (irrespective of planned completion dates) and IIP items closed by CNSC in 2022.

Table 11: DNGS IIP (based on planned dates)

Total commitments	Overall	2022
Planned by OPG	622	31
Completed by OPG	471	43
Closed by the CNSC	428	28

Periodic safety review

In February 2020, OPG notified the CNSC of its intent to commence a Periodic Safety Review (PSR), intended to review the status of the DNGS to support operations beyond 2025. The PSR Basis Document was submitted in September 2020 and accepted by CNSC staff in January 2021. Fifteen Safety Factor Reports were submitted to CNSC staff for review between July and September 2021. CNSC staff technical reviews were completed in January 2022. OPG submitted the Global Assessment Report (GAR) in December 2022; and review of the GAR is in progress.

The Global Assessment Report (and the Safety Factor Reports) do form the basis for the development of the Integrated Implementation Plan (IIP), which requires CNSC staff's acceptance. The IIP will be submitted to the CNSC for acceptance, as per [REGDOC-2.3.3, Periodic Safety Reviews](#). Work on this project is expected to continue into 2024 and will contribute to the re-licensing of DNGS beyond 2025.

Production of Mo-99 at DNGS

In fall of 2021 the Commission amended OPG's PROL to include the production of Molybdenum-99 (Mo-99) through the use of a new Isotope Irradiation System (IIS) (also known as the target delivery system (TDS); the Mo-99 IIS / TDS) that would deliver (into the core) natural molybdenum-98 and harvest Mo-99. In late fall 2022, OPG commenced installation activities during the D2221 outage following the removal of the two regulatory hold points by the CNSC EVP-CROO. OPG continues to progress with commissioning & available for service (AFS) activities as well as fulfilling the associated regulatory commitments. CNSC staff are continuing to provide regulatory oversight of this project and will review the AFS documentation as discussed in CMD 21-H107.

While the Commission was considering the licensing matter, CNSC staff performed a field inspection (August 2021) against OPG's use of its "wholly owned subsidiary" Laurentis Energy Partners (LEP) to execute design acceptance of recently prepared vendor documents for the engineering changes associated with the Mo-99 IIS / TDS. The use of either a third party that has not been qualified as an approved supplier, or a corporate entity with no accountabilities or relationship to the Darlington PROL, represented a non-compliance with OPG's Management System. CNSC staff determined the safety significance of this non-compliance to be low as OPG continued to use fully qualified staff seconded to LEP. Through correspondences in 2022 and 2023, OPG acknowledged the non-compliance against its management system and determined that LEP should be

qualified as an external vendor under CSA N286-12. CNSC staff will continue to provide regulatory oversight of OPG's management system, including the use of third-party organizations to perform activities on behalf of OPG.

Compliance program

CNSC staff concluded that OPG had met the applicable regulatory requirements and the expectations of CNSC staff for all SCAs at DNGS in 2022, with the exception of Security SCA.

Table 12 lists the inspections at the DNGS that were considered in this regulatory oversight report (inspection reports were included if they were sent to OPG by February 27, 2023). The quarterly Type II inspections include 67 field inspections conducted at DNGS in 2022.

Table 12: List of inspection reports at the DNGS

Safety and Control Area	Report Title	Report Issue Date
Management System	DRPD-2022-10686- INSPECTION REPORT - TII - Refurbishment Supply Chain Type II Inspection	March 8, 2022
	PRPD-2022-13903 & DRPD-2022-14332 - Type II Compliance Inspection Report - Problem and Event Cause and Resolution Effectiveness Investigation and Trend Analysis	September 29, 2022
	DRPD-2022-12467 Type II Inspection Report: DNRU3 Construction, Installation and Special Processes	February 16, 2023
Human Performance	DRPD-2022-10480 - Desktop – Design, Development and Grading of Simulator Examinations and Requalification Tests	May 16, 2022
	DRPD-2022-14120 – Report –TII - Conduct of a Simulator-based Examination	October 17, 2022
	DRPD-2022-15754 & PRPD-2022-14313 PRRP Compliance Verification Report - Fleet-wide Desktop Inspection of OPG's Nuclear Emergency Response Organization Training Program	December 1, 2022
	DRPD-2022-14967 & PRPD-2022-14314 – Inspection Report –TII - Non-Certified Training Programs	January 24, 2023
	DRPD-2022-15170 - Type II - Evaluation of OPG's Analysis for Changes on Training Program due to Refurbishment	February 22, 2022

Safety and Control Area	Report Title	Report Issue Date
	DRPD-2022-15569 & PRPD-2022-15714 – Inspection Report – Minimum Shift Complement Verification	February 23, 2023
Operating Performance	DRPD-2022-10230 - Type II – Q4 Quarterly Inspection Report	June 23, 2022
	DRPD-2022-11844 DNRU1 Defueling Inspection Report	June 23, 2022
	DRPD-2022-14429-Type II - Q1 Quarterly Inspection Report	October 21, 2022
	DRPD-2022-FIR-15513 SOE Field Inspection	November 15, 2022
	DRPD-2022-14635 - Type II - Darlington Refurbishment Foreign Material Exclusion Program	November 17, 2022
	DRPD-2022-14835 Q2 Inspection Report	February 2, 2023
Physical Design	DRPD-2021-10193 - Inspection Report – TII – Environmental Qualification	June 7, 2022
	DRPD-2022-10680 - Type II – Pressure Boundary Program Implementation	December 15, 2022
Fitness for Service	DRPD-2022-14658-INSPECTION REPORT-TII-Instrument Air System	October 24, 2022
	DRPD-2022-15125 Type II Compliance Report for ECI	January 17, 2023
	DRPD-2022-10219 - Type II - System Inspection - RRS	February 2, 2023
Radiation Protection	DRPD-2022-11824 - Desktop - Radiation Protection, Source Term, and ALARA Program in refurbishment	April 21, 2022
	DRPD-2022-15005 - Type II - DNRU1 RP Activities Associated with Core Disassembly	December 13, 2022
Conventional Health and Safety	DRPD-2022-14980 - Refurbishment Conventional Health and Safety Program	December 6, 2022
Environment Protection	PRPD-2022-15102 & DRPD-2022-14705 – Report – TII – Fleet Environment Monitoring Program at Pickering and Darlington NGS	February 27, 2023
Emergency Management and Fire Protection	DRPD-2022-09202 - Type II - Emergency Preparedness and Response	June 2, 2022
	DRPD-2022-14843 – Field Inspection - Fire Protection Equipment Inspection,	January 30, 2023

Safety and Control Area	Report Title	Report Issue Date
	Testing and Maintenance	
Security	DRPD-2022-10777 & PRPD-2022-13057 – Inspection Report – Search and Screening Equipment at the Entrance and Egress of the Protected Area	April 20, 2022
	Darlington and Pickering NGS: CNSC Field Inspection Report: DRPD-2022-10782 & PRPD-2022-13568 Nuclear Response Force (NRF) Response Vehicle Verification and Nuclear Security Officer (NSO) Equipment and Asset Verification	June 28, 2022
	DRPD-2022-10305 & PRPD-2022-12739 – Desktop Inspection Report – Fleet-Wide Cyber Security	September 28, 2022
	DRPD-2023-15818 - Field Inspection - Darlington NGS: Central Alarm Station and Protected Area	February 17, 2023
	DRPD-2023-15819 - Field Inspection - Darlington NGS: Public Agent Requirements	February 17, 2023

Event Initial Reports

No event initial reports pertaining to DNGS were submitted to the Commission in 2022.

3.1.1 Management system

CNSC staff conducted a total of 24 inspections that included records management verifications and determined that the Darlington NGS continued to maintain and implement a record and document management system that complied with the requirements of CSA N286-12, *Management system requirements for nuclear facilities*. CNSC staff's inspection of OPG's fleet-wide problem and event cause and resolution effectiveness investigation and trend analysis (DRPD-2022-14332) identified several non-compliances of low safety significance regarding complete and properly approved procurement records. While several of the non-compliances are still being resolved, as all of them were of low safety implications, CNSC staff were satisfied with the DNGS's progress to-date in correcting the non-compliances.

There were no safety significant non-compliant findings against the management system at Darlington NGS.

OPG continued to meet business continuity requirements, including those related to the COVID-19 pandemic, throughout 2022. Through on-site monitoring and surveillance activities, and review of event reports, CNSC staff found that OPG

took adequate corrective actions and has adequate measures in place relating to business continuity in the event of disabling circumstances such illness and severe weather.

3.1.2 Human performance management

An inspection conducted on initial simulator certification examinations (DRPD-2022-14120), revealed some findings related to administration of exams which required corrective actions to be implemented by OPG. There is no evidence of recurrence of the issue. CNSC staff will continue to monitor OPG's corrective actions and will apply reactive oversight activities in 2023 to ensure that they are not repeated, nor indicative of deficiencies in the overall certification program.

CNSC staff are continuing to follow up on corrective actions identified during an inspection pertaining to Responsible Health Physicist (RHP) roles and responsibilities (DRPD-2021-08027), stemming from an earlier revision of governing documents that reduced clarity in some sections. OPG has a corrective action plan in place and CNSC staff will verify its completion in 2023. In addition, reactive compliance activities are planned to ensure that RHP's certified at Darlington continue to have a clear understanding of their roles and responsibilities as required by governance and applicable to both existing and upcoming operations and initiatives planned at Darlington.

3.1.3 Operating performance

OPG continued to operate DNGS in a safe manner within the bounds of the operating policies and operational safety requirements. All DNGS reactor units operated within the conditions prescribed by Power Reactor Operating Licence and the licence conditions handbook. Operating practices observed during the year were adequate and effective.

During 2022, DNGS experienced one unplanned reactor power change and two reactor setbacks. OPG reported these events to the CNSC in accordance with REGDOC-3.1.1. CNSC staff found that OPG controlled reactor power transients in accordance with operational procedures. All operating DNGS units met WANO's PHWR target of 1.0 trip per 7,000 hours of operation. Unit 1 has been shut down for refurbishment since February 14, 2022, while Unit 3 has been undergoing refurbishment since September 2020. Following the D2222 outage, Unit 2 remained critical throughout 2022, except for an outage in December 2022 related to the Molybdenum-99 project.

DNGS was compliant with the regulatory requirements with respect to scheduled reports under REGDOC-3.1.1 and submitted five event reports related to this SCA in 2022. CNSC staff reviewed OPG's corrective action plans and continued to monitor OPG's progress to implement corrective measures as of the end of 2022.

The inspections conducted in 2022 produced a very high ratio of compliant findings. However, CNSC staff identified trends in procedure inadequacy and safe operating envelope (SOE) related issues through other compliance verification activities. In one case CNSC staff identified a low safety significance finding for a

repeat non-compliance, for not providing prior written notification of changes to the SOE document according to Licence Conditions G.2 and 3.1. As a result, CNSC staff increased regulatory scrutiny by holding recurring meetings to ensure OPG's commitment to SOE compliance. OPG submitted an acceptable corrective action plan to the CNSC, and CNSC staff continued to monitor OPG's progress in implementing this plan throughout 2022.

3.1.4 Safety analysis

In 2022, OPG submitted the GOTHIC safety analysis report to document the results of the Maximum Pressure Analysis, Minimum Pressure Analysis, Integrated Over-Pressure Analysis, and Re-pressurization Time Analysis. The report was intended to support allowable Main Containment, Main Vacuum Chamber, and Upper Vacuum Chamber pressures during the concurrent refurbishment of two units at Darlington NGS. As part of the refurbishment, bulkheads were installed to isolate the two refurbishing units from the containment, and their removal was planned to restore the units to containment. CNSC staff reviewed the submission and concurred with OPG's request for a Temporary Modification to the Vacuum Structure Pressure Operating Set Points for Two-Unit Concurrent Refurbishment and for a Temporary Change to Operating Policies and Principles.

OPG submitted an assessment of pipe break probabilities for Darlington reactors to determine a Threshold Break Size (TBS) for use in Large Break Loss of Coolant Accident (LBLOCA) Deterministic Safety Analysis (DSA). On completion of the review of the OPG determination of the TBS, CNSC staff concluded that the evaluation of the TBS is consistent with the OPG pre-established methodology. Based on the review of OPG proposed TBS for the in-scope piping systems equivalent to a single-ended guillotine break of Nominal Pipe Size (NPS) 12 piping, CNSC staff re-categorized the three LBLOCA-related CANDU Safety Issues (CSI) from Category 3 to a lower risk category, Category 2, for DNGS.

OPG also submitted a LBLOCA DSA for Darlington reactors. The DSA used a hybrid analysis approach - breaks smaller than the TBS were analyzed using the traditional Limit of Operating Envelope (LOE) approach, while breaks larger than the TBS were analyzed using a realistic analysis approach. CNSC staff found that the DSA for Darlington LBLOCA followed the CNSC staff guidance. CNSC staff have identified some areas for further discussion and resolution to achieve a mutual understanding with respect to the implication of the analysis approach to Safe Operating Envelope (SOE) limits and the level of confidence in the analysis results. OPG has committed to developing work plans to address the CNSC staff concerns.

OPG has met CNSC staff's expectations with their PSA submissions. The transition plan to REGDOC-2.4.2, *Probabilistic Safety Assessment (PSA) for Reactor Facilities*, has been successfully implemented and CNSC staff confirmed OPG's compliance with REGDOC-2.4.2. In addition, OPG continues to update their PSA for Darlington on a 5-year cycle.

To comply with CSA N293 requirements, DNGS performs regular updates of the Fire Hazard Assessment (FHA) and the Fire Safe Shut Down Analysis (FSSA), either through revisions or reaffirmations at least once every five years, or as needed to reflect plant modifications, changes in fire hazards, operating experience, or operational changes. In 2022, DNGS submitted updated reports for both the FHA and FSSA as required and as of the end of 2022, CNSC staff review was still in progress.

3.1.5 Physical design

OPG continued to implement and maintain a design program at DNGS to confirm that safety-related systems, structures and components, and any modifications to them, continue to meet their design bases and to confirm that SSCs continue to be able to perform their safety functions under all plant states, in accordance with the conditions prescribed in the PROL and LCH.

In 2022, CNSC type II Environmental qualification (EQ) inspection (DRPD-2021-10193) identified two compliant findings and one non-compliant finding of low safety significance related to this SCA. OPG has submitted a corrective action plan (CAP) which was under review at the end of 2022. CNSC staff concluded that OPG continued to meet the applicable EQ requirements of CSA N290.13-05, *Environmental qualification of equipment for CANDU nuclear power plants* for DNGS.

OPG submitted an update to the implementation plan of the standard CSA-N290.13, revision of 2018. The submission has been under review.

During a Type II inspection on Pressure Boundary for refurbishment unit 3 (DRPD-2022-10680), CNSC staff identified only compliant findings.

OPG submitted quarterly pressure boundary reports in a timely manner, which CNSC staff reviewed and found to be compliant with reporting requirements.

OPG was compliant with the requirements of CSA N289.1-08, General requirements for seismic design and qualification of CANDU nuclear power plants, and seismic control areas observed during compliance activities.

During a Type II inspection on the preservation of seismic design basis conducted in 2021, CNSC staff issued a notice of non-compliance in the inspection report DRPD-2021-10223 on the seismic qualifications of components using an experience-based method which was not mentioned in the OPG procedure. In 2022, CNSC staff reviewed OPG's update to their CAP. In the CAP, OPG referenced CSA N289.1-08 which allows seismic qualification by the experience-based methods. LCH includes N289.1-08 as requirements for seismic, design and qualification of CANDU nuclear power plants.

CNSC staff found that OPG continued to implement its fire protection program at DNGS in accordance with the requirements of CSA N293-12, *Fire protection for nuclear power plants*. CNSC accepted OPG's final update on the action plan for the resolution of fire protection code-of-record gaps.

Based on the 2021 Annual Fuel Performance Report, CNSC staff determined that the fuel performance at the Darlington NGS site remained safe, and fuelling operations were conducted within the design basis power-burnup envelope.

3.1.6 Fitness for service

Although, CNSC staff concluded that OPG met the applicable regulatory requirements and the expectations of CNSC staff for the Fitness for Service SCA in 2022, a notable exception related to pressure tubes in extended operation with regions of potentially elevated hydrogen equivalent concentration near the inlet rolled joints. A risk-informed decision-making evaluation concluded that continued operation of affected pressure tubes in Unit 4 was acceptable for a period of at least 3 years [CMD 22-M37]. For pressure tubes potentially affected by the issue of elevated hydrogen equivalent concentration near outlet rolled joints, alternate fitness for service criteria were satisfied [CMD 21-H112, CMD 21-H114, CMD 21-H114 record of decision]. Appendix I contains an update on industry's response to the elevated Heq findings near the rolled joint burnish marks of Bruce Unit 3 and Unit 6 pressure tubes in 2021.

CNSC staff confirmed that all special safety systems for DNGS met their unavailability targets in 2022.

CNSC staff reviewed OPG's annual reliability report and determined that the report met CNSC staff expectations.

The performance of Darlington's maintenance program met CNSC staff's expectations in 2022. The critical corrective maintenance backlog, deficient maintenance backlog and the number of critical preventive maintenance deferrals were maintained at a very low level in 2022 (Table 13). The average preventive maintenance completion ratio was 96%, which was acceptable. There were no safety significant findings related to maintenance program performance based on the review of the reportable events. CNSC staff also conducted several maintenance focused inspections in 2022 that confirmed that Darlington's maintenance program consistently met the applicable regulatory requirements.

Table 13: Trend of maintenance backlogs and deferrals for critical components for the DNGS, 2020 to 2022

Parameter	Average quarterly work orders per unit			Three-year trending	Quarterly 2022 work orders				Industry average for 2022
	2020	2021	2022		Q1	Q2	Q3	Q4	
Corrective maintenance backlog	0	0	0	steady	0	0	0	0	1
Deficient maintenance backlog	1	1	1	steady	1	1	1	0	3
Deferrals of preventive maintenance	1	1	1	steady	3	0	1	1	1

OPG continues to manage aging of DNGS structures, systems and components (SSCs) within a systematic and integrated framework in accordance with CNSC [REGDOC-2.6.3, Fitness for Service: Aging Management](#).

OPG conducted on-line and outage inspections, where periodic and in-service inspection programs were conducted in accordance with accepted programs and any findings were dispositioned to confirm there was no impact to safe operation.

Appendix I contains an update on industry's response to the elevated Heq findings near the rolled joint burnish marks of Bruce Unit 3 and Unit 6 pressure tubes in 2022.

3.1.7 Radiation protection

In 2022, CNSC staff assessed OPG's application of ALARA at the DNGS and found it to be compliant with regulatory requirements and meeting CNSC staff's performance expectations. OPG established dose targets, tracked collective and individual dose performance against approved targets and limits, and implemented various initiatives aimed at controlling occupational exposures during the year.

In 2022, CNSC staff determined that OPG met the regulatory requirements for controlling worker doses at the DNGS. The radiation doses received by workers at the station were below both the regulatory dose limits (refer to table and figures in Section 2.7) and the action levels specified in OPG's radiation protection program.

In 2022, OPG complied with the regulatory requirements for Radiation Protection Program Performance at the DNGS. OPG used performance metrics and self-assessments to monitor and control the program's performance in all aspects. Additionally, OPG leveraged operating experience and benchmarked with the industry to enhance the program's performance.

CNSC staff verified that OPG implemented controls that satisfied the regulatory requirements for managing radiological hazards and safeguarding workers at the DNGS. Furthermore, OPG remained below the action levels for contamination control at the station during that year.

3.1.8 Conventional health and safety

OPG has established appropriate procedures to ensure the protection of the environment and the health of individuals against hazardous materials. OPG is compliant with the relevant requirements of the "*Occupational Health and Safety Act of Ontario*," the "*Labour Relations Act*," and OPG's "Occupational Health and Safety Policy".

During the reporting year, there were eight reportable events in this area, four of which were COVID-19 related. CNSC was satisfied with OPG's response to these events. No significant issues were identified in this area.

In 2022, Darlington NGS achieved excellent safety results with an accident severity rate (ASR), accident frequency (AF), and industrial safety accident rate (ISAR) of 0, 0.04, and 0 person-hours, respectively. Additionally, Darlington NGS had over 3.8 million person-hours without a lost time injury. Moreover, the AF at Darlington decreased from 0.08 in 2021 to 0.04 in 2022, which is less than the 5-year average value. The number of calendar days lost at Darlington remained unchanged at 0.0 in 2022.

3.1.9 Environmental protection

CNSC staff found that OPG had made adequate provisions for the protection of the environment and the health of individuals.

Releases were maintained below the action levels and regulatory limits. The dose to the public from the Darlington site in 2022 (0.0006 mSv) remained well below the regulatory limit of 1 mSv/year and in similar range to previous years, which shows that radionuclide concentrations measured in the environment remained low.

All events have been satisfactorily addressed to date, and there were no exceedances of the Environmental Action Level (EAL) or Derived Release Limits (DRL).

According to the 2022 Environmental Compliance Approval (ECA) quarterly reports which were non-mandatory for OPG to submit, there were no hazardous substance release exceedances of provincial ECA limits, and effluent streams at DNGS were discharged to the environment via the approved provincial ECA Control Points.

3.1.10 Emergency management and fire protection

CNSC staff concluded that OPG has sufficient provisions for preparedness and response capability to mitigate the effects of accidental releases of nuclear and hazardous substances on the environment and maintain the health and safety of persons and the national security.

In February 2022, OPG conducted a full-scale emergency exercise at DNGS named Exercise Unified Command. The exercise was done over a period of 3 days from February 23-25. The exercise assessed the performance of OPG's emergency response organization to a design basis accident that progressed to a severe accident. The exercise involved municipal, provincial, and federal authorities.

CNSC staff conducted an inspection of this exercise and identified 15 compliant findings, along with one non-compliance of negligible safety significance.

OPG provided a satisfactory implementation plan for CSA N293-12 (R2017) *Fire protection for nuclear power plants*, Update 1, to achieve full compliance at Darlington NGS by June 30, 2023.

3.1.11 Waste management

CNSC staff confirmed that OPG continued to implement an effective waste management program and preliminary decommissioning plan at the DNGS in 2022. The safety performance indicator (SPI) Low- and Intermediate- Level Radioactive Solid Waste Generated for DNGS in 2022 had no deviations from the historic values.

CNSC staff were satisfied with the values of the safety performance indicator for low and Intermediate-Level Radioactive Solid Waste Generated for DNGS in 2022.

3.1.12 Security

CNSC staff concluded that OPG did not meet all the applicable regulatory requirements for the SCA Security at the DNGS in 2022.

In 2022, CNSC staff reviewed the annual threat and risk assessment and conducted five field inspections (one Facilities and Equipment inspection, one Security Practices inspection and three Response Arrangements inspections).

The security inspections conducted in 2022 resulted in 13 non-compliant findings spanning across multiple specific areas. These findings included the need for clearer documentation and consistency regarding the qualifications and number of nuclear security officers (NSOs) required for the minimum shift complement. Additionally, there were instances where NSOs did not meet the qualification requirements outlined in REGDOC-2.2.4, *Fitness for Duty, Volume III: Nuclear Security Officer Medical, Physical, Psychological Fitness* at the required frequency. Furthermore, security measures were not fully in place for all pathways at site, as mandated by RD-321, Criteria for Physical Protection Systems and Devices at High-Security Sites.

OPG promptly took corrective actions to address the findings identified during the inspections conducted in 2022. These actions were implemented to ensure compliance and enhance the overall security measures at the site.

Additionally, CNSC staff completed a fleet-wide Cyber Security Program Desktop Inspection (DRPD-2022-10305), focusing on the design,

implementation, and maintenance of the Cyber Security Program at the Darlington NGS. The inspection identified five non-compliant findings of low safety significance in the areas of performance assessments and cyber security. In response, OPG created a corrective action plan to address these findings. CNSC staff will continue to follow up on the proposed corrective actions.

In 2021, an action item was identified within Facilities and Equipment that indicated OPGs performance significantly deviated from the applicable requirements and CNSC staff's expectations. The action item remained open in 2022. The details of the findings contain prescribed information and are therefore classified as confidential.

UPDATE: OPG has completed their self-assessment in February 2023, which was initiated in 2022 as a response to the non-compliances identified in the supplemental CMD for the 2021 NPGS ROR. CNSC staff increased regulatory scrutiny in this area due to the non-compliances observed in 2021 and 2022. It is important to note that, based on the assessment conducted, there is no immediate risk to safety and security.

UPDATE: In 2023, the CNSC issued an Administrative Monetary Penalty (AMP) to OPG as a result of a failure to comply with a licence condition in relation to its security program at the Pickering and Darlington Nuclear Generating Stations.

The AMP was issued to promote compliance and deter recurrence. OPG has put corrective actions in place to address the non-compliance and has paid the penalty amount. Based on a declining trend in compliance performance observed, CNSC staff are conducting enhanced regulatory oversight of this SCA. These non-compliant findings will be detailed in a supplemental CMD as the details are confidential.

3.1.13 Safeguards and non-proliferation

CNSC staff determined that OPG implemented and maintained a program for accountancy and control of nuclear material at the DNGS that satisfies the regulatory requirements of REGDOC-2.13.1, *Safeguards and Nuclear Material Accountancy*.

During the reporting period of 2022, OPG provided the required nuclear material accountancy and control reports to the CNSC and the IAEA for their safeguards' verification activities.

OPG granted the required access and assistance to the IAEA for safeguards activities, including inspections, and for the maintenance of IAEA equipment at the DNGS.

OPG submitted the required annual operational programme with quarterly updates and the annual update to the Additional Protocol to the CNSC in a timely manner. The CNSC reviewed these documents and determined that they met requirements and expectations.

CNSC staff determined that OPG met the applicable regulatory requirements for safeguards equipment, containment, and surveillance in 2022 at the DNGS. In

2022, OPG provided the support required for the IAEA's safeguards equipment, containment, and surveillance activities.

As requested by the IAEA, OPG facilitated the replacement of the IAEA's four core discharge monitor (CDM) detector boxes and associated wiring in Unit 3 in October and November 2022.

3.1.14 Packaging and transport

There were no non-compliant inspection findings and no reportable events during the review period.

3.2 Darlington Waste Management Facility

3.2.0 Introduction

The DWMF is located within the traditional territory of the Michi Saagiig Anishinaabe people. These lands are covered by the Williams Treaty between Canada and the Mississauga and Chippewa Nations. The CNSC regulates the DWMF under a waste facility operating licence (WFOL). At the DWMF, OPG processes and stores dry storage containers (DSCs) containing used nuclear fuel (high-level radioactive waste) generated at the DNGS. OPG also manages the intermediate level radioactive waste generated from the refurbishment of the DNGS in Darlington storage overpacks (DSOs) at the Retube Waste Storage Building (RWSB) at the DWMF.



The DWMF consists of an amenities building, one DSC processing building, two DSC storage buildings (Storage Buildings #1 and #2), and the RWSB. The DWMF has the capacity to store 983 DSCs and 490 DSOs. The transfer route of the loaded DSCs and DSOs from the DNGS to the DWMF is on OPG property.

With the exception of the RWSB, the DWMF is contained within its own protected area, which is separate from the protected area of the DNGS but within the boundary of the Darlington site. The RWSB is also located within the boundary of the Darlington site but not within a protected area.

The Waste Facility Operating Licence (WFOL) for the DWMF authorizes OPG to construct two additional DSC storage structures (Storage Structures #3 and #4), which would allow for an additional storage capacity of 1,200 DSCs.

Licensing

Following a public hearing held on January 26, 2023, the [Commission renewed](#) the WFOL for the DWMF in May 2023, with an expiry date of April 30, 2033.

Licence Conditions Handbook

CNSC staff did not revise the DWMF LCH in 2022. However, OPG implemented several CNSC regulatory documents in 2022. Future revisions of the LCH will reflect those new publications (or new versions of existing publications) as sources of compliance verification criteria for the DWMF.

Compliance program

CNSC staff concluded that OPG had met the applicable regulatory requirements and the expectations of CNSC staff for all SCAs at DWMF in 2022.

Table 14 lists the inspections at the DWMF that were considered in this regulatory oversight report (inspection reports were included if they were sent to OPG by March 6, 2023).

Table 14: List of Inspections at DWMF

Safety and control area	Inspection title	Inspection report sent date
Radiation Protection	Radiation Protection Inspection: OPG-DWMF-2022-01	May 2022
Management System	Management System Inspection: OPG-DWMF-2022-03	March 2023
Security	Facility Specific – Security: DWMF-NSD-T2-2022-001	June 2022

Event Initial Reports

No event initial reports pertaining to DWMF were submitted to the Commission in the year 2022.

3.2.1 Management system

In November 2022, CNSC staff conducted a Type II inspection (OPG-DWMF-2022-03) on the management system and identified six non-compliant findings of low safety significance. Two findings were related to the lack of information in some event reports, either the investigation was incomplete, or the codes used for identifying the causes of the event were missing. Two other findings were related to the purchasing requirements and the monitoring of suppliers. One finding was related to a form that provides a summary of processes used for interfacing programs, and one finding was related to the preservation of records from loss and damage. The corrective action plan submitted by OPG is currently under review by CNSC staff.

Changes to licensing-basis documents are reviewed by CNSC staff to ensure that OPG maintains its management system at the DWMF and that changes do not adversely impact safety. OPG has processes in place to maintain or restore critical safety and business functions in the event of disabling circumstances.

3.2.2 Human performance management

CNSC staff reviewed OPG's 2022 quarterly and annual operations reports for DWMF and there were no issues identified for the specific area of Personnel Training and Human Performance Management.

3.2.3 Operating performance

In 2022, OPG met their target of 57 DSCs to be loaded at the DNGS and transferred to the DWMF.

Additionally, OPG placed 13 Retube Waste Containers (RWCs) in storage at the DWMF in 2022. OPG submitted all scheduled quarterly and annual reports as required and within the appropriate timelines. CNSC staff's reviews of OPG's operational reports did not identify any issues or situations that suggested that licensed activities at the DWMF were unsafe. The reviews also confirmed that OPG's reporting and trending, and its responses to comments and requests for follow-up information and clarification, met CNSC staff's requirements.

3.2.4 Safety analysis

In 2021, OPG submitted the required 5-year update to the safety analysis report for DWMF. CNSC staff reviewed the report and concluded that the updated safety report met the applicable regulatory requirements. CNSC staff accepted OPG's updated safety analysis report in 2022.

3.2.5 Physical design

CNSC staff has confirmed that OPG effectively maintains its design and pressure boundary programs, ensuring that modifications to the facilities are implemented in accordance with established engineering change control processes to maintain the design basis. Additionally, through desktop review of the DWMF quarterly and annual compliance reports, DWMF has been found to implement its fire protection program in accordance with the requirements of CSA N393, *Fire protection for facilities that process, handle, or store nuclear substances*.

3.2.6 Fitness for service

As part of the aging management activities for DSCs, OPG submitted the aging management report for the OPG DWMF. CNSC staff reviewed the submission and determined that it complied with OPG's aging management program.

3.2.7 Radiation protection

CNSC staff's Type II compliance inspection of the DWMF, along with compliance reviews of quarterly reports submitted by OPG, and licensee responses to reportable events determined that:

- The DWMF adhered to the *Nuclear Safety and Control Act*, the Regulations made under the Act, and the conditions of its CNSC-issued operating licence
- Measures were implemented to ensure that the DWMF was compliant with regulatory requirements related to Radiation Protection
- The DWMF achieved its year-end collective dose target
- OPG did not exceed any action levels for dose to workers. The annual effective doses for all DWMF workers were well below the regulatory limit of 50 mSv
- OPG did not exceed any action levels for contamination control
- The perimeter dose rates at the DWMF were within OPG's targets and consistent with the results of the previous years

A focused inspection on Radiation Protection was conducted in 2022, which identified five non-compliant findings of low safety significance. Two findings were related to conducting self-assessments, one finding was related to performance monitoring of collective dose, and two findings were related to retaining calibration source records. All five non-compliant findings have been resolved to the satisfaction of CNSC staff. CNSC staff concluded that DWMF continued to implement an effective Radiation Protection Program in accordance with regulatory requirements.

3.2.8 Conventional health and safety

In 2022, CNSC staff compliance verification activities did not identify any non-compliant findings related to conventional health and safety. Additionally, OPG did not report any lost-time injuries at the DWMF in 2022.

3.2.9 Environmental protection

CNSC staff found that OPG made adequate provisions for the protection of the public and the environment. Environmental releases remained well below the DRLs and Action Levels.

OPG assessed their stormwater monitoring program at the DWMF. As a result, OPG requested to discontinue tritium and gross gamma monitoring in stormwater, as there are no regulatory requirements to conduct this monitoring. CNSC and ECCC reviewed the request and accepted OPG's request to discontinue the stormwater monitoring in 2022. Stormwater will continue to be considered as part of the ERA and groundwater protection programs.

The dose to the public from the Darlington site in 2022 (0.0006 mSv) remained well below the regulatory limit of 1 mSv/year and in similar range to the previous years, which shows that radionuclides concentrations measured in the environment remain low.

3.2.10 Emergency management and fire protection

OPG has a facility emergency program for the DWMF. Main fire response is done by Clarington Fire Department (CFD). To ensure familiarity with the facility, CFD staff are given orientation tours at the DWMF. CFD staff train with Darlington Emergency Response Team (ERT) at OPG's live fire training facility near Wesleyville, Ontario.

Overall, OPG has an adequate Fire Protection Program (FPP) to minimize both the probability of occurrence and the consequences of fire at DWMF. The FPP complies with the requirements of CSA N393-13, *Fire protection for facilities that process, handle, or store nuclear substances*.

As part of the transition plan to comply with the National Fire Code of Canada 2015 edition, it was discovered that some fire dampers at the DWMF are not being inspected annually. OPG reported this event in accordance with REGDOC-3.1.2. Further, OPG's submission indicated that on February 15-17, 2022, all fire dampers were inspected and were confirmed to be open and in good condition with the exception of some fire dampers that had accessibility issues. However,

the submission indicated that a work request had been initiated to perform full inspection and obtain information for future execution inspections of these damper that have accessibility issues. CNSC staff found that the actions taken by OPG were acceptable.

3.2.11 Waste management

CNSC staff confirmed that OPG continued to maintain an effective waste management program and preliminary decommissioning plan for the DWMF in 2022. CNSC staff were satisfied with the information provided by OPG in the quarterly and annual operations reports for the DWMF in 2022.

3.2.12 Security

One security inspection (DWMF-NSD-T2-2022-001) was conducted in 2022 at DWMF. This inspection identified that DWMF was compliant with regulatory requirements. CNSC staff reviewed the DWMF annual site compliance report, and the threat and risk assessment report, and confirmed that OPG met all the applicable regulatory requirements pertaining to the Security SCA at DWMF.

3.2.13 Safeguards and non-proliferation

CNSC staff determined that OPG's accountancy and control of nuclear material complied with the applicable regulatory requirements at the DWMF.

OPG granted the required access and assistance to the IAEA for safeguards activities, including inspections, and for the maintenance of IAEA equipment at the DWMF.

CNSC staff determined that OPG met the applicable regulatory requirements for operational and design information in 2022 at the DWMF. OPG provided the required operational and design information to facilitate IAEA safeguards activities. OPG provided the support required for the IAEA's safeguards equipment, containment, and surveillance activities.

3.2.14 Packaging and transport

OPG maintains a packaging and transport program for the DWMF that ensures compliance with the [*Packaging and Transport of Nuclear Substances Regulations, 2015*](#), and the [*Transportation of Dangerous Goods Regulations*](#). No nuclear substances were transported at the facility in 2022.

3.3 Pickering Nuclear Generating Station

3.3.0 Introduction

The [Pickering site](#) is located on the north shore of Lake Ontario in Pickering, Ontario, 32 kilometres northeast of Toronto and 21 kilometres southwest of Oshawa. The Pickering site lies within the traditional territory of the Michi Saagiig Anishinaabe people. These lands are covered by the Williams Treaty between Canada and the Mississauga and Chippewa Nations.



The Pickering site consists of the Pickering Nuclear Generating Station (PNGS) and the Pickering Waste Management Facility (PWMF), both owned and operated by OPG. The CNSC regulates the PNGS and PWMF under two separate, independent licences – a power reactor operating licence (PROL) for the PNGS and a waste facility operating licence (WFOL) for the PWMF.

The PNGS consists of 8 CANDU reactors. Units 1, 2, 3 and 4 (formerly known as PNGS A) went into service in 1971–73. Units 2 and 3 were defueled in 2008 and remain in a safe shutdown state; there are no plans to put them back into operation. Units 5, 6, 7 and 8 (formerly known as PNGS B) continue to operate safely since they were brought into service in 1983–86.

Each operating reactor for Units 1 and 4 has a gross electrical output of 542 MWe (megawatts electrical). Each operating reactor for Units 5–8 has a gross electrical output of 540 MWe.

Licensing

In 2018, the [Commission renewed](#) the PROL for a 10-year period covering September 1, 2018, to August 31, 2028. This licence period includes three phases of operational activities:

- continued commercial operation until December 31, 2024
- stabilization phase (post-shutdown defueling and dewatering of reactors), which lasts approximately 3 to 4 years
- beginning of safe storage for Units 1 and 4 and Units 5–8

Following the end of commercial operation and permanent shutdown, each unit will undergo stabilization activities in preparation for an extended phase of safe storage with surveillance. The safe storage with surveillance phase is expected to begin in 2028. OPG requires Commission authorization should it decide to operate any PNGS units beyond December 31, 2024.

On September 29, 2022, the [Ontario Ministry of Energy announced](#) its support of continued commercial operation of PNGS units 5-8 until 2026 and asked OPG to update its feasibility assessment for refurbishing PNGS units 5-8. In December

2022, OPG informed CNSC staff in a letter of its intent to seek Commission authorization to operate Pickering Units 5–8 until the end of 2026 and submitted its formal application to the CNSC requesting such Commission authorization in June 2023. To support the continued operation of Pickering Units 5-8, OPG has conducted a Periodic Safety Review (PSR) reassessment in accordance with licence conditions 15.1 and 15.4 of the Licence Conditions Handbook. A public Commission hearing to consider this matter is expected to be held in June 2024. PNGS Units 1 and 4 would shut down as currently planned, by December 31, 2024.

The PROL was not amended in 2022.

***Fisheries Act* authorization**

On January 17, 2018, [Fisheries and Oceans Canada](#) (DFO) issued a [Fisheries Act](#) authorization (FAA) to OPG for the PNGS under paragraph 35(2)(b) of the Act. In 2022, OPG submitted the 2021 Fish Impingement Monitoring report in accordance with its FAA. CNSC staff and DFO each independently reviewed OPG’s 2021 report and concluded that the report was acceptable and complied with the conditions of the FAA.

Integrated implementation plan

In May 2021, OPG completed all required IIP commitments, and CNSC staff have closed all PNGS IIP commitments as of June 2021.

Compliance program

CNSC staff concluded that OPG had met the applicable regulatory requirements and the expectations of CNSC staff for all SCAs at PNGS in 2022, with the exception of Security SCA.

Table 15 lists the inspections at the PNGS that CNSC staff considered in this regulatory oversight report (inspection reports were included if they were sent to OPG by February 27, 2023). The quarterly Type II inspections include 55 field inspections conducted at the PNGS in 2022.

Table 15: List of inspection reports at the PNGS

Safety and Control Area	Report Title	Report Issue Date
Management System	PRPD-2022-13903 & DRPD-2022-14332 - Type II Compliance Inspection Report - Problem and Event Cause and Resolution Effectiveness Investigation and Trend Analysis	September 29, 2022
Human Performance	PRPD-2022-13868- DTI - REPORT - Design, development and grading of a Pickering 1-4 CRSS Simulator-based Examination	November 7, 2022

Safety and Control Area	Report Title	Report Issue Date
	DRPD-2022-15754 & PRPD-2022-14313 PRRP Compliance Verification Report - Fleet-wide Desktop Inspection of OPG's Nuclear Emergency Response Organization Training Program	December 1, 2022
	DRPD-2022-14967 & PRPD-2022-14314 – Inspection Report –TII - Non-Certified Training Programs	January 24, 2023
	PRPD-2022-15209 - REPORT - Conduct and Grading of Certified Shift Personnel Requalification Examination	February 21, 2023
	DRPD-2022-15569 and PRPD-2022-15714 – Inspection Report – Minimum Shift Complement Verification	February 23, 2023
Operating Performance	PRPD-2021-11631 – REPORT – TII – Unit 7 (P2171) Outage	March 22, 2022
	PRPD-2022-12076 - Report - TII - Quarterly Field Inspection Report Q3 2021-2022	March 23, 2022
	PRPD-2022-12909 - Report - TII - Quarterly Field Inspection Report Q4 2021-2022	June 30, 2022
	PRPD-2022-12914 – REPORT – TII – Unit 5 (P2251) Planned Outage	August 31, 2022
	PRPD-2022-13990 - Report - TII - Quarterly Field Inspection Report Q1 2022-2023	September 29, 2022
	PRPD-2022-14702 - REPORT - TII - Quarterly Field Inspection Report Q2 2022-2023	December 15, 2022
Physical Design	PRPD-2022-14712 - Report - TII - Fire Protection at Pickering NGS	November 25, 2022
Fitness for Service	PRPD-2022-11039 Type II Maintenance Planning and Scheduling Compliance Verification Report	May 26, 2022
	PRPD-2022-12794 - Type II Inspection Report - Negative Pressure Containment System	July 13, 2022
Radiation protection	PRPD-2022-14730 - Inspection Report - Application of ALARA	February 24, 2023
Environmental Protection	PRPD-2022-15102 & DRPD-2022-14705 – Report – TII – Fleet	February 27, 2023

Safety and Control Area	Report Title	Report Issue Date
	Environment Monitoring Program at Pickering and Darlington NGS	
Security	PRPD-2022-FI-13568-13567 - Security Field Inspection #10 & 14	March 2, 2022
	DRPD-2022-10777 and PRPD-2022-13057 – Inspection Report – Search and Screening Equipment at the Entrance and Egress of the Protected Area	April 20, 2022
	DRPD-2022-10782 and PRPD-2022-13568 Nuclear Response Force (NRF) Response Vehicle Verification and Nuclear Security Officer (NSO) Equipment and Asset Verification	June 28, 2022
	PRPD-2022-13697 – REPORT - Field Inspection Report – Security Measures (Procedures) for entry-egress of Protected Areas, Vital Areas, and Inner Areas	July 26, 2022
	DRPD-2022-10305 & PRPD-2022-12739 - Desktop Inspection Report - Fleet-Wide Cyber Security	September 28, 2022

Event Initial Reports

No event initial reports pertaining to PNGS were submitted to the Commission in 2022.

3.3.1 Management system

In 2022, CNSC staff conducted an inspection (PRPD-2022-13903) of OPG's fleet-wide problem and event cause and resolution effectiveness investigation and trend analysis. This inspection resulted in fifteen compliant findings and five non-compliant findings and one recommendation. The five non-compliant findings were either of negligible or low safety significance. The non-compliant findings concerned Station Condition Record and investigation report record management requirements. OPG has implemented numerous corrective actions and CNSC staff continue to review and follow up on OPG's implementation.

OPG continued to meet business continuity requirements, including those related to the COVID-19 pandemic, throughout 2022. OPG has adequate measures in place relating to business continuity in the event of disabling circumstances such as illness and severe weather.

3.3.2 Human performance management

CNSC staff identified a total of eight non-compliant findings within the SCA, of which three were of negligible safety significance and five were of low safety significance.

Two of the low safety significance findings were identified during an inspection of OPG's Non-Certified Training Programs (PRPD-2022-14314) and were related to discrepancies in non-certified training programs, specifically related to Fire Protection training program analysis documentation and the maintenance of qualification linkages between OPG's Training Qualification Document and Learning Management System. OPG has implemented corrective actions to address these findings, and CNSC staff will follow up on and verify their implementation.

The other three low safety significance findings were identified during an inspection of OPG's Emergency Response Organization Training Program (PRPD-2022-14313) and were related to discrepancies in documentation and training material. OPG is also implementing corrective actions for these findings.

Finally, a finding related to the grading requirements of a Control Room Shift Supervisor Simulator-based Certification Examination was identified during an inspection of OPG's development and Grading of a Control Room Shift Supervisor (CRSS) Simulator-based Certification Examination at Pickering NGS (PRPD-2022-13868) but had no impact on the validity of the examination. A recommendation for continuous improvement was provided to OPG.

3.3.3 Operating performance

OPG continued to operate PNGS in a safe manner within the bounds of the operating policies and operational safety requirements. All reactor units operated at the conditions prescribed by Power Reactor Operating Licence within the power limits identified in the licence conditions handbook for PNGS. Operating practices observed during the year were adequate and effective.

In 2022, Pickering Units 1&4 experienced one automatic reactor trip (or shutdown) and no setbacks. Pickering Units 5-8 experienced one automatic reactor trip, no stepbacks and one setback. Unit 4 tripped when a steam relief valve failed open during warm-up of the Unit 4 Heat Transport System. Unit 6 tripped due to incorrect operation of a circuit breaker that caused a trip of the primary heat transport system main circuit pump. Unit 5 experienced a setback due to a debris run, which prompted the Unit 5 turbine to be manually tripped. All transients were properly controlled, and power reduction was automatically initiated by the reactor control systems. All PNGS units met WANO's PHWR target of 1.0 trip per 7,000 hours of operation.

In 2022, PNGS experienced two forced outages among its six operating reactors. In April 2022, Unit 8 underwent a forced outage to repair oil ingress into the generator collector assembly. In May, Unit 8 underwent a forced outage to resolve an issue with two shut off rods that were unable to drive out of core following a partial rod drop test. All forced outages were adequately followed up by OPG.

CNSC staff concluded that OPG's management of planned outages at PNGS met applicable regulatory requirements and expectations. Staff confirmed that OPG used an approved reactor shutdown guarantee state during planned outages, monitored heat sinks and components, completed regulatory undertakings, and operated the main control room in accordance with their operations program. In 2022, two outage inspection reports were issued. For the Unit 7 Planned Maintenance Outage (PRPD-2021-11631), CNSC staff identified nine compliant findings and no non-compliant findings. During the Unit 5 Planned Maintenance Outage (PRPD-2022-12914), CNSC staff identified 17 compliant findings and no non-compliant findings.

PNGS was compliant with the regulatory requirements in [REGDOC-3.1.1 Reporting Requirements for Nuclear Power Plants](#). All scheduled REGDOC-3.1.1 reports were submitted to the CNSC in a timely manner.

OPG reported 38 events in 2022 that were reportable under REGDOC-3.1.1. CNSC staff conducted reviews of these events, using a graded approach based on risk significance of the event. For the completed event reviews CNSC staff confirmed that OPG took appropriate corrective actions.

3.3.4 Safety analysis

OPG provided an update on its REGDOC-2.4.1 implementation plan for the 2022-2024 period. In 2022, OPG continued to execute the planned upgrades of the Safety Report Appendices, in alignment with their LCH. A graded approach to requirements was used based on safety significance, complexity, and novelty of the analyses. As of the end of 2022, CNSC staff were conducting an ongoing review of OPG's REGDOC-2.4.1 implementation plan for the 2022-2024 period.

OPG's updated analyses of Small Break Loss of Coolant (SBLOCA), Loss of Flow (LOF) and Neutron Overpower Protection (NOP) accidents confirmed the effectiveness of the shutdown systems under these conditions. Following a CNSC staff request for an additional analysis for a very small LOCA break size (100 kg/s), OPG included trip coverage assessments covering aged conditions and the additional accident case. OPG's analysis showed that the 100kg/s break size case was bounding by the backup trip. CNSC staff found the analyses were compliant with the applicable requirements and adequately enveloped operations using conservative assumptions.

OPG provided corrective action plans for all five notices of non-compliance (NNC) related to the Probabilistic Pressure Tube Evaluations and TUF code, which were discovered during the inspection of the Software QA Program (PRPD-2020-07065). All corrective action plans for the NNCs were found to be acceptable, and NNC#4 has been closed. OPG is expected to provide an update on the implementation of the outstanding corrective action plans by August 2023 to address the remaining non-compliances.

The Safety Report, Facility Description underwent a 5-year update and was recently submitted by OPG. As of the end of 2022, the report was under review by CNSC staff.

In 2022, Ontario Power Generation completed the Pickering NGS Units 5-8 Probabilistic Safety Assessment (PSA) five-year update. OPG submitted twelve different reports as part of the update. As of the end of 2022, CNSC staff were still reviewing these reports, except for the Level 1 At-Power PSA, which had already been completed and accepted by CNSC staff.

CNSC staff has finished reviewing the PSA Hazard Screening Analysis and identified an issue regarding the external flood PSA's use of old precipitation data, when more recent data should be used. In response, CNSC staff communicated their expectations to OPG that they incorporate more up-to-date climate change precipitation data to account for the potential impact of climate change.

In December 2022, OPG submitted a compliance assessment of the existing Probabilistic Seismic Hazard Assessment (PSHA) for Pickering NGS against CSA N289.2-21, *Ground motion determination for seismic qualification of nuclear power plants*, to CNSC staff for review. OPG concluded that the existing Pickering site seismic hazard characterization remains valid and was applied in the 2022 Pickering B PSA update. CNSC staff have consulted with seismological experts from NRCan for this review, and as of the end of 2022, their review was still in progress.

OPG also submitted an updated high wind hazard assessment for the Pickering site as part of the Pickering B PSA update in December of 2022. The updated assessment utilizes updated methodology and incorporates newest wind data up to 2020. CNSC staff review is ongoing.

3.3.5 Physical design

OPG continued to implement and maintain a design program at PNGS to confirm that safety-related systems, structures and components, and any modifications to them, continue to meet their design bases and to confirm that SSCs continue to be able to perform their safety functions under all plant states, in accordance with the conditions prescribed in the PROL and LCH.

OPG submitted quarterly pressure boundary reports in a timely manner, which CNSC staff reviewed and found to be compliant with reporting requirements.

OPG submitted an update to the implementation plan of the standard CSA-N290.13, revision of 2018. The submission has been under review at the end of 2022.

CNSC staff found that OPG continued to implement its fire protection program at PNGS in accordance with the requirements of CSA N293-12, *Fire protection for nuclear power plants*. CNSC staff accepted OPG's implementation plan for N293-12 (R2017).

During the 2021 Environmental Qualification (EQ) Program inspection (PRPD-2021-10881) three NNCs were raised related to the conduct of EQ walkdowns by OPG. At the end of 2022, CNSC staff was following up on the corrective actions from licensee to ensure the EQ walkdowns are conducted in accordance with the applicable requirements.

During the Type II Fire protection inspection (PRPD-2022-14712), CNSC staff found that the design procedures and processes were followed for fire protection system modifications.

Based on the 2021 Annual Fuel Performance Report, CNSC staff determined that the fuel performance at the Pickering NGS site remained safe, as fuelling operations were conducted within the design basis power-burnup envelope. However, the residency time for defected bundles in the core is high relative to the industry average, due to the design limitations. CNSC staff recommended that OPG takes steps to detect and remove these defects from the core in a timely manner.

3.3.6 Fitness for service

In regard to the Pickering Units 5 to 8 pressure tubes in extended operation, specifically related to potential regions of elevated hydrogen equivalent concentration near the rolled joints, OPG met the alternate fitness for service criteria by demonstrating that flaws do not exist in the regions of interest at the inlet and outlet rolled joints. Appendix I contains an update on industry's response to the elevated Heq findings near the rolled joint burnish marks of Bruce Unit 3 and Unit 6 pressure tubes in 2021.

CNSC staff confirmed that all special safety systems for PNGS met their unavailability targets in 2022.

CNSC staff reviewed OPG's annual reliability report and determined that the report met CNSC staff expectations.

The performance of Pickering's maintenance program met CNSC staff's expectations in 2022. Pickering maintained the critical corrective maintenance backlog very low. The critical deficient maintenance backlog was also maintained low in the past 3 years. The number of critical preventive maintenance deferrals was reduced close to the industry average. Pickering maintained the average preventive maintenance completion ratio at 98% which was better than industry average. CNSC staff also conducted several inspections in 2022 that confirmed that Pickering's maintenance program consistently met the applicable maintenance-related regulatory requirements. The corrective critical maintenance backlog, deficient critical maintenance backlog, and the number of critical preventive maintenance deferrals are given in Table 16.

Table 16: Trend of maintenance backlogs and deferrals for critical components for the PNGS, 2020 to 2022

Parameter	Average quarterly work orders per unit			Three-year trending	Quarterly 2022 work orders				Industry average for 2022
	2020	2021	2022		Q1	Q2	Q3	Q4	
Corrective maintenance backlog	0	0	0	Steady	0	0	0	0	1
Deficient maintenance backlog	2	3	2	Steady	2	2	2	3	3
Deferrals of preventive maintenance	4	4	2	Improving	0	2	2	2	1

Aging Management

OPG continues to manage aging of PNGS structures, systems and components (SSCs) within a systematic and integrated framework in accordance with CNSC [REGDOC-2.6.3, Fitness for Service: Aging Management](#).

OPG conducted on-line and outage inspections, where periodic and in-service inspection programs were conducted in accordance with accepted programs and any findings were dispositioned to confirm there was no impact to safe operation.

In October 2022, the Pickering Nuclear Generating Station conducted its Vacuum Building Outage. During the month-long outage, all operating units were shut down to allow for inspection and testing of the vacuum building and pressure relief duct. These outages are conducted as part of the station's operating license requirements at a frequency of every 12 years. OPG notified the CNSC of the inspection and test results from the outage which are currently being reviewed by CNSC staff.

3.3.7 Radiation protection

In 2022, CNSC staff assessed OPG's application of ALARA at the PNGS and found it to be compliant with regulatory requirements. OPG established dose targets, tracked collective and individual dose performance against approved targets and established limits, and undertook various initiatives to aid in the control of occupational exposures.

In December 2022, CNSC staff conducted a desktop inspection (PRPD-2022-14730) to review the application of ALARA at OPG. Based on the inspection, a NNC was issued to OPG, and one recommendation for improvement was made. The NNC required OPG to develop governance support documents to formalize the requirements for creating and maintaining a 5-year ALARA plan and create an implementation plan for corrective actions. CNSC staff will continue to monitor

and assess OPG's implementation of its five-year ALARA plan at PNGS and its incorporation of lessons learned and OPEX.

CNSC staff determined that OPG implemented provisions that met the applicable regulatory requirements for the control of radiological hazards and the protection of workers at the PNGS. In 2022, there were no action level exceedances for contamination control.

Radiation doses to workers at the PNGS were below the regulatory dose limits. However, OPG reported one action level exceedance for an internal intake of tritium resulting in a total effective dose of 1.59 mSv to a Nuclear Energy Worker, which is well below the regulatory limit of 50 mSv. CNSC staff confirmed that OPG implemented corrective actions to prevent a recurrence.

In 2022, OPG complied with the regulatory requirements for Radiation Protection Program Performance at the PNGS. OPG utilized regular metrics reporting to stakeholders and employed performance metrics and self-assessments to monitor and control performance in all aspects of the radiation protection program. OPG also utilized operating experience and benchmarking with the industry to improve performance.

3.3.8 Conventional health and safety

OPG continued to maintain a robust conventional health and safety program in compliance with provincial and federal regulatory requirements. OPG demonstrated compliance with the relevant requirements of the "*Occupational Health and Safety Act of Ontario*," "*Labour Relations Act*," and OPG governance. The conventional health and safety conditions at OPG PNGS ensured a high degree of personnel safety. OPG also effectively identified workplace hazards in 2022. There were no reportable events.

The Accident Severity Rate (ASR), Accident Frequency (AF) and Industrial Safety Accident Rate (ISAR) indicates OPG performance is acceptable. The 2022 ASR for PNGS remained steady at 0.00, the same as in 2019-2021 period and is below the industry average of 0.35. AF increased from 0.07 in 2021 to 0.22 in 2022 and is below the industry average of 0.25. 2022 ISAR remained steady at 0.00, the same as in 2019-2021 period and below the industry average of 0.03.

OPG has appropriate procedures in place to ensure the protection of the environment and the health of persons against hazardous materials. CNSC staff reviewed quarterly SPI reports and are satisfied with the reported performance values and concluded OPG has provided the information as required under REGDOC-3.1.1.

3.3.9 Environmental protection

CNSC staff found that OPG had made adequate provisions for the protection of the environment and the health of individuals.

Releases were maintained below the action levels and regulatory limits. The dose to the public from the Pickering site in 2022 (0.0019 mSv) remained below the

regulatory limit of 1 mSv/year and in similar range to previous years, which shows that radionuclide concentrations measured in the environment remained low.

There were no exceedances of the Environmental Action Level (EAL) or Derived Release Limits (DRL).

According to the 2022 Environmental Compliance Approval (ECA) quarterly reports, there were no hazardous substance releases exceedances of provincial ECA limits, and effluent streams at PNGS were discharged to the environment via the approved provincial ECA Control Points.

3.3.10 Emergency management and fire protection

CNSC staff concluded that OPG has sufficient provisions for preparedness and response capability to mitigate the effects of accidental releases of nuclear and hazardous substances on the environment and maintain the health and safety of persons and the national security.

In 2022, CNSC staff inspected the Fire Protection program at Pickering NGS (PRPD-2022-14712) and found fifteen compliant findings and three non-compliances of low safety significance. The non-compliances pertained to compressed gas storage, minimization of impairment durations of fire protection systems, and some inconsistencies between the pre-fire plans and the conditions of the plant. UPDATE: CNSC staff reviewed the corrective plan provided by OPG and agreed with their proposed actions. CNSC staff continue to actively monitor the implementation of the corrective plan and evaluate its effectiveness.

In 2022, OPG commissioned a qualified third party to conduct the plant condition inspection at PNGS that covered all Pickering NGS Units and the exterior areas of the station. The objective of the inspection was to assess compliance with the operational requirements of CSA N293-12 and National Fire Code of Canada (NFCC). The report concluded that plant conditions met the operational requirements of CSA N293-12 and NFCC. Although some areas were identified to further align operations with the requirements of NFCC, no unsafe work practices or risk significant fire precursors were identified.

OPG provided a satisfactory implementation plan and plans to comply with CSA N293-12 (R2017), Fire protection for nuclear power plants, Update 1, at Pickering NGS by June 30, 2023.

On February 22, 2022, a low safety significance event occurred in Unit 058 Screen House. A pump caught fire due to repeated motor starts and poor vendor quality of the motor rewind complete in 2014. The fire was isolated to the Screen House building and was promptly extinguished by an operator prior to the arrival of the Emergency Response Team. The damage was limited to the pump and bell housing. A forensic inspection report confirmed the cause of the fire. OPG initiated preventive maintenance on similar pumps from the same vendor to prevent future failures.

As identified in the quarterly field inspection report (PRPD-2022-13990), CNSC staff found that OPG was not compliant with a requirement in REGDOC-2.10.1, *Nuclear Emergency Preparedness and Response*, as offsite emergency centers were not tested over a minimum of five-year period. Two non-compliances were raised in the Emergency Preparedness and Fire Protection SCA, and one in the Human Performance SCA. OPG was requested to provide updates on planned drills for two offsite centers and to implement corrective action plans to align with REGDOC-2.10.1 and correct inconsistencies within its internal procedures.

3.3.11 Waste management

CNSC staff confirmed that OPG continued to maintain an effective waste management program and preliminary decommissioning plan at the PNGS in 2022. The safety performance indicator (SPI) Low- and Intermediate- Level Radioactive Solid Waste Generated for PNGS in 2022 had no deviations from the historic values.

CNSC staff were satisfied with the values of the safety performance indicator for Low and Intermediate-Level Radioactive Solid Waste Generated for PNGS in 2022.

3.3.12 Security

CNSC staff concluded that OPG did not meet all the applicable regulatory requirements for the SCA Security at the PNGS in 2022.

In 2022, CNSC staff reviewed the annual threat and risk assessment and conducted three field inspections and one Type II inspection in Facilities and Equipment (PRPD-2022-13057).

The security inspections conducted revealed four non-compliant findings spanning across multiple specific areas. The findings from the security inspections highlighted the importance of improving documentation and ensuring consistency in relation to the qualifications and number of nuclear security officers (NSOs) required for the minimum shift complement. In addition, based on the finding at DNGS for NSOs not meeting the qualifications requirements of REGDOC-2.2.4 at the required frequency, OPG was requested to consider any wider potential applications of the findings, and the same condition were found at PNGS.

OPG promptly took corrective actions to address the findings identified during the inspections conducted in 2022. These actions were implemented to ensure compliance and enhance the overall security measures at the site.

In addition, CNSC staff completed a fleet-wide Cyber Security Program Desktop Inspection (PRPD-2022-12739), focusing on the design, implementation, and maintenance of the Cyber Security Program at the Pickering NGS. The inspection identified five non-compliant findings of low safety significance in the areas of performance assessments and cyber security. In response, OPG created a corrective action plan to address these findings. CNSC staff will continue to follow up on the proposed corrective actions.

In 2021, an action item was identified within Facilities and Equipment that indicated that OPGs performance significantly deviated from the applicable requirements and CNSC staff's expectations. The action item remained open in 2022. The details of the findings contain prescribed information and are therefore classified as confidential.

UPDATE: OPG has completed their self-assessment in February 2023, which was initiated in 2022 as a response to the non-compliances identified in the supplemental CMD for the 2021 NPGS ROR. CNSC staff are actively monitoring and following up on these matters, and there has been an increased regulatory scrutiny in this area due to the trend of non-compliances observed in 2021 and 2022. It is important to note that, based on the assessment conducted, there is no immediate risk to safety and security.

UPDATE: In 2023, the CNSC issued an Administrative Monetary Penalty (AMP) to OPG as a result of a failure to comply with a licence condition in relation to its security program at the Pickering and Darlington Nuclear Generating Stations. The AMP was issued to promote compliance and deter recurrence. OPG has put corrective actions in place to address the non-compliance and has paid the penalty amount. Based on a declining trend in compliance performance observed, CNSC staff are conducting enhanced regulatory oversight of this SCA. These non-compliant findings will be detailed in a supplemental CMD as the details are confidential.

3.3.13 Safeguards and non-proliferation

CNSC staff determined that OPG implemented and maintained a program for accountancy and control of nuclear material at the PNGS that satisfies the regulatory requirements of [REGDOC-2.13.1, Safeguards and Nuclear Material Accountancy](#).

During the reporting period for 2022, OPG provided the required nuclear material accountancy and control reports to the CNSC and the IAEA for their safeguards' verification activities.

OPG granted the required access and assistance to the IAEA for safeguards activities, including inspections, and for the maintenance of IAEA equipment at the PNGS.

OPG submitted the required annual operational programme with quarterly updates and the annual update to the Additional Protocol to the CNSC in a timely manner. The CNSC reviewed these documents and determined that they met requirements and expectations.

CNSC staff determined that OPG met the applicable regulatory requirements for safeguards equipment, containment, and surveillance in 2022 at the PNGS. In 2022, OPG provided the support required for the IAEA's safeguards equipment, containment, and surveillance activities.

3.3.14 Packaging and transport

In 2022, the CNSC staff conducted one field inspection of the PNGS packaging and transportation program. During the inspection, the staff verified that the contractors involved in transport-related activities held valid training certificates, the radioactive materials designated for transport were appropriately classified and packaged, all safety markings were appropriately displayed on the packages, and the documentation accompanying the shipments was correctly completed. The inspection did not reveal any non-compliance findings.

There was one reportable event related to packaging and transport reported by OPG in 2022, in relation to minor damage to an incoming package. The event was not safety significant. CNSC staff is satisfied with actions taken by OPG, following of the event

3.4 Pickering Waste Management Facility

3.4.0 Introduction

The PWMF is located within the traditional territory of the Michi Saagiig Anishinaabe people. These lands are covered by the Williams Treaty between Canada and the Mississauga and Chippewa Nations. The CNSC regulates the PWMF under a waste facility operating licence (WFOL). At the



PWMF, OPG processes and stores dry storage containers (DSCs) containing used nuclear fuel (high-level radioactive waste) generated at the PNGS. OPG also manages the intermediate level radioactive waste generated from the refurbishment of the PNGS Units 1-4 in 36 above-ground dry storage modules (DSMs) located at the Retube Component Storage Area (RCSA) at the PWMF. With the exception of periodic inspection, monitoring, and maintenance of DSMs and the RCSA, there have been no operational activities for RCSA since 1993.

The PWMF spans over 2 separate areas - Phase I and Phase II - within the overall boundary of the Pickering site. Phase I is located within the protected area of the PNGS and consists of the DSC Processing Building, two DSC storage buildings (Storage Buildings #1 and #2) and the RCSA. Phase II of the PWMF is located northeast of Phase I and is contained within its own protected area, but within the boundary of the Pickering site. Phase II contains Storage Building #3 and #4. The PWMF currently has the capacity to store 1,778 DSCs. The transfer route of the loaded DSCs from the PWMF Phase I to the PWMF Phase II is on OPG property.

Under the WFOL for the PWMF, OPG is authorized to construct 2 additional DSC storage buildings in Phase II (Storage Buildings #5 and #6) and 1 DSC processing building to replace the current DSC Processing Building. The additional storage buildings would allow OPG to store all of the used fuel generated at the PNGS to the end of its commercial operational life.

Licensing

In April 2017, the [Commission renewed](#) the WFOL for the period from April 1, 2018, to August 31, 2028.

Licence Conditions Handbook

CNSC staff did not revise the PWMF LCH in 2022. However, OPG implemented several CNSC regulatory documents in 2022. Future revisions of the LCH will reflect those new publications (or new versions of existing publications) as sources of compliance verification criteria for the PWMF.

Compliance program

CNSC staff concluded that OPG had met the applicable regulatory requirements and the expectations of CNSC staff for all SCAs at PWMF in 2022.

Table 17 lists the inspections at the PWMF that were considered in this regulatory oversight report (inspection reports were included if they were sent to OPG by March 6, 2023).

Table 17: List of Inspections at PWMF

Safety and control area	Inspection title	Inspection report sent date
Radiation Protection	Radiation Protection Inspection: OPG-PWMF-2022-02	May 2022
Human Performance Management	Training focused Inspection: OPG-PWMF-2022-01	June 2022
Security	Facility Specific – Security: PWMF-NSD-T2-2022-001	June 2022
Operating Performance	General Inspection: OPG-PWMF-2022-03	August 2022
Management System	Management System Inspection: OPG-PWMF-2022-04	March 2023

Event Initial Reports

No event initial reports pertaining to PWMF were submitted to the Commission in the year 2022.

3.4.1 Management system

In November 2022, CNSC staff conducted a Type II inspection (OPG-PWMF-2022-04) on the management system and identified six non-compliant findings of low safety significance. Two findings were related to the lack of information in some event reports, either the investigation was incomplete, or the codes used for identifying the causes of the event were missing. Two other findings of low safety

significance were related to the purchasing requirements and the monitoring of suppliers. One finding was related to a form that provides a summary of processes used for interfacing programs, and one finding was related to the preservation of records from loss and damage. The corrective action plan submitted by OPG is currently under review by CNSC staff.

Changes to licensing-basis documents are reviewed by CNSC staff to ensure that OPG maintains its management system at the PWMF and that changes do not adversely impact safety. OPG has processes in place to maintain or restore critical safety and business functions in the event of disabling circumstances.

3.4.2 Human performance management

CNSC staff reviewed OPG's 2022 quarterly and annual operations reports for PWMF and there were no issues identified for the specific area of Personnel Training and Human Performance Management.

In 2022, CNSC staff conducted a remote Type II inspection (OPG-PWMF-2022-01) in the specific area of Personnel Training. The inspection resulted in four non-compliant findings of low safety significance related to some training documentation not being developed in accordance with OPG's training governance requirements, and some inconsistent descriptions and assignment of training qualification requirements. CNSC staff reviewed OPG's corrective actions plan to address these non-compliances and found them to be acceptable.

3.4.3 Operating performance

In 2022, OPG met their target of 65 DSCs to be loaded at PNGS and transferred to the PWMF.

OPG submitted all scheduled 2022 quarterly and annual reports as required and within the appropriate timelines. CNSC staff's reviews of OPG's operational reports did not identify any issues or situations that suggested that licensed activities at the PWMF were unsafe. The reviews also confirmed that OPG's reporting and trending, and its responses to comments and requests for follow-up information and clarification, met CNSC staff's requirements.

3.4.4 Safety analysis

In 2022, CNSC staff did not identify any non-compliant findings relevant to the Safety Analysis SCA through review of PWMF's quarterly and annual compliance reports.

3.4.5 Physical design

CNSC staff confirmed that OPG maintained an effective design program and pressure boundary program, implemented modifications to the facilities in accordance with established engineering change control process to maintain the design basis. PWMF continued to implement its fire protection program in accordance with the requirements of CSA N393, *Fire protection for facilities that process, handle, or store nuclear substances*.

3.4.6 Fitness for service

As part of the aging management activities for DSCs, OPG submitted the aging management report for the PWMF. CNSC staff reviewed the submission and determined that it complied with OPG's aging management program.

3.4.7 Radiation protection

CNSC staff's Type-II compliance inspection of the PWMF, reviews of quarterly reports submitted by OPG and licensee responses to reportable events determined that:

- Measures were implemented to ensure that the PWMF was compliant with regulatory requirements related to Radiation Protection
- The PWMF achieved its year-end collective dose target
- OPG did not exceed any action levels for dose to workers. The annual effective doses for all PWMF workers were well below the regulatory limit of 50 mSv
- OPG did not exceed any action levels for contamination control
- The perimeter dose rates at the PWMF were within OPG's targets and consistent with the results of the previous years

A focused inspection on Radiation Protection was conducted in 2022. There were four non-compliant findings of low safety significance. One finding was related to performance monitoring of collective dose, one related to documentation of the roles and responsibilities within the radiation protection program, one related to conducting self-assessments, and one related to radiological material monitoring. All four non-compliances have been suitably resolved. CNSC staff concluded that PWMF continued to implement an effective Radiation Protection Program in accordance with regulatory requirements.

3.4.8 Conventional health and safety

In 2022, CNSC staff compliance verification activities did not identify any non-compliant findings relevant to conventional health and safety. OPG did not report any lost-time accidents at the PWMF. During Type II inspections, CNSC staff observed OPG staff wearing appropriate personal protective equipment (PPE).

3.4.9 Environmental protection

CNSC staff found that OPG made adequate provisions for the protection of the public and the environment. Environmental releases remained well below the DRLs and Action Levels.

OPG assessed their stormwater program at the PWMF. As a result, OPG requested to discontinue tritium and gross gamma monitoring in stormwater, as there are no regulatory requirements to monitor this discharge. CNSC and ECCC reviewed the request and agreed with OPG's request to discontinue the

stormwater monitoring in 2022. Stormwater will continue to be considered as part of the ERA and groundwater protection programs.

The dose to public from the Pickering site in 2022 (0.0019 mSv) remained well below the regulatory dose limit of 1 mSv/year and in similar range to the previous years, which shows that radionuclides concentrations measured in the environment remain low.

In 2022, CNSC staff reviewed the 2022 updated ERA report for Pickering Nuclear and 2022 Predictive Effects Assessment (PEA) for Pickering Nuclear Safe Storage 2022 Addendum Report. CNSC staff concluded that these reports are compliant with CSA N288.6-12, *Environmental risk assessments at class I nuclear facilities and uranium mines and mills*.

3.4.10 Emergency management and fire protection

OPG has a facility emergency program for the PWSMF. Main fire response is done by the Pickering Fire Department (PFD). To ensure familiarity with the facility, PFD staff train with the Pickering ERT at OPG's live fire training facility near Wesleyville, Ontario.

CNSC staff's review of the Commissioning Report for PWSMF storage building 4, fire protection program audit identified no areas of concern. Overall, OPG has an adequate Fire Protection Program (FPP) to minimize both the probability of occurrence and the consequences of fire at PWSMF. The FPP comply with the CSA N393-13 requirements. CNSC staff's review of the updated Fire Response Needs Analysis to include PWSMF storage building 4 did not identify any concerns.

3.4.11 Waste management

CNSC staff confirmed that OPG continued to maintain an effective waste management program and preliminary decommissioning plan for the PWSMF in 2022. CNSC staff were satisfied with the information provided by OPG in the quarterly and annual operations reports for the PWSMF in 2022. CNSC staff conducted a general inspection at the PWSMF in 2022. As a result of the inspection, OPG did not receive any non-compliances for the PWSMF regarding the Waste Management SCA in 2022.

3.4.12 Security

One security inspection (PWSMF-NSD-T2-2022-001) was conducted in 2022 at PWSMF. This inspection identified that PWSMF was compliant with CNSC regulatory requirements. CNSC staff reviewed the PWSMF annual site compliance report, and the threat and risk assessment report, and confirmed that OPG met all the applicable regulatory requirements pertaining to the Security SCA at PWSMF.

3.4.13 Safeguards and non-proliferation

CNSC staff determined that OPG's accountancy and control of nuclear material complied with the applicable regulatory requirements at the PWSMF.

OPG granted the required access and assistance to the IAEA for safeguards activities, including inspections, and for the maintenance of IAEA equipment at the PWMF.

CNSC staff determined that OPG met the applicable regulatory requirements for operational and design information in 2022 at the PWMF. OPG provided the required operational and design information to facilitate IAEA safeguards activities. OPG provided the support required for the IAEA's safeguards equipment, containment, and surveillance activities.

3.4.14 Packaging and transport

OPG maintains a packaging and transport program for the PWMF that ensures compliance with the [*Packaging and Transport of Nuclear Substances Regulations, 2015*](#) and the [*Transportation of Dangerous Goods Regulations*](#).

No nuclear substances were transported at the facility in 2022.

3.5 Bruce Nuclear Generating Station

3.5.0 Introduction

Bruce Nuclear Generating Stations A and B (hereinafter “BNGS A and B”) are located on the shores of Lake Huron, in the Municipality of Kincardine, Ontario. The facilities are operated by Bruce Power under a lease agreement with the owner, Ontario Power Generation (OPG). The Bruce site lies within the Traditional Territory of the Saugeen Ojibway Nation (SON), and the harvesting areas of the Georgian Bay Métis Nation of Ontario (MNO) and the Historic Saugeen Métis (HSM) peoples.

BNGS A station has 4 CANDU reactors (Units 1-4) with each unit rated up to 841 Mwe (megawatts electrical). BNGS B station has 4 CANDU reactors (Units 5–8) with each unit rated up to 872 MWe. Seven units were operational throughout 2022. Unit 6 at BNGS B has been in planned major component replacement (MCR) outage since January 2020. This report groups the two stations together because BNGS A and B have one power reactor operating licence (PROL) and Bruce Power uses common programs at both stations. However, the performance of each station was assessed separately, where appropriate, due to the differences in implementation of some programs at BNGS A and B.

The Western Waste Management Facility (WWMF) is also located at the same site. However, it is operated by OPG under a different licence and is assessed separately in section 3.6 of this regulatory oversight report.

In October 2022, Bruce Power submitted an application to amend the licence. Bruce Power requested to remove licence condition 15.3 related to hydrogen equivalent concentrations (Heq), and to consolidate all requirements applicable to pressure tubes under licence condition 6.1, Fitness for Service Program. CNSC staff reviewed the application and made its recommendation to the Commission; a decision had not been made by the Commission at the time of writing this CMD.

UPDATE: As of June 1, 2023, the license amendment was undergoing a Commission hearing in writing.



Licensing

The PROL 18.00/2028 for BNGS A and B was renewed by the Commission in 2018 for a period of 10 years. The renewed licence is valid from October 1, 2018, to September 30, 2028. This 10-year licence period encompasses Bruce Power's operation, as well as activities related to the ongoing major component replacement (MCR), which started in 2020 with activities at Unit 6. An amendment was made in 2021 to the BNGS A and B licence (PROL 18.02/2028) in relation to the production of cobalt-60 and lutetium-177.

Fisheries Act authorization

In December 2019, [Fisheries and Oceans Canada](#) (DFO) issued a *Fisheries Act* authorization (FAA) for the ongoing operation of BNGS A and B. The authorization covers the impact on fish through impingement and entrainment due to the water intakes that draw water from Lake Huron for the cooling water systems. The conditions of the FAA include monitoring and inspections, as well as maintenance of mitigation structures (velocity cap / chain rope barrier) at the water intake to reduce fish impingement.

Bruce Power submitted the 2022 annual report in accordance with its FAA. The 2022 report was the third in a series of annual reports that Bruce Power will be submitting until the authorization expires on December 31, 2028. The 2022 annual report indicated that there were no failures in the avoidance and mitigation structures that required repair in 2022.

CNSC staff reviewed the results of fish impingement monitoring and maintenance of mitigation structures in 2022 and confirmed that Bruce Power met the conditions of the FAA for 2022.

Periodic safety review

Bruce Power conducted a periodic safety review in support (PSR) of its PROL and the planned refurbishment of Units 3 to 8. To address safety improvements identified in the PSR, Bruce Power continued carrying out its integrated implementation plan (IIP) during the reporting period between January 1, 2022, to December 31, 2022.

UPDATE: Bruce Power submitted the 2022 IIP annual report in March 2023 and identified that eight IIPs were completed. As of mid-2023, CNSC staff reviewed and closed the nine IIPs of 2022.

Table 18 summarizes the IIP tasks that were planned, completed, and closed in 2022.

Table 18: BNGS A and B IIP task status (based on planned dates as of December 2022)

Total commitments	Overall	2022
Planned by Bruce Power	191	7
Completed by Bruce Power	61	8
Closed by the CNSC	53	9

Bruce Power has completed their IIPs according to the plan, while many of the planned IIPs relate to the future MCR activities.

Refurbishment

Bruce Power's MCR project involves Units 3 to 8. The MCR project includes replacing major reactor components such as the steam generators, fuel channels and feeders

The MCR project has the following phases:

- Preparation phase – preparation work on reactor defueling, dewatering and bulkhead installation
- Component removal – removal of key components, including pressure and calandria tubes
- Component installation – installation of key components and the associated testing and quality control verifications to demonstrate fitness for service
- Return to service/Completion phase – transition from the end of the installation phase to full-power operation of reactor

CNSC oversight of MCR execution began in January 2020 with the first MCR outage at Unit 6. The Unit 6 MCR project started the component installation phase in 2021. During 2022, the steam generators, calandria tubes, upper feeders and fuel channel assemblies were installed, and the installation of the lower feeders commenced. Throughout the reporting period, Bruce Power performed installation work, testing and checks to confirm that systems are available for safe operation and available for service. Over the year, a number of inspections were conducted by CNSC staff on the training program changes, radiation protection, engineering change control, human performance management, and fire protection, prior to the start of return to service phase. In response to CNSC staff findings in records management, maintenance and radiological hazard control, Bruce Power has implemented corrective actions to improve initiation of condition reports, and fire barrier door verification. CNSC staff determined that addressing these issues during the year was adequate and will continue to monitor this area through future compliance activities.

The Unit 3 MCR project remained in the preparation phase in 2022. During the reporting period, Bruce Power focused on the preparation work for the outage. Over the year, CNSC staff conducted inspections on the supply management, radiation protection program and ALARA program. Inspection findings were identified with contractor management and Bruce Power is completing corrective actions to improve management of contractors' performance.

UPDATE: The component installation phase of Unit 6 MCR was completed in April 2023 and the first regulatory hold point (loading fuel) was removed in May 2023 as part of the return to service of Unit 6 during the completion phase. The preparation phase for Unit 3 MCR project is expected to finish in the fall of 2023.

Event Initial Reports

There were two event initial reports (EIRs) pertaining to the BNGS A and B submitted to the Commission for the reporting period between January 1, 2022, to December 31, 2022:

1. CMD 22-M16, Elevated Hydrogen equivalent concentration (Heq) in the inlet rolled joint (IRJ) of a Bruce pressure tube (PT) removed from service; see Appendix I for more details.
2. CMD 22-M28, Bruce B Unit 6, Major Component Replacement, Inadequate control of quarantined items; see details below.

With respect to CMD 22-M28, Bruce Power was made aware of suspected items supplied for Unit 6 fuel channels on July 25, 2022. Bruce Power submitted a preliminary report on August 3, 2022, to notify CNSC staff of suspect material used in several end fittings. At the time of reporting, six of the end fittings impacted by the suspect material had been installed.

On August 16, 2022, Bruce Power notified CNSC staff that an additional suspect end fitting had been installed and a second suspect end fitting had been incorporated within a sub-assembly.

On August 22, 2022, CNSC staff conducted a reactive field inspection and observed that there was no physical segregation of the suspect end fittings carried out by Bruce Power as required. Discussions with Bruce Power staff revealed that a decision was made by Bruce Power to not segregate the suspect end fittings.

On August 23, 2022, CNSC staff requested Bruce Power to stop work on all fuel channel installation activities as a result of this deliberate non-compliance.

CNSC staff continue to follow-up with Bruce Power on this issue with the focus on causes and corrective actions surrounding the supply chain process.

Lutetium-177 Project

Bruce Power and Isogen have formed a partnership to install and operate the Isotope Production System (IPS) at Bruce B Unit 7 for the production of lutetium-177 (Lu-177), which research has shown to be effective in treating prostate cancer. Bruce Power and the SON have entered a partnership to jointly market new isotopes produced at Bruce Power, creating new economic opportunities

within SON territory. In April 2021, CNSC staff submitted CMD 21-H100 to recommend the Commission's approval to amend the PROL, with a Regulatory Hold Point (RHP). The Commission accepted CNSC staff recommendation and amended the PROL in September 2021.

In 2022, Bruce Power installed and commissioned the IPS successfully. CNSC staff reviewed the information submitted and determined that Bruce Power has met all RHP commitments and pre-requisites. The RHP was released by the CNSC Executive vice-president and chief regulatory operations office in October 2022, allowing Bruce Power to begin commercial production of Lu-177.

Going forward, CNSC staff will perform baseline compliance activities to ensure the safe production of Lu-177. Based on CNSC staff's review of Bruce Power's submissions related to Lu-177 production, CNSC staff are satisfied that Bruce Power adequately considered the safety analysis, physical design, radiation protection and human performance in this project.

Compliance program

CNSC staff concluded that Bruce Power had met the applicable regulatory requirements and the expectations of CNSC staff for all SCAs at BNGS A and B in 2022.

Table 19 lists the inspections at BNGS A and B that were considered in this regulatory oversight report. The inspection reports were included if they were sent to Bruce Power by February 23, 2023. CNSC staff conducted a total of 61 field inspections at the BNGS A and B in 2022, which are included in the quarterly field inspection summary reports.

Table 19: List of inspection reports at the BNGS A and B

Safety and Control Area	Report Title	Report Issue Date
Management System	BRPD-MCR-2022-13166: Desktop - Bruce B Unit 6 Major Component Replacement Self-Assessments	April 14, 2022
	BRPD-MCR-2022-12668: Inspection Report - TII - U6 MCR Engineering Change Control	April 21, 2022
	BRPD-MCR-2022-14425: Inspection Report - TII - Supply Management	November 24, 2022
	BRPD-AB-2022-13042: Inspection Report - TII - Non-Certified Training Programs - Emergency Response Organization	June 1, 2022

Safety and Control Area	Report Title	Report Issue Date
Human Performance	BRPD-B-2022-12747: Desktop – Design, Development and Marking of a U0 CRO General Multiple Choice Question Certification Examination	August 2, 2022
	BRPD-AB-2022-14025: Desktop - SAT review of Training program for selected job family	November 9, 2022
	BRPD-B-2022-14439: Desktop - Bruce B - Design and Development Certification Training Requalification Testing CST	December 2, 2022
	BRPD-B-2022-14438: Inspection Report - TII - Conduct and Grading of Certified Shift Personnel Simulator Based Requalification Tests	December 14, 2022
	BRPD-AB-2022-15393: Inspection Report - TII - Certified Training Programs - CRSS/SM	January 20, 2023
Operating Performance	BRPD-AB-2022-12975: Inspection Report - TII - Quarterly Field Inspection Summary Report Q4 2021-22	May 24, 2022
	BRPD-B-2022-13102: Inspection Report - TII - Bruce B Unit 5 B2251 Planned Outage	July 4, 2022
	BRPD-A-2022-13516: Inspection Report - TII - Vacuum Building Outage	July 19, 2022
	BRPD-MCR-2021-11047: Desktop - U6 MCR CT Install and Leak Testing	August 22, 2022
	BRPD-AB-2022-13904: Type II - Quarterly Field Inspection Summary Report Q1 2022-23	August 31, 2022
	BRPD-A-2022-14063: Inspection Report – TII - Unit 2 Outage A2221 Planned Outage	September 8, 2022

Safety and Control Area	Report Title	Report Issue Date
	BRPD-AB-2022-14628: Inspection Report - TII - Quarterly Field Inspection Summary Report Q2 2022-23	December 20, 2022
	BRPD-AB-2022-15651 -Type II - Quarterly Field Inspection Summary Report	February 22, 2023
Physical Design	BRPD-B-2022-14640: Inspection Report – TII - Preservation of Seismic Design Basis	February 23, 2023
Fitness for Service	BRPD-A-2022-14099: Inspection Report-TII-System Inspection-Service Water Systems	July 21, 2022
	BRPD-AB-2022-14803: Inspection Report - TII - Chemistry Control	October 27, 2022
	BRPD-AB-2022-15094 - Inspection Report - TII - Pressure Boundary	December 22, 2022
Radiation Protection	BRPD-B-MCR-2022-11048 – Inspection Report - TII - Radiation Protection	March 21, 2022
	BRPD-AB-2022-14880 – Inspection report - TII - Radiological Hazard Control	December 14, 2022
	BRPD-MCR-2022-1 – Desktop - Capability of the licensee's Radiation Protection Program During Refurbishment	January 20, 2023
	BRPD-MCR-2022-15679 – Desktop - ALARA plans, construction work packages and radiation exposure permits	January 20, 2023
Environmental Protection	BRPD-AB-2022-15666 - Inspection Report - TII - Environmental Monitoring	December 21, 2022
Emergency management and fire protection	BRPD-AB-2022-13095 Inspection Report - TII - Fire Protection Program	April 29, 2022
	BRPD-AB-2022-13614 - Inspection Report - TII - Fire Response	July 20, 2022

Safety and Control Area	Report Title	Report Issue Date
	BRPD-MCR-2022-15232 - Inspection Report - TII - MCR6 Fire Protection Program	December 14, 2022

3.5.1 Management system

In 2022, CNSC staff conducted Type II inspections on engineering change control (BRPD-MCR-2022-12668), supply management (BRPD-MCR-2022-14425), and Desktop inspection (BRPD-MCR-2022-13166) on self-assessment. CNSC staff also performed field inspections for different elements of the management system per the compliance verification plan. The inspection results identified eighteen compliant findings, six recommendations, three non-compliant findings of low safety significance and three non-compliant findings of negligible safety significance. Bruce Power took corrective actions for the for Recommendations and Notices of Non-compliances issued during the inspections. CNSC staff continues to assess and monitor Bruce Power's implementation of corrective action plans to address the non-compliant findings of low safety significance.

Bruce Power adequately implemented elements of its management system including records management, change management, contractor management, configuration management, and performance assessment, improvement, and management review. Any non-compliances identified in compliance verification activities were satisfactorily addressed.

Throughout 2022, Bruce Power revised its management system documentation to improve its structure. CNSC staff is in the process of reviewing these changes to ensure compliance with applicable requirements.

On September 1, 2022, Bruce Power was issued an Administrative Monetary Penalty (AMP) of \$24,760 for improperly segregating suspect end fittings. In August 2022, suspect end fittings were installed on Unit 6 during Major Component Replacement (MCR). Bruce Power elected not to segregate the suspect end fittings as required per management system requirements, specifically clause 7.6.9 of CSA N286-12 requiring quarantining of counterfeit, fraudulent or suspect items. CNSC staff presented this event to the Commission on September 15, 2022. Following this event, Bruce Power implemented several corrective actions.

Due to the COVID-19 pandemic, Bruce Power requested a deferral of the planned Nuclear Safety and Security Culture Assessment (NSSCA) from 2021 to 2022. CNSC staff approved the deferral on the basis that Bruce Power retain the 5-year periodicity for NSSCA required by REGDOC-2.1.2. In September – November 2022, Bruce Power conducted the NSSCA and created improvement plans based on the results, to continue to foster nuclear safety and security culture within the organization.

Bruce Power met business continuity requirements, including those related to the COVID-19 pandemic, throughout 2022. CNSC staff reviewed event reports and found that Bruce Power took adequate corrective actions and had adequate measures in place for business continuity in the event of disabling circumstances such as illness and severe weather.

3.5.2 Human performance management

CNSC staff concluded that Bruce Power has successfully implemented and maintained a human performance program that meets the applicable regulatory requirements and verified Bruce Power's compliance in this SCA. CNSC staff confirmed that Bruce Power has maintained sufficient personnel at BNGS A and B for all certified positions, and that all certified workers possessed the necessary knowledge and skills to perform their duties safely and competently. Bruce Power reported any hours of work non-compliances in a timely manner and maintained adequate programs and processes to ensure worker fitness for duty.

In 2022, CNSC staff conducted a review of multiple submissions from Bruce Power regarding human performance in the BNGS B lutetium-177 Isotope project. Based on the review, CNSC staff determined that Bruce Power had appropriately considered human performance factors in the project.

CNSC staff conducted six inspections related to human performance during 2022. While three procedural non-compliances related to Personnel Training and Personnel Certification were identified during relevant inspections [BRPD-A-2022-12735, BRPD-A-2022-13516, BRPD-B-2022-14439], CNSC staff determined that they have low safety significance. Bruce Power took prompt corrective actions to address these non-compliances, and CNSC staff are monitoring the full implementation of outstanding corrective actions. Non-compliances identified during field inspections were addressed before the quarterly inspection reports were issued.

In 2022, Bruce Power reported three events of below minimum complement at BNGS A and B, due to sudden staff sickness, family emergency, and expired certification qualifications. CNSC staff reviewed the event reports and found that Bruce Power took appropriate corrective actions to resolve these issues and prevent their recurrence.

3.5.3 Operating performance

In 2022, BNGS A experienced no automatic trips, one stepback and two setbacks. BNGS B experienced no trips, no stepbacks and one setback. CNSC staff confirmed that Bruce Power staff followed approved procedures and took appropriate corrective actions for all transients and power reductions. The reactor trips performance against the target for 2022 was better than industry performance target (0.0 for BNGS A and 0.0 for BNGS B). All BNGS A and B units met WANO's PHWR target of 1.0 trip per 7,000 hours of operation. All transients were controlled properly, and power reduction was automatically initiated by the reactor control systems.

In 2022, BNGS A experienced five forced outages:

- Two at Unit 1 due to failed boiler feed valve and moderator leak
- Three at Unit 3 due to repair of Primary Heat Transport (PHT) leak turbine governor control issues and turbine trip

BNGS B experienced four forced outages:

- Two at Unit 5 due to repair of PHT leak and fuel handling bridge
- One at Unit 7 due to repair of generator hydrogen leak
- One at Unit 8 due to repair of fuel handling bridge

All forced outages were manual shutdowns. CNSC staff concluded that all forced outages were adequately followed up by Bruce Power. All BNGS units met WANO's PHWR target of 1.0 trip per 7,000 hours of operation.

In 2022, BNGS A had two planned outages (at Unit 2 and 4) and a vacuum building test outage for all BNGS A units. BNGS B had one planned outage that started in 2021 and continued into 2022 (at Unit 7) and one planned outage in 2022 (at Unit 5). CNSC staff conducted compliance inspections on these planned outages and confirmed that all outage-related undertakings, such as reactor shutdown guarantees, and heat sink strategy management were performed safely by Bruce Power. CNSC staff concluded that Bruce Power appropriately managed all planned outages.

In 2022, CNSC staff conducted several inspections of BNGS A and B related to this SCA. Most findings were compliant with regulatory requirements. Any non-compliant findings identified had negligible safety significance and were promptly and effectively addressed by Bruce Power. Additionally, REGDOC-3.1.1 scheduled reports were submitted in a timely manner throughout 2022. Bruce Power submitted a total of 67 REGDOC-3.1.1 event reports (including 9 related specifically to operating performance) in 2022. However, there were three events in 2022 that were reported late.

All nine reported events related to this SCA were non-safety significant and were evaluated by Bruce Power with adequate root cause analysis, when required. CNSC staff followed up on all reportable events and confirmed that Bruce Power took appropriate corrective actions to prevent their reoccurrence.

3.5.4 Safety analysis

Bruce Power is required to update its Safety Report every 5 years as per licensing requirements. In December 2021, Bruce Power submitted its plans for the 2022 update of the Safety Report, which includes several updates such as the addition of Common Mode Events analysis.

In November 2020, Bruce Power submitted an update to its BNGS B Regulatory Communication Plan (RCP) for the safety analysis of Major Component Replacement (MCR). This update provided further information on planned submissions and meetings related to the safety analysis for the Unit 6 MCR which

is intended to demonstrate that the unit can be safely restarted after the MCR outage. In 2022, CNSC staff continued to review the MCR safety analysis submissions for Unit 6 and commenced the review of Bruce Power's submissions prepared to support Unit 3 and Unit 4 MCRs, starting with the Safety Analysis Impact Report (SAIR). Bruce Power will submit the supporting analyses in stages for Unit 3 and 4 MCRs over the next several years; these analyses will be reviewed by CNSC staff.

The industry has developed a composite analytical approach (CAA) to address the safety margin issues related to Large Break Loss of Coolant Accident (LBLOCA). One important aspect of the CAA is the reclassification of a portion of LBLOCA scenarios from the Design Basis Accident (DBA) category to Beyond Design Basis Accident (BDBA) category. This is based on the argument that breaks of large diameter pipes above a certain size have a very low probability of occurrence.

Bruce Power has played a leading role in incorporating the CAA into the licensing application for BNGS B reactors. The first significant step was determining the threshold break size (TBS), which distinguishes between DBA and BDBA breaks based on a pipe break frequency evaluation. In August 2020, CNSC approved Bruce Power's request to reclassify breaks above the TBS as BDBA for BNGS B reactors, given the low probability of breaks above the TBS. However, there remains some challenges related to re-classifying breaks that are larger than the TBS from DBA to BDBA (such as determining what is considered a "realistic" method for performing the BDBA analysis). Therefore, CAA cannot be implemented until the issues related to BDBA has been resolved.

In February 2022, Bruce Power provided additional information and requested CNSC staff acceptance of DBA analysis at or below the TBS, while continuing discussions and workshops with CNSC staff on the BDBA-LBLOCA realistic analysis. At the end of 2022, CNSC staff were reviewing this additional information.

In 2022, Bruce Power submitted two assessments to determine the threshold break size (TBS) for BNGS A reactors to CNSC staff for concurrence. However, additional information was required by CNSC staff, and Bruce Power provided a response in December 2022 to address the comments.

CNSC staff had previously deemed the 2018 PSA update for BNGS A and B nuclear generating stations compliant with REGDOC-2.4.2. In December 2021, Bruce Power submitted a Regulatory Communication Plan for the 2024 PSA update, along with PSA methodologies and computer codes required for acceptance by CNSC staff in accordance with REGDOC-2.4.2. After review, CNSC staff concluded that the submitted methodologies and codes complied with REGDOC-2.4.2 requirements.

Bruce Power sought practical changes to reduce Bruce A Fire PSA risk below the administrative target, resulting in a major engineering change. Ongoing Very Early Warning Fire Detection (VEWFD) design reviews and the upcoming 2024 Fire PSA update will consider this change and include improvements to

Emergency Management Equipment (EME) modeling for enhanced safety. Further opportunities for reductions will be explored during reviews of the Fire PSA. [RIB 14761]

3.5.5 Physical design

Bruce Power continued to implement and maintain a design program at BNGS A and B to confirm that safety-related systems, structures and components, and any modifications to them, continue to meet their design bases and to confirm that SSCs continue to be able to perform their safety functions under all plant states, in accordance with the conditions prescribed in the PROL and LCH.

In 2022, CNSC's staff inspections identified five compliant findings related to Environmental qualification (EQ). CNSC staff concluded that Bruce Power continued to meet the applicable EQ requirements of CSA N290.13-05, *Environmental qualification of equipment for CANDU nuclear power plants* for BNGS A and B.

Bruce Power implementation of the revised version of the standard CSA-N290.13-18 was accepted by CNSC staff in August 2022.

During a Type II inspection on Pressure Boundary (BRPD-AB-2022-15094), CNSC staff identified several compliant findings. However, there were three non-compliant findings related to governance and procedures, specifically in Component Design, with one finding being low and two others of negligible safety significance. Bruce Power has developed a corrective action plan for these non-compliances, which is currently in-progress and will be submitted to CNSC staff for review.

Bruce Power was compliant with the requirements of CSA N289.1-08, *General requirements for seismic design and qualification of CANDU nuclear power plants*, and seismic control areas observed during compliance activities.

During a Type II inspection on the preservation of seismic design basis (BRPD-B-2022-14640), Bruce Power was found to be in compliance with the regulatory requirements for physical design.

As part of a Type II Inspection on Unit 6 MCR Engineering Change Control (BRPD-MCR-2022-12668), CNSC staff determined that Bruce Power was compliant with Human Factors in Design.

CNSC staff concluded that Bruce Power continued to implement its fire protection program at BNGS A and B in accordance with the requirements of CSA N293-12, *Fire protection for nuclear power plants*. The fire protection measures at Bruce Power are controlled and coordinated to meet regulatory requirements.

In 2022, Bruce Power submitted revised Fire Protection Assessment (FPA) reports for Bruce NGS A and B to the CNSC for acceptance. CNSC staff concluded that additional information was required prior to acceptance of the revised reports. At the end of 2022 Bruce Power was addressing CNSC staff's comments associated with the revised FPA reports.

After conducting the review of the Annual Fuel Performance Report, CNSC staff found that Bruce Power's fuel design and inspection program met all regulatory requirements and performance expectations. Additionally, the staff confirmed that Bruce Power operated its units within the applicable fuel power limits, and that the fuel condition was satisfactory, indicating safe operation throughout 2022.

In 2022, Bruce Power's cable system program was monitored through its surveillance program that includes cable condition monitoring and cable aging management programs. The CNSC staff reviewed this program and found no concerns associated with the cable system at BNGS A and B. The cable aging management program was found to be in compliance with CNSC staff performance expectations.

3.5.6 Fitness for service

CNSC staff concluded that Bruce Power met the applicable regulatory requirements and the expectations of CNSC staff for the Fitness for Service SCA in 2022, with the exception of some pressure tubes in extended operation with regions of potentially elevated hydrogen equivalent concentration near the inlet rolled joints. A risk-informed decision-making evaluation concluded that continued operation of affected pressure tubes was acceptable, from the risk perspective, for a period of at least 3 years. For pressure tubes potentially affected by regions of elevated hydrogen equivalent concentration near outlet rolled joints, alternate fitness for service criteria were satisfied. Appendix I contains an update on industry's response to the elevated Heq findings near the rolled joint burnish marks of Bruce Unit 3 and Unit 6 pressure tubes in 2021.

CNSC staff confirmed that all special safety systems for BNGS A and B met their unavailability targets in 2022, except for the Negative Pressure Containment (NPC). The NPC system exceedances of their Actual Past Unavailability (APU) target for BNGS A and B in 2022 were caused by un-secured equipment. Based on Bruce Power's assessment, the un-secured requirement could have impacted operation of the Instrument Pressure Relief (IPRVs) and/or Auxiliary Pressure Relief Valves (APRVs). The un-secured equipment was removed, and Bruce Power implemented corrective actions to prevent recurrence. The system unavailability occurred while the remaining pressure relief valves were out of service due to maintenance, testing and other activities, and was assessed to be of low safety significance. The remaining Special Safety Systems at BNGS A and B met their reliability targets in 2022.

CNSC staff reviewed Bruce Power's annual reliability report and determined this report met CNSC staff expectations.

CNSC staff determined that Bruce Power's maintenance program met the applicable regulatory requirements and performance expectations at both stations. BNGS A and B maintained both the critical corrective maintenance backlog and the number of critical preventive maintenance deferrals very low. BNGS A maintained the critical deficient maintenance backlog low and reached around the industry average. BNGS B maintained the critical deficient maintenance backlog

better than the industry average. In 2022, the average preventive maintenance completion ratio was around 96% and 92% for BNGS A and B respectively, which is acceptable. CNSC staff also conducted several maintenance related inspections in 2022 that confirmed that maintenance program in BNGS A and B consistently met the applicable maintenance-related regulatory requirements. The corrective critical maintenance backlog, deficient critical maintenance backlog, and the number of critical preventive maintenance deferrals are given in Table 20 for BNGS A and in Table 21 for BNGS B.

Table 20: Trend of maintenance backlogs and deferrals for critical components for BNGS A, 2020 to 2022

Parameter	Average quarterly work orders per unit			Three year trending	Quarterly 2022 work orders				Industry average for 2022
	2020	2021	2022		Q1	Q2	Q3	Q4	
Corrective maintenance backlog	1	0	0	down	0	0	0	0	1
Deficient maintenance backlog	5	7	4	steady	7	5	2	3	3
Deferrals of preventive maintenance	1	0	0	improving	0	0	0	0	1

Table 21: Trend of maintenance backlogs and deferrals for critical components for BNGS B, 2020 to 2022

Parameter	Average quarterly work orders per unit			Three year trending	Quarterly 2022 work orders				Industry average for 2022
	2020	2021	2022		Q1	Q2	Q3	Q4	
Corrective maintenance backlog	0	0	0	steady	0	0	0	0	1
Deficient maintenance backlog	2	3	2	steady	2	2	1	1	3
Deferrals of preventive maintenance	0	1	0	steady	0	1	0	0	1

Bruce Power continues to manage aging of BNGS structures, systems, and components (SSCs) within a systematic and integrated framework in accordance with CNSC REGDOC-2.6.3, *Fitness for Service: Aging Management*.

Bruce Power conducted on-line and outage inspections, where periodic and in-service inspection programs were conducted in accordance with accepted programs and any findings were dispositioned to confirm there was no impact to safe operation.

Appendix I contains an update on industry's response to the elevated Heq findings near the rolled joint burnish marks of BNGS Unit 3 and Unit 6 pressure tubes.

3.5.7 Radiation protection

During 2022, CNSC staff determined that Bruce Power complied with the regulatory requirements and met performance expectations for the application of ALARA at the BNGS A and B. Bruce Power demonstrated their commitment to the ALARA principle through maintenance of their program, which involved establishing dose targets, monitoring collective and individual dose performance against approved targets and established limits, and implementing initiatives aimed at controlling occupational exposures.

In 2022, CNSC staff determined that Bruce Power complied with the regulatory requirements for controlling worker doses at the BNGS A and B. Throughout the year, Bruce Power maintained worker doses below the regulatory dose limits (refer to table and figures in Section 2.7). Moreover, there were no unplanned exposure events that resulted in exceedances of the action levels at BNGS A and B.

CNSC staff verified that Bruce Power consistently assessed the performance of its radiation protection program against industry-established objectives, goals, and targets. Furthermore, Bruce Power updated several implementing procedures to enhance governance and align with the recent amendments to the [Radiation Protection Regulations](#) (RPRs).

In 2022, CNSC staff determined that Bruce Power implemented controls for managing radiological hazards at BNGS A and BNGS B that satisfied the regulatory requirements. Bruce Power's radiation protection program ensured that measures were in place to monitor and control radiological hazards effectively. Additionally, no action levels related to contamination control were exceeded during the year.

3.5.8 Conventional health and safety

Bruce Power is compliant with the relevant requirements of the "*Occupational Health and Safety Act of Ontario*," the "*Labour Relations Act*," and Bruce Power's "Occupational Health and Safety Policy". The conventional health and safety conditions at BNGS A and B continued to achieve a high level of personnel safety. Bruce Power has appropriate procedures in place to ensure the protection of the environment and the health of persons against workplace hazards. BNGS A and B staff adequately identified workplace hazards in 2022. All minor procedural non-compliances concerning the posting of barriers and signage, identified during CNSC field inspections, were promptly and adequately corrected by Bruce Power. All four reported events relevant to this SCA were non-safety significant and were

supported with adequate root cause analysis, when required. CNSC staff followed up on all reportable events and confirmed that Bruce Power took appropriate corrective actions to prevent the events reoccurrences. In 2022, CNSC staff's surveillance activities showed that this SCA at BNGS A and B met industry standards.

The ASR for the BNGS A and B was 0.93 for 2022, which is less than 5-year average value. The AF for the BNGS A and B was 0.43 for 2022, which is a slight increase over the 5-year average. The number of calendar days lost at BNGS A and B was 41 for 2022 which is a downgrade in comparison to 2021. There was an above average number of worker slips/trips/fall incidents during the reporting period that were sufficiently severe to result in lost work time of 39 days lost in Q4; industrial safety accident rate (ISAR) was 0.09 for 2022 at BNGS A and B.

3.5.9 Environmental protection

In 2022, CNSC staff found that Bruce Power had made adequate provisions for the protection of the environment and the health of individuals.

CNSC staff conducted various assessments and inspections to verify compliance with the Environmental Protection specific areas. Environmental releases from BNGS A and B were well below the DRLs and no radiological releases exceeded regulatory limits. Although the environmental action level for weekly airborne Iodine-131 emissions was exceeded (by 25%) at BNGS A on February 9, 2022, CNSC staff found that Bruce Power's immediate and corrective actions were acceptable and there was no safety impact on the environment and the public health.

The Bruce Power environmental management system was found to effectively prevent and mitigate adverse environmental impacts and complied with [REGDOC-2.9.1, *Environmental Principles, Assessments and Protection Measures*](#). CNSC staff also concluded that hazardous substance releases from BNGS A and B were below regulatory limits, thus protecting the public from any impacts.

Bruce Power's environmental monitoring, analysis, and reporting were effectively developed and consistently implemented, as verified by CNSC staff through assessments of their quarterly and annual reports. The assessments confirmed that Bruce Power complied with regulatory requirements, including keeping environmental releases well below DRLs and ensuring the estimated public dose in 2022 (0.0024 mSv) remained well below the regulatory limit of 1mSv/year.

Bruce Power's 2022 Environmental Risk Assessment (ERA) complies with all the applicable requirements of CSA N288.6-12, *Environmental risk assessments at Class I nuclear facilities and uranium mines and mills*, including requirements to evaluate the important uncertainties for each stage of the risk assessment, to identify and discuss the uncertainties associated with the models and data used in preparing the assessment and to address appropriate Quality Assurance (QA) and Quality Control (QC) activities. CNSC staff verified that the Bruce Power 2022 ERA provided a complete evaluation of all potential risks to human health and the

environment associated with the facility operations. The results of the ERA indicated that meaningful human health or ecological risks attributable to current Bruce Power NGS operations were unlikely.

3.5.10 Emergency management and fire protection

Bruce Power has sufficient provisions for preparedness and response capability to mitigate the effects of accidental releases of nuclear and hazardous substances on the environment and protect the health and safety of persons and the national security.

In 2022, CNSC staff conducted various compliance verification activities to verify adherence to regulatory requirements. These activities resulted in a limited number of non-compliant findings. Bruce Power responded satisfactorily to the minor issues identified during inspections. Further, CNSC staff is satisfied with Bruce Power's response to the events reported in this SCA.

Bruce Power has an extensive fire drill and training program. All minor procedural non-compliances, identified during field inspections and related to the fire protection response equipment availability requirements, were promptly and adequately addressed by Bruce Power before the quarterly inspection reports were issued. CNSC staff also reviewed Bruce Power's submission, which provided the 2022 third party evaluation of industrial fire brigade drill report and found the report to be acceptable.

3.5.11 Waste management

CNSC staff confirmed that Bruce Power continued to implement effective programs for the characterization of radioactive and hazardous wastes during 2022. CNSC staff confirmed through field inspections, that Bruce Power complied with the applicable regulatory requirements for waste control and practices for waste transfer documents. Minor procedural non-compliances on the radioactive waste control, identified at these inspections, were promptly and adequately addressed by Bruce Power. There were no REGDOC-3.1.1 event reports in this area in 2022.

The safety performance indicator Low- and Intermediate- Level Radioactive Solid Waste Generated for BNGS A and B in 2022 had no deviations from the historic values.

3.5.12 Security

In 2022, CNSC staff reviewed the annual threat and risk assessment and conducted four field inspections as part of oversight activities. During the inspections, one non-compliance related to Vital Areas was identified at Bruce Power. The actions taken by Bruce Power to address this non-compliance are currently under review by CNSC staff.

In response to the ongoing COVID-19 restrictions, regulatory discretion was exercised in certain areas. This included the renewal of site security clearances

and the postponement of the scheduled 2022 Force-on-Force (FOF) exercise and Master Trainer certification for Nuclear Response Force (NRF) fitness testing.

In accordance with REGDOC-3.1.1, Bruce Power reported several events, which were evaluated by CNSC staff. Based on the assessment, these events were determined to have no significant impact on safety or security.

3.5.13 Safeguards and non-proliferation

CNSC staff determined that Bruce Power implemented and maintained a program for accountancy and control of nuclear material at BNGS A and B that satisfies the regulatory requirements in [REGDOC-2.13.1, *Safeguards and Nuclear Material Accountancy*](#).

During the 2022 reporting period, Bruce Power provided the required nuclear material accountancy and control reports to the CNSC and the IAEA for safeguards verification activities.

Bruce Power granted the required access and assistance to the IAEA for safeguards activities, including inspections, and for the maintenance of IAEA equipment at BNGS A and B.

Bruce Power submitted the required annual operational programme with quarterly updates and the annual update to the Additional Protocol to the CNSC in a timely manner. The CNSC reviewed these documents and determined that they met requirements and expectations.

3.5.14 Packaging and transport

In 2022, the packaging and transport program for BNGS A and B was implemented effectively, and the transport of nuclear substances to and from the facility was conducted safely. The inspections conducted in the area found no non-compliant issues.

However, there were two reportable events related to packaging and transport in 2022. Although these events were not safety significant, CNSC staff reviewed the corrective actions taken by Bruce Power to prevent their recurrence and are satisfied with the actions taken.

3.6 Western Waste Management Facility

3.6.0 Introduction

The WWMF lies within the Traditional Territory of the Saugeen Ojibway Nation (SON), and the harvesting areas of the Georgian Bay Métis Nation of Ontario (MNO) and the Historic Saugeen Métis (HSM) peoples.

The CNSC regulates the WWMF under a waste facility operating licence (WFOL) and the nearby RWOS-1 under a waste nuclear substance licence (WNSL). The WWMF and RWOS-1 are owned and operated by OPG.

At the WWMF, OPG processes and stores dry storage containers (DSCs) containing used nuclear fuel (high level radioactive waste) generated at Bruce A and B. At this facility, OPG also manages the low and intermediate-level radioactive wastes (L&ILW) generated from the operation of OPG-owned facilities. In addition to receipt of low- and intermediate-level wastes from BNGS, the WWMF receives transfers of low- and intermediate-level wastes from the Pickering and Darlington sites, for the processing and storage of those wastes. OPG also manages the L&ILW generated from the refurbishment of BNGS A and B Major Component Replacement at the WWMF.

The WFOL for the WWMF allows limited activities of import and export of nuclear substances, which occur primarily as contaminants in laundry, packaging, shielding or equipment.

The WFOL spans two separate areas – the L&ILW Storage Facility and the Western Used Fuel Dry Storage Facility (WUFDSF) – within the overall boundary of the Bruce site.

The L&ILW Storage Facility consists of the Amenities Building, the Waste Volume Reduction Building, the Transportation Package Maintenance Building, 14 above-ground, low-level storage buildings (LLSBs), and two above-ground, refurbishment waste storage buildings; and various in-ground containers, trenches, and tile holes for the storage of ILW.

OPG has operated a radioactive waste incinerator at the WWMF since 1977. The current incinerator has been in operation since 2003. The incinerator handles both solid and liquid low-level radioactive waste. The incinerator operates under an



Environmental Compliance Approval from the Ontario Ministry of Environment, Conservation and Parks.

The WUFDSF is located within its own protected area, separate from the protected area of Bruce A and B, but within the boundary of the Bruce site.

The WUFDSF contains 1 DSC processing building and 4 DSC storage buildings (Storage Buildings #1, #2, #3, #4, #5 and #6). The WWMF currently has the capacity to store 2,984 DSCs. The transfer of loaded DSCs from Bruce A and B to the WWMF is conducted on property controlled by Bruce Power and OPG.

Under the WFOL for the WWMF, OPG is authorized to construct two additional DSC storage buildings (Storage Buildings #7 and #8), 11 additional LLSBs, 270 additional in-ground containers, 30 in-ground containers for heat exchangers, 1 large object processing building, and 1 waste sorting building. The new structures will provide additional storage for used nuclear fuel and additional storage and processing facilities to manage L&ILW.

At RWOS-1, OPG stores L&ILW generated at the Douglas Point Nuclear Generating Station and PNGS Units 1-4. The RWOS-1 site comprises a number of in-ground waste storage structures, including concrete-lined trenches and steel-lined concrete holes. The RWOS-1 site is no longer receiving waste and is in a state of storage with surveillance by OPG.

Licensing

The Commission renewed the WFOL for the WWMF in May 2017 for a period of 10 years until May 31, 2027. The WNSL for RWOS-1, issued by a Designated Officer, is valid until October 31, 2029.

Licence Conditions Handbook

CNSC staff did not revise the WWMF and the RWOS-1 LCHs in 2022. However, OPG implemented several CNSC regulatory documents in 2022. Future revisions of the LCH will reflect those new publications (or new versions of existing publications) as sources of compliance verification criteria for the WWMF and RWOS-1.

Compliance program

CNSC staff concluded that OPG had met the applicable regulatory requirements and the expectations of CNSC staff for all SCAs at WWMF and RWOS-1 in 2022.

Table 22 lists the inspections at the WWMF and RWOS-1 that were considered in this regulatory oversight report (inspection reports were included if they were sent to OPG by March 6, 2023).

Table 22: List of Inspections at WWMF

Safety and control area	Inspection title	Inspection report sent date
Operating Performance	OPG-RWOS1-2022-01	March 2022
Operating Performance	General Inspection: OPG-WWMF-2022-01	March 2022
Human Performance	Human Performance Inspection: OPG-WWMF-2022-02	July 2022
Radiation Protection	Radiation Protection Inspection: OPG-WWMF-2022-03	July 2022

Event Initial Reports

No event initial reports pertaining to WWMF were submitted to the Commission in the year 2022.

3.6.1 Management system

In 2022, CNSC staff did a follow-up of OPG corrective actions to address the six non-compliant findings of a low safety significance raised during the Type II inspection (OPG-WWMF-2020-02), which was focused on the management system. Two NNC were related to OPG documentation, one was related to the implementation of self-assessment program, two were raised for information missing for trend codes and the completion of corrective actions. The remaining NNC was related to the storage condition of in-process Quality Assurance records.

OPG corrective actions to address NNCs were satisfactory to CNSC staff. All NNCs are now closed.

Changes to licensing-basis documents are reviewed by CNSC staff to ensure that OPG maintains its management system at the WMWF and that changes do not adversely impact safety.

3.6.2 Human performance management

CNSC staff reviewed OPG's 2022 Western WMF and RWOS-1 quarterly and annual operations reports and there were no issues identified during these assessments for the specific areas of Personnel Training and Human Performance Management.

CNSC staff conducted a hybrid Type II inspection (OPG-WWMF-2022) in the specific area of Human Performance Management. This inspection resulted in one non-compliant finding of low safety significance related to staffing issues. On December 2, 2022, OPG provided a corrective action plan to address the non-compliance. The corrective action plan identified that OPG WWM had actively hired in 2022 and that 71 of the 72 positions had been filled. However, OPG did

not provide their plan and associated timeline to resolve the non-compliance. As such, the CNSC staff sent correspondence to OPG WWMF requesting submission of the plan and associated timelines. CNSC staff reviewed OPG's response to the non-compliant finding and found OPG's proposed staffing plan and timelines acceptable.

3.6.3 Operating performance

In 2022, OPG received 115 loaded DSCs and processed a total of 120 Dry Storage Containers (DSCs) at the WUFDSF.

The total volume of radioactive waste received at the Western Low and Intermediate Level Waste Storage Facility (WLILWSF) in 2022 was 5,905.3 m³ and increase from 4,360.7 m³ in 2021. The breakdown of the waste is 5,714 m³ of LLW and 191.3 m³ of ILW. During 2022, the incinerator operated for 250 days on solids and 216 days on liquids. In 2022, OPG submitted all scheduled quarterly and annual reports as required and within the appropriate timelines.

CNSC staff's reviews of OPG's quarterly and annual reports did not identify any issues or situations that suggested that licensed activities at the WWMF were unsafe. The reviews also confirmed that OPG's reporting and trending, and its responses to comments and requests for follow-up information and clarification, met CNSC staff's requirements.

CNSC staff reviewed the commissioning report for additional in-ground storage containers (IC-18s), batch #6. On December 22, 2022, CNSC staff determined that the commissioning report for IC-18 batch #6 was acceptable and OPG may proceed to operate the IC-18s.

In 2022, OPG notified the CNSC of a dry storage container that yielded unusual results during the vacuum drying process. OPG determined that there was foreign material in the DSC, and CNSC staff concluded that OPG acted appropriately to identify the foreign material and the impact of the material on the storage of the used fuel and the DSC. During a compliance inspection, CNSC staff reviewed all records on the DSC and confirmed that the appropriate labeling and signage was affixed to the DSC.

RWOS-1 is in a state of care and maintenance; no waste was placed in or removed from RWOS-1 in 2022.

3.6.4 Safety analysis

In late 2022, OPG submitted the required 5-year update to the safety analysis report for WWMF. OPG is addressing comments provided by CNSC staff.

3.6.5 Physical design

CNSC staff concluded that OPG maintained an effective design program and pressure boundary program and implemented modifications to the facilities in accordance with established engineering change control process to maintain the design basis. OPG submitted its 2022 Fire Hazard Assessment. CNSC staff

reviewed OPG's submission and found it to be acceptable. WWMF continued to implement its fire protection program in accordance with CSA N393, *Fire protection for facilities that process, handle, or store nuclear substances*.

3.6.6 Fitness for service

As part of the aging management activities for DSCs, OPG submitted the aging management report for the OPG WWMF. CNSC staff reviewed the submission and determined that it complied with OPG's aging management program.

3.6.7 Radiation protection

CNSC staff's Type II compliance inspection of the WWMF/RWOS-1, along with compliance reviews of quarterly reports submitted by OPG, and licensee responses to reportable events determined that:

- The WWMF/RWOS-1 adhered to the *Nuclear Safety and Control Act*, the Regulations made under the Act, and the conditions of its CNSC-issued operating licence
- Measures were implemented to ensure that the WWMF/RWOS-1 was compliant with regulatory requirements related to Radiation Protection
- OPG did not exceed any action levels for dose to workers. The annual effective doses for all WWMF workers were well below the regulatory effective dose limit of 50 mSv
- OPG did not exceed any action levels for contamination control
- There was no dose to workers at RWOS-1 in 2022
- The perimeter dose rates were within OPG's targets and consistent with the results of the previous years

A focused inspection on Radiation Protection was conducted in 2022, which identified four non-compliant findings of low safety significance. One finding was related to radiological hazard posting, two were related to radiological surveys and material monitoring, and one was related to retaining calibration source records. Two of the non-compliant findings have been resolved to the satisfaction of CNSC staff. CNSC staff are monitoring the corrective actions to address the remaining non-compliances, which relate to radiological survey monitoring and retaining calibration source records. CNSC staff concluded that WWMF/RWOS-1 continued to implement an effective Radiation Protection Program in accordance with regulatory requirements.

3.6.8 Conventional health and safety

CNSC staff compliance verification activities did not identify any non-compliant findings relevant to conventional health and safety in 2022. OPG did not report any lost-time accidents at the WWMF or RWOS-1 in 2022. Furthermore, during the Type II inspections, CNSC staff observed OPG staff wearing appropriate personal protective equipment (PPE).

3.6.9 Environmental protection

OPG made adequate provisions for the protection of the public and the environment in 2022.

CNSC staff reviewed the WWMF 2022 quarterly and annual compliance reports and confirmed that OPG met all the applicable regulatory requirements.

In 2022, hazardous substances released to the environment from WWMF were below the regulatory limits. CNSC staff concluded that people were protected from the impacts of the non-radiological substances released from the facility. The required 5-year update to the WWMF ERA was submitted by OPG at the end of 2021. CNSC staff reviewed the revised ERA and found that the document is consistent with applicable regulatory requirements and that OPG has taken adequate measures to protect human health and the environment in the vicinity of the WWMF and RWOS-1.

3.6.10 Emergency management and fire protection

OPG has a facility emergency program for the WWMF that includes basic fire response for facility staff to respond to small fires with fire extinguishers. Bruce Power Emergency Response Team (Bruce Power ERT) do main fire response. To ensure familiarity with the facility, Bruce Power ERT are given orientation tours in addition to participating in annual fire response drills.

CNSC staff also reviewed one reportable event report, as well as four quarterly operations reports, for WWMF, and confirmed that OPG met all the applicable regulatory requirements pertaining to all specific areas.

3.6.11 Waste management

CNSC staff confirmed that OPG continued to maintain an effective waste management program and preliminary decommissioning plan for the WWMF and RWOS-1 in 2022.

CNSC staff were satisfied with the information provided by OPG in the quarterly and annual operations reports for the WWMF and RWOS-1 in 2022.

CNSC staff performed an inspection of the WWMF in 2022 that covered the Waste Management SCA, and no areas of non-compliance were identified. During the inspection, CNSC staff observed labels on DSCs, and reviewed the inventory for the WWMF, work instruction for completing records in eMWaste, OPG's inventory tracking system, and characterization records in eMWaste for various waste containers.

3.6.12 Security

One inspection (OPG-WWMF-2022-01) was conducted in 2022 at WWMF. This inspection identified that WWMF was compliant with regulatory requirements. CNSC staff reviewed the WWMF annual site compliance report, and the threat and risk assessment report, and confirmed that OPG met all the applicable regulatory requirements pertaining to the Security SCA at WWMF.

3.6.13 Safeguards and non-proliferation

CNSC staff determined that OPG's accountancy and control of nuclear material complied with the applicable regulatory requirements at the WWMF.

OPG granted the required access and assistance to the IAEA for safeguards activities, including inspections, and for the maintenance of IAEA equipment at the WWMF.

CNSC staff determined that OPG met the applicable regulatory requirements for operational and design information in 2022 at the WWMF. OPG provided the required operational and design information to facilitate IAEA safeguards activities. OPG provided the support required for the IAEA's safeguards equipment, containment, and surveillance activities.

IAEA reverification of a small number of DSCs were required due to the failure of IAEA equipment. OPG provided the notifications and support required to facilitate the IAEA activity.

3.6.14 Packaging and transport

OPG maintains a packaging and transport program for the WWMF that ensures compliance with the [*Packaging and Transport of Nuclear Substances Regulations, 2015*](#) and the [*Transportation of Dangerous Goods Regulations*](#). The program was effectively implemented and the transport of nuclear substances to and from the facility was conducted safely.

There was one packaging and transport event reported in 2022 related to issues with a package certificate. CNSC staff reviewed the corrective actions taken by OPG to prevent their recurrence and are satisfied with the actions taken.

3.7 Point Lepreau Nuclear Generating Station

3.7.0 Introduction

The [Point Lepreau site](#) is located on the Lepreau Peninsula, 40 kilometres southwest of Saint John, New Brunswick. The Point Lepreau site lies within the traditional territory covered by the Peace and Friendship Treaties with the Wolastoqey, Peskotomuhkati and Mi'gmaq peoples.



The facilities are owned and operated by New Brunswick Power

Corporation (NB Power) and include a single CANDU reactor with a rated capacity of 705 Mwe (megawatts electrical). The Point Lepreau site also includes the Solid Radioactive Waste Management Facility (SRWMF), which is a short distance from the power reactor and within the exclusion zone. The CNSC regulates the Point Lepreau Nuclear Generating Station (PLNGS) and the SRWMF under a single power reactor operating licence (PROL).

Radioactive waste storage includes short-term storage in the service building prior to transfer of the waste to the SRWMF for long-term storage. The SRWMF is used for the storage of solid radioactive waste, including used nuclear fuel that is produced at the PLNGS.

The SRWMF comprises the following Phase I, II and III sites:

- Phase I of the facility is used to store operational waste
- Phase II is a dry storage facility for used fuel
- Phase II Extension is an additional area prepared in 2006 to allow for dry storage of used fuel. Approval is required in accordance with the PROL prior to its commissioning and use
- Phase III of the facility stores waste from fuel channel replacement and other activities completed during the refurbishment outage

Licensing

The Commission Public Hearing, Part 1, for NB Power's licence renewal application was held on January 26, 2022, and Part 2 was held from May 10–12, 2022. The Commission released a [Record of Decision](#) approving a 10-year renewal of the Point Lepreau licence effective July 1, 2022. The Commission directed NB Power and CNSC staff to provide a comprehensive update on the licensed activities during a public meeting at the mid-point of the licence term.

Fisheries Act authorization

NB Power was granted a *Fisheries Act* Authorization by Fisheries and Oceans Canada on August 23, 2022.

Periodic safety review

The PROL requires NB Power to perform a periodic safety review (PSR) in accordance with [REGDOC-2.3.3, Periodic Safety Reviews](#). CNSC staff noted that the PSR did not identify any major gaps between the current state of the NPP and modern requirements for the PSR validity period (2022–32). Table 23 provides an update to the status of the PLNGS IIP.

Table 23: PLNGS IIP status

Total commitments	Overall	2022
Planned by NB Power	346	11
Completed by NB Power	291	10*
Closed by the CNSC	266	266

*Submitted for closure in February 2022.

Event Initial Reports

On December 14, 2022, PLNGS experienced a partial Loss of Class IV power due to an electrical fault that occurred on a cable connected to the Unit Service Transformer (UST), followed by a heavy water leak from the Heat Transport System. This event was the subject of an Event initial Report (EIR) which was presented in a Commission Meeting on January 25, 2023. Subsequently, an unplanned outage followed, and CNSC staff conducted compliance activities in the areas for operating performance, fitness for service, safety analysis, radiation protection, environmental protection, and engineering change control. The inspection report had not been issued by February 27th, 2023, and as such it will be reflected in the 2023 ROR.

UPDATE: The Detailed Event Report was submitted to CNSC staff on May 29th, 2023, and was undergoing its review as of June 1, 2023.

Compliance program

CNSC staff concluded that NB Power had met the applicable regulatory requirements and the expectations of CNSC staff for all SCAs at PLNGS in 2022.

Table 24 lists the CNSC inspections at the PLNGS outcomes of which were considered in this regulatory oversight report (inspection reports were included if they were sent to NB Power by February 27, 2023). The quarterly reports include 96 field inspections conducted at PLNGS.

Table 24: List of inspection reports at the PLNGS

Safety and control area	Report title	Report issue date
Management System	GPLRPD-2022-FIR-13226 - Contractor Management	July 2022
	GPLRPD-2022-14322 - Rod-Based Guaranteed Shutdown State (RBGSS) Safe Operating Envelope (SOE) - Reactive field from Surveillance and Monitoring	July 2022
	GPLRPD-2022-13373 - Problem Identification and Resolution	January 2023
Human Performance Management	GPLPRD-2022-12736 - Design, Development and Grading of Simulator-based Certification Examinations	May 2022
	GPLRPD-2022-14844 - Certified Training Program	December 2022
	GPLRPD-2022-15009 – Type I Inspection Report: Implementation of REGDOC-2.2.4, Fitness for Duty: Managing Worker Fatigue	December 2022
	GPLRPD-2022-15082 - Type II - Conduct of Simulator-Based Initial Certification Examinations	January 2023
Operating Performance	GPLRPD-2022-12038 - Quarterly Field Inspection Summary Report: Quarter 3, Fiscal Year 2021-2022	April 2022
	GPLRPD-2022-12889 – Quarterly Field Inspection Summary Report Quarter 4, Fiscal Year 2021-2022	July 2022
	GPLRPD-2022-14597 - Quarterly Field Inspection Summary Report: Quarter 1, Fiscal Year 2022-2023	September 2022
	GPLRPD-2022-13654 - 2022 Planned Outage	September 2022
	GPLRPD-2022-14668 - Quarterly Field Inspection Summary Report: Quarter 2, Fiscal Year 2022-2023	December 2022
	GPLRPD-2022-15543 - Quarterly Field Inspection Summary Report: Quarter 3, Fiscal Year 2022-2023	February 2023
Physical Design	GPLRPD-2022-14929 - Environmental Qualification	January 2023
	GPLRPD-2022-12755 - System Inspection: Primary Heat Transport	June 2022

Safety and control area	Report title	Report issue date
Fitness for Service	(PHT), Pressure and Inventory Control, and PHT Auxiliaries	
	GPLRPD-2022-12931 - System Inspection – Emergency Power Supply	June 2022
	GPLRPD-2022-14473 - System Inspection – Shutdown System Two	October 2022
	GPLRPD-2022-14513 - System Inspection – End Shield Cooling System	October 2022
	GPLRPD-2022-15128 – Type II - Periodic Inspection Program	December 2022
Radiation Protection	GPLRPD-2022-12822 – Radiological Hazard Control	May 2022
Security	GPLRPD-2022-FIR-12888 #6B – Fresh Water Pumphouse	July 2022
	GPLRPD-2022-09793 - Type I Cyber Security	June 2022

3.7.1 Management system

CNSC staff concluded that NB Power was compliant with the requirements of CSA N286-12, *Management system requirements for nuclear facilities*. In 2022, CNSC staff inspections identified twelve non-compliant findings of negligible safety significance and eight non-compliant findings of low safety significance in this SCA. For three of the non-compliant findings of negligible safety significance, no enforcement was needed as NB Power took prompt corrective actions to address the deficiencies. For the remaining non-compliant findings, CNSC staff issued NNCs, requiring NB Power to take corrective actions. Further details on the inspection findings are discussed below. CNSC staff will continue to monitor NB Power’s implementation of corrective actions.

CNSC staff determined that NB Power’s Management System program met regulatory requirements. NB Power’s organizational structure is clearly defined, and roles and responsibilities are documented. CNSC staff inspections and compliance assessments confirmed compliance with applicable regulatory requirements.

CNSC staff conducted a Type I inspection (GPLRPD-2022-15009) on the implementation of REGDOC 2.2.4, *Fitness for Duty: Managing Worker Fatigue* which raised three non-compliant findings of low safety significance resulting in 6 NNCs being issued in the specific areas of Performance Assessment, Improvement and Management Review; Organization; and Operating Experience. NB Power is implementing corrective actions and is expected to submit an updated corrective action plan in September 2023. CNSC staff will

review the updated corrective action plan and continue to monitor the corrective actions implementation by NB Power.

CNSC staff determined that NB Power met the applicable regulatory requirements for Performance Assessment, Improvement, and Management Review. However, a Type I inspection on Cyber Security (GPLRPD-2022-09793), identified one non-compliant finding of low safety significance for the Self Assessments area. CNSC staff will continue to monitor NB Power's implementation of corrective actions.

NB Power met regulatory requirements for change management. A CNSC inspection on Certified Training Program (GPLRPD-2022-14844) found one non-compliant finding of low safety significance, related to change management. CNSC staff have accepted NB Power's response to address this non-compliance.

NB Power met regulatory requirements for configuration management. CNSC inspections identified only compliant findings in this area, indicating a high commitment to aligning the as-built configuration with design and safety analysis at PLNGS.

CNSC staff determined that NB Power's records management program met regulatory requirements. The Q3 Quarterly Inspection Report (GPLRPD-2022-12038) found 1 non-compliant finding of low safety significance with respect to the review and control of external vendor documents. CNSC staff will continue to monitor NB Power's response to address this non-compliance.

An inspection on Problem Identification and Resolution (GPLRPD-2022-13373) found one non-compliant finding of low safety significance regarding a modified form after its approval and signature. CNSC staff's review on NB Power's response to address this non-compliance was expected by April 2023.

NB Power met the applicable regulatory requirements for the management of contractors and supply chain in 2022. A field inspection of Contractor Management found one non-compliant finding of low safety significance. CNSC staff accepted NB Power's response to the non-compliance and the corrective action plan has been implemented.

NB Power met business continuity requirements throughout 2022, including those related to the COVID-19 pandemic. CNSC staff reviewed the event reports and found that NB Power took adequate corrective actions and had adequate measures in place for business continuity in the event of disabling circumstances such illness and severe weather.

3.7.2 Human performance management

CNSC staff concluded that NB Power met the regulatory requirements and performance expectations for managing fitness for duty in 2022. However, CNSC staff conducted a Type I inspection (GPLRPD-2022-15009) on the implementation of REGDOC 2.2.4, *Fitness for Duty: Managing Worker Fatigue* which raised three non-compliant findings of low safety significance resulting in 6 NNCs being issued in the areas of Personnel Training and Fitness for Duty. One

non-compliant finding in Fitness for Duty was related to limits of hours of work during an outage being exceeded and schedules of broad population workers not providing sufficient time off to allow for recovery from sleep debt. The second non-compliant finding in Fitness for Duty was related to the shift scheduling software allowing workers in safety-sensitive positions to be scheduled in violation of hours of work limits. Concerning Personnel Training, CNSC staff identified that training related to the management of fatigue was not commensurate with the roles and responsibilities of workers. NB Power is implementing corrective actions and is expected to submit an update corrective action plan in September 2023. CNSC staff will review the updated corrective action plan and continue to monitor the corrective actions implemented by NB Power.

An inspection (GPLRPD-2022-12822) on Radiological Hazard Control identified one non-compliant finding of low safety significance related to procedure adherence for respiratory protection and the execution of radiological work activities performed in rubber areas. CNSC staff have reviewed NB Power's corrective actions to address the issue and are satisfied with their implementation.

The Cyber Security Type I inspection (GPLRPD-2022-09793) identified one non-compliant finding of medium safety significance under Personnel Training area. Due to the nature of the inspection (Protected B Restricted) further details are restricted. CNSC staff will continue to monitor NB Power's response to address the non-compliance.

During an inspection (GPLRPD-2022-14844) of the Senior Health Physicist Certified Training Program, one non-compliant finding of low safety significance was identified, with respect to the accuracy of the training program description documentation. However, CNSC staff were satisfied with NB Power's implementation of the corrective actions to address the finding.

Based on CNSC staff's assessment in May 2022, NB Power's implementation of their Multiple-Choice Question (MCQ) methodology was found to be adequate, and the General Certification Examination conducted in July 2021 using the MCQ methodology was acceptable. CNSC staff provided NB Power with observations based on the assessment, and NB Power addressed all observations satisfactorily by September 2022. CNSC staff concluded that NB Power met the applicable regulatory requirements and CNSC staff expectations in the specific area of Personnel Certification.

In 2022, NB Power reported to CNSC staff that they have implemented REGDOC-2.2.4, *Fitness for Duty Volume 2: Managing Alcohol and Drug Use*. A Type I inspection to assess compliance with this regulatory document is planned for the next fiscal year (2023/24).

CNSC staff determined that NB Power's Work Organization and Job Design program met regulatory requirements and expectations. However, in the Q3 Quarterly Inspection report (GPLRPD-2022-12038), one non-compliant finding of low safety significance related to a negative trend in minimum shift

complement (MSC) violations for Emergency Response Team (ERT) members was identified. NB Power has provided a corrective action plan to address this non-compliance, and CNSC staff are expecting an update in June 2023 on the implementation of the corrective actions.

On September 10, 2022, the ERT was below MSC for approximately one hour as the result of an ERT member leaving the site due to a family medical emergency. CNSC staff were satisfied with NB Power's actions to find a replacement.

On November 4, 2022, duty shift was below MSC for approximately 8.5 hours as the result of a duty shift member, an Electrical, Instrumentation & Control Technician (EI&C) having to leave the site due to an emergent family issue. MSC was re-established when the incoming duty EI&C Technician arrived for the next shift.

3.7.3 Operating performance

NB Power continued to operate PLNGS in a safe manner within the bounds of the operating policies and operational safety requirements. The reactor was operated at the conditions prescribed by Power Reactor Operating Licence within the power limits identified in the licence conditions handbook. Operating practices observed during the year were adequate and effective.

NB Power experienced two reactor trips in 2022 which led to the exceedance of the unplanned reactor trips target of 1.5 trips per 7,000 hours of operation. The first occurred on August 2, 2022, when an overcurrent to ground fault caused a trip of the Primary Heat Transport pump motor. This triggered an automatic stepback, followed by a Shutdown System 1 trip due to low Heat Transport flow. The second trip happened on December 14, 2022, when an electrical fault on a cable from the Unit Service Transformer caused a partial loss of Class IV power. This demanded a reactor setback by the Reactor Regulating System and automatically initiated Shutdown System 1 and Shutdown System 2. In both events, the PLNGS staff responded appropriately

In 2022, NB Power conducted a single planned outage and successfully fulfilled all associated regulatory commitments. CNSC staff conducted an inspection during the outage, resulting in the identification of three non-compliant findings of low safety significance.

UPDATE: NB Power addressed these findings by completing all required corrective actions by February 2023, and CNSC staff have closed the associated action item.

CNSC staff issued three non-compliant findings of negligible and low safety significance during surveillance activities on the Rod-Based Guaranteed Shutdown State (RBGSS) Safe Operating Envelope (SOE) at PLNGS. CNSC staff found the SOE documentation was not kept up to date following changes to safety analysis and operating procedures, and the operational limits for the moderator poison concentration during the RBGSS could have led to operation outside of the SOE. NB Power submitted an action plan which CNSC staff found acceptable. As part of NB Power's corrective actions, updated SOE

documentation was submitted to the CNSC in February 2023 and is under review by CNSC.

All REGDOC-3.1.1 scheduled reports were submitted to the CNSC in a timely manner. NB Power was compliant with the regulatory requirements in [REGDOC-3.1.1, Reporting Requirements for Nuclear Power Plants](#) in 2022.

3.7.4 Safety analysis

In 2022, NB Power made progress in implementing REGDOC-2.4.1, *Deterministic Safety Analysis*, with the goal of completing implementation by April 2024. As part of this effort, NB Power submitted updates to the deterministic safety analysis (DSA), including the Main Steam Line Break Analysis, Boiler Feedwater Trip Coverage Analysis, and Loss of Flow Analysis. CNSC staff reviewed these updates in accordance with NB Power's implementation schedule and are satisfied with the progress made towards REGDOC-2.4.1 implementation.

CNSC staff completed the review of NB Power's update of the Solid Radioactive Waste Management (SRWMF) Safety Report and determined it was acceptable.

CNSC staff completed the review of NB Power's 2021 PSA update, which included submissions for Level 1 and Level 2 Internal Events, Internal Fire Events, Internal Flood Events, Seismic Events, and the Integrated Overall PSA. CNSC staff concluded that NB Power's 2021 PSA update met the requirements of REGDOC-2.4.2, *Probabilistic Safety Assessment (PSA) for Reactor Facilities*.

3.7.5 Physical design

Based on the review of the Annual Fuel Performance Report, CNSC staff determined that NB Power's fuel design and inspection program met regulatory requirements and performance expectations. Additionally, NB Power met the expectations for fuel bundle inspections and has established a strategy to address the recent elevated defects levels. Overall, the fuel performance was satisfactory, and it was operated safely.

In October 2022, CNSC staff conducted a Type II Environmental Qualification inspection and NB Power was found to be in compliance with the regulatory requirements. However, one non-compliant finding of low safety significance was identified in the specific area of flooding assessments of Industrial Wire Poly Vinyl Chloride (PVC) in the Reactor Building post-Loss of Coolant Accident. NB Power is in the process of implementing corrective actions, and CNSC staff will continue to monitor their progress.

3.7.6 Fitness for service

All Special Safety Systems met reliability targets except for Emergency Core Cooling (ECC) and Containment. ECC experienced unavailability during shutdown conditions. The unavailability was due to planned work on ECC pipework to replace a rupture disc during a planned outage and the work took place during an outage condition when the decay heat level was low. Containment experienced unavailability due to the failure of a containment isolation valve while testing during a planned outage. A blank flange was installed at the isolation valve and the test was successfully completed. There was no impact on nuclear safety from these events for ECC and Containment. CNSC staff are satisfied with NB Power's corrective actions.

CNSC staff reviewed NB Power's annual reliability report and determined that the report met CNSC staff expectations.

The performance of NB Power's maintenance program met CNSC staff's expectations in 2022. NB Power maintained the critical corrective maintenance backlog low. The number of critical preventive maintenance deferrals was trending up slightly but was still relatively low. The critical deficient maintenance backlog was above the industry average (noting that the industry average has improved in the last 5 years). Given that the components associated with the deficient maintenance backlog can still maintain their safety function, CNSC staff is monitoring the number and trending of the critical deficient maintenance backlog through baseline compliance activities, and if necessary, reactive compliance activities can be conducted. The average preventative maintenance completion ratio was approximately 93%. The corrective critical maintenance backlog, deficient critical maintenance backlog, and the number of critical preventive maintenance deferrals are provided in Table 25.

Table 25: Trend of maintenance backlogs and deferrals for critical components for the PLNGS, 2020 to 2022

Parameter	Average quarterly work orders per unit			Three year trending	Quarterly 2022 work orders				Industry average for 2022
	2020	2021	2022		Q1	Q2	Q3	Q4	
Corrective maintenance backlog	1	1	1	steady	2	1	1	1	1
Deficient maintenance backlog	17	18	14	steady	15	13	18	10	3
Deferrals of preventive maintenance	1	1	2	up	0	1	3	2	1

Based on findings from field activities and the review of scheduled reports, CNSC staff conclude that NB Power meets regulatory requirements in Chemistry Control.

NB Power continues to manage aging of PLNGS structures, systems, and components (SSCs) within a systematic and integrated framework in accordance with CNSC REGDOC-2.6.3, *Fitness for Service: Aging Management*.

NB Power conducted on-line and outage inspections, where periodic and in-service inspection programs were conducted in accordance with accepted programs and any findings were dispositioned to confirm there was no impact to safe operation.

In November 2022, CNSC staff conducted a Type II inspection of NB Power's Periodic Inspection Program at PLNGS. CNSC staff identified two non-compliant findings which NB Power promptly addressed. As a result, no regulatory action was taken.

3.7.7 Radiation protection

In 2022, CNSC staff verified that NB Power's implementation of ALARA at PLNGS was compliant with the regulatory requirements and met the performance expectations. NB Power established dose targets and monitored collective and individual dose performance against the approved targets throughout the year. Moreover, NB Power undertook various initiatives to help maintain radiation doses ALARA at PLNGS in 2022.

In 2022, CNSC staff determined that NB Power was compliant with the applicable regulatory requirements for worker dose control at PLNGS. Radiation doses to workers at PLNGS were maintained below the regulatory dose limits, as well as below the action levels established in NB Power's radiation protection program.

During 2022, CNSC staff confirmed that NB Power continuously monitored performance of its radiation protection program against industry-established objectives, goals, and targets. NB Power employed standardized performance metrics and performed self-assessments to monitor and control performance in all aspects of the radiation protection program. Operating experience and benchmarking with industry were also utilized to enhance the program's performance. As required by REGDOC-3.1.1, NB Power provided information for SPIs 1-4 which are: collective radiation exposure, personal contamination events, unplanned dose/unplanned exposures, and loose contamination events. No regulatory follow-up was necessary for the reported information.

CNSC staff determined that NB Power's controls for radiological hazards and worker protection at PLNGS met the applicable regulatory requirements in 2022. Additionally, NB Power did not exceed any action levels for contamination control at PLNGS during the same period.

CNSC staff identified deficiencies in the maintenance of contamination control area at PLNGS in 2022. Some contamination control areas were not being maintained in accordance with the requirements outlined in NB Power's procedure. NB Power developed a corrective action plan to address the deficiencies, and CNSC staff determined the proposed corrective actions to be acceptable. CNSC staff will continue to monitor NB Power's progress in implementing the corrective actions through ongoing compliance verification activities.

3.7.8 Conventional health and safety

There were no lost-time accidents at PLNGS in 2022. There were four events that resulted in minor injuries. CNSC staff followed up on these events and were satisfied with NB Power's corrective actions.

All performance indicators in this SCA were satisfactory 2022. The accident severity rate and the Industrial Safety Accident rate continued to be 0.00, with no lost-time injuries. In 2022, the Accident Frequency (AF) for PLNGS was 0.19, which continued the decreasing trend compared to the previous three years.

3.7.9 Environmental protection

NB Power made adequate provision for the protection of the environment and public health in 2022.

In 2022, NB Power consistently implemented monitoring, analysis, and reporting of environmental data. CNSC staff assessed the quarterly and annual reports and concluded that NB Power met regulatory requirements in REGDOC-3.1.1 and REGDOC-2.9.1. There were no environmental exceedances or spills at PLNGS in 2022. The assessed dose to the public from the Point Lepreau site (0.0011mSv) remained well below the regulatory limit of 1 mSv/year and was in a similar range as the previous year, indicating that radionuclide concentrations in the environment remained low. Airborne and waterborne effluents released from PLNGS were within Derived Release Limits (DRLs) and bounded by action

levels (set at 1% of the DRL). Hazardous substance releases from PLNGS operations met applicable release authorizations issued by New Brunswick and posed negligible risks to human health and the environment.

In 2022, the Department of Fisheries and Oceans Canada (DFO) issued a *Fisheries Act* authorization to NB Power.

3.7.10 Emergency management and fire protection

CNSC staff concluded that NB Power has sufficient provisions for emergency preparedness and response capability to mitigate the effects of accidental releases of nuclear and hazardous substances on the environment and maintain the health and safety of persons and national security.

In 2022, CNSC staff conducted various compliance verification activities across different areas, such as the review of quarterly reports ensuring adherence to the applicable regulatory requirements. These activities resulted in a limited number of non-compliant findings, most of which were promptly addressed by the licensees through the implementation of corrective actions. Overall, CNSC staff is satisfied with the licensees' performance and acting appropriately to address any identified non-compliances.

CNSC staff also concluded that NB Power maintains a comprehensive fire response capability and fire protection program that met the applicable regulatory requirements. NB Power has an extensive fire drill and training program which includes a training facility where live fire training is conducted at PLNGS site. In April 2021, CNSC staff identified a non-compliant finding of low safety significance during a Type II Fire Protection Program inspection. NB Power is expected to provide an update to the corrective action plan to address this non-compliance by June 2023.

In addition to CNSC staff compliance verification activities, NB Power conducts expert Third Party Reviews (TPR) of an annual plant condition inspection bi-annual fire drill audit and tri-annual fire program audit. The TPR concluded that NB Power met the applicable requirements.

3.7.11 Waste management

CNSC staff confirmed that NB Power complied with the applicable regulatory requirements for the collection, minimization, and segregation of radioactive and conventional waste.

The PROL for PLNGS requires NB Power to submit a quarterly report on the Solid Radioactive Waste Management Facility (SRWMF). CNSC staff were satisfied with all reports and additional information submitted by NB Power for the SRWMF in 2022.

In 2022, 5 canisters (2699 spent fuel bundles) were transferred to Phase II of the SRWMF from the PLNGS. The spent fuel inventory at the SRWMF increased to 240 canisters filled (129597 bundles in total), each canister holds 540 fuel bundles.

3.7.12 Security

CNSC staff concluded that NB Power met the applicable regulatory requirements and CNSC staff expectations for the Security SCA at the PLNGS in 2022, with one exception in the cyber security area. The non-compliances identified in the specific area of cyber security were identified during a Type I inspection. However, the Security SCA rating is still considered satisfactory.

In 2022, CNSC staff completed a Type I inspection of NB Power's cyber security program regarding the implementation of the new CSA N290.7-14, *Cyber security for nuclear power plants and small reactor facilities*. A total of nine compliant, and 11 non-compliant (one medium and ten low safety significant) findings were identified. The medium finding is referenced in the Human Performance Management SCA. Additionally, twenty-three recommendations were also included for continuous improvement. Due to the nature of the inspection further details are restricted. NB Power submitted their Action Plan to address all the non-compliances. CNSC staff will continue to monitor NB Power's corrective actions.

Three field inspections for the SCA of Security were completed in 2022. One non-compliant finding of negligible safety significance was identified under the Security Practices area which was promptly closed due to immediate corrective actions from NB Power.

Following inspections conducted for the specific areas of Facilities and Equipment and Security Practices in 2022, CNSC staff concluded that NB Power was compliant with the regulatory requirements and did not find evidence of undue risk to the health and safety of persons, to the environment, to security, or to compromising Canada's international obligations.

3.7.13 Safeguards and non-proliferation

CNSC staff determined that NB Power implemented and maintained a program for accountancy and control of nuclear material at PLNGS that satisfies the regulatory requirements of [REGDOC-2.13.1, Safeguards and Nuclear Material Accountancy](#).

During the reporting period of 2022, NB Power provided the required nuclear material accountancy and control reports to the CNSC and the IAEA for their safeguards' verification activities.

NB Power granted the required access and assistance to the IAEA for safeguards activities, including inspections, and for the maintenance of IAEA equipment at PLNGS.

NB Power submitted the required annual operational programme with quarterly updates and the annual update to the Additional Protocol to the CNSC in a timely manner. The CNSC reviewed these documents and determined that they met requirements and expectations.

In 2022, NB Power provided the support required for the IAEA's safeguards equipment, containment, and surveillance activities.

3.7.14 Packaging and transport

In 2022, CNSC staff verified that NB Power's Packaging Design and Maintenance program met the applicable regulatory requirements and expectations. During a field inspection of packaging and transport, CNSC staff confirmed that all employees engaged in transport-related activities were adequately trained, radioactive materials were appropriately classified and packaged, and the accompanying documentation was completed correctly. No non-compliant findings were identified during the inspection.

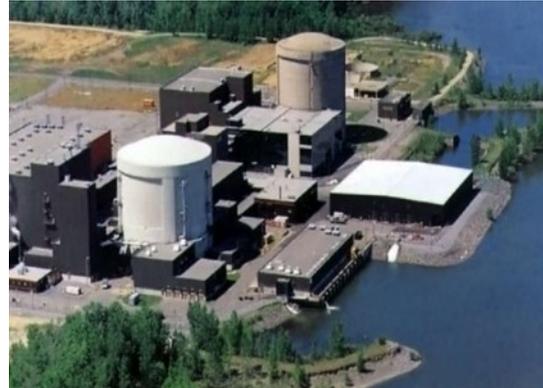
Additionally, the packaging and transport program was effectively implemented for PLNGS, and the transport of nuclear substances to and from the facility was conducted safely in 2022.

3.8 Gentilly-2 Facilities

3.8.0 Introduction

Le site de Gentilly-2 est situé sur le territoire traditionnel des Abénaquis de Wôlinak et d'Odanak, qui sont représentés par le Grand Conseil de la Nation Waban-Aki (GCNWA), ainsi que de la Nation huronne-wendat.

Gentilly-2 est située sur la rive sud du fleuve Saint-Laurent à Bécancour (Québec), environ 15 km à l'est de la ville de Trois-Rivières. Elle appartient à Hydro-Québec et est gérée par celle-ci.



Le réacteur CANDU de Gentilly-2 présentait une capacité nominale de 675 mégawatts électriques (MWé). Il est entré en exploitation commerciale en 1983, et a été mis à l'arrêt définitif le 28 décembre 2012.

En décembre 2020, Gentilly-2 a complété le transfert de tout son combustible irradié vers les modules de stockage à sec CANSTOR.

Autorisation

En 2016, la Commission a délivré à Hydro-Québec un permis de déclassement d'un réacteur de puissance pour les installations de Gentilly-2. Le permis est en vigueur du 1er juillet 2016 au 30 juin 2026.

Autorisation en vertu de la Loi sur les pêches

Hydro-Québec avait réalisé une autoévaluation en vertu de *la Loi sur les pêches* avant la délivrance de son permis en 2016. Le personnel de la CCSN avait examiné cette autoévaluation et avait conclu qu'une autorisation en vertu de *la Loi sur les pêches* n'était pas requise.

Programme de vérification de la conformité

Le personnel de la CCSN a conclu qu'Hydro-Québec respectait les exigences réglementaires applicables et que son rendement répondait aux attentes du personnel de la CCSN en ce qui concerne tous les domaines de sûreté et de réglementation (DSR) aux installations de Gentilly-2 en 2022.

Les inspections réalisées aux installations de Gentilly-2 qui ont été prises en compte dans les évaluations de la sûreté servant au présent rapport de surveillance réglementaire sont incluses au Tableau 26.

Tableau 26: Liste de rapport d'inspection aux Installations de Gentilly-2

Domaine de sûreté	Titre du rapport	Date du rapport
Radioprotection	HQ-G2-2022-01: Type II Radioprotection	28 septembre 2022
Gestion des urgences et protection-incendie	HQ-G2-2021-02: Inspection de chantier - Exercice Incendie – Aide mutuelle entre Hydro-Québec et le service sécurité et incendie de Bécancour (SSIB)	28 juillet 2023
Gestion des déchets	HQ-G2-2021-01 : Inspection de chantier - Installations de gestion des déchets radioactifs à Gentilly-2	28 juillet 2023
Sécurité	HQ-G2-2022-02: Rapport d'inspection de conformité de Type II ciblée sur le programme de sécurité État de cœur déchargé (ECD)	17 février 2023

Rapports initiaux sur l'événement

Aucun rapport initial d'événement concernant Gentilly-2 n'a été soumis à la Commission en 2022.

3.8.1 Système de gestion

Le personnel de la CCSN a conclu qu'Hydro-Québec respectait les exigences réglementaires applicables et que son rendement répondait aux attentes du personnel de la CCSN en ce qui concerne le domaine de sûreté et de réglementation (DSR) Système de gestion aux installations de Gentilly-2 en 2022.

3.8.2 Gestion de la performance humaine

Le personnel de la CCSN a conclu qu'Hydro-Québec respectait les exigences réglementaires applicables et que son rendement répondait aux attentes du personnel de la CCSN en ce qui concerne le DSR Gestion de la performance humaine aux installations de Gentilly-2 en 2022.

3.8.3 Conduite de l'exploitation

Les rapports trimestriels, semestriels et annuels soumis par Hydro-Québec en 2022 qui documentent les activités réalisées ont montré une conformité aux exigences du permis. Lors de la revue de ces rapports par le personnel de la

CCSN, aucune lacune ou situation qui aurait pu indiquer que les activités menées aux installations de Gentilly-2 étaient non sécuritaires ou en deçà des attentes du personnel n'a été remarquée. Hydro-Québec a fourni des réponses satisfaisantes dans un délai acceptable au personnel de la CCSN qui a réalisé l'examen de ces rapports. De plus, Hydro-Québec a signalé à la CCSN les événements survenus aux installations de Gentilly-2 en 2022 et a apporté des correctifs à la satisfaction du personnel de la CCSN. Il y a eu un événement qui a été rapporté à la CCSN concernant la transmission d'un rapport trimestriel en retard à la CCSN en octobre 2022. Le personnel de la CCSN sont satisfait des mesures prises par HQ suite à l'événement.

3.8.4 Analyse de la sûreté

En 2021, Hydro-Québec a soumis une nouvelle révision de son rapport de sûreté. Ce rapport jumelle le rapport de sûreté de l'installation nucléaire ainsi que le rapport de sûreté des installations de déchets radioactifs solides et du combustible irradié de Gentilly-2. Ceci fait en sorte qu'il y a qu'un seul rapport de sûreté pour toutes les installations de Gentilly-2 dorénavant. Le personnel de la CCSN font la revue de ce rapport.

3.8.5 Conception matérielle

Le personnel de la CCSN a conclu qu'Hydro Québec continue de mettre en œuvre son programme de protection contre les incendies à Gentilly-2 conformément aux exigences de CSA N293, *Protection contre l'incendie dans les centrales nucléaires*.

3.8.6 Aptitude fonctionnelle

Le personnel de la CCSN était satisfait du rapport sur la dégradation des enveloppes de pression des systèmes de sûreté pour l'année 2022.

3.8.7 Radioprotection

En 2022, Hydro-Québec a abandonné son permis de dosimétrie, et ont fait parvenir leurs documents pour supporter ce changement à la CCSN. Le personnel de la CCSN était d'accord avec ceci et a suggéré qu'Hydro-Québec ajoute une précision pour les circonstances où la contamination est sur la peau des extrémités versus la peau pour le reste du corps.

En 2022, il n'y a eu aucun dépassement des limites réglementaires pour les doses reçues aux travailleurs à Gentilly-2. Également, il n'y a eu aucun dépassement des seuils d'intervention réglementaires rapporté.

L'indicateur de rendement en matière de sûreté pour les événements de contamination du personnel a permis de relever quelques événements mineurs, mais aucun événement significatif n'a été rapporté en 2022. Les indicateurs de rendement en matière de sûreté relatifs aux doses non planifiées ont tous indiqués « 0 » pour les trimestres de 2022. Aucun événement de contamination non fixée a

eu lieu au site de Gentilly-2 en 2022. Ceci tend à indiquer qu'il n'y avait aucun problème lié à ces aspects en 2022 chez Hydro Québec.

3.8.8 Santé et sécurité classiques

Le personnel de la CCSN note qu'il n'y a eu aucun rapport en 2022 faisant état d'accidents avec perte de temps de travail, d'accidents nécessitant des soins médicaux ou encore des jours de travail perdus.

3.8.9 Protection de l'environnement

Le personnel a examiné les rapports du plan de surveillance environnementale de Gentilly-2 soumis semestriellement, ainsi que le rapport annuel 2022 sur le programme de surveillance de l'environnement. Les quantités de rejets radioactifs et non radioactifs dans l'environnement sont demeurés très inférieures aux limites établies. En 2022, la dose au public à proximité du site de Gentilly-2 (0.001 mSv) était inférieure à la limite de dose réglementaire de 1 mSv/an, et demeure similaire à celle de l'année passée, démontrant que les concentrations de radionucléides dans l'environnement restent basses.

Bien que le réacteur nucléaire à Gentilly-2 soit en arrêt depuis décembre 2012, quelques activités menant à la dormance ont continué à engendrer de faibles émissions de tritium. Parmi ces activités il y a par exemple les travaux de traitement des inventaires de chiffons contaminés par trempage et désorption, ainsi que les activités de mise en barils de l'eau lourde de grade modérateur. Toutefois, ces émissions radioactives devraient diminuer avec le temps.

Étant donné qu'Hydro Québec satisfait aux limites autorisées par sa province, il y a un risque négligeable à la santé des humains et l'environnement des rejets des substances non radiologiques venant des opérations de Gentilly-2.

Les informations sur la performance issues de l'évaluation technique de ces rapports montrent que Hydro-Québec a atteint les attentes en matière de contrôle des effluents et émissions en 2022.

3.8.10 Gestion des urgences et protection-incendie

Le personnel de la CCSN a examiné les indicateurs de rendement en matière de sûreté relatifs à l'indice de participation à l'exercice de l'organisation d'intervention d'urgence et à l'indice de vérification des ressources d'intervention d'urgence, et s'est déclaré satisfait des résultats communiqués par Hydro-Québec en 2022.

Le personnel de la CCSN conclut qu'Hydro-Québec continue à maintenir une capacité d'intervention en cas d'incendie et un programme de protection contre les incendies conformes aux exigences réglementaires applicables.

L'intervention d'urgence en cas d'incendie est maintenant assurée par les municipalités environnantes, notamment un protocole d'entente a été renouvelé en 2022 avec le Service de sécurité incendie de la ville de Bécancour (SSIB) pour

officialiser et renforcer le service d'intervention en cas d'incendie et de sauvetage du SSIB au site de Gentilly-2.

En novembre 2022, Hydro-Québec a mené un Exercice (EX) d'intervention en cas d'incendie avec aide mutuelle mené par Hydro-Québec et le service sécurité et incendie de Bécancour (SSIB) au site de Gentilly-2. Puisque le rapport d'inspection du personnel de la CCSN de cet exercice n'a pas été envoyé à HQ avant le 1 février 2022, les constats de l'inspection de chantier sont inclus dans ce rapport annuel de 2022. Aucune action correctrice réglementaire significative nécessaire n'a été observé par le personnel de la CCSN durant cette inspection.

À la suite de cet Exercice et à la revue du rapport d'EX d'Hydro-Québec, le personnel de la CCSN a requis en novembre 2022 des informations complémentaires concernant le suivi des Actions Correctrices identifiées par Hydro-Québec dans ce rapport. Notamment l'échéancier et mise à jour des procédures de vérification radiologique / décontamination des pompiers (produits de combustion) afin de respecter les règles de radioprotection du site de Gentilly-2, mais également celles de la Commission des normes, de l'équité, de la santé et de la sécurité du travail (CNESST) en prévention du cancer chez les pompiers.

Le personnel de la CCSN est satisfait des Actions Correctrices engagées par Hydro-Québec dans le cadre de cet exercice.

De plus, en 2022, Hydro-Québec a continué de mettre en œuvre adéquatement son plan et ses procédures de réponse pandémie, initialement activés en 2020, qui ont permis de poursuivre ses opérations en toute sécurité pendant la pandémie de COVID-19 en 2022.

3.8.11 Gestion des déchets

Le personnel de la CCSN a examiné les rapports semestriels de 2022 pour la gestion des installations de déchets radioactifs solides et du combustible irradié de Gentilly-2. Les rapports répondaient aux exigences réglementaires et le personnel de la CCSN n'avait pas de commentaires.

En 2020, le personnel de la CCSN a fait la revue du Plan de déclassement préliminaire des Installations de Gentilly-2, des garanties financières et du Plan pour la phase de stockage sous surveillance. Ces plans n'ont pas été modifiés en 2022 et demeurent toujours valide.

En 2022, Hydro-Québec a démontré la validité de sa garantie financière au moyen du rapport annuel sur l'état de la garantie financière.

3.8.12 Sécurité

En novembre 2022, le personnel de la CCSN a effectué une inspection de type II ciblée sur le programme de sécurité État de cœur déchargé (ECD) des Installations de Gentilly-2 (HQ-G2-2022-02). Les résultats de l'inspection ont identifié quatre avis de non-conformités (NC). Le personnel de la CCSN a fait la revue des actions prises par HQ pour adresser ces NC, et a conclu que la réponse est acceptable et considère maintenant ces NC fermés. À la suite de cette

inspection, un inspecteur de la CCSN a émis ordre numéro 0539 à Hydro-Québec concernant le programme de sécurité des installations nucléaires de Gentilly-2. Selon les processus et pratiques de la CCSN, trouvé au REGDOC-3.5.2, tome II, *Conformité et application de la loi, tome II : Ordres donnés en vertu de la Loi sur la sûreté et la réglementation nucléaires*, Hydro-Québec a été avisé par le fonctionnaire désigné (FD) autorisé qu'elle a la possibilité de se faire entendre afin de présenter des renseignements au FD pour qu'ils en tiennent compte dans leur examen de l'ordre. L'exercice du droit d'être entendue s'est déroulé le 12 avril 2023, à Ottawa, Ontario. Le fonctionnaire désigné autorisé a conclu que la décision de l'inspecteur de donner un ordre était fondée. Après examen de cette question, le fonctionnaire désigné autorisé a décidé de modifier l'ordre. Deux problèmes ont été identifiés dans l'ordre dans les domaines particuliers arrangement en matière d'intervention et entraînements et exercices. Hydro-Québec fourni tous les documents demandés par la CCSN pour répondre aux actions de l'ordre. Le personnel de la CCSN continue de surveiller les mesures prises par Hydro-Québec suite à l'ordre.

À la lumière de l'inspection de type II et de l'ordre de sécurité émis, le personnel de la CCSN a noté que le rendement du titulaire de permis demeure satisfaisant, mais que la tendance est à la baisse en ce qui a trait au DSR Sécurité.

3.8.13 Garanties et non-prolifération

Le personnel de la CCSN a conclu que la comptabilité et le contrôle des matières nucléaires à Gentilly-2 satisfaisaient à toutes les exigences réglementaires pertinentes en 2022. Hydro-Québec a fourni à la CCSN et à l'Agence internationale de l'énergie atomique (AIEA) les rapports de comptabilité et de contrôle des matières nucléaires requis pour les activités de garanties, y compris les inspections en 2022.

En 2022, Hydro-Québec a fourni l'accès et l'assistance nécessaires aux activités de l'AIEA, y compris les inspections et l'entretien de l'équipement de l'AIEA.

Le personnel de la CCSN a conclu que les informations opérationnelles et renseignements descriptifs à Gentilly-2 satisfaisait à toutes les exigences réglementaires applicables en 2022. Hydro-Québec a fourni les informations opérationnelles et renseignements descriptifs requis pour faciliter les activités de garanties et non-prolifération de l'AIEA. Suivant la confirmation que tout le combustible a été transféré de la piscine à l'aire de stockage à sec en 2020, le personnel de la CCSN a mis à jour ses exigences au niveau des garanties pour Gentilly-2.

Hydro-Québec a fourni le soutien nécessaire pour l'équipement de garanties, confinement et surveillance de l'AIEA. Lors d'une activité en septembre 2022, l'AIEA a pu confirmer que tout le combustible sur le site a été transféré à l'aire de stockage à sec et a procédé à l'enlèvement de l'équipement de surveillance supplémentaire dans l'installation.

3.8.14 Emballage et transport

Hydro Québec maintient un programme d'emballage et de transport à Gentilly-2 qui assure la conformité au [Règlement sur l'emballage et le transport des substances nucléaires \(2015\)](#) et au [Règlement sur le transport des marchandises dangereuses](#).

Le programme a été mis en œuvre de façon efficace, et le transport des substances nucléaires à destination et en provenance de l'installation était effectué de manière sûre. Au cours de l'année 2022, aucun incident relié à l'emballage ou au transport a été rapporté.

4 Conclusions for the regulatory oversight of nuclear power generating sites in 2022

In 2022, CNSC staff continued to conduct regulatory oversight of nuclear power plants (NPPs) and waste management facilities (WMFs) using remote and in-person means, as was appropriate based on pandemic restrictions. CNSC staff concluded that the NPPs and the associated WMFs on their respective sites operated safely in 2022. This conclusion was based on detailed CNSC staff assessments of findings from compliance verification activities for each facility in the context of the 14 CNSC safety and control areas. The conclusion was supported by safety performance measures and other observations.

Important performance measures and observations include the following:

- The ongoing pandemic did not lead to decreased safety performance of the facilities or the systems, structures, and components, and did not affect human or organizational performance.
- The NPP and WMF licensees followed approved procedures and took appropriate corrective action for all events reported to the CNSC.
- NPPs and WMFs operated within the bounds of their operating policies and principles.
- There were no serious process failures at the NPPs. The number of unplanned transients and trips in the reactors was low and acceptable to CNSC staff. All unplanned transients in the reactors were properly controlled and adequately managed.
- Radiation doses to the public were well below the regulatory limits.
- Radiation doses to workers at the NPPs and WMFs were also below the regulatory limits.
- The frequency and severity of non-radiological injuries to workers were low.
- Radiological releases to the environment from the NPPs and WMFs were below regulatory limits.
- Licensees met the applicable requirements related to Canada's international obligations; safeguards inspection results were acceptable to the International Atomic Energy Agency.

Overall compliance oversight activities conducted in 2022 allowed CNSC staff to conclude that the licensees complied with the applicable requirements and met CNSC staff expectations for all safety and control areas at all the NPPs and WMFs, with the exception of the security SCA for the Pickering and Darlington NPPs.

References

1. CMD 21-M36, Regulatory Oversight Report for Canadian Nuclear Power Generating Sites for 2020.
2. CNSC website, General Description of Regulatory Framework for Nuclear Power Generating Sites:
<https://nuclearsafety.gc.ca/eng/resources/publications/reports/regulatory-oversight-reports/general-description-of-regulatory-framework-for-NPGS.cfm>
3. CMD 15-H111, Modification au permis de Gentilly-2 pour inclure REGDOC-3.1.1.
4. CNSC Open Government Portal, Radionuclide Release Datasets:
<https://open.canada.ca/data/en/dataset/6ed50cd9-0d8c-471b-a5f6-26088298870e>
5. CNSC website, CNSC's Independent Environmental Monitoring Program:
<http://www.nuclearsafety.gc.ca/eng/resources/maps-of-nuclear-facilities/iemp/index-iemp.cfm>

Glossary

For definitions of terms used in this document, see [REGDOC-3.6, *Glossary of CNSC Terminology*](#), which includes terms and definitions used in the *Nuclear Safety and Control Act* and the Regulations made under it, and in CNSC regulatory documents and other publications.

Appendix A. Rating definitions

The rating categories are defined as follows.

Satisfactory (SA)

Licensee meets all of the following criteria:

- Performance meets CNSC staff expectations
- Licensee non-compliances or performance issues, if any, are not risk-significant
- Any non-compliances or performance issues have been, or are being, adequately corrected

Below expectations (BE)

One or more of the following criteria apply:

- Performance does not meet CNSC staff expectations
- Licensee has risk-significant non-compliance(s) or performance issue(s)
- Non-compliances or performance issues are not being adequately corrected

Unacceptable (UA)

One or both of the following criteria apply:

- Risk associated with a non-compliance or performance issue is unreasonable
- At least one significant non-compliance or performance issue exists with no associated corrective action

Appendix B. Current and predicted status of key parameters and models for pressure tubes in Canadian power reactors [RIB 14757]

The Commission requested to be informed of updates related to Bruce Power's pressure tube fracture toughness model, and report on the maximum [Heq] of the pressure tubes as part of the NPP Status Report during each Commission Meeting through the NPP Status Report, as well as in the NPP ROR.

Status Per Site

Status	Effective Full Power Hours	Peak Heq concentration, ppm	Existing fracture toughness model valid?
DNGS Unit 1	Undergoing refurbishment		
DNGS Unit 2	20,477	No measurements since refurbished	
DNGS Unit 3	Undergoing refurbishment		
DNGS Unit 4	225,995	111	Yes
PNGS Unit 1	169,735	75	Yes
PNGS Unit 4	144,744	57	Yes
PNGS Unit 5	262,793	91	Yes
PNGS Unit 6	272,663	84	Yes
PNGS Unit 7	264,196	87	Yes
PNGS Unit 8	250,098	82	Yes
BNGS Unit 1	71,834	53	Yes
BNGS Unit 2	71,412	53	Yes
BNGS Unit 3	240,997	N/A	Yes
BNGS Unit 4	235,828	104	Yes
BNGS Unit 5	267,479	97	Yes
BNGS Unit 6	Undergoing refurbishment		
BNGS Unit 7	260,324	96	Yes
BNGS Unit 8	246,882	90	Yes
PLNGS	70,552	61.8 ¹	Yes

¹ An estimate of the Peak Heq concentration is as of January 1, 2023, using conservative assumptions. The refurbished pressure tubes are early in their operating life so there have been limited Heq measurements for model refinement.

Future Situation Per Site

Status per site	Key Date(s)	Anticipated EFPH	Predicted maximum Heq conc., ppm	Existing fracture toughness model valid?
DNGS Unit 1	Unit has been refurbished			Yes
DNGS Unit 2	Unit has been refurbished			Yes
DNGS Unit 3	Unit undergoing refurbishment			Yes
DNGS Unit 4	Refurbishment outage in 2023			Yes
PNGS Unit 1	Dec 2024	192,000	86	Yes (see note 1)
PNGS Unit 4	Dec 2024	167,500	65	Yes
PNGS Unit 5	Dec 2024	287,500	100	Yes
PNGS Unit 6	Dec 2024	295,000	93	Yes
PNGS Unit 7	Dec 2024	287,000	95	Yes
PNGS Unit 8	Dec 2024	274,500	88	Yes
BNGS Unit 1	Unit has been refurbished			Yes (see note 1)
BNGS Unit 2	Unit has been refurbished			Yes (see note 1)
BNGS Unit 3	Unit undergoing refurbishment			N/A
BNGS Unit 4	Jan 2025 (Refurbishment)	251,000	111	Yes
BNGS Unit 5	Jan 2026 (Refurbishment)	~300,000	108	Yes (see note 1)
BNGS Unit 6	Unit undergoing refurbishment			N/A
BNGS Unit 7	Jul 2028 (Refurbishment)	~300,000	109	Yes (see note 1)
BNGS Unit 8	Jul 2030 (Refurbishment)	~300,000	117	Yes (see note 1)
PLNGS	Unit has been refurbished			Yes (rev2)

Notes:

1. For pressure tubes operating beyond 210,000 EFPH, the Heq predictions are valid outside the defined Regions of Interest near the inlet and outlet burnish marks where elevated Heq has been observed. Research activities are underway to improve Heq modelling capabilities in these regions of the pressure tubes. An update on these activities is provided in Appendix I.

The pressure tube fracture toughness model was accepted for fitness for service compliance verification assessments for Heq up to 100 ppm in the front-end region of a pressure tube (the end that is extruded first during fabrication) and 140 ppm in the remainder of a pressure tube. The fracture toughness model was not accepted for use in the regions of interest for elevated Heq near the burnish marks in 2022. Continued operation of pressure tubes with the potential for elevated Heq near the outlet rolled joint was based on Records of Decision DEC 21-H114, DEC 21-H11, DEC 21-H111 and DEC 21-H112. The incremental risk of continued operation of pressure tubes with the potential for elevated Heq near the inlet burnish mark was assessed to be low until at least 2025 and remains under investigation.

Appendix C. List of licence conditions handbook changes

The following table lists the licence conditions handbook (LCH) for each facility covered by the regulatory oversight report and indicates the changes made to the LCHs in 2022.

For LCHs that were revised in 2022, the details are provided below.

Facility	LCH #	Revision # as of December 31, 2022	Revision date
DNGS	LCH-PR-13.02/2025	R005	August 12, 2022
PLNGS	LCH-PR-17.00/2032	R000	November 28, 2022

Revisions for Darlington Nuclear Generating Station LCH (2022)

On August 12, 2022, CNSC staff made a number of changes to clarify recommendations, guidance, and the compliance verification criteria in various sections to include a new or revised CNSC regulatory documents and CSA Group standards (these developments are described in this report and are aligned with the Commission decisions) and licensee documents. The table below summarizes the changes made in revision R005:

LC(s)	Change	Subsection

1.	<p><u>General-Administrative Changes</u></p> <p>Updated:</p> <p>LCH revision number</p> <p>Licence number based on Mo-99 decision</p> <p>Effective date</p> <p>E-Doc numbers</p> <p>Updates applied throughout, including:</p> <p>title and cover pages</p> <p>change summary</p> <p>headers and footers</p> <p>Effective dates will be updated when signed</p>	LCH-PR-13.02/2025-R005 cover page
2.	<p>Administrative</p> <p>Updated reference to OPG document “OPG-PROG-0010”, which was superseded by “OPG-PROG-0005”. In addition, any original references to OPG-PROG-0005 was updated to have the latest title.</p>	<p>1.1 - CVC</p> <p>8.1 CVC</p> <p>9.1 CVC</p> <p>9.1 CVC</p> <p>11.1 CVC</p> <p>Appendix D</p>

3.	OPG had requested the removal of N-TQD-601-00001.	2.1 CVC Appendix D
4.	<p>Administrative - Update to LCH text</p> <p>REGDOC 2.2.4 <i>Fitness for Duty, Volume II, Managing Alcohol and Drug Use</i> Version 3 - updated to align with OPGs letter in which they state that they are in compliance with REGDOC 2.2.4 <i>Fitness for Duty, Volume II, Managing Alcohol and Drug Use</i> Version 3, except for pre-placement and random alcohol and drug testing (e-Doc 6728014)</p> <p>RD-363 has been replaced by REGDOC 2.2.4 - <i>Fitness for Duty, Volume III: Nuclear Security Officer Medical, Physical, and Psychological Fitness</i></p>	2.1 CVC 12.1 CVC Appendix C
5.	Updated for the removal of the SATS position.	2.1 CVC
6.	<p>Due to the recent finding with respect to SOE (e-doc 6504135), CNSC staff have added the OSRs and IUCs to the LCH, having the OSRs being directly referenced is aligned with other DPRR LCHs.</p> <p>The OSR reports only capture Safety Analysis Limits. For each Safety Analysis Limit, there is a corresponding Safe Operating Limit which incorporates measurement uncertainty. These Safe Operating Limits are the ‘legal’ operating limits and are used to identify impairments to safety related SSCs. Therefore, the IUCs have been added to the LCH.</p>	3.1 CVC Appendix D
7.	Updated the link to the delegation of authority and removed the “general criteria” that was not meant to be associated with serious process failures.	3.2 CVC
8.	Updated PSR text to align with REGDOC 2.3.3	3.4 PSR
9.	Updated preamble to be aligned with Pickering.	4.1 - Preamble
10.	Updated text associated with REGDOC 2.4.1 to account for the latest implementation plan (N-PLAN-03500-0500515 R005).	4.1 - CVC

11.	Updated title of CSA standard	5.1 - Guidance Appendix E
12.	Updated based on CNSC Radiation Protection Specialists' feedback	7.1 - Guidance
13.	Updated effective date and revision for REGDOC-2.10.1, to align with OPG's letter e-doc 6648225, which states that Darlington NGS is fully compliant with the document.	10.1 - CVC Appendix C
14.	Updated text associated with implementation plan for CSA N293-12 based on OPGs latest update in e-doc 6648225.	10.2 - CVC
15.	N-PROC-OP-0043, Waste Management has been superseded with OPG-STD-0156 R000, "Management of Waste and Other Environmentally Regulated Materials".	11.1 – CVC Appendix D
16.	Updated the revision of the CSA document. In 2022, OPG confirmed they completed the implementation of the revised standard.	11.2 – CVC Appendix C
17.	Removed RD-363 since it has been superseded by REGDOC 2.2.4, <i>Fitness for Duty Volume III</i> . Removed Revision 2013 of REGDOC 2.12.1 as it has been superseded by the 2018 revision of REGDOC 2.12.1. Added REGDOC 2.12.3 Revision 2013.	12.1 CVC 12.1 Recommendations and Guidance Appendix C Appendix E
18.	The tactical plan has been added to the CVC as a change to this document could result in an intolerable likelihood of altering the licensee's safety and control measures and/or licensing basis in the negative direction. Regulatory expectations for the documents are contained in S. 3, S. 16, and S. 32 of the <i>Nuclear Security Regulations</i> . The significant cyber asset document was superseded. To align with Pickering LCH, OPG-PROG-0042 has been added as CVC.	12.1 CVC Appendix D Appendix D
19.	Updated the text associated with implementing the requirements of non-fuel nuclear material inventory based on OPGs latest update, e-doc 6669911.	13.1 CVC
20.	Updated the text associated with the TRF, in which OPG will be undertaking refurbishment activities to extend the operational life of the TRF beyond 2025.	15.1 CVC

21.	Added the reference to the Return to Service Program Management Plan.	15.2 - CVC
22.	Based on Unit 2 Refurbishment lessons learned, OPG no longer completes Re-start Reports. Text was updated to reflect current OPG practices based on the Return to Service Management Plan.	15.2 CVC
23.	CNSC accepted Revision 3 of the IIP.	15.3 - CVC 15.3 - CVC
24.	Added the references to the unit 3 and unit 1 protocols. Added further guidance based on Unit 2 Refurbishment lessons learned.	15.4 – Recommendation and Guidance
25.	New LCH text to reflect Mo-99 IIS related Licence amendment. Updated from proposal in CMD 21-H107 to reflect Commissions decision around additional units and insights gained from Operating Manual.	15.6 - Preamble
26.	New LCH text to reflect Mo-99 IIS related Licence amendment. Updated from proposal in CMD 21-H107 to reflect Commissions decision around additional units and insights gained from Operating Manual	15.6 - CVC Appendix D
27.	All e-doc #s and associated column were removed as they are no longer kept current on e-docs.	Appendix C

Revisions to the Point Lepreau Nuclear Generating Station LCH

On October 31, 2022, CNSC staff made a number of changes including a name change to match established nomenclature and multiple administrative changes throughout the document such as correcting titles of licensee documents as well as updating implementation timelines.

The table below summarizes the changes made in revision R000:

LC(s)	Subsection	Change
N/A	N/A (administrative)	Corrected the licence number from PROL 22.00/2032 to PROL 17.00/2032. Updated the entire document to use LCH 17.01/2032 in lieu of LCH 22.00/2032.
4.1	CVC (administrative)	Updated the document numbers on PLNGS 2021 Safety Report Part II - Accident Analysis and PLNGS 2021 Safety Report Part III – Appendices.
Appendix F	Safety Analysis (administrative)	Updated the document number on PLNGS 2021 Safety Report Part II - Accident Analysis and PLNGS 2021 Safety Report Part III – Appendices.
5.3	CVC (administrative)	Updated implementation date and note at the bottom of Licensing Basis Publication table.

Appendix D. Indigenous Nations, Communities and Organizations that have Traditional and/ or Treaty Territories and/or interests within proximity to Nuclear Power Generating Sites

Darlington / Pickering
<ul style="list-style-type: none"> • Williams Treaties First Nations, which include: <ul style="list-style-type: none"> - Alderville First Nation - Curve Lake First Nation - Hiawatha First Nation - the Mississaugas of Scugog Island First Nation - the Chippewas of Beausoleil First Nation - the Chippewas of Georgina Island First Nation - the Chippewas of Rama First Nation • Métis Nation of Ontario (Region 8) • Mohawks of the Bay of Quinte • Six Nation of the Grand River
Bruce
<ul style="list-style-type: none"> • Saugeen Ojibway Nation • Métis Nation of Ontario • Historic Saugeen Métis
Point Lepreau
<ul style="list-style-type: none"> • Wolastoqey Nation of New Brunswick (representing 6 Wolastoqey communities in New Brunswick) • Mi'gmawe'l Tplu'taqnn Incorporated (representing 8 Mi'gmaq communities) • Kopit Lodge (representing Elsipogtog First Nation) • Passamaquoddy Recognition Group Inc. (representing the Peskotomuhkati Nation)
Gentilly-2
<ul style="list-style-type: none"> • Grand Conseil de la Nation Waban-Aki • Nation huronne-wendat

Appendix E. Summary of engagement in relation to CNSC's Terms of Reference for Long-term Engagement and Associated Workplans in 2022

CNSC staff have formalized several long-term engagement relationships with interested Indigenous Nations and communities through ToR collaboratively developed with each interested Indigenous Nation or community. A summary of the engagement activities that occurred in 2022 in relation to each of the existing ToRs for long-term engagement is included below. These summaries were collaboratively drafted by CNSC staff and each respective Indigenous Nation or community.

E.1 Curve Lake First Nation - CNSC Long-term Engagement Terms of Reference

As committed to with Curve Lake First Nation (CLFN) as part of the Terms of Reference for long-term engagement with the CNSC, the update below was prepared in collaboration with CLFN representatives.

In 2020, CNSC staff started discussions with CLFN to establish a formal long-term relationship with the community, and a Terms of Reference for long-term engagement was signed between the CLFN and CNSC in February 2021. This ToR ensures that CLFN is provided with adequate and meaningful funding, support, and capacity to participate in consultation and engagement activities required throughout the year. As part of the Terms of Reference a yearly work plan is developed between the CNSC and CLFN, which provides information on the scope of work, detailed activities, and timelines associated with work items for collaboration and engagement.

In 2022 the work plan included:

- Terms of Reference maintenance and updates
- Participation in the CNSC's Independent Environmental Monitoring Program (IEMP)
- Updates and discussions on specific Projects and Ongoing Operations of Existing Nuclear Facilities of Interest
- Co-Jurisdictional Matters of Significance (i.e., Fisheries Act Authorization, Emergency preparedness and thermal emissions from Nuclear Generation Stations (NGS))
- Information, communication, and other topics (i.e., REGDOC updates, feedback on CNSC reporting and processes, PFP opportunities)
- Developing a plan for a Curve Lake First Nation Indigenous Knowledge Study

In 2022, due to capacity constraints and other priorities CLFN and CNSC were not able to initiate discussions on developing a plan for an Indigenous Knowledge study. However, it is CLFN and CNSC's commitment to develop a plan for a Curve Lake IK Study in 2023.

In 2022, CLFN and CNSC staff continued to meet monthly and work collaboratively to make progress on a number of the agreed upon initiatives in the work plan. Through routine monthly meetings and interactions, CLFN and CNSC have developed a good working level relationship; one that has been more conducive to open and direct communications.

Topics of discussion included ongoing environmental monitoring activities, fish impingement and entrainment at the DNGS and PNGS, the DWMF licence renewal and OPG's intent to submit the licence to construct for the Darlington New Nuclear Project including information about the selected technology and regulatory review process.

In 2022, CLFN and CNSC staff worked collaboratively on communication products (such as a KI Pill information sheet and pamphlet for the Cameco Fuel Manufacturing Environmental Protection Review Report) to improve how information is shared with CLFN community members.

In October 2022, CLFN hosted CNSC staff in their community for a lunch and meeting with their leadership. CLFN also shared their knowledge during a tour of the Petroglyphs Provincial Park. These activities were invaluable for building and strengthening the relationship, advancing project-specific discussions, and enhancing CNSC staff cultural awareness and understanding. CNSC staff and CLFN are planning on organizing another in-person event in the CLFN community and territory in 2023.

In 2022, CLFN provided feedback through their intervention on the 2021 RORs and continue to do so through ongoing discussions. CNSC staff have made a number of improvements to reports and documentation based on the feedback, such as including land acknowledgements for each facility and creating a separate Indigenous consultation and engagement section. CNSC staff and CLFN are working together to discuss and address the common themes raised in CLFN's interventions.

CNSC staff and CLFN continue to be committed to strengthening the relationship through on-going respectful dialogue to share knowledge, information on culture, history and perspectives that help CNSC staff and CLFN learn from each other. CNSC staff will also continue to have discussions regarding areas of interest and issues or concerns related to existing CNSC-regulated nuclear activities of interest to CLFN.

In 2023, CLFN and CNSC staff are planning to initiate discussions on the scope and approach to a Territory wide study of Indigenous Knowledge and Land Use Study as it relates to CNSC regulated facilities and activities. Discussions will include the specific funding and capacity needs in order for CLFN to be able to meaningfully participate and complete these important studies and research. CLFN and CNSC staff will also continue to foster and create a safe ethical space for Indigenous knowledge to be collected and shared.

E.2 Historic Saugeen Métis – CNSC Long-term Engagement Terms of Reference

As committed to with the Historic Saugeen Métis (HSM) as part of the Terms of Reference (ToR) for long-term engagement with the CNSC, the update below was prepared in collaboration with HSM representatives.

Following the licence renewal hearing for the BNGS in 2018, a [Terms of Reference](#) was agreed upon and signed April 12, 2019, between CNSC staff and the HSM, which ensure that HSM is provided with adequate and meaningful funding, support and capacity to participate in consultation and engagement activities required throughout the year.

Topics of discussion related to the facilities in this ROR included updates and discussions about the Bruce Nuclear Generating Station (Major Component Replacement and operational activities including updates on pressure tubes), OPG's Western Waste Management Facility, CNL's Douglas Point decommissioning project and NWMO's Adaptive Phase Management project.

CNSC staff and HSM representatives collaborated on the IEMP sampling campaign that took place around BNGS in 2022. CNSC staff appreciated the HSM's involvement in the Independent Environmental Monitoring Program, through selection of samples and participating in sample collection. Their contributions have helped to strengthen the IEMP monitoring program. HSM and CNSC staff also discussed how to best share results with HSM community members and committed to working collaboratively once results are available.

While the HSM did not have any outstanding concerns related to the nuclear activities on the Bruce site, they continued to actively participate and make informed contributions to address any potential impacts on HSM rights and interests. CNSC staff plan to continue to engage and update HSM on regulatory activities on a semi-annual basis as agreed upon in the Terms of Reference including communicating results from the IEMP sampling campaign in 2022.

E.3 Mississaugas of Scugog Island First Nation – CNSC Long-term Engagement Terms of Reference

As committed to with the Mississaugas of Scugog Island First Nation (MSIFN) as part of the Terms of Reference for long-term engagement with the CNSC, the update below was prepared in collaboration with MSIFN representatives.

In September 2021, CNSC staff started discussions with MSIFN to establish a formal long-term relationship with the community, and ToR was signed between MSIFN and the CNSC in March 2022. The ToR ensures that MSIFN is provided with adequate and meaningful funding, support, and capacity to participate in consultation and engagement activities required throughout the year. As part of the ToR, a yearly work plan is developed between the CNSC and MSIFN, which provides information on the scope of work, detailed activities, and timelines associated with work items for collaboration and engagement.

In 2022, the work plan included:

- Learning about and engaging in the CNSC's Independent Environmental Monitoring Program (IEMP)
- Collaborative annual reporting to the Commission and to MSIFN Chief and Council
- Updates and discussions on specific projects and ongoing operations of licenced nuclear facilities of interest
- Enhancing information sharing and communication between the CNSC and MSIFN members
- Emergency management and preparedness

In 2022, MSIFN and CNSC staff continued to meet monthly and work collaboratively to make progress on a number of the agreed upon initiatives in the work plan.

Topics of discussion related to the facilities in this ROR included updates and discussions about the Darlington Nuclear Generating Station, Darlington Waste Management Facility, Pickering Nuclear Generating Station, and Pickering Waste Management Facility. CNSC staff and MSIFN met several times, including an in-person meeting in October 2022, to discuss the Darlington Waste Management Facility licence renewal and OPG's intent to extend existing operations at the Picking Nuclear Generating Station. In 2022, CNSC staff

also met with MSIFN to discuss the Potassium Iodide Pill Working Group activities and are working with MSIFN to develop related communication materials in 2023.

E.4 Métis Nation of Ontario – CNSC Long-term Engagement Terms of Reference

As committed to with the Métis Nation of Ontario (MNO) as part of the Terms of Reference (ToR) for long-term engagement with the CNSC, the update below was prepared in collaboration with MNO representatives.

Following the licence renewal hearing for the BNGS in 2018, a Terms of Reference was agreed upon and signed on December 18, 2019, between CNSC staff and the MNO, which formally documents the engagement with their nation. As the MNO is a province-wide organization, a specific engagement plan under the Terms of Reference was also signed in December 2019 with MNO Region 7, which is the consultation committee region that includes the Bruce site to address their areas of interest.

In 2022, the engagement plan included:

- Participation in the CNSC's IEMP
- Sharing information on NWMO's Adaptive Phase Management initiative
- Sharing information on SMRs
- CNSC to support MNO capacity building through professional development workshops
- Communication with MNO citizens

The following facilities covered in this ROR are of interest: Bruce Nuclear Generating Station, Western Waste Management Facility, Douglas Point, and NWMO's Adaptive Phase Management initiative.

As per the engagement plan, in 2022, CNSC staff continued to meet with MNO representatives semi-annually to discuss topics such as the Douglas Point decommissioning licence application, the Bruce Power Major Component Replacement project and the pressure tube findings, OPG's WWMF and NWMO's APM project. CNSC staff worked with MNO to update the work plan to identify areas of collaboration, including environmental monitoring through the IEMP and providing information related to Impact Assessments and Small Modular Reactors. In 2022, MNO representatives participated in the IEMP sample campaign that took place around BNGS. Representatives observed the air sampling station set up by Baie-du-Doré and helped with identifying vegetation in the area that is important to their citizens (e.g., plantains, cattails).

As discussed at Bruce Power's licence renewal hearing in 2018, MNO Region 7 would like to be more involved in environmental monitoring activities and addressing the concerns their citizens have regarding perceived environmental impacts related to the Bruce site. CNSC staff will continue to collaborate and engage with the MNO Region 7 on areas of interest with regards to the Bruce site

E.5 Saugeen Ojibway Nation- CNSC Long-term Engagement Terms of Reference

As committed to with the Saugeen Ojibway Nation (SON) as part of the Terms of Reference (ToR) for long-term engagement with the CNSC, the update below was prepared in collaboration with SON representatives.

A ToR was signed between SON and the CNSC in 2019. The ToR ensures that the SON is provided with adequate and meaningful funding, support, and capacity to participate in consultation and engagement activities required throughout the year. As part of the ToR, a yearly work plan is developed between the CNSC and SON, which provides information on the scope of work, detailed activities, and timelines associated with work items for collaboration and engagement.

In 2022, the work plan included:

- Joint review and analysis of licensee submissions, particularly around environmental protection
- Participation in the CNSC's IEMP
- Inclusion on the design and review of Bruce Power's study of available mitigation measures for environmental impacts
- SON community outreach
- Sharing the results of CNSC's environmental oversight, such as inspection reports
- Identifying federal, provincial, and municipal decision-making agencies, as needed
- Coordinating meetings with federal and provincial Crown agencies, as needed
- Sharing information on the Western Waste Management Facility, Douglas Point and NWMO's Adaptive Phase Management initiative

The work plan sets out detailed tasks and timelines for each of these items.

Topics of discussion related to the facilities in this ROR included updates and discussions about the Bruce Nuclear Generating Station, Western Waste Management Facility, Douglas Point, and NWMO's Adaptive Phase Management initiative.

CNSC staff understand that the SON continue to have concerns regarding the environmental impacts resulting from the nuclear activities at the BNGS, which were presented in their intervention in Bruce Power's licence renewal hearing on March 14, 2018. The focus of the activities in the work plan is to ensure SON oversight, inclusion, and a means to obtain additional information that will provide clarity, transparency and assurances for the communities and the SON leadership regarding the interactions between the BNGS facility and the environment.

In 2022, CNSC staff and the SON continued to meet and work collaboratively to complete a number of the agreed upon initiatives in the work plan. These activities included CNSC's funding support for a traditional land use and occupancy study to obtain a baseline inventory of mapped cultural sites in relation to the SON's Territory, including the Territory around the Bruce Power site. However, due to the pandemic and inability to meet with community members in person, this work has been delayed, however is expected to be completed in early 2023.

Work was completed on Bruce Power's mitigation measures study. The outcomes of this process have led to further collaboration between SON and CNSC staff on environmental monitoring as well as future updates to the CNSC's regulatory framework.

CNSC staff and members from the SON community participated in the Independent Environmental Monitoring Program sampling campaign for 2022. SON helped to select and provide samples (including fish) that would be meaningful to their community members. As part of IEMP sampling, CNSC staff also conducted some outreach activities as well to explain the program as well as health impacts due to radiation.

CNSC staff participated in a number of outreach activities with SON. Spring and Fall community information sessions were organized by SON Environment Office staff and were very well attended. This provided the opportunity for SON members to ask questions and learn more about how nuclear energy and radiation is regulated in Canada. Additionally, SON Environment Office staff and CNSC staff provided a joint presentation at the 2022 CNS Conference on the participation by SON in regulatory inspections to share this experience with the nuclear industry.

In addition, the SON completed another year of the Coastal Waters Monitoring Program (CWMP), which is an initiative funded in cooperation with Bruce Power, but designed, led, and implemented by the SON to monitor environmental conditions in the nearshore areas of the Saugeen Peninsula. SON has recently shared with CNSC the 2022 Annual CWMP Report, as has been done in previous years. CNSC staff are interested in the results of the CWMP, as this will provide data that can be used in future environmental risk assessments in relation to the BNGS.

SON has on-going concerns regarding the storage of nuclear waste in their traditional territory. In 2022, CNSC staff provided information on the update to Natural Resource Canada's plans to update Canada's nuclear waste policy. In addition, work is on-going to provide information on how SON can contribute to and participate in the processes around new nuclear projects in Ontario in which waste may be stored at the Western Waste Management Facility, or a potential DGR sited in SON Territory.

CNSC staff and SON will continue to work collaboratively to address areas of concern, rights, and interests for the SON in relation to the Bruce site.

Appendix F. Participant Funding Recipients for the 2022 NPGS Regulatory Oversight Report

Recipients
Paul Sedran
Passamaquoddy Recognition Group Inc.
Hiawatha First Nation
Grand Conseil de la Nation Waban-Aki
Nuclear Transparency Project
Canadian Environmental Law Association

Further information on the CNSC's participant funding program can be found on the [CNSC website](#).

Appendix G. Summary Table of the Status of Issues, Concerns, and Requests from Intervenors in the 2021 NPGS ROR

In direct response to the Commission's action [RIB 26782] following the presentation of the 2021 RORs, CNSC staff have established tracking tables for each intervening Indigenous Nation or Community in the 2021 NPGS ROR to organize the requests, concerns and comments submitted in their interventions. These tables also summarize CNSC's efforts to respond to and address intervenor comments, where feasible. In the 2021 CNL ROR meeting, the Commission noted the concerns raised by several intervenors that their comments and recommendations made regarding past RORs had not been addressed directly by CNSC staff. As a result, the Commission expects to be updated on the status of CNSC staff's efforts to address and track intervenor recommendations across all RORs, including the NPGS ROR, moving forward. The Commission has directed CNSC staff to provide an update on how comments and recommendations made in particular by Indigenous Nations and communities have been or will be, addressed, including where there are disagreements.

The purpose of this Appendix is to provide a summary of information and data from CNSC's issues tracking tables to the Commission. The tables below provide an overview of the issues raised in the interventions in relation to the previous year's ROR, and the proposed path forward to address them. Table A outlines the number of specific issues and concerns raised by each intervenor and their related themes, as well as CNSC responses and proposed path forward. Table B provides an overview of the key thematic categories raised by each intervenor and the total number of times each theme or topic was raised by all intervenors in their interventions. Tracking this thematic information will provide a baseline to help direct CNSC staff to focus their efforts to areas that generate the most concerns. This is a new ROR development, and it will continue taking shape moving forward as CNSC staff acquire experience in tracking progress with addressing matters of interest to Indigenous Nations and Communities as well as repeat public intervenors.

CNSC staff are committed to responding to and following up with intervenors with regards to their interventions and working collaboratively to identify options for a path forward to address the comments, where possible. For Indigenous Nations and communities that have a ToR for long-term engagement with the CNSC, requests, concerns and comments raised in relation to the ROR have been integrated into the engagement work plan and regular meetings with each Indigenous Nation or community, including sharing the specific issues and concerns tracking table with each Indigenous Nation and community in order to verify the data and discuss a path forward for meaningfully addressing their comments.

In addition, CNSC staff have also followed up with Indigenous Nations and communities with whom the CNSC does not currently have a ToR for long-term engagement, in order to follow up on or set a path forward to discuss their comments and issues.

Table A: Issues and Concerns Raised in Interventions from Indigenous Nations and Communities from the 2021 NPGS ROR Tracking and Response Table

2021 NPGS ROR Interventions from Indigenous Nation and Communities	The number of requests/ Concerns/ Comments Raised in the intervention for the 2021 ROR	Requests/ Concerns/ Comments Responded to*	Notes
Curve Lake First Nation	28 (falling within 6 main subjects/ categories)	28	<p>The issues, concerns and recommendations raised by Curve Lake First Nation in their intervention for the 2021 NPGS ROR are being addressed and discussed with Curve Lake First Nation based on an issues tracking table designed by CNSC staff and regular meetings and the associated workplan in relation to the CNSC- Curve Lake First Nation ToR for long-term engagement. CNSC staff look forward to working with CLFN to address their comments and recommendations.</p> <p>Examples of the themes and issues raised include improvements to the ROR process and consultation and engagement.</p>

2021 NPGS ROR Interventions from Indigenous Nation and Communities	The number of requests/ Concerns/ Comments Raised in the intervention for the 2021 ROR	Requests/ Concerns/ Comments Responded to*	Notes
Chippewas of Kettle and Stony Point First Nation	7 (falling within 4 subject / categories)	7	<p>The issues, concerns and recommendations raised by the Chippewas of Kettle and Stony Point First Nation in their intervention for the 2021 NPGS ROR are being addressed and discussed with the Chippewas of Kettle and Stony Point First Nation based on an issues tracking table designed by CNSC staff to track the issues, concerns, and comments that Chippewas of Kettle and Stony Point First Nation have raised.</p> <p>CNSC staff have reached out to offer to have a specific meeting and discussions to address their concerns, comments, and recommendations in relation to the 2021 NPGS ROR. CNSC staff looks forward to working with Chippewas of Kettle and Stony Point First Nation to address their comments and recommendations.</p> <p>Examples of the themes and issues raised include consultation and engagement and socio-economic impacts</p>
Le Grand Conseil de la Nation Waban-Aki	2 (falling into 1 subject/ categories)	2	<p>GCNWA indicated that they do not have any specific concerns but requested they continue to be informed and provided information.</p> <p>CNSC staff have followed up with the GCNWA and look forward to ongoing discussions and collaboration.</p>
Passamaquoddy Recognition Group Inc	41 (falling within 4 main categories)	41	<p>The issues, concerns and recommendations raised by Passamaquoddy Recognition Group Inc in their intervention for the 2021 NPGS ROR are being addressed and discussed with Passamaquoddy</p>

2021 NPGS ROR Interventions from Indigenous Nation and Communities	The number of requests/ Concerns/ Comments Raised in the intervention for the 2021 ROR	Requests/ Concerns/ Comments Responded to*	Notes
			<p>Recognition Group Inc through an issues tracking table designed by CNSC staff, which has been shared with the Passamaquoddy Recognition Group Inc. In addition, CNSC staff reached out to the Passamaquoddy Recognition Group Inc to offer to have a specific meeting and discussions to address their concerns, comments, and recommendations in relation to the 2021 NPGS ROR. CNSC staff looks forward to working with Passamaquoddy Recognition Group Inc to address their comments and recommendations.</p> <p>Examples of the themes and issues raised include impacts to Indigenous and/or Treaty rights and improvements to the ROR process</p>
Saugeen Ojibway Nation	0	0	Intervention was submitted, but no specific issues were identified. CNSC staff look forward to our ongoing collaboration and engagement with the SON through the CNSC-SON ToR for long-term engagement.
Wolastoqey Nation in New Brunswick	11 (falling within 4 main subjects / categories)	11	The issues, concerns and recommendations raised by Wolastoqey Nation in New Brunswick in their intervention for the 2021 NPGS ROR are being addressed and discussed with Wolastoqey Nation in New Brunswick through an issues tracking table designed by CNSC staff. The table was shared with Wolastoqey Nation in New Brunswick and an initial meeting to discuss the table and next steps was held on February 22, 2023. In addition, CNSC staff offered to have a specific meeting and

2021 NPGS ROR Interventions from Indigenous Nation and Communities	The number of requests/ Concerns/ Comments Raised in the intervention for the 2021 ROR	Requests/ Concerns/ Comments Responded to*	Notes
			<p>discussions to address their concerns, comments, and recommendations in relation to the 2021 NPGS ROR. WNNB indicated that they were satisfied with the responses provided at this time. CNSC staff have also offered to develop a TOR for long-term engagement and look forward to our ongoing work together.</p> <p>Examples of the themes and issues raised include impacts to Indigenous and/or Treaty rights and improvements to the ROR process.</p>

* “Responded to” refers to the number of requests/concerns/comments that CNSC staff have provided dispositions to, responded to directly, or have made requests with intervenors to have a specific meeting and discussions to address their concerns, comments, and recommendations. See notes column for more details.

Engagement with Other Public Intervenors

CNSC staff are committed to engaging with the public intervenors and learning more about their values, issues, and concerns. CNSC has reached out to repeat public intervenors, including individuals and civil society organizations, to follow up on their issues, concerns, and recommendations. To date only the Canadian Environmental Law Association (CELA) responded to our requests. Follow up is being facilitated through existing opportunities for engagement and individualized bilateral meetings – the first of which have either been offered or already taken place.

CNSC Staff engaged in a productive meeting with CELA to address their specific areas of interest. The discussions covered a wide range of topics, including CNSC oversight activities such as the annual compliance verification plans and the Licence Conditions Handbooks for NPPs. After the meeting, CNSC staff provided CELA with the requested information related to these topics. Furthermore, the conversation delved into emergency management and environmental monitoring matters, such as the distribution of KI pills, the PNERP technical study, and the reporting via the Open Government data repository.

The following table provides an overview of the key thematic categories raised in the interventions in relation to the 2021 NPGS ROR and the number of times each theme or topic was raised in total across all interventions. In total for 2021 NPGS ROR, there were 9 intervenors that raised concerns in the categories outlined below. The categories included in Table B have been ordered from most frequently raised to least. The thematic categories are derived from the review of the 2021 interventions and CNSC staff’s analysis of the issues and topics raised.

CNSC staff are committed to continuing to follow up and work with each intervenor in Table A, as well as other repeat individuals and civil society organizations who intervened to continue discussions on how best to address these themes and areas of interest identified in their interventions.

Table B. Interventions by Thematic Category

Requests/Concerns/ Comments Category in the intervention for the 2021 NPGS ROR	Number of times the topic category was raised across 2021 NPGS ROR interventions	Number of Intervenors who raised the topic in their intervention
Improvements to ROR process and ROR content (e.g., requests related to: improving accessibility, providing additional information or clarification in specific sections of the report, providing information about the performance rating system and improving the format of the report)	94	6
CNSC's Consultation and Engagement activities with Indigenous Nations and communities and Stakeholders (e.g., suggestions for improvements to the approach to consultation and engagement and request for meaningful responses to issues raised)	19	6
CNSC Regulatory Oversight Activities (e.g., concerns about potential gaps in the CNSC's oversight and questions about the approach to and conclusions made in relation to oversight activities)	12	5
Availability of Data (e.g., requests for specific data to be posted publicly)	6	1
Indigenous Knowledge (e.g., requests to clarify how Indigenous Knowledge has been considered and incorporated)	3	2
Participant Funding Program (e.g., request for capacity funding and increased transparency related to funding decisions)	3	2

Emergency Management (e.g., concerns about lack of detail and request for information about the process for notification in an emergency)	3	2
Environmental Monitoring (e.g., requests to be included in the development of monitoring plans and for additional monitoring to occur)	2	2
Impacts to Indigenous and/or Treaty Rights (e.g., concern about impacts from historical issues and on-going operations)	2	2
Licensees Engagement Activities (e.g., request for additional engagement on topics of interest)	2	2
Waste Management (e.g., concern about impacts from increased amounts of waste)	1	1
Socio-economic Impacts (e.g., concern about impacts from the influx of workers on the housing market)	1	1

Conclusion

CNSC staff take the issues and concerns raised by intervenors seriously and will continue to work with each intervenor identified in Table A as well as other repeat intervenors on identifying approaches to addressing the different topics areas, requests and comments raised, as appropriate. Furthermore, the CNSC is committed to continuously improving the quality of data included in RORs, and the ROR reporting process. CNSC acknowledges that the two main themes of issues raised in the 2021 NPGS ROR were “improvements to the ROR process and ROR content” and “CNSC Regulatory Oversight Activities” and has made it a priority to further discuss and address these issues, where feasible. As part of this commitment, CNSC staff have initiated the inclusion of new annexes in all 2022 RORs with information on the issues and concerns raised by intervenors and the status of the CNSC’s work to follow-up, respond to, and address each intervention as appropriate, and are working towards the continued expansion and enhancement of reporting to the Commission on issues tracking and engagement efforts.

The CNSC is dedicated to continuous improvement, and actively works to identify meaningful ways and approaches for addressing the concerns, comments and recommendations made by intervenors, where appropriate. In instances where issues and concerns are raised that the CNSC and the intervenor may disagree on, the CNSC is open to having dialogue and working towards improving understanding around key issues within the CNSC’s mandate and authority.

Appendix H. Pickering Nuclear Generating Station Mid-Term Update

Background

In 2018, the [Commission renewed](#) the Pickering PROL for a 10-year period covering September 1, 2018, to August 31, 2028. This licence period includes 3 phases of operational activities:

- continued commercial operation until December 31, 2024
- stabilization (post-shutdown defueling and dewatering), which lasts approximately 3 to 4 years
- beginning of safe storage for Units 1 and 4 and Units 5–8



Following end of commercial operation and permanent shutdown, each unit will undergo stabilization activities in preparation for an extended phase of safe storage with surveillance. The safe storage with surveillance phase is expected to begin in 2028. OPG requires Commission authorization to commercially operate any PNGS units beyond December 31, 2024.

In December 2022, OPG informed CNSC staff in a letter of its intent to seek Commission authorization to operate Pickering Units 5–8 until 2026 and submitted its formal application to the CNSC requesting such Commission authorization in June 2023. A public Commission hearing to consider this matter is expected to be held in June 2024.

In its 2018 Record of Decision [H1], the Commission directed that around the mid-point of the 10-year licence period and no later than 2023, OPG shall present to the Commission a comprehensive mid-term update on its licensed activities at the PNGS. OPG will provide this mid-term update in coordination with CNSC staff's presentation of the 2022 Regulatory Oversight Report on Nuclear Generating Stations in Canada (NPGS ROR). The purpose of this appendix is to provide CNSC staff's regulatory oversight context on topics covered in OPG's mid-term update that were of public interest during the 2018 relicensing hearing. This mid-term update covers the PNGS and does not include the PWF.

PROL and Licence Conditions Handbook Amendments Since 2018 Renewal

OPG's PROL for the PNGS has been amended once since being issued by the Commission in 2018. The Commission issued the amended licence, PROL 48.01/2028, on April 9, 2020, as described in Commission's Record of Decision in the matter [H2]. This Commission decision amended Licence Condition 2.4 to replace RD-204, Certification of Persons Working at Nuclear Power Plants with [REGDOC-2.2.3, Personnel Certification, Volume III: Certification of Persons Working at Nuclear Power Plants](#).

The PNGS licence conditions handbook (LCH) is updated on an as needed basis to clarify recommendations, guidance, and the compliance verification criteria (CVC) and to include new

or revised CNSC regulatory documents (REGDOCs), CSA Group standards, and licensee documents. To date, there have been 5 revisions to the PNGS LCH since the 2018 relicensing hearing. A summary of these LCH revisions is included in Annex 1 (Section 0). CNSC staff report to the Commission on changes to the PNGS LCH as part of the annual NPGS ROR.

Regulatory Oversight and Safety Performance

During the first half of the licence period, CNSC staff have verified that OPG has complied with regulatory requirements across the 14 SCAs through various compliance verification activities, including inspections and the review of submitted documents and event reports. OPG continues to meet the CNSC's reporting requirements contained in [REGDOC-3.1.1, Reporting Requirements for Nuclear Power Plants](#).

CNSC staff have provided detailed updates to the Commission on the results of CNSC staff's compliance verification activities at the PNGS for each SCA in the annual NPGS RORs [H3]–[H6]. A list of CNSC inspection reports pertaining to the PNGS is also included in Annex 2 (Section E.16).

OPG has maintained satisfactory performance across the 14 safety and control areas (SCAs), with the exception of the Security SCA in 2021 and 2022. CNSC staff have increased regulatory oversight of the PNGS security program and issued an Administrative Monetary Penalty (AMP) to OPG in June 2023 to deter future non-compliances.² A summary of OPG's performance across the 14 SCAs since 2018 is provided in Table E-1. Details on security related findings have been provided to the Commission through confidential supplemental submissions and are not publicly available.

Table E-1 – Summary of PNGS SCA performance ratings (2018-2022)

SCA	2018	2019	2020	2021	2022
1. Management system	SA	SA	SA	SA	SA
2. Human performance management	SA	SA	SA	SA	SA
3. Operating performance	FS*	SA	SA	SA	SA
4. Safety analysis	FS*	SA	SA	SA	SA
5. Physical design	SA	SA	SA	SA	SA
6. Fitness for service	SA	SA	SA	SA	SA
7. Radiation protection	SA	SA	SA	SA	SA
8. Conventional health and safety	FS*	SA	SA	SA	SA
9. Environmental protection	SA	SA	SA	SA	SA
10. Emergency management and fire protection	SA	SA	SA	SA	SA
11. Waste management	SA	SA	SA	SA	SA

² Information on CNSC regulatory actions, including AMPs and orders, can be found on the CNSC website:

<https://www.cnsccsn.gc.ca/eng/acts-and-regulations/regulatory-action/index.cfm>

SCA	2018	2019	2020	2021	2022
12. Security	SA	SA	SA	BE	BE
13. Safeguards and Non-Proliferation	SA	SA	SA	SA	SA
14. Packaging and transport	SA	SA	SA	SA	SA

Legend: FS* – Fully Satisfactory; SA – Satisfactory; BE – Below Expectations; UA – Unacceptable
 *As of 2019, CNSC staff no longer assign the FS rating

Integrated Implementation Plan

To support the 2018 relicensing of the PNGS, OPG conducted a periodic safety review in accordance with [REGDOC-2.3.3, Periodic Safety Reviews](#). A PSR involves an assessment of the state of the plant and its performance to determine the extent to which it conforms to applicable modern codes, standards, and practices, as well as to identify any factors that would limit safe long-term operation. Committed actions to enhance PNGS safety were documented in the associated integrated implementation plan (IIP) [H7]. The PNGS IIP included numerous actions to enhance safety including:

- Updating the life cycle management plans for the major components, including steam generators, feeders, calandria internals, and fuel channels
- Updating the safety analyses impacted by aging
- Implementing upgrades to ensure containment integrity under beyond design basis accidents, including severe accidents

In April 2021, the Commission approved a revision to the PNGS IIP, as described in its record of decision on the matter [H8]. This revision included extending the due date for some IIP commitments. OPG completed and CNSC closed the final IIP commitment in June 2021. As directed at the 2018 relicensing hearing, CNSC staff have provided updates to the Commission regarding OPG's IIP for the PNGS through the annual NPGS RORs.

Fitness for Service of Major Components

As reported on through the annual NPGS RORs, OPG has met the applicable regulatory requirements and CNSC staff expectations for the Fitness for Service SCA.

The fitness for service of major components, including feeders, steam generators, and fuel channels, was of interest to the Commission during the 2018 relicensing hearing. CNSC staff have reported to the Commission through the annual NPGS RORs on work performed by OPG during the licence period to ensure that these components remain fit for service. This includes the submission of annual Life Cycle Management Plans for major components, the Joint Fueling Machine Reliability Project, and reduction of OPG's maintenance backlog. Additionally, CNSC staff have included new compliance verification criteria text for fitness for service in the PNGS LCH since 2018, including related to pressure tube fracture toughness, selection criteria for pressure tube inspections, and evaluation of results and dispositions for pressure tubes.

Elevated Hydrogen Equivalent Concentration in Pressure Tubes in Extended Operation

CNSC staff updated the Commission regarding the discovery of elevated hydrogen equivalent concentration (Heq) in CANDU reactor pressure tubes in extended operation at the September 3, 2021, meeting of the Commission [H9]. As a result of this discovery, the CNSC issued orders to CANDU reactor licensees, including to OPG for PNGS units 5–8, requiring that certain conditions related to demonstrating pressure tube fitness for service be met prior to the restart of reactor units. Pressure tubes in PNGS Units 1 and 4 had not accumulated sufficient operating time to be impacted by the elevated Heq phenomena, having been previously replaced. In two separate records of decision [H10]–[H11], the Commission authorized the restart of PNGS Units 5–8 following future outages based on the demonstrated low likelihood of flaws that could call into question the fitness for service of pressure tubes in the region of interest.

In November 2022, CNSC staff provided an update on the elevated Heq matter to the Commission in coordination with the 2021 NPGS ROR [H12]. With respect to PNGS Units 5–8, CNSC staff found that fitness for service can be demonstrated because there are no active degradation mechanisms for the formation of flaws that are at risk for crack initiation within the pressure tube regions where the elevated levels of Heq have been observed in other CANDU units. OPG has committed to participate in an industry wide research and development program that will further investigate the elevated Heq matter.

The elevated Heq matter is further discussed in Appendix G of the 2022 NPGS ROR.

Environmental Protection

As reported on through the annual NPGS RORs, OPG has maintained satisfactory performance in the Environmental Protection SCA at the PNGS. Environmental monitoring results confirm that releases to the environment continue to remain well below regulatory limits.



CNSC staff conducted an Independent Environmental Monitoring Program (IEMP) campaign at the PNGS in 2021. Measurements conducted through the IEMP have consistently found levels of radioactivity in the environment to be low, and well within the range of natural background radiation levels. As a result, CNSC staff concluded that no effects on human health are expected.

IEMP results are available on the CNSC website.³

³ The Pickering IEMP results can be found at <https://nuclearsafety.gc.ca/eng/resources/maps-of-nuclear-facilities/iemp/pickering.cfm#current>

Additionally, OPG posts ground water, fish impingement, and other environmental monitoring data on its website.⁴

During the 2018 relicensing hearing, the Commission enquired about potential risks to the environment from the operation of the PNGS, including tritium releases, fish impingement, and impacts on round whitefish from thermal plume. Tritium releases to the environment from the PNGS have remained below regulatory limits during the licence period. OPG continues to implement tritium emission reduction initiatives at the PNGS and provides semi-annual update reports to CNSC staff. OPG continues to report annually to the CNSC on fish impingement and CNSC staff have found OPG's fish impingement reports acceptable. At the 2018 relicensing hearing, the Commission directed OPG to carry out thermal plume monitoring to confirm findings and reassess uncertainties of risk regarding the survival of round whitefish embryo. OPG conducted thermal plume monitoring over two periods (2018-2019 and 2019-2020) and submitted a final report to the CNSC in 2021. CNSC staff and Environment and Climate Change Canada (ECCC) each independently concluded that there are likely no adverse effects on round whitefish embryo survival or on the local or regional round whitefish population from thermal plume at the PNGS.

Emergency Management and Fire Protection

As reported on through the annual NPGS RORs, OPG has met the applicable regulatory requirements and CNSC staff expectations for the Emergency Management and Fire Protection SCA at the PNGS. OPG conducted a full-scale emergency exercise at the PNGS in 2020 to test and validate emergency preparedness and response capabilities. The next PNGS full-scale emergency exercise is scheduled for September 2023.

During the 2018 relicensing hearing, the Commission discussed topics related to the emergency distribution of potassium iodide (KI) pills and provincial nuclear emergency response plans. In 2018, OPG updated its Consolidated Nuclear Emergency Plan to align with Ontario's 2017 Provincial Nuclear Emergency Response Plan (PNERP). Through the annual NPGS RORs, CNSC staff have updated the Commission on topics related to the PNERP, including Ontario's 2019 technical study report on the PNERP. Emergency Management Ontario (EMO) is currently undertaking work to update the PNERP.

Following the 2018 relicensing hearing, CNSC staff established the [KI Pill Working Group](#) (KIPWG) with OPG, EMO, the Ontario Ministry of Health (MOH), and the municipalities located within the PNGS ingestion planning zone (IPZ) to consider plans related to KI pill distribution. CNSC staff continue to update the Commission on activities of the KIPWG as part of the status report on power reactors, which are provided at every Commission meeting. In 2022, CNSC staff presented the KIPWG Phase I report [H13] to the Commission.

In October 2022, EMO was given the responsibility to complete the Phase II objectives of the working group through the revision of the PNERP anticipated for 2023. EMO and the Ontario MOH drafted a discussion paper concerning the Phase II objectives, including the development of a strategy for emergency distribution of KI pills and examination of the feasibility of KI pill pre-distribution to all schools in the IPZ. This discussion paper was shared with the KIPWG in December 2022 for comments. The discussion paper is intended to inform the upcoming revision to the PNERP. The revised PNERP is expected to undergo a public review period, which will

⁴ OPG's regulatory reporting webpage can be found at <https://www.opg.com/reporting/regulatory-reporting/>

also provide an opportunity for the KIPWG to discuss the revision and provide comments to EMO. Additional information on the KIPWG is available on the CNSC.

Indigenous Engagement

The PNGS site lies within the traditional territory of the Michi Saagiig Anishinaabe people. These lands are covered by the Williams Treaty⁵ between Canada and the Mississauga and Chippewa Nations. The Mohawks of the Bay of Quinte (MBQ), Six Nation of the Grand River, and the Métis Nation of Ontario (MNO), on behalf of the MNO Region 8 Consultation Committee, have also asked to be kept informed of any activities related to the PNGS.

CNSC staff continue to engage with Indigenous Nations and communities in the vicinity of the PNGS by holding regular meetings to discuss the ongoing operations and performance of the PNGS. The CNSC signed a Terms of Reference (TOR) with the MNO in 2019, Curve Lake First Nation (CLFN) in 2021, and the Mississaugas of Scugog Island First Nation in 2022. These TOR provide a forum through which to collaborate and address areas of interest or concern regarding CNSC-regulated facilities and activities. As part of the TOR, a yearly work plan is developed which provides information on the scope of work, detailed activities, and timelines associated with work items for collaboration and engagement. Comprehensive updates on CNSC staff's engagement activity are provided through the annual NPGS RORs.

CNSC staff are satisfied with OPG's engagement efforts and activities to date. OPG has met with and shared information with interested Indigenous Nations, communities, and organizations including the Williams Treaties First Nations, the MNO, and the MBQ. Topics of discussion have included environmental monitoring activities and fish impingement and entrainment at the PNGS. In 2022, OPG provided support for CLFN, including consultation, archaeological, and environmental capacity.

Public Information and Disclosure

OPG has maintained a satisfactory fleet wide Public Information and Disclosure Program (PIDP) and regularly engages with the community in the vicinity of the PNGS. OPG uses various means of communication to accomplish this engagement, including Community Advisory Committee meetings, regular printed newsletter updates, virtual and in person community events, and other educational, environmental, and charitable initiatives. In 2022, OPG began to transition events that had been made virtual due to the COVID-19 pandemic back to in-person. These events include station tours, public information sessions, and annual open houses.

In 2019, OPG updated its website and increased its presence on social media. OPG's updated website provides information about the PNGS, as well as disclosure of information that is relevant to residents such as event reports, environmental monitoring reports, emergency preparedness information, and information on KI pills.

⁵ Williams Treaties First Nations include the Mississaugas of Alderville First Nation, Curve Lake First Nation, Hiawatha First Nation, Mississaugas of Scugog Island First Nation, Chippewas of Beausoleil First Nation, Chippewas of Georgina Island First Nation, and Chippewas of Rama First Nation.

Future PNGS Developments

Request to Operate Units 5–8 to 2026

In December 2022, OPG informed CNSC staff in a letter of its intent to seek Commission authorization to operate Pickering Units 5–8 until 2026 and submitted its formal application to the CNSC requesting such Commission authorization in June 2023. A public Commission hearing to consider this matter is expected to be held in June 2024.

Permanent Shutdown of Units 1 and 4 in 2024

Under the PROL for the PNGS, OPG will permanently shut down Units 1 and 4 by December 31, 2024, and transition the units to a period of safe storage with surveillance. To transition to safe storage, OPG will conduct stabilization activities including defueling the reactor, de-watering reactor systems, and end stating systems no longer needed for the safe operation of the plant. To support this transition, OPG is required to prepare a Sustainable Operations Plan (SOP) and a Stabilization Activity Plan (SAP), as per licence condition 15.4 of the PROL. The purpose of the SOP is to manage anticipated challenges while approaching the end of commercial operation, whereas the purpose of the SAP is to manage the anticipated challenges during the transition period from shutdown to safe storage.

In accordance with the expected schedule, OPG first provided the CNSC with its SOP in 2019 and its SAP in 2021. OPG has also provided the CNSC with annual revisions that address CNSC staff comments and incorporate necessary updates. In addition, CNSC staff have conducted technical reviews of high-level preliminary information provided by OPG on its planned safe storage activities including proposed design modifications. OPG will also provide more detailed submissions to the CNSC in the future regarding the transition to storage with surveillance. In 2022, OPG updated its preliminary decommissioning plans (PDP) for facilities included under its consolidated financial guarantee for the 2023-2027 review period. In December 2022, the Commission accepted OPG's proposed revised financial guarantee for the 2023-2027 period [H14]. OPG will implement [REGDOC 2.11.2, Decommissioning](#), at the PNGS by January 2024, and CNSC staff anticipate submission of OPG's detailed decommissioning plan at least 2 years in advance of the start of the storage with surveillance period.

Refurbishment Feasibility for Units 5–8

In September 2022, the Ontario government directed OPG to update its feasibility assessment for refurbishing Pickering units 5–8 for operation beyond 2026. A decision from the Ontario government on whether to seek refurbishment is expected by the end of 2023. CNSC staff continue to provide early regulatory engagement with OPG on the refurbishment feasibility assessment to communicate regulatory expectations should the project advance to further planning stages. OPG requires Commission authorization to refurbish Units 5–8 and such a request would be considered at a public hearing of the Commission where members of the public, civil society organizations, and Indigenous Nations and communities would have the opportunity to intervene.

Conclusion

Throughout the first half of the licence period, CNSC oversight continued to verify that OPG operates the PNGS in accordance with regulatory requirements. CNSC staff conclude that OPG has complied with the applicable requirements and met CNSC staff expectations for all SCAs, with the exception of the Security SCA. OPG has completed and CNSC staff has closed all IIP commitments. CNSC staff confirm that OPG continues to operate the PNGS safely and to protect the health and safety of the public and the environment. Additionally, OPG's engagement and communication efforts with members of the public and Indigenous Nations and communities have met CNSC staff's expectations.

Going forward, CNSC staff will continue its regulatory oversight activities. CNSC staff will update the Commission on regulatory activities and OPG's safety performance at the PNGS as part of the status report on power reactors and the annual NPGS RORs. CNSC staff will also continue its engagement activities to build trust and relationships with Indigenous Nations and communities in the vicinity of the PNGS, as well as other stakeholders.

References

- [H1] [Record of Decision in the Application to Renew the Nuclear Power Reactor Operating Licence for the Pickering Nuclear Generating Station; 2018-H6](#)
- [H2] [Record of Decision in the Matter of Applications to Amend Four Nuclear Power Reactor Operating Licences to reference REGDOC-2.2.3, *Personnel Certification, Volume III: Certification of Persons Working at Nuclear Power Plants*; DEC 20-H100](#)
- [H3] [Regulatory Oversight Report for Canadian Nuclear Power Generating Sites: 2018; CMD 19-M30](#)
- [H4] [Regulatory Oversight Report for Canadian Nuclear Power Generating Sites: 2019; CMD 20-M24](#)
- [H5] [Regulatory Oversight Report for Canadian Nuclear Power Generating Sites: 2020; CMD 21-M36](#)
- [H6] [Regulatory Oversight Report for Canadian Nuclear Power Generating Sites: 2021; CMD 22-M34](#)
- [H7] [CNSC Staff Submission for the 2018 PNGS Relicensing Hearing; CMD 18-H6](#)
- [H8] [Record of Decision in the Matter of OPG's Request for Commission Approval to Amend its Integrated Implementation Plan for the Pickering Nuclear Generating Station; 2020-H110](#)
- [H9] [Minutes of the Commission Meeting held on September 3, 2021](#)
- [H10] [Record of Decision in the Request for Authorization to Restart Pickering Nuclear Generating Station Unit 5 following a forced outage; DEC 21-H111](#)
- [H11] [Record of Decision in the Request for Authorization to Restart Pickering Nuclear Generating Station B Units 6-8 following future outages; DEC 21-H112](#)
- [H12] [CNSC staff update on elevated hydrogen equivalent concentration discovery events in the pressure tubes of reactors in extended operation; CMD 22-M37](#)
- [H13] [Potassium Iodide Pill Working Group – Phase I Report; CMD 22-M6](#)
- [H14] [Record of Decision in the Application for Acceptance of Ontario Power Generation's Revised Consolidated Financial Guarantee; DEC 22-H104](#)

Annex 1 – Licence Conditions Handbook Revisions

Table E-2 provides a summary of the revisions made to the PNGS LCH to date since the 2018 relicensing hearing.

Table E-2 – PNGS LCH Revisions

LCH Revision	Technical Changes
LCH-PR-48.00/2028-R000 <i>Effective: 2018-09-01</i>	<ul style="list-style-type: none"> Published following the Commission’s Summary record of Decision in the matter of OPG’s Application to Renew the Nuclear Power Reactor Operating Licence for the Pickering Nuclear Generating Station.
LCH-PR-48.00/2028-R001 <i>Effective: 2018-12-21</i>	<ul style="list-style-type: none"> Only minor administrative changes to reflect text in the Commission’s detailed Record of Decision [H1].
LCH-PR-48.00/2028-R002 <i>Effective: 2019-11-01</i>	<p><u>Added as CVC</u></p> <ul style="list-style-type: none"> REGDOC-2.1.2 <i>Safety Culture</i> REGDOC-2.2.4 <i>Fitness for duty: managing worker fatigue</i> CSA N285.5-18 (specific clauses only) REGDOC-2.13.1 <i>Safeguards and nuclear material accountancy</i> <p><u>Added as Guidance</u></p> <ul style="list-style-type: none"> REGDOC-3.5.3 REGDOC-2.2.1 <i>Human Factors</i> REGDOC-2.2.5 <i>Minimum Staff Complement</i> REGDOC-2.5.1 <i>General Design Considerations: Human Factors</i> CSA N288.8-17 <i>Establishing and implementing action levels for releases to the environment from nuclear facilities</i> CSA N288.9-18 <i>Guideline for design of fish impingement and entrainment programs at nuclear facilities</i>
LCH-PR-48.00/2028-R003 <i>Effective: 2020-04-17</i>	<p><u>Added as CVC</u></p> <ul style="list-style-type: none"> REGDOC-2.2.4 <i>Fitness for Duty, Volume III: Nuclear Security Officer Medical, Physical and Psychological Fitness</i> REGDOC-2.2.3 <i>Personnel Certification, Volume III: Certification of Persons Working at Nuclear Power Plant</i>

LCH Revision	Technical Changes
	<ul style="list-style-type: none"> • REGDOC-2.10.1 <i>Nuclear Emergency Preparedness and Response, Version 2</i> • REGDOC-2.12.1 <i>High Security Facilities, Volume I: Nuclear Response Force, Version 2.</i>
<p>LCH-PR-48.00/2028-R004 <i>Effective: 2021-04-14</i></p>	<p><u>Added as CVC</u></p> <ul style="list-style-type: none"> • REGDOC-3.2.1 <i>Public Information and Disclosure.</i> • REGDOC-2.2.4 <i>Fitness for Duty, Volume II: Managing Alcohol and Drug Use, Version 3,</i> • REGDOC-2.6.1 <i>Reliability Programs for Nuclear Power Plants</i> • REGDOC-2.6.2 <i>Maintenance Programs for Nuclear Power Plants.</i> • REGDOC-2.9.1 <i>Environmental Protection: Environmental Principles, Assessments and Protection Measures, VI.1</i> • CSA N294:19 <i>Decommissioning of facilities containing nuclear substances</i> <p><u>Added as Guidance</u></p> <ul style="list-style-type: none"> • REGDOC-2.8.1 <i>Conventional Health and Safety</i>
<p>LCH-PR-48.00/2028-R005 <i>Effective: 2023-02-24</i></p>	<p><u>Added as CVC</u></p> <ul style="list-style-type: none"> • CSA N290.14-15 (R2020) <i>Qualification of digital hardware and software for use in instrumentation and control applications for nuclear power plants</i> • CSA N287.7-17 <i>In-service examination and testing requirements for concrete containment structures for CANDU nuclear power plants</i> • CSA N288.7-15 <i>Groundwater protection programs at Class I nuclear facilities and uranium mines and mills</i> • CSA N293-12 <i>Fire protection for nuclear power plants, and Update (R2017)</i> • REGDOC-2.11.2 <i>Decommissioning (added to CVC but implementation won't be complete until 2024)</i> • REGDOC-3.3.1 <i>Financial guarantees for decommissioning of nuclear facilities and termination of licensed activity. (added to CVC but implementation won't be complete until 2024)</i> • CSA N288.8-17 <i>Environmental action levels (EALs)</i>

LCH Revision	Technical Changes
	<p><u>Added as Guidance</u></p> <ul style="list-style-type: none"> <li>• REGDOC-2.11 <i>Framework for Radioactive Waste Management and Decommissioning in Canada, Version 2</i> <li>• REGDOC-2.1.1 <i>Management Systems</i> <li>• REGDOC-2.4.3 <i>Nuclear Criticality Safety, Version 1.1</i> <li>• REGDOC-2.7.1 <i>Radiation Protection</i> <li>• REGDOC-2.7.2 <i>Dosimetry, Volume I: Ascertaining Occupational Dose</i> <li>• REGDOC-2.9.1 <i>Environmental Protection: Environmental Principles, Assessments and Protection Measures, Version 1.2</i> <li>• REGDOC-2.11.1 <i>Waste Management, Volume I: Management of Radioactive Waste</i> <li>• REGDOC-2.12.1 <i>High Security Facilities, Volume II: Criteria for Nuclear Security Systems and Devices</i> <li>• REGDOC-2.12.3 <i>Security of Nuclear Substances: Sealed Sources and Category I, II and III Nuclear Material, Version 2.1</i> <li>• REGDOC-2.14.1 <i>Volume 1, Information Incorporated by Reference in Canada's Packaging and Transport of Nuclear Substances Regulations, 2015, Version 2</i> <li>• REGDOC-3.2.2 <i>Version 1.2 Indigenous Engagement</i> <li>• CSA N288.1:20 <i>Guidelines for modelling radionuclide environmental transport, fate, and exposure associated with the normal operation of nuclear facilities</i> <li>• CSA N288.2:19 <i>Guidelines for calculating the radiological consequences to the public of a release of airborne radioactive material for nuclear reactor accidents</i> <li>• CSA N288.4:19 <i>Environmental monitoring programs at nuclear facilities and uranium mines and mills</i> <li>• CSA N288.6:22 <i>Environmental risk assessments at nuclear facilities and uranium mines and mills</i>

Annex 2 – CNSC Inspections at the PNGS

Table E-3 provides a summary of the CNSC inspection reports issued regarding the PNGS since 2018. More information on these inspections can be found in the annual NPGS RORs.

Table E-3 – Inspection Reports Issued Regarding the PNGS Since 2018

Inspection Title and Number	Inspection Report Date
Pickering Nuclear Generating Station Quarterly Field Inspection Third Quarter FY 2017/18 PRPD-2017-023	January 2018
Problem Identification and Resolution – Event Investigation PRPD-2017-019	February 2018
Design and Development of the December 2017 Pickering 1–4 CRSS Simulator-based Certification Examination PRPD-2018-004	February 2018
Outage Inspection (Unit 1) PRPD-2017-021	March 2018
Reactive – Fuel Handling Conveyor Tunnel PRPD-2018-003	March 2018
Planned Emergency Response Exercise PRPD-2018-005	March 2018
Operations Testing and Maintenance Procedure PRPD-2018-001	April 2018
Conduct of Simulator Certification Examinations and Requalification Tests PRPD-2018-006	April 2018
Cyber Security PRPD-2018-008	May 2018
CANDU Safety Issue IH6: Need for Systematic Assessment of High Energy Line Break Effects, Verification of Methodology Assumptions PRPD-2018-013	May 2018
System Inspection of Vault Vapor Recovery PRPD-2018-011	June 2018
Pickering Nuclear Generating Station Quarterly Field Inspection Fourth Quarter FY 2017/18 PRPD-2018-012	June 2018
Nuclear Power Plant Management Interview for Shift	June 2018

Inspection Title and Number	Inspection Report Date
Personnel PRPD-2018-014	
Reactive – Physical Design Program PRPD-2018-010	July 2018
System Inspection Report – Irradiated Fuel Bays PRPD-00247-2018	August 2018
Outage Inspection (Unit 6) PRPD-2018-002	September 2018
Design, Development and Grading of a RO Simulator-based Certification Examination – Pickering 5–8 PRPD-2018-015	September 2018
Pickering Nuclear Generating Station Quarterly Field Inspection First Quarter FY 2018/19 PRPD-2018-00364	September 2018
Outage Inspection (Unit 4) PRPD-2018-00204	October 2018
Pickering Nuclear Generating Station Quarterly Field Inspection Second Quarter FY 2018/19 PRPD-2018-00806	December 2018
Annulus Gas Dew Point Hygrometer Calibration PRPD-2018-01128	December 2018
2018 System Inspection NPC – E-FADs Operability/EME Connections PRPD-2018-01524	December 2018
Type II Inspection – Change Management – Software Maintenance PRPD-2018-01219	January 2019
Quarterly Field Inspection Third Quarter FY 2018/19 PRPD-2018-01509	March 2019
P1881 Unit 8 Planned Outage Inspection PRPD-2018-00840	March 2019
Human Performance Program PRPD-2019-00607	April 2019
Pickering Units 1 and 4 Conduct of a Reactor Operator Simulator-based Certification Examination PRPD-2019-01721	June 2019

Inspection Title and Number	Inspection Report Date
Quarterly Field Inspection Fourth Quarter FY 2018/19 PRPD-2019-02116	June 2019
Leadership and Management Training Program PRPD-2019-02754	June 2019
Nuclear security reactive inspection RPD-2019-03860	June 2019
Records Management Program – Management of Documents and Records PRPD-2019-00606	August 2019
P1971 Unit 7 Planned Maintenance Outage PRPD-2019-00608	August 2019
Review of PNGS Q4 2018 Report on NPP Personnel PRPD-2019-03976	August 2019
Quarterly Field Inspection First Quarter FY 2019/20 PRPD-2019-03480	September 2019
Nuclear security reactive inspection PRPD-2019-04446	September 2019
Design, Development and Grading of a Pickering 1–4 Reactor Operator Simulator-Based Certification Examination PRPD-2019-01784	October 2019
Effluent Control and Monitoring Program PRPD-2019-03373	November 2019
Certified Training Program PRPD-2019-03870	December 2019
Quarterly Field Inspection Second Quarter FY 2019/20 PRPD-2019-03882	December 2019
System Inspection – Auxiliary Boiler Feedwater System PRPD-2019-03901	December 2019
(classified) PRPD-2019-FIR -05572	
(classified) Report number: PRPD-2020-FIR-05646	
(classified) Report number: PRPD-2020-FIR-06001	
System Inspection – Fuel Handling PRPD-2020-03380	February 2020

Inspection Title and Number	Inspection Report Date
Radiological Hazard Control PRPD-2019-04793	February 2020
Quarterly Field Inspection Q3 FY2018/19 PRPD- 2019-04285	March 2020
Unit 5 planned Outage PRPD-2020-04591	April 2020
Engineering Change Control PRPD-2020-04618	April 2020
Unit 5 planned Outage PRPD-2020-04660	April 2020
Management System Program Implementation PRPD-2020-05248	April 2020
Simulator Certification Examination PRPD- 2020-04269	May 2020
REGDOC-2.24 Implementation PRPD- 2020-05333	May 2020
Managing Worker Fatigue PRPD-2020- 06899	May 2020
Quarterly Field Inspection Q4 FY2018/19 PRPD- 2020-04286	June 2020
Quarterly Field Inspection Q1 FY2019/20 PRPD- 2020-07273	August 2020
Unit 1 planned Outage PRPD-2020-05710	September 2020
Quarterly Field Inspection Q2 FY2019/20 PRPD- 2020-07758	September 2020
Aging Management PRPD-2020-05250	October 2020
System Inspection – Instrument Air PRPD-2020-07549	December 2020
Full Scale Emergency Exercise PRPD-2020- 08303	January 2021
Simulator Certification Exam PRPD-2020-08418	January 2021
Simulator Certification Examination and Requalification Test PRPD-2020-04270	February 2021

Inspection Title and Number	Inspection Report Date
Quarterly Field Inspection Report Q3 2020-2021 PRPD-2021-07752	March 2021
OPG Fleet wide Supply Management Compliance Verification Report PRPD-2021-06985/DRPD-2021-09519	May 2021
Non-Certified Training Programs at Pickering NGS and Darlington NGS PRPD-2021-06811/DRPD-2021-07525	June 2021
Quarterly Field Inspection Report Q4 2020-2021 PRPD-2021-07753	June 2021
Pickering Fire Response Program – Compliance Verification Report PRPD-2021-07777	June 2021
Unit 6 Outage at Pickering NGS PRPD-2021-07742	July 2021
Desktop Inspection Report – Software Quality Assurance Program PRPD-2021-07065	August 2021
Quarterly Field Inspection Report Q1 2021-2022 PRPD-2021-10582	September 2021
Environmental Qualification Programs Pickering NGS PRPD-2021-10881	September 2021
Unit 8 Planned Maintenance Outage - Compliance Inspection Report PRPD-2021-08860 - P2181	October 2021
Chemistry Control at Pickering NGS PRPD-2021-11416	November 2021
Quarterly Field Inspection Report Q2 2021-2022 PRPD-2021-11197	December 2021
System Inspection of Irradiated Fuel Bays at Pickering NGS PRPD-2021-11748	February 2022
Simulator Examinations and Requalification Tests at Pickering NGS PRPD-2021-11760	February 2022
P2171 Unit 7 Outage PRPD-2021-11631	March 2022
Quarterly Field Inspection Report Q3 2021-2022	March 2022

Inspection Title and Number	Inspection Report Date
PRPD-2022-12076	
Security Field Inspection #10 & #14 PRPD-2022-FI-13568-13567	March 2022
Search and Screening Equipment at the Entrance and Egress of the Protected Area PRPD-2022-13057/DRPD-2022-10777	April 2022
Type II Maintenance Planning and Scheduling Compliance Verification Report PRPD-2022-11039	May 2022
Quarterly Field Inspection Report Q4 2021-2022 PRPD-2022-12909	June 2022
Nuclear Response Force (NRF) Response Vehicle Verification and Nuclear Security Officer (NSO) Equipment and Asset Verification PRPD-2022-13568/DRPD-2022-10782	June 2022
Negative Pressure Containment System PRPD-2022-12794	July 2022
Security Measures (Procedures) for entry-egress of Protected Areas, Vital Areas, and Inner Areas PRPD-2022-13697	July 2022
P2251 Unit 5 Planned Outage PRPD-2022-12914	August 2022
Fleet-Wide Cyber Security PRPD-2022-12739/DRPD-2022-10305	September 2022
Problem and Event Cause and Resolution Effectiveness Investigation and Trend Analysis PRPD-2022-13903/DRPD-2022-14332	September 2022
Quarterly Field Inspection Report Q1 2022-2023 PRPD-2022-13990	September 2022
Design, development and grading of a Pickering 1-4 CRSS Simulator-based Examination PRPD-2022-13868	November 2022
Fire Protection at Pickering NGS PRPD-2022-14712	November 2022
Fleet-wide Desktop Inspection of OPG's Nuclear Emergency Response Organization Training Program PRPD-2022-14313/DRPD-2022-15754	December 2022

Inspection Title and Number	Inspection Report Date
Non-Certified Training Programs PRPD-2022-14314/DRPD-2022-14967	January 2023
Application of ALARA PRPD-2022-14730	February 2023
Fleet Environment Monitoring Program at Pickering and Darlington NGS PRPD-2022-15102/DRPD-2022-14705	February 2023
Minimum Shift Complement Verification PRPD-2022-15714/DRPD-2022-15569	February 2023

Appendix I. CNSC Staff Update on Elevated Hydrogen Equivalent Concentration Discovery Events in the Pressure Tubes of Reactors in Extended Operation [RIB 25788]

Introduction

Commission meetings were held in September 2021, March 2022, and November 2022 to discuss the discovery events related to elevated hydrogen equivalent concentration (Heq) in Bruce A and B pressure tubes in extended operation (i.e., beyond 210,000 equivalent full power hours (EFPH)). The reported events involved the discovery of elevated Heq near the outlet rolled joint burnish mark as well as near the inlet rolled joint burnish mark of some pressure tubes in Bruce A and B. The Heq values measured in specific locations of these pressure tubes exceeded the limit of 120 parts per million by weight (ppm) established for the accepted pressure tube fracture toughness model at the time of the events. The findings were presented in Commission Member Documents ([CMD 21-M39](#), [CMD 21-M37](#), [CMD 22-M16](#) and [CMD 22-M37](#)). The findings were pertinent to pressure tubes in extended operation at Bruce, Darlington and Pickering, which included Bruce Units 3, 4, 5, 7 and 8, Pickering Units 5, 6, 7 and 8 and Darlington Units 1 and 4. Bruce Unit 3 and Darlington Units 1 and 4 were originally included in the list of reactors having been impacted by the elevated Heq discoveries. Bruce Unit 3 and Darlington Unit 1 have since been shutdown for refurbishment, while Darlington Unit 4 is expected to be shutdown for refurbishment in Q3 of 2023. During the most recent Commission meeting, on November 3rd, 2022, CNSC staff presented their conclusion that these findings posed a low risk for nuclear safety for the affected units for at least three additional years of operation.

Pressure tube failure is a design-basis event for CANDU reactors, which have built-in mitigating capabilities that would ensure that the releases into the environment would be small and dose to the public would be within the prescribed dose limits should this event occur. In addition, pressure tube failure is accounted for in the probabilistic safety assessment, and the results for Bruce and Pickering stations show that the safety goals are met with adequate margin. Bruce Power and OPG have undertaken additional surveillance and monitoring activities such as investigating the root cause of the locally elevated Heq near the inlet and outlet rolled joints, introducing operational changes and additional training to minimize the possibility of cold overpressure transients, and progressing with planned research and development (R&D) activities to update predictive model capabilities and analytical tools for the rolled joint region of pressure tubes.

Purpose

During the November 3rd, 2022, Commission Meeting regarding the update on the discovery of elevated Heq in the pressure tubes of reactors in extended operation, the Commission directed CNSC staff to provide a similarly comprehensive update on the progress to address elevated Heq at a future public meeting (par. 100 in [I8]).

This Appendix provides CNSC staff's update to the Commission on progress made to date by Bruce Power and OPG on R&D activities, which was submitted to CNSC staff in the first semi-annual update.

Background

Through physical inspections, it is known that pressure tubes in CANDU reactors have surface flaws (on the inner surface) caused by the interactions with fuel bundles, inspection tools and foreign material. These flaws, under certain conditions, can result in initiation of a pressure tube crack that could grow through-wall. High Heq reduces the fracture toughness (resistance to fracture) of pressure tubes at lower-than-normal operating temperatures (i.e., during unit heat up/cooldown), which could increase the likelihood of a pressure tube failure should a crack be initiated. While in-service cracking has been observed in pressure tubes in the 1980's and 1990's, the contributing factors had been identified, measures were taken to address the causes and the impacted tubes were replaced. In-service cracking has not been observed in the current population of pressure tubes to date.

Elevated Heq discoveries near the Outlet and Inlet Rolled Joints

Refer to Appendix A of [CMD 22-M37](#) for a detailed description of the background information covering the period of the original event reports from July 2021 to the November 2022 Commission Meeting. Highlights are summarized below.

Elevated Heq Discovery near the Outlet Rolled Joint Burnish Mark:

- Elevated Heq was discovered near the outlet rolled joint in Bruce Unit 6 and Unit 3 pressure tubes exceeding the Licence Condition 15.3 Heq limit of 120 parts per million.
- An Event Initial Report (EIR) was presented to the Commission on September 29, 2021 ([CMD 21-M39](#)).
- The estimation of the fracture toughness used for pressure tube fitness for service evaluations was called into question for the region of pressure tubes in extended operation near the outlet burnish mark for the following reasons:
 - Uncertainty associated with the model predictability for Heq uptake
 - The high Heq measurements discovered at Bruce A Unit 3 and Bruce B Unit 6 exceed the validity range of the current fracture toughness model
 - The absence of measurements in the same areas in the pressure tubes of units operating beyond 210,000 EFPH.
- In response to the discovery issues, CNSC staff requested that all Canadian NPP licensees evaluate the impact of the finding on their pressure tubes under *General Nuclear Safety and Control Regulations* (GNSCR) 12(2) [I1-I3]. Upon review of the responses, CNSC staff concluded that the finding had the potential to impact all units in extended operation beyond 210,000 EFPH.
- While the phenomenon had not yet been observed in Darlington and Pickering pressure tubes, it could not be ruled out because:

- No tubes in the Darlington or Pickering reactors with similar operating time as the Bruce Unit 6 tube had been subject to detailed Heq examination.
- The root cause could not be confirmed and there was no means of predicting which pressure tubes would be affected.
- Designated Officer (DO) Orders were issued to Bruce Power and OPG [I4-I6] requiring the licensees to seek Commission authorization to restart reactors following any outage that resulted in cooldown of the PHTS.
 - These DO Orders led to a series of Commission Hearings to obtain the necessary restart authorizations for the reactor units that were in-scope ([DEC 21-H110](#), [DEC 21-H111](#), [DEC 21-H112](#), [DEC 21-H113](#), [DEC 21-H114](#), [DEC 22-H100](#)).
- Authorization for continued operation for all the in-scope units was based on analyses demonstrating compliance with Restart Criteria Option (b) [I4-I6] by confirming that inspection data was available for each reactor unit to justify, with a high degree of certainty, that no flaws are present in the region of interest (ROI) greater than 0.15 mm in depth.

Elevated Heq Discovery near the Inlet Rolled Joint Burnish Mark:

- In December 2021, after further testing on the same Bruce B Unit 6 B6S13 surveillance tube, Bruce Power discovered elevated Heq exceeding 120 ppm near the inlet rolled joint burnish mark near the 1 o'clock orientation, which is referred to as a “blip” because of the appearance of the Heq profiles.
- CNSC staff presented an EIR to inform the Commission of this new finding on March 23, 2022 under [CMD 22-M16](#).
- In addition to the smaller observed extent of the region of the blip at the inlet end of the B6S13 pressure tube compared to the outlet end finding, there are other important factors, namely:
 - The Heq measured from the punch sample was only marginally above the 120 ppm licensing limit.
 - Flaws that have the potential for crack initiation can exist near the inlet rolled joint burnish mark in the Bruce Power and Darlington reactors.
 - Diametral expansion due to irradiation induced creep is not an issue at the inlet end of pressure tubes so the blips cannot be attributed to the same mechanism that was attributed to the outlet rolled joint burnish mark findings.
 - Further examination of the B6S13 tube material containing the blip also revealed that there was a significant through thickness gradient of Heq with higher Heq values near the outer diameter surface and lower Heq values near the inner diameter surface.

- For the Pickering reactors, there are no driving mechanisms for the formation of flaws that are at risk for crack initiation since the fuel bundles do not reside at the inlet rolled joint burnish mark during operation and the shield plug extends almost 100 mm past the burnish mark.
 - For the Pickering pressure tubes in extended operation, fitness for service can be demonstrated in a manner that is consistent with Restart Criteria Option (b) [I4-I6] that was used for the outlet rolled joint elevated Heq issue.
- CNSC staff have concluded that the analysis of fitness for service of the pressure tubes subject to the inlet rolled joint Heq blips could not be adequately assessed for Bruce Power and Darlington reactors and that a risk informed assessment would be required to determine whether the incremental risk from continued operation of these units would be acceptably low.
 - Based on CNSC staff's risk assessment of elevated Heq at the inlet end of pressure tubes from reactors in extended operation at Bruce A and B and Darlington [I7], CNSC staff concluded that the risk to nuclear safety due to elevated Heq at the inlet rolled joint of pressure tubes is negligible for up to 3 years of continued operation; as such, no immediate action is required.
- Bruce Power and OPG have committed to completing R&D in this time period to address the effects of elevated Heq on pressure tube fitness for service.

Overview of Fitness for Service Evaluations for Flaws

The fitness for service CVC for pressure tubes can only be established for pressure tubes with Heq below the applicable limits of the evaluation models, most notably the fracture toughness model. At the time of the Bruce Power and Pickering licence renewals in 2018, the upper Heq limit of the fracture toughness model in CSA N285.8, *Technical requirements for in-service evaluation of zirconium alloy pressure tubes in CANDU reactors*, was 120 ppm, and the end-of-life Heq values for some pressure tubes in extended operation (i.e., beyond 210,000 EFPH) was expected to exceed the 120 ppm limit. Industry was actively engaged in a testing program to increase the validity limit of the model to at least 160 ppm to support longer operating lives for some reactor units.

Licensee assessment of Fitness for service for pressure tubes with flaws and the role of the Heq model predictions in that process is briefly described as follows and further depicted in Figure F1:

- The Heq model predicts a probability distribution for the Heq value at the location of the flaw. For deterministic evaluations (for example, dispositions for detected flaws) an upper bound value of Heq is selected from the distribution. For probabilistic flaw evaluations, the full distributions are used. These results feed into pressure tube material models for crack initiation, fracture toughness and crack growth rate.

- These material models are used in conjunction with models related to changes in pressure tube dimensions and the operating conditions to evaluate the impact of the pressure tube flaws for a specified operating period.
- Various flaw evaluations are performed in order to demonstrate the fitness for service acceptance criteria, detailed under Section 6.1 of the Bruce A and B, Pickering, and Darlington LCHs, have been satisfied. If the acceptance criteria are satisfied, pressure tube operation can continue for the specified operating period without restriction. Otherwise, corrective actions would be required, which could include shortening the operating period, replacing affected pressure tubes, or shutting down the reactor.
- For the current situation, with regions of elevated Heq near the burnish marks, the uncertainty in the output from the models that predict and rely on the Heq in the pressure tube prevent definitive conclusions from being made regarding satisfying the acceptance criteria. Alternate approaches have been adopted on a temporary basis, as discussed in the above Sections, to assess the impact of pressure tube flaws near the burnish mark on safe operation. More detailed descriptions of the key issues that need to be addressed from the elevated Heq findings, which would allow licensees to return to the process presented in Figure F1 for pressure tubes in extended operation, can be found in Appendix A of [CMD 23-M3](#).

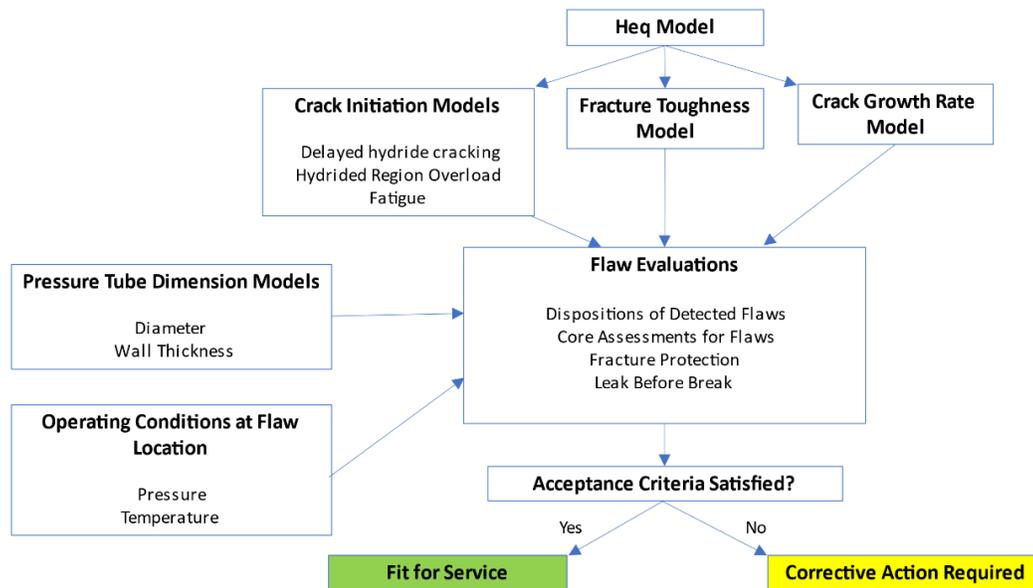


Figure F1: Overview of Fitness for Service Evaluations for Flaws in Pressure Tubes

Updates Since the November 3rd, 2022, Commission Meeting

CNSC staff have been actively engaging with Bruce Power and OPG on key issues regarding the execution of the R&D plans and have reviewed the first semi-annual update submitted by Bruce Power and OPG. Bruce Power and OPG are committed to providing updates to CNSC staff on a semi-annual basis through to completion of their R&D plan, which is targeted for the summer of 2026.

The first update for the elevated Heq R&D project did not include results for specific model development activities or testing beyond what was previously reported. The early phase of the project was largely focused on planning, procurement of materials and preparation of samples for physical tests, as well as model development work and sensitivity studies for the analytical modelling. There was no reduction in scope of work identified in the updates. In fact, several activities include increases in scope primarily focused on performing additional sensitivity studies and benchmarking for analytical models.

In March 2023, CNSC staff raised action items for OPG and Bruce Power to track the completion of the R&D plan, as well as the commitment to providing semi-annual updates to CNSC staff. Closure of these action items will only be considered after the following items have been completed:

- Submission of reports for completion of all activities related to the elevated Heq discoveries, including:
 - Submission of reports for crack initiation model validation,
 - Submission of reports for fracture toughness model validation,
- Disposition of comments from public interventions [CMD 22-M37.4](#) and [CMD 22-M37.5](#),
- Submission of progress reports on a 6-month frequency, and
- Closure of all comments arising from CNSC staff review of the R&D activities.

Update on In-Service Inspection, Scrape Campaign and Material Surveillance Measurements

The updates from licensees provided a brief summary of in-service inspection, scrape campaign and additional material surveillance measurements since the elevated Heq events. Inspection outages completed in the last 18 months by Bruce Power and OPG have not identified new flaws near the outlet rolled joints of pressure tubes exceeding 0.15 mm in depth, and Heq scrape samples gathered and analyzed during that period have not identified additional pressure tubes with elevated Heq measurements near the burnish marks. Some key highlights include:

- Additional measurements from a Bruce Unit 6 pressure tube (B6N07) removed for surveillance measurements showed evidence of circumferential variation inboard of the inlet burnish mark and outboard of the outlet burnish mark. However, there was no evidence of blip formation.
- Additional measurements from a Bruce Unit 3 pressure tube (B3K20) did not show evidence of blip formation.
- Surveillance measurements from a Pickering Unit 5 pressure tube (P5N09) are pending.
- Scrape campaign results from a pressure tube taken during the Pickering Unit 6 maintenance outage (P2361) are pending.

- There were no new flaws detected near the inlet burnish mark during the Pickering Unit 6 maintenance outage (P2361).
- There were no elevated Heq measurements reported for the scrapes completed during the Bruce Unit 7 (B2171), Unit 4 (A2241) or Unit 5 (B2251) maintenance outages for the outlet rolled joint region.
- There were no flaws deeper than 0.15 mm reported in the outlet rolled joint region for the Bruce Unit 7 (B2171), Unit 4 (A2241) or Unit 5 (B2251) maintenance outages.

Update on R&D Activities

The majority of the activities are reportedly on track for completion according to the original plans ([CMD 22-M37.1](#) and [CMD 22-M37.3](#)) with seven tasks to be somewhat delayed, as shown in the table below. At this time, it is not expected that these delays will challenge the projected completion date of winter 2026. Table F1 summarizes the key activities under the industry R&D program for Heq model refinement that CNSC staff is monitoring. The target and expected completion dates refer to the dates industry expects to complete the activities and do not account for the time required for reviews carried out by CNSC staff to adopt the updated models for fitness for service compliance verification. As Table I1 shows, industry has expanded the scope of several key activities in the R&D program based on preliminary findings. The scope expansions include more benchmarking and sensitivity studies for analytical models and more experimental data sets. The scope expansions are not expected to delay the final deliverables.

Table I1: Update on Timelines of Key R&D Activities

Key Activity	Scope Change?	Target Completion	Expected Completion
Update finite element software to simulate outlet rolled joint Heq evolution	Increase	Fall 2023	Fall 2023
Develop finite element software to simulate inlet rolled joint Heq evolution	Increase	Fall 2023	Fall 2023
Perform evaluation to assess the potential impact of the high levels of Heq on flaws at the inside surface of pressure tubes near the inlet region of interest	Increase	Fall 2023	Fall 2023
Improve characterization of 'blip' and expected evolution of the inlet region	No	Spring 2024	Spring 2024

Key Activity	Scope Change?	Target Completion	Expected Completion
of elevated Heq with continued operation			
Confirm the potential roles of hydrogen isotope ingress and redistribution on the development of the inlet regions of elevated Heq	No	Summer 2023	Fall 2023
Improve characterization of solubility behaviour of hydrogen isotopes in tubes with elevated Heq	No	Winter 2024	Winter 2024
Enhance modeling of temperature distributions near the outlet rolled joint region of pressure tubes	No	Summer 2023	Fall 2023
Define input parameters required for interim updates to the Heq model	No	Summer 2023	Fall 2023
Develop interim Heq model	No	Fall 2024	Fall 2024
Validation activities for the interim Heq model to support development of final comprehensive model	No	Fall 2025	Fall 2025
Define input parameters required for the final comprehensive Heq model	No	Summer 2025	Summer 2025
Define the relative importance of variables influential to Heq evolution	No	Fall 2025	Fall 2025
Develop the final comprehensive Heq model	No	Winter 2026	Winter 2026
Complete hydride related crack initiation experiments for unirradiated material at	No	Fall 2024	Spring 2025

Key Activity	Scope Change?	Target Completion	Expected Completion
Heq of 220 ppm or higher			
Complete fatigue crack initiation experiments for unirradiated material at Heq of 220 ppm or higher	No	Fall 2024	Spring 2025
Complete crack initiation experiments for irradiated material with elevated Heq without flaws present	No	Fall 2024	Spring 2025
Complete crack initiation and crack growth experiments for irradiated material with elevated Heq with flaws present	Scope increase	Fall 2024	Spring 2025

Overall Conclusions

Based on available information assessed to date, CNSC staff conclude that:

- For the Pickering units, there are no active mechanisms for the formation of flaws that are at risk for crack initiation within the pressure tubes where elevated levels of Heq have been observed in the inlet and outlet ROIs of reactors at Bruce and Darlington (inlet only). Therefore, alternate fitness for service compliance verification criteria continues to be in place to address the potential impact of the elevated Heq discoveries.
- There are no flaws in the outlet rolled joint regions of pressure tubes in extended operation in Bruce A and B units, and no mechanisms for the formation of flaws that are at risk for crack initiation within the ROI. Therefore, alternate fitness for service compliance verification criteria to address the potential impact of the elevated Heq discoveries continue to apply.
- With respect to the inlet rolled joint regions of pressure tubes in extended operation at Bruce A and B, the conclusion of the RIDM relating to risk metrics such as severe core damage frequency and large release frequency due to postulated increases in pressure tube failure frequency have not changed.
- All Darlington Units have been refurbished or are undergoing refurbishment, as of Q3 of 2023, and are no longer affected by the elevated Heq discoveries.
- Based on the review of the R&D plans and the first update, CNSC staff conclude that Bruce Power and OPG continue to target the key issues raised regarding pressure tube fitness for service with respect to the elevated Heq discoveries.

- There was no reduction in scope of work identified in the updates and several activities include increases in scope primarily focused on performing additional sensitivity studies and benchmarking for analytical models.
- At this time, Bruce Power and OPG have not reported any substantive delays in the R&D work that may adversely impact the overall project schedule.

References

- [11] CNSC Letter, A. Viktorov to M. Burton, “Bruce A and B: Request pursuant to Subsection 12(2) of the *General Nuclear Safety and Control Regulations: Issues Relating to Measurement of Hydrogen Equivalent Concentration in Pressure Tubes*”, July 13, 2021, e-Doc 6603948 ([EN](#), [FR](#))
- [12] CNSC Letter, A. Viktorov to S. Gregoris and J. Franke, “Darlington and Pickering NGS: Request pursuant to Subsection 12(2) of the *General Nuclear Safety and Control Regulations: Issues Relating to Measurement of Hydrogen Concentration in Pressure Tubes*”, July 13, 2021, e-Doc 6603931 ([EN](#), [FR](#))
- [13] CNSC Letter, A. Viktorov to M. Power, “PLNGS: Request pursuant to Subsection 12(2) of the *General Nuclear Safety and Control Regulations: Issues Relating to Measurement of Hydrogen Equivalent Concentration in Pressure Tubes*”, July 13, 2021, e-Doc 6604246 ([EN](#), [FR](#))
- [14] Designated Officer Order, R. Jammal to Bruce Power, “Order by a Designated Officer Under Paragraph 37(2)(f) and Subsection 35(1) of the *Nuclear Safety and Control Act*”, July 26, 2021, e-Doc 6612405 ([EN](#), [FR](#))
- [15] Designated Officer Order, R. Jammal to Bruce Power, “Order by a Designated Officer Under Paragraph 37(2)(f) and Subsection 35(1) of the *Nuclear Safety and Control Act*”, July 26, 2021, e-Doc 6612405 ([EN](#), [FR](#))
- [16] Designated Officer Order, R. Jammal to Bruce Power, “Order by a Designated Officer Under Paragraph 37(2)(f) and Subsection 35(1) of the *Nuclear Safety and Control Act*”, July 26, 2021, e-Doc 6612405 ([EN](#), [FR](#))
- [17] CNSC Risk Assessment Report, “Risk Informed Considerations Related to Elevated Heq Levels at the Inlet Rolled Joint Region of Pressure Tubes – Risk assessment Report Revision 1”, November 2022, e-Doc 6788784.
- [18] Minutes of the Canadian Nuclear Safety Commission (CNSC) Meeting held on December 15 and 16, 2022, e-Doc 6951748 ([EN](#), [FR](#))