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**Regulatory Oversight
Report for Canadian
Nuclear Power
Generating Sites for 2020**

Public Meeting

**Rapport de surveillance
réglementaire des sites
de centrales nucléaires
au Canada pour 2020**

Réunion publique

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CNSC Staff

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Soumise par :
Le personnel de la CCSN

Summary

This CMD presents the *Regulatory Oversight Report for Canadian Nuclear Power Generating Sites for 2020*.

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 2020. 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 from the use of nuclear energy 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.
 - 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 2020.

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 2020. 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 contre l'utilisation de l'énergie nucléaire et respecter les obligations internationales que le Canada a assumées.
- 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 bien 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
- Les titulaires de permis se sont conformés aux exigences applicables

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

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TABLE OF CONTENTS

	EXECUTIVE SUMMARY	12
	REGULATORY OVERSIGHT REPORT FOR NUCLEAR POWER GENERATING SITES: 2020.....	14
1	INTRODUCTION.....	14
	1.1 About the regulatory oversight report.....	14
	1.2 Scope of the regulatory oversight report.....	15
	1.3 Nuclear facilities covered by this regulatory oversight report.....	16
	1.3.1 Nuclear power generating sites and associated waste management facilities in Canada.....	17
	1.3.2 Nuclear power plants	17
	1.3.3 Waste management facilities	19
	1.4 Regulatory framework and oversight.....	19
	1.4.1 CNSC requirements	20
	1.4.2 Licensing.....	21
	1.4.3 Reporting.....	21
	1.4.4 Compliance verification program	22
	1.4.5 Safety assessment ratings.....	23
	1.4.6 Update on CNSC Covid-19 Response and NPP Oversight	23
2	GENERAL AND SUPPORTING INFORMATION	25
	2.1 Management system.....	25
	2.2 Human performance management	26
	2.3 Operating performance	30
	2.4 Safety analysis	33
	2.5 Physical design.....	37
	2.6 Fitness for service	38
	2.7 Radiation protection.....	43
	2.8 Conventional Health and Safety	47
	2.9 Environmental protection.....	49
	2.10 Emergency management and fire protection	51
	2.11 Waste management	53
	2.12 Security	53
	2.13 Safeguards and non-proliferation.....	54
	2.14 Packaging and transport.....	56
	2.15 Other matters of regulatory interest	56
3	NUCLEAR POWER PLANT AND WASTE MANAGEMENT FACILITY SAFETY PERFORMANCE AND REGULATORY DEVELOPMENTS	67
	3.1 Darlington Nuclear Generating Station	67
	3.1.0 Introduction.....	67
	3.1.1 Management System.....	71
	3.1.2 Human Performance	74
	3.1.3 Operating Performance	75

3.1.4	Safety Analysis	77
3.1.5	Physical Design.....	77
3.1.6	Fitness for Service.....	79
3.1.7	Radiation Protection.....	81
3.1.8	Conventional Health and Safety	82
3.1.9	Environmental Protection	83
3.1.10	Emergency Management and Fire Protection.....	84
3.1.11	Waste Management.....	85
3.1.12	Security	86
3.1.13	Safeguards and Non-Proliferation.....	87
3.1.14	Transport and Packaging.....	88
3.2	Darlington Waste Management Facility	89
3.2.0	Introduction.....	89
3.2.1	Management System.....	90
3.2.2	Human Performance	90
3.2.3	Operating Performance	91
3.2.4	Safety Analysis	91
3.2.5	Physical Design.....	91
3.2.6	Fitness for Service.....	91
3.2.7	Radiation Protection.....	92
3.2.8	Conventional Health and Safety	92
3.2.9	Environmental Protection	92
3.2.10	Emergency Management and Fire Protection.....	93
3.2.11	Waste Management.....	94
3.2.12	Security	94
3.2.13	Safeguards and Non-Proliferation.....	94
3.2.14	Transport and Packaging.....	95
3.3	Pickering Nuclear Generating Station	96
3.3.0	Introduction.....	96
3.3.1	Management System.....	100
3.3.2	Human Performance	102
3.3.3	Operating Performance	104
3.3.4	Safety Analysis	106
3.3.5	Physical Design.....	107
3.3.6	Fitness for Service.....	109
3.3.7	Radiation Protection.....	112
3.3.8	Conventional Health and Safety	113
3.3.9	Environmental Protection	113
3.3.10	Emergency Management and Fire Protection.....	114
3.3.11	Waste Management.....	115
3.3.12	Security	116
3.3.13	Safeguards and Non-Proliferation.....	117
3.3.14	Transport and Packaging.....	118
3.4	Pickering Waste Management Facility	119
3.4.0	Introduction.....	119
3.4.1	Management System.....	120

3.4.2	Human Performance	121
3.4.3	Operating Performance	121
3.4.4	Safety Analysis	121
3.4.5	Physical Design.....	121
3.4.6	Fitness for Service.....	122
3.4.7	Radiation Protection.....	122
3.4.8	Conventional Health and Safety	122
3.4.9	Environmental Protection	122
3.4.10	Emergency Management and Fire Protection.....	123
3.4.11	Waste Management.....	123
3.4.12	Security	124
3.4.13	Safeguards and Non-Proliferation.....	124
3.4.14	Transport and Packaging.....	125
3.5	Bruce Nuclear Generating Station	126
3.5.0	Introduction.....	126
3.5.1	Management System.....	131
3.5.2	Human Performance	134
3.5.3	Operating Performance	136
3.5.4	Safety Analysis	138
3.5.5	Physical Design.....	139
3.5.6	Fitness for Service.....	140
3.5.7	Radiation Protection.....	145
3.5.8	Conventional Health and Safety	146
3.5.9	Environmental Protection	146
3.5.10	Emergency Management and Fire Protection.....	148
3.5.11	Waste Management.....	149
3.5.12	Security	150
3.5.13	Safeguards and Non-Proliferation.....	151
3.5.14	Transport and Packaging.....	152
3.6	Western Waste Management Facility	153
3.6.0	Introduction.....	153
3.6.1	Management System.....	154
3.6.2	Human Performance	155
3.6.3	Operating Performance	155
3.6.4	Safety Analysis	156
3.6.5	Physical Design.....	156
3.6.6	Fitness for Service.....	156
3.6.7	Radiation Protection.....	156
3.6.8	Conventional Health and Safety	157
3.6.9	Environmental Protection	157
3.6.10	Emergency Management and Fire Protection.....	158
3.6.11	Waste Management.....	159
3.6.12	Security	159
3.6.13	Safeguards and Non-Proliferation.....	159
3.6.14	Transport and Packaging.....	160
3.7	Point Lepreau Nuclear Generating Station	161

3.7.0	Introduction.....	161
3.7.1	Management System.....	164
3.7.2	Human Performance	167
3.7.3	Operating Performance	168
3.7.4	Safety Analysis	170
3.7.5	Physical Design.....	171
3.7.6	Fitness for Service.....	172
3.7.7	Radiation Protection.....	174
3.7.8	Conventional Health and Safety	176
3.7.9	Environmental Protection	176
3.7.10	Emergency Management and Fire Protection.....	177
3.7.11	Waste Management.....	178
3.7.12	Security	179
3.7.13	Safeguards and Non-Proliferation.....	180
3.7.14	Transport and Packaging.....	180
3.8	Gentilly-2	182
3.8.0	Introduction.....	182
3.8.1	Système de gestion.....	182
3.8.2	Gestion de la performance humaine	183
3.8.3	Conduite de l'exploitation.....	183
3.8.4	Analyse de la sûreté	184
3.8.5	Conception matérielle	184
3.8.6	Aptitude fonctionnelle	184
3.8.7	Radioprotection.....	184
3.8.8	Santé et sécurité classiques	185
3.8.9	Protection de l'environnement.....	185
3.8.10	Gestion des urgences et protection-incendie.....	186
3.8.11	Gestion des déchets.....	188
3.8.12	Sécurité	188
3.8.13	Garanties et non-prolifération	189
3.8.14	Emballage et transport	190
4	CONCLUSIONS FOR THE REGULATORY OVERSIGHT OF NUCLEAR POWER GENERATING SITES IN 2020.....	191
	REFERENCES.....	192
	APPENDICES	193
A.	RATING DEFINITIONS AND METHODOLOGY	194
	A.1 Definitions.....	194
	A.2 Rating methodology – general approach	195
	A.3 Detailed Description of Steps in Rating methodology.....	195
B.	LIST OF REGULATORY REQUIREMENTS AT THE END OF 2020....	199

C. CURRENT AND PREDICTED STATUS OF KEY PARAMETERS AND MODELS FOR PRESSURE TUBES IN CANADIAN POWER REACTORS 202

D. DERIVED RELEASE LIMITS AND RADIOLOGICAL RELEASES TO THE ENVIRONMENT 205

E. LIST OF LICENCE CONDITIONS HANDBOOK CHANGES..... 218

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EXECUTIVE SUMMARY

The regulatory oversight report describes the regulatory oversight and safety performance of nuclear power generating sites, consisting of nuclear power plants (NPPs) and their associated waste management facilities (WMFs) in Canada in 2020. For certain topics, updates on developments in 2021 are also described. This is the fourth Canadian Nuclear Safety Commission (CNSC) regulatory oversight report to cover both NPPs and WMFs.

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 (DNCS), which includes the Tritium Removal Facility and Retube Waste Processing Building
- Darlington Waste Management Facility (DWMF), which includes the Retube Waste Storage Building
- Pickering Nuclear Generating Station (PNGS)
- Pickering Waste Management Facility (PWMF)
- Bruce A Nuclear Generating Station and Bruce B Nuclear Generating Station
- Western Waste Management Facility (WWMF)
- Radioactive Waste Operations Site-1 (RWOS-1)
- Point Lepreau Nuclear Generating Station (PLNGS), which includes Solid Radioactive Waste Management Facility (SRWMF)
- Gentilly-2 Facilities

CNSC staff concluded that the NPPs and WMFs operated safely in 2020. 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 (SCAs). The conclusion was supported by safety performance measures and other observations.

Important performance measures and observations include the following:

- 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.
- No serious process failures occurred 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 IAEA.

CNSC staff assessments for 2020 concluded that the licensees complied with the applicable regulatory requirements and also met CNSC staff expectations for all SCAs at all the NPPs and WMFs.

Referenced documents in this CMD are available to the public upon request.

REGULATORY OVERSIGHT REPORT FOR NUCLEAR POWER GENERATING SITES: 2020

1 INTRODUCTION

1.1 About the regulatory oversight report

The *Regulatory Oversight Report for Canadian Nuclear Power Generating Sites: 2020* provides Canadian Nuclear Safety Commission (CNSC) staff assessment of the overall performance of Canadian nuclear power plants (NPPs) and their associated waste management facilities (WMFs) for 2020.

Section 1 provides introductory material that explains this report, the licensed facilities that are covered, and the CNSC regulatory framework and practices.

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

Section 3 contains highlights from the individual assessments for each facility. The CNSC approach to the safety assessments of the NPPs and WMFs is described in section 1.4.5.

Sections 2 and 3 are organized according to the CNSC safety and control area (SCA) framework, as it existed at the end of 2020.

Section 4 contains CNSC staff conclusions based on the assessments presented in this report.

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

This report includes information requested by the Commission from previous Regulatory Oversight Reports (RORs) 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
23134	Provide an update on asbestos phase-out	2.15
22116	Provide updates on matters related to emergency management and emergency preparedness at PNGS	3.3.10

RIB #	Request	Report section
20544	Present how many IIP commitments in each NGS were planned, completed, reviewed and closed	3.1 3.3 3.5 3.7
17557	Follow up to the licence renewal for Pickering Nuclear Generating Station (PNGS) (i) provide update on the status of the integrated implementation plan (IIP) (ii) describe methodology and progress for whole site probabilistic safety assessment (PSA) (iii) provide update on the joint fuel machine reliability project	(i) 3.3.0 (ii) 2.4 (iii) 2.6
16516	Provide update on PNGS fish diversion system (i) improvements and resulting fish impingement rate (ii) results of Ontario Power Generation's (OPG's) thermal plume monitoring (iii) a) OPG's compliance with its <i>Fisheries Act</i> authorization and b) involvement of Indigenous groups in activities related to the authorization	(i) 3.3.0 (ii) 3.3.0 (iii) a) 3.3.0 (iii) b) 2.15
14761	Describe enhancements at Bruce A to bring internal fire risk below the safety goal target	3.5.5
14757	Describe developments related to pressure tube fracture toughness for Bruce A and B, including: (i) fracture toughness modelling (ii) estimates of the maximum amount of equivalent hydrogen	(i) 3.5.6 (ii) Appendix C
14755	Provide update on the implementation of automated data transfer from Bruce A and B to the CNSC Emergency Operations Centre	3.5.10
14753	Provide update on status of major component replacement for Bruce A and B	3.5.0
8504	Provide update on the CNSC's regulatory position on risk aggregation	2.4

1.2 Scope of the regulatory oversight report

The scope of the *Regulatory Oversight Report for Canadian Nuclear Power Generating Sites: 2020* is similar to that of the *Regulatory Oversight Report for Canadian Nuclear Power Generating Sites: 2019* [1]. It 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 2020, and the status that is described is valid as of December 2020. The word “UPDATE” is used to identify topics where more recent information (up to June, 2021) is included (for example, progress on corrective actions, descriptions of significant events and updates that the Commission specifically requested).

The detailed scope of the safety assessments in this regulatory oversight report is covered by the set of specific areas that constitute each SCA. They are described in more detail in *General Description of Regulatory Framework for Nuclear Power Generating Sites* [2]. The detailed information contained in reference 2 should be read in tandem with this regulatory oversight report. Note that some specific areas do not apply to Gentilly-2 and the WMFs. Therefore, they were not considered in the safety assessments for those facilities.

1.3 Nuclear facilities covered by this regulatory oversight report

Figure 1 shows the geographic location in Canada of the NPPs and WMFs which includes the type of waste stored at the WMF and the status of each reactor on-site, covered by this report. All sites are located on traditional territories of Indigenous peoples in Canada.

Canadian reactors

- Low-level waste
- ▲ Intermediate-level waste
- Spent fuel
- In-service
- In-service & refurbished
- In refurbishment
- ⊗ Safe storage

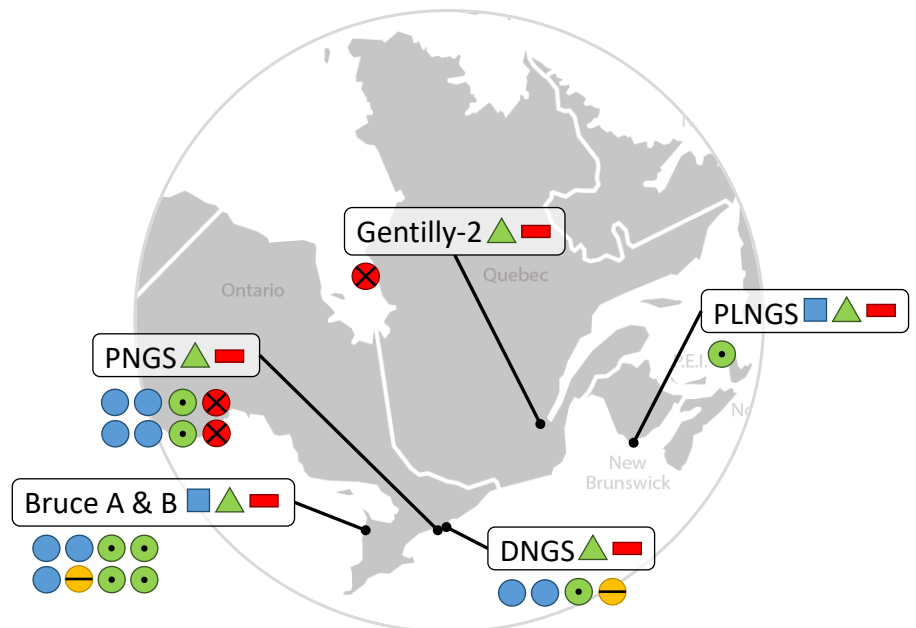


Figure 1: Locations and facilities of nuclear power generating sites in Canada

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 DNGS and DWMF are authorized under separate licences. See sections 3.1 and 3.2 for details. The site also includes the Darlington New Nuclear Project (DNNP), which is at the Licence to Prepare Site (LTPS) 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 PNGS and PWMF are authorized under separate licences. See sections 3.3 and 3.4 for details.

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 WWMF, RWOS-1 and Douglas Point Waste Facility are authorized under separate licences. See sections 3.5 and 3.6 for details. Note that the Douglas Point Waste Facility is not covered in this report, but in the *Regulatory Oversight Report for Canadian Nuclear Laboratories Sites: 2020*.

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, Quebec, and consists of CNL's Gentilly-1 Waste Facility and Hydro-Québec's Gentilly-2 Facilities. The operation of 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 in the *Regulatory Oversight Report for Canadian Nuclear Laboratories Sites: 2020*.

1.3.2 Nuclear power plants

Operating NPPs

There were 17 reactors which continued to operate in Canada throughout 2020. They are located in 2 provinces (Ontario and New Brunswick – see figure 1) and are operated by 3 distinct licensees (OPG, Bruce Power and NB Power). These NPPs range in size from 1 to 8 power reactors, all of which are of the Canada Deuterium Uranium (CANDU) 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 2020. Additional information on the NPPs and licences is provided in section 3.

Operating Performance of the Canadian Nuclear Fleet

Operable status (Average age – 25 Years)

- In service within design life
- In service / Returned to service
- Safe storage state
- In refurbishment

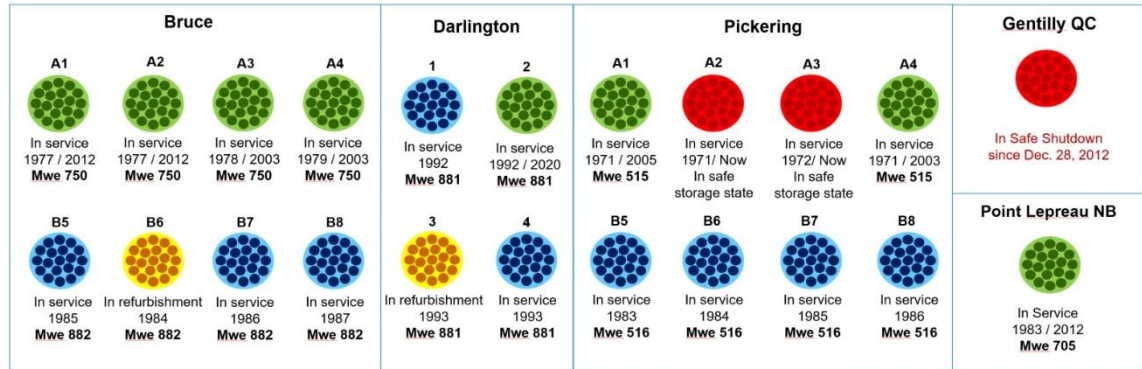


Figure 2: Basic information for all NPPs

Non-operating reactors

As indicated in figure 2, BNGS Unit 6 and DNGS Unit 3 were taken offline for refurbishment in 2020, while DNGS Unit 2 returned to service in the same year. The PNGS also includes Units 2 and 3, which remained defueled and in safe storage. They are also CANDU designs and are governed by the same PROL as the operating units.

In addition, the NPP at Gentilly-2 is shut down and is proceeding to decommissioning through preparation for the “storage with surveillance” phase. It is also a CANDU design 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 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 2020, OPG submitted an application to renew its licence (PRSL 18.00/2022), requesting the licence be renewed for a 10-year term. OPG’s application to renew the PRSL was heard at a public [Commission Hearing](#) held June 10-11, 2021. OPG has announced its intention to select a reactor technology in 2021 and submit an application for a licence to construct in 2022.

CNSC staff noted that OPG did not conduct any licence to prepare site (LTPS) activities during the current licence period. However, OPG has carried out some baseline site characterization and other long lead-time work to address selected commitments. CNSC staff assessed OPG’s application and concluded that the DNNP site remains suitable.

1.3.3 Waste management facilities

The WMFs that are included in this regulatory oversight report are licensed independently from the associated NPP. 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 licenced under a Waste Nuclear Substance Licence (WNSL).

Table 2 provides data for each WMF, including the initial start-up date, the name of the licensee, the expiry date of the licence, and the type of waste managed at each facility (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 discussed in section 1.3.1, both the Point Lepreau and Gentilly-2 sites also have WMFs that are further discussed in sections 3.7 and 3.8, respectively.

Table 2: Basic information for WMFs

Facility	Licensee	Location	Operation start	WFOL expiry	Manages
DWMF	OPG	Clarington, ON	2008	Apr. 30, 2023	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 refurbishment. L&ILW from DNGS, PNGS, and Bruce A and B NPPs operations.
RWOS-1	OPG	Tiverton, ON	Mid-1960	Oct. 31, 2029	L&ILW from Douglas Point and PNGS.

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 risk-informed regulatory approach, applying resources and regulatory oversight commensurate with the risk associated with the regulated facility and activity. Additional information on the CNSC 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 licensing basis. The licensing basis is defined in CNSC [REGDOC-3.5.3, *Regulatory Fundamentals*](#), and is comprised of the following:

(i)	the regulatory requirements set out in the applicable laws and regulations
(ii)	the conditions and safety and control measures described in the licence, and the documents directly referenced in that licence
(iii)	the safety and control measures described in the licence application and the documents needed to support that licence application

The requirements in parts (ii) and (iii) of the licensing basis are unique to each licensed facility – they depend on the content of a given licence application and the applicant’s supporting documentation. Regulations made under the [Nuclear Safety and Control Act \(NSCA\)](#), including the [Class I Nuclear Facilities Regulations](#), provide requirements on the content of licence applications for NPPs and WMFs.

Licence applications for NPPs and WMFs cite CNSC regulatory documents, CSA Group standards, and other publications, as well as the applicant’s own documentation. 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.

Appendix B lists all CNSC regulatory documents and CSA Group standards that are identified as containing compliance verification criteria in the LCHs for the NPPs and WMFs covered by this regulatory oversight report. The appendix illustrates the large number of CNSC regulatory documents and CSA Group standards that provide requirements relevant to all SCAs.

Appendix B also indicates the CNSC regulatory documents and CSA Group standards that the licensees are implementing. Details about the implementation of these publications are provided under the relevant SCAs throughout this regulatory oversight report.

In this report, CNSC regulatory documents typically start with “REGDOC”, followed by an identifying number. CSA Group standards are typically identified by “CSA N####”, where #### is the number of the publication.

Each licensee implements new CNSC regulatory documents and 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 improved requirements are implemented in a measured and 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 DNGS, and in 2018, the Commission granted Bruce Power a 10-year licence for BNGS and OPG a 10-year licence for PNGS. For operating NPPs, this longer licence is 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 a framework to systematically identify practicable safety enhancements, which are documented in an integrated implementation plan (IIP). For operating NPPs, licence conditions have been used to require the licensee to implement the IIP during the licence period and to conduct a PSR in support of the next licence renewal. A PSR is not a requirement for Gentilly-2 and the WMFs because, relative to operating NPPs, there are fewer associated hazards and the requirements change on a less frequent basis, such that the regular licensing process and implementation of CNSC regulatory documents and CSA Group standards are sufficient to assure safe, long-term 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 the establishment of offsets to compensate for any residual harm caused to fish and fish habitats after mitigation measures have been put in place. The CNSC has a [memorandum of understanding](#) (MOU) with Fisheries and Oceans Canada whereby CNSC staff are responsible for monitoring activities and verifying compliance for FAA. The Minister of Fisheries and Oceans Canada is responsible for enforcing the authorizations in the event of non-compliance.

1.4.3 Reporting

Licensees are required to provide various reports and notices to the CNSC in accordance with regulations made under the NSCA. LCHs clarify CNSC expectations for these requirements, if needed.

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; for example, quarterly reports on the safety performance indicators that are discussed in this report.

REGDOC-3.1.1 also provides detailed requirements related to the submission of other important reports (such as updates to the final safety analysis report, proposed decommissioning plan and annual environmental protection report). REGDOC-3.1.1 also requires licensees to report any unplanned situations and events to the CNSC.

For Gentilly-2, 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.

During 2020, NPP licensees reported to CNSC staff on 213 events, and submitted 90 scheduled reports. In accordance with the *General Nuclear Safety and Control Regulations*, the WMF licensee, OPG, also submitted 8 reportable events to CNSC staff that occurred at the DWMF, PWMF and WWMF.

1.4.4 Compliance verification program

The safety assessments presented in this report were based on the results of activities planned through the CNSC compliance verification program (CVP). In 2020, these activities included Type I inspections that evaluate the licensee programs, Type II inspections that evaluate the outputs and outcomes of licensee programs, field inspections that collect data on the outputs and outcomes of licensee programs, desktop inspections, technical assessments and surveillance.

Additional reactive compliance verification activities for NPPs and WMFs are added as needed. These focus on site-specific matters and known or potential licensee challenges. CNSC staff then validate the annual plans by using a risk informed approach that considers the status, performance history, and conditions and challenges of each facility to ensure appropriate regulatory oversight and safety performance evaluation. Additional compliance verification activities for NPPs and WMFs may also be added as necessary during the year in response to new or emerging licensee challenges. The goal is to ensure that the CVPs for NPPs and WMFs are always timely, 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. Data for 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, which are assigned to their respective SCAs and assessed against a set of high-level performance objectives for the SCAs, as well as the detailed regulatory requirements and CNSC staff performance expectations. 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.2 for a description of the rating methodology used for this regulatory oversight report.

In generating the ratings, CNSC staff considered 1,508 findings for NPPs and WMFs.

All of these findings were assessed as being either compliant, negligible or of low safety significance. In other words, they had either a positive, insignificant, or small negative impact on safety within the specific area.

For the Bruce A and B, Darlington and Pickering sites, the NPP and WMF are rated 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).

1.4.6 Update on CNSC Covid-19 Response and NPP Oversight

On March 15, 2020, the CNSC activated the Business Continuity Plan (BCP) in response to the COVID-19 pandemic. Effective March 16, 2020, all CNSC staff in Ottawa and at regional and site offices were directed to work from home. CNSC management immediately suspended all regular NPP compliance verification activities and identified activities that were considered critical in order to support continued safe power reactor operation and regulatory decision making in relation.

In April 2020, a new procedure to plan and conduct compliance verification activities at NPPs during the COVID-19 pandemic was approved to ensure continued regulatory oversight. This procedure was utilized during the calendar year 2020 and will be used until normal compliance processes resume.

It provides direction for the conduct of oversight activities both remotely and on-site, as well as direction on revising the annual compliance plan for this fiscal year.

The procedure provides a framework for conducting remote oversight activities, and enhancing the number and capabilities of site inspectors to work remotely.

CNSC staff have worked with licensees to provide comprehensive and remote access to site information systems, actual plant data and participation in all key plant management meetings.

In addition to this new procedure, a pandemic-related Pre-Job Brief was developed as additional instructions to be delivered by the site office supervisors to site inspectors prior to performing on-site oversight activities. Provision of personal protective equipment (PPE) to site inspectors prior to any on-site activities forms part of this Pre-Job Brief.

In May 2020, on-site oversight activities resumed at NPPs in a modified capacity. These activities focused on general health and safety issues (e.g., control of combustible material, housekeeping, contamination posting), as well as licensee adherence to their pandemic response plans and COVID-19 health protocols. The CNSC has made adjustments to the way oversight is conducted, such as utilizing remote video-conferencing to assure the presence of specialists during inspections can continue and conducting the documentation portion of an inspection via desktop inspection. All licensee safety and health procedures are being followed by CNSC site inspectors. CNSC staff continue to conduct oversight activities during the COVID-19 pandemic to ensure the protection of the environment, and the health and safety of people.

2 GENERAL AND SUPPORTING INFORMATION

This section provides information, organized by Safety and Control Area (SCA), which serves as background for the assessments in section 3. In some cases, it describes and assesses data and issues that are applicable to more than 1 facility. The sub-sections are organized according to the specific areas of each SCA, although some specific areas are omitted if there is no new information. A similar approach was adopted for the sub-sections under section 3. General information about the SCAs and the applicability of the specific areas is provided in the *General Description of Regulatory Framework for Nuclear Power Generating Sites* [2].

2.1 Management system

Safety culture

In April 2018, CNSC published [REGDOC-2.1.2, Safety Culture](#) which contains requirements applicable to Nuclear Power Plants (NPPs), Uranium Mines and Mills (UMMs) and other Class I nuclear facilities, including the Ontario Power Generation (OPG) Waste Management Facilities (WMFs). This regulatory document also contains guidance for the above mentioned licensees and for all other CNSC licensees. Requirement 1 “Fostering safety culture” is applicable to all Class I licensees (including NPPs and OPG WMFs). Requirement 2 “Assessing safety culture” is applicable only to NPPs.

NPP licensees provided implementation plans for REGDOC-2.1.2 in 2019; in OPG’s case, these plans also covered their WMF licences. OPG and Bruce Power updated governance documents to reflect compliance with REGDOC-2.1.2, including security culture in 2020. NB Power has committed to updating its governance to meet the requirements of REGDOC-2.1.2 by August 31, 2021. As part of their implementation work, OPG, Bruce Power and NB Power committed to conduct their next self-assessments in accordance with REGDOC-2.1.2. Additionally, OPG and Bruce Power have implemented safety culture monitoring panels following the guidance provided by the Nuclear Energy Institute.

Hydro-Québec submitted its implementation plan for REGDOC-2.1.2 and it was accepted in February 2020. Hydro-Québec has committed to continuing to foster a healthy safety culture but is exempt from the requirement to assess safety culture, as the reactor is in a safe shut down state.

Business continuity

The Licence Conditions Handbooks (LCHs) for the NPPs include a requirement for licensees to maintain a Business Continuity Plan (BCP). The licensees must maintain contingency plans to provide for essential services through a sustained period with significant employee absenteeism. In response to the COVID-19 pandemic, all NPP licensees implemented their BCPs.

All NPP licensees took measures to ensure that the minimum shift complement is not compromised by the COVID-19 pandemic, such as:

- Ensuring that all non-essential personnel work from home
- Cancellation of vacation requests
- Restricted access to the plant, especially the Main Control Room (MCR)
- Closing several buildings on-site to allow for cleaning crews to focus on more critical infrastructure
- Staggering shift changes to minimize the number of staff in the same area
- Switching rooms for shift turn-over meetings to allow for greater social distancing and using thermal imaging cameras to monitor staff on-site

All NPP licensees initially delayed major activities in order to minimize the number of personnel/contractors on-site. Outages continued to be planned for critical periodic inspections. However, a major part of that decision is to ensure that they complete the relevant inspection and collect data to demonstrate continued fitness for service to the CNSC. All rescheduled activities have maintained adequate safety margins and were able to demonstrate the acceptable level of fitness for service.

Overall, licensees are adequately prepared with their plans for events involving labour and pandemic actions.

2.2 Human performance management

Human performance program

All NPPs and OPG WMFs have implemented human performance programs that meet CNSC requirements. CNSC inspection activities in 2020 indicate that licensees have developed human performance programs using a systematic approach including consideration for the interplay between humans, technology and the organization to support worker performance.

Personnel training

The CNSC requires all NPPs and OPG WMFs to use training systems that are based on the principles of a systematic approach to training (SAT) and adhere to regulatory requirements identified in CNSC [REGDOC 2.2.2, *Personnel Training*](#) and CSA N286-12, *Management system requirements for nuclear facilities*, section 4.5.2.

Compliance verification activities conducted in 2020 confirm that implementation of these training systems at each facility meets regulatory requirements.

Personnel certification

The CNSC requires NPP licensees to employ certified shift supervisors, shift managers, reactor operators and responsible health physicists. Due to the design of Bruce Nuclear Generating Station (BNGS) A, BNGS B and Darlington Nuclear Generating Stations (DNGS), the CNSC requires these licensees to also employ certified Unit 0 operators (U0O). It should be noted that Gentilly-2 no longer employs certified shift workers, and therefore responsible health physicists (“responsables techniques de radioprotection”) are the only remaining certified workers at the Gentilly-2 NPP.

Table 3 below shows the number of certified personnel who are available in the certified positions at each NPP, as of December 31, 2020. 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 3: Number of available certifications per NPP and certified positions for 2020

Station	Reactor operator	Unit 0 operators ^a	Shift supervisor ^b	Health physicist	Total
Darlington Nuclear Generating Station					
Actual	63	15	28	4	110
Minimum	30	10	10	1	51
Pickering Nuclear Generating Station 1, 4 ^c					
Actual	40		18	2	60
Minimum	20		10	1	31
Pickering Nuclear Generating Station 5–8					
Actual	62		23	2	87
Minimum	30		10	1	41
Bruce Nuclear Generating Station A ^d					
Actual	51	22	28	3	104
Minimum	30	10	10	1	51
Bruce Nuclear Generating Station B					
Actual	63	21	27	3	114
Minimum	30	10	10	1	51
Point Lepreau Nuclear Generating Station					
Actual	10		9	2	21

Station	Reactor operator	Unit 0 operators ^a	Shift supervisor ^b	Health physicist	Total
Minimum	6		6	1	13
Gentilly-2^e					
Actual				2	2
Minimum				1	1

- There are no Unit 0 positions at PNGS Units 1 and 4 and Units 5–8, or Point Lepreau.
- At multi-unit NPPs, the shift supervisor number is the total of certified shift managers plus certified control room shift supervisors.
- There are 2 certified health physicists in all at Pickering, who cover both PNGS Units 1 and 4 and Units 5–8.
- There are 4 certified health physicists in all at Bruce, who cover both Bruce A and Bruce B.
- There are no reactor operators, U0Os or shift supervisors at Gentilly-2.

As for Initial certification examinations and requalification tests, as noted above, health physicists are the only certified personnel employed at Gentilly-2. Since CNSC staff administer the initial examinations and requalification tests of the health physicists for Hydro-Québec, this specific area does not apply to Gentilly-2. There are no certified staff at the WMFs.

Work organization and job design

All NPP licensees have a documented minimum shift complement (MSC), 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 manual tracking mechanisms to record the availability of staff as they enter and exit the facility.

In 2020, licensees reported no MSC violations at the DNGS, 3 violations at the Pickering Nuclear Generating Station (PNGS), 4 violations at BNGS A and B and 2 violations at Point Lepreau Nuclear Generating Station (PLNGS). 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.

Fitness for duty

CNSC oversight of fitness for duty includes assessing licensee measures related to managing worker fatigue, managing alcohol and drug use, and minimum requirements for medical, physical and psychological certificates for nuclear security officers.

Managing worker fatigue

All NPP and OPG WMF licensees, as well as Gentilly-2 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), a term which includes NPPs and OPG WMFs, with the aim of minimizing the potential for errors that could affect nuclear safety and security. OPG, Bruce Power and Hydro-Québec implemented this regulatory document in 2019.

CNSC staff compliance verification activities took place in 2020 to confirm compliance with REGDOC-2.2.4.

NB Power planned to implement REGDOC-2.2.4 by 2020 for normal operations and 2022 for outages. However, as a result of challenges related to the COVID-19 pandemic, NB Power requested an extension to their implementation for normal operations to March 2021 which was accepted by CNSC staff. NB Power's commitment to implement the regulatory document for outages in 2022 was unaffected. NB Power's plan involved expanding its security and emergency response team staff (from a 5 to a 6 crew format working on a 42-day shift cycle, which would match its operations staff). CNSC staff compliance verification activities took place in 2020 to confirm NB Power complied with their procedures for managing worker fatigue.

UPDATE: NB Power submitted updates to their two hours of work procedures in March 2021 as part of the implementation of [REGDOC-2.2.4 *Fitness for Duty: Managing Worker Fatigue*](#). CNSC staff met with NB Power to seek clarification of the changes and request a gap analysis. The gap analysis was provided by NB Power and additional updates to the procedures were submitted. A review of the updated procedures by CNSC staff is in progress.

Managing alcohol and drug use

[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 High Security Sites (HSS). All licensees of HSS provided implementation plans early in 2018, which were accepted by CNSC staff. In late 2018, OPG, Bruce Power and NB Power requested an amendment to include oral fluid testing to supplement the urinalysis testing required by the regulatory document. OPG, Bruce Power and NB Power requested a change to their implementation dates, proposing to implement REGDOC-2.2.4 Volume II within a period following the date of its amendment (or from the date it is determined that it will not be amended). The licensees proposed, specifically, to implement the requirements other than random testing within 6 months of that date and to implement random testing within 12 months of that date. CNSC staff reviewed and accepted the request and began work in 2019 to revise REGDOC-2.2.4 Volume II. The amendment was presented to the Commission on November 5, 2020 and approved for publication and use. The new version (version 3) was published on January 22, 2021. Hydro-Québec implemented version 2 of REGDOC-2.2.4 Volume II in July 2019, and have been requested to conduct a gap analysis and provide an implementation plan for version 3.

Nuclear security officer medical, physical and psychological fitness

Licensees are required to ensure that all nuclear security officers have medical, physical and psychological certificates that meet CNSC's requirements. CNSC [REGDOC-2.2.4, Fitness for Duty, Volume III: Nuclear Security Officer Medical, Physical and Psychological Fitness](#) sets out the expectations and minimum requirements for medical, physical and psychological certificates for nuclear security officers. All licensees committed to implement the document by December 31, 2020. Inspections to verify compliance are being planned, with the first at PLNGS scheduled for September 2021.

2.3 Operating performance

Conduct of licensed activity

There were 17 reactors which continued to operate in Canada throughout 2020, along with the WMFs at the same sites. Unit 2 at DNGS returned to service during 2020 following refurbishment, while Unit 3 was shut down to facilitate refurbishment. Unit 6 at Bruce was also shut down in 2020 to facilitate refurbishment.

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

Table 4 summarizes the number of unplanned transients for the operating NPPs caused by stepbacks, setbacks and reactor trips, where the trip resulted in a reactor shutdown. Stepbacks and setbacks are power changes intended to eliminate potential risks to plant operations. Reactor trips are reductions initiated by any of a reactor's safety circuits to rapidly shutdown the reactor. "Industry total" provides the data for the operating NPPs as a whole. In 2020, 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 4: Number of unplanned transients

NPPs	Number of operating reactors ³	Number of hours of operation	Unplanned reactor trips ¹	Step backs	Set backs	Total unplanned transients	Number of trips per 7,000 operating hours
DNGS	3	28,944	0	3	4	7	0.00
PNGS 1, 4	2	10,814	0	n/a ²	0	0	0.00
PNGS 5–8	4	31,241	0	0	3	3	0.00

NPPs	Number of operating reactors ³	Number of hours of operation	Unplanned reactor trips ¹	Step backs	Set backs	Total unplanned transients	Number of trips per 7,000 operating hours
BNGS A	4	31,762	1	6	1	6	0.22
BNGS B	3	22,987	0	3	2	5	0.0
PLNGS	1	7,302	0	0	0	0	0.00
Industry total	17	133,052	1	10	10	21	0.05

Notes:

- 1 This includes automatic reactor trips only; it does not include manual reactor trips or trips during commissioning testing.
- 2 Stepbacks are not a design feature at PNGS Units 1 and 4.
- 3 DNGS Units 2 and 3 were down for refurbishment at different times, but never overlapping.

Figure 3 shows the total number of unplanned transients from 2016 to 2020 for the operating NPPs

Figure 3: Trend of unplanned transients for stations and industry

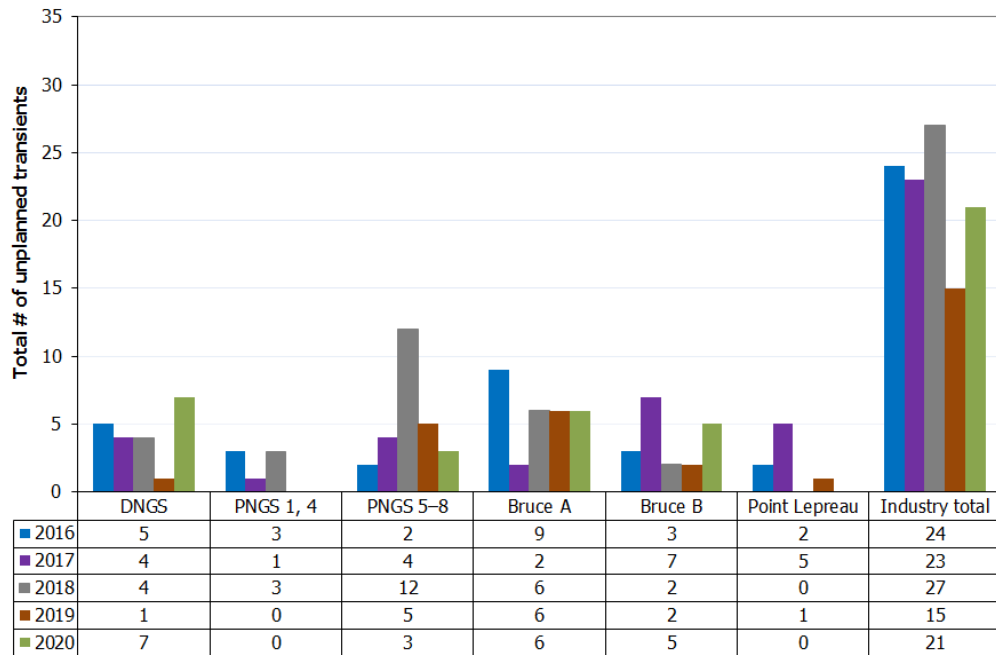
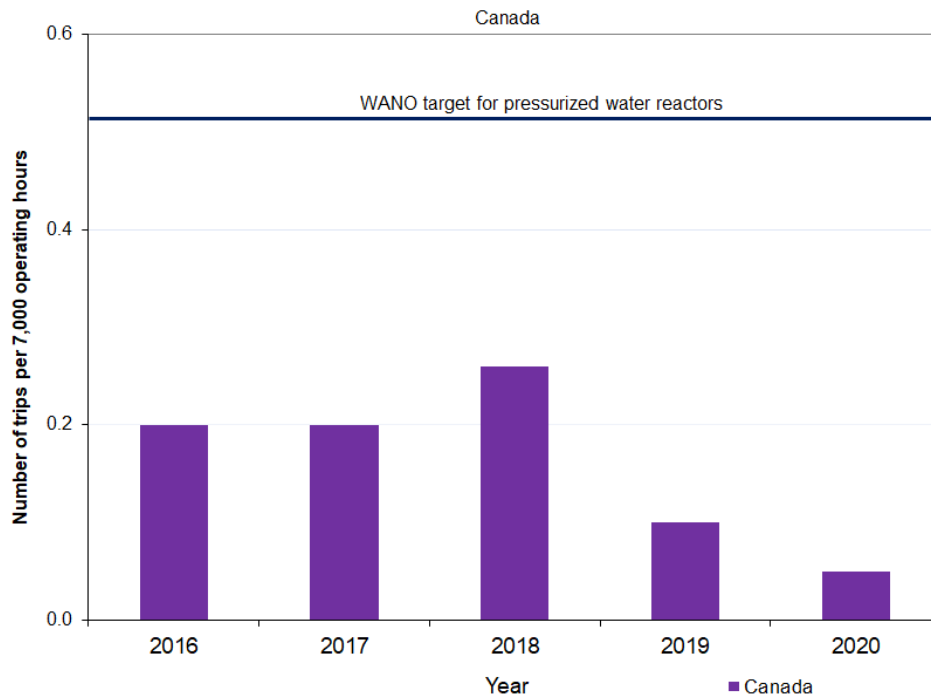


Figure 4 compares the number of unplanned reactor trips for Canada's operating NPPs per 7,000 hours of operation, which is a measure used by the World Association of Nuclear Operators (WANO). This WANO indicator is defined as the number of unplanned automatic scrams (reactor protection system logic actuations)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

- The pressurized heavy water reactors (PHWR) individual target (which is the target for each of the 17 individual operational units) is 1.5 trips per 7,000 hours critical. All units in Canada met this target in 2020.
- The PHWR industry target (which is the equivalent industry total trips per 7,000 hour 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



Outage management performance

CNSC staff confirmed that forced outages and outage extensions were managed safely and in accordance with the applicable regulatory requirements. CNSC staff informed the Commission of unplanned outages resulting from reactor trips and their outcomes via status reports on NPPs in 2020.

At each unit's planned outage in 2020, CNSC staff conducted compliance verification activities and determined that regulatory requirements were met and outages are executed safely. All planned and unplanned (forced) outages were carried out appropriately by licensees' staff.

Safe operating envelope

CNSC staff determined that all licensees had adequate safe operating envelope (SOE) programs in 2020 that were based on the requirements of CSA N290.15-10 *Requirements for the safe operating envelope of nuclear power plants*.

All licensees have in place a hierarchy of governance, standards, processes and procedures to support producing, updating and maintaining SOE-related documentation. CNSC staff also concluded that all licensees operated within the SOE in 2020.

Severe accident management and recovery and Accident management and recovery

[REGDOC-2.3.2, *Accident Management*, Version 2](#) provides updated regulatory requirements for accident management at reactor facilities.

CNSC staff have reviewed OPG's written notification concerning the changes to their revised Beyond Design Basis Accident (BDBA) management as required by PNGS and DNGS LCHs. CNSC staff performed an assessment to confirm if the document changes remain within the licensing basis. REGDOC-2.3.2 defines the requirements for OPG's BDBA management, which is specifically intended to provide a framework (Emergency Mitigating Equipment Guides and Severe Accident Management Guides) for identifying appropriate mitigating actions for events that are or have the potential to progress to a severe accident. CNSC staff determined that the proposed changes once applied by OPG are consistent with the licensing requirements in the PNGS and DNGS LCHs, and REGDOC-2.3.2.

UPDATE: In March 2021, OPG applied the changes to the OPG BDBA management standard.

2.4 Safety analysis

Deterministic safety analysis

In 2020, the NPP licensees continued their safety analysis improvement programs, which are linked to the ongoing staged implementation of [REGDOC-2.4.1, *Deterministic Safety Analysis*](#). CNSC staff were satisfied with the progress in 2020 and provided recommendations to the licensees on their ongoing safety analyses improvements.

Aging of a reactor affects certain characteristics of the heat transport system, which can result in a gradual reduction of safety margins. Therefore, compensatory measures are implemented to mitigate the impact of aging when needed. The structures, system and components (SSCs) of a reactor are affected by aging simultaneously and to different degrees. As such, the overall safety case of an NPP needs to be periodically assessed and the existing safety margins quantified.

Important parameters related to the safety analysis of reactor aging are systematically monitored by an aging management program put in place by the licensees. Details for each facility are provided further in section 3.

Probabilistic safety assessment

The regulatory document REGDOC-2.4.2, [Probabilistic Safety Assessment \(PSA\) for Nuclear Power Plants](#), version 2 was introduced in the Licensees' LCH with an implementation plan for compliance. This regulatory document replaced S-294, *Probabilistic Safety Assessment (PSA) for Nuclear Power Plants*:

- PLNGS has been compliant with REGDOC-2.4.2 since 2016.
- BNGS A and BNGS B completed its PSA submissions in compliance with REGDOC-2.4.2, in June 2019. CNSC staff review is ongoing and will be completed by end of 2021.
- PNGS completed its transition to REGDOC-2.4.2 compliance in 2020. CNSC staff completed their verification concluding that the PNGS was compliant with REGDOC 2.4.2 in 2020.
- DNGS completed the submission of the PSA for compliance with REGDOC-2.4.2 in 2020. CNSC staff review is ongoing and will be completed by end of 2021.

As part of their submissions, OPG and Bruce Power have addressed the additional requirements outlined in REGDOC-2.4.2 beyond S-294 requirements, such as consideration of multi-unit impacts, combinations of hazards, plant operational states other than the at-power and shutdown states, and the consideration of other radioactive sources including the irradiated fuel bay.

Table 5 summarizes the status of PSAs at the operating NPPs in 2020.

Table 5: Status of PSAs and reviews

PSA submission	DNGS	PNGS 1, 4	PNGS 5–8	BNGS A	BNGS B	PLNGS
Last PSA report received	2020	2020	2020	2019	2019	2016
Review status	Ongoing †	Completed	Completed	Ongoing †	Ongoing †	Completed
Next PSA report expected	2025	2023	2022	2024	2024	2021
REGDOC-2.4.2 Compliance	2020	2020	2020	2019	2019	2016

† CNSC staff review will be completed during 2021.

In addition to addressing the new requirements in REGDOC-2.4.2, NPP licensees have also worked collaboratively to address direction from the Commission to OPG (associated with the renewal of the operating licence for the PNGS in 2013) to develop an approach for whole-site PSA. Whole-site PSA involves estimating aggregate risk for sites with multiple reactors and other radioactive sources.

OPG provided the result of the DNGS aggregated whole-site risk for Large Release Frequency in [CMD 15-H8.1](#), in 2015. OPG also submitted the whole-site PSA for PNGS in 2017. Bruce Power submitted its whole-site PSA methodology in 2018 and submitted the aggregated risk values for whole-site PSA for BNGS A and B in April 2019.

CNSC staff engaged in international projects on Site-Level PSA and risk aggregation with the International Atomic Energy Agency (IAEA) and Nuclear Energy Agency (NEA) (2016 – 2019). The completion of these 2 projects showed there is no international consensus on risk aggregation, and the completion of both the NEA and IAEA projects reaffirmed that the scope of risk aggregation is highly dependent on the regulatory requirements, as well as on the intended uses and applications of the PSA [RIB 8504].

Therefore, CNSC staff reiterate their position with regard to risk aggregation which remains as stated in Section 4.2.2 guidance of REGDOC-2.5.2:

“It is recognized that when the risk metrics for external events are conservatively estimated, their summation with the risk metrics for internal events can lead to misinterpretation. Should the aggregated total exceed the safety goals, conclusions should not be derived from the aggregated total until the scope of the conservative bias in the other hazards is investigated”.

Severe accident analysis

CNSC staff completed the review of OPG’s submission requesting CNSC acceptance for the use of computer code, MAAP-CANDU v5.00a for PSA in accordance with CNSC regulatory document REGDOC-2.4.2. This request is made according to DNGS and PNGS LCHs under the compliance verification criteria of licence condition 4.1 (Safety Analysis Program). CNSC staff concluded that OPG provided sufficient information to support accepting the use of version 5.00a of MAAP-CANDU in their PSAs.

OPG developed a software package to estimate the source term and doses to members of the public following a reactor accident. CNSC staff assessed the adequacy of calculation assumptions, appropriateness of the input data, and ensured the software package met the required Quality Assurance documentation based on CSA N286.7, *Quality Assurance of Analytical, Scientific, and Design Computer Programs*.

Additionally, CNSC staff completed review of an OPG submission requesting acceptance of an updated computer code used for PSA, in accordance with CNSC regulatory document REGDOC-2.4.2. CNSC staff concluded the use of the updated computer code is acceptable.

CNSC staff completed the review of NB Power’s technical assessment requesting acceptance of the use of MAAP5-CANDU v5.00 for Level 2 PSA and concluded that NB Power provided sufficient information to support accepting the use of MAAP5-CANDU v5.00 for their PSA projects in accordance to CSA N286.7. This NB Power request was made in accordance with licence condition 4.1 (Safety Analysis Program) of PLNGS LCH.

Management of safety issues (including R&D programs)

CNSC staff continue to monitor the management of CANDU Safety Issues (CSIs) by licensees of operating NPPs to ensure timely and effective implementation of plant-specific safety improvement initiatives and risk control measures.

CNSC staff have assessed the status update for the CSI AA3 Computer Code and Plant Model Validation program for all licensees and determined that the CNSC comments on the code validation and accuracy estimation guidelines are properly addressed and implemented in the revised versions of both guidelines. CNSC staff have noted that some progress on the code applicability assessment has been made; however, more validation work is needed to continue to evaluate modeling uncertainties and the code accuracies pertinent to better analyzing postulated accident scenarios. CNSC staff completed the review of OPG's submission related to the CSI IH6, Piping Inspection Results for PNGS as requested by CNSC staff. Based on the submission review and OPG's follow-up clarifications to CNSC staff questions, CNSC staff were satisfied with OPG's inspection results obtained from additional inspection points in the 3 non-nuclear High Energy Lines (HELs) inside the Reactor Building (RB). CNSC staff will monitor OPG's implementation of these new inspection points, through compliance verification activities related to OPG's Periodic Inspection Program. Furthermore, the Integrated Implementation Plan (IIP) was kept open to track OPG's completion of the conditions associated to the conditional re-categorization of CSI IH6 from category 3 to category 2 for PNGS Units 1-4. For PNGS Units 5-8, the CSI IH6 was re-categorized from category 3 to category 2 in 2018.

In 2019, CNSC staff accepted Bruce Power's analysis methodology and results demonstrating that the frequency of pipe breaks larger than the threshold break size (TBS) for BNGS reactors is in the frequency band associated with BDBAs. Bruce Power's request for the re-categorization of the 3 large Loss of Coolant Accident (LOCA) CANDU Safety Issues (AA9, PF9 and PF10) from Category 3 to Category 2 was also accepted, given the demonstrated low likelihood of the large breaks. Subsequently, in January 2020, Bruce Power submitted a revised Large Break Loss of Coolant Accident (LBLOCA) safety analysis using realistic conditions for breaks above TBS, and requested that CNSC staff reclassify breaks above the TBS as BDBA events. CNSC staff have determined that Bruce Power's submission established a generally acceptable approach for safety analysis of LBLOCA events above the TBS. Given the demonstrated low likelihood of breaks above the TBS and the corresponding low risk, in August 2020, CNSC staff accepted Bruce Power's request to reclassify breaks above the TBS from DBA to BDBA. CNSC staff review of Bruce Power's LBLOCA safety analysis is ongoing. OPG has informed CNSC staff that they intend to use the same methods developed by Bruce Power in their next LBLOCA safety analysis submissions for their NPPs.

The industry continues to develop methodology to address the LBLOCA CSI's, which industry termed the Composite Analytical Approach (CAA). Through an industry-wide agreement, Bruce Power is taking the lead in the development and implementation of probabilistic analysis techniques for break frequency of large diameter heat transport piping.

In 2020, CNSC staff continued to undertake systematic evaluations to confirm that the industry maintains or has access to a robust Research & Development (R&D) capability to address emerging issues and enhance knowledge and confidence in safety provisions in key areas.

All licensees submitted their 2020 CANDU Owners Group (COG) R&D Annual Reports, which included:

- The annual COG R&D program overview reports and operational plans and;
- The multi-year strategic plans and capability maintenance reviews

2.5 Physical design

Design governance

NPP and WMF licensees as well as Gentilly-2 continuously maintain a Fire Hazard Assessment and update the assessment periodically to reflect changes and modifications in the plant. In addition, licensees implement various fire protection measures that identify, minimize, monitor and control fire hazards within the plant on an ongoing basis supported by various policies and procedures.

System design

In 2020, CNSC staff confirmed that the licensees' electrical power systems (EPSs) and instrumentation and control (I&C) functioned as required.

Components design

Licensees of operating NPPs have mature fuel design and inspection programs.

Over the past several years, operating NPPs have experienced challenges related to fuel performance (such as fuel defects or fuel bundle vibrations). However, licensee fuel programs and personnel have adequately managed these challenges and have mitigation strategies in place or in development. CNSC staff continued to monitor the status of the mitigation strategies and were satisfied with the industry's management of these issues in 2020. Regulatory limits for fuel bundle and fuel channel power were met by all licensees throughout this period.

The licensees of operating NPPs have cable condition monitoring and surveillance programs in place which are verified through compliance verification activities to ensure their effectiveness. CNSC staff are satisfied with industry's management of these programs. CNSC staff will continue to monitor these programs to ensure safe and reliable operations.

2.6 Fitness for service

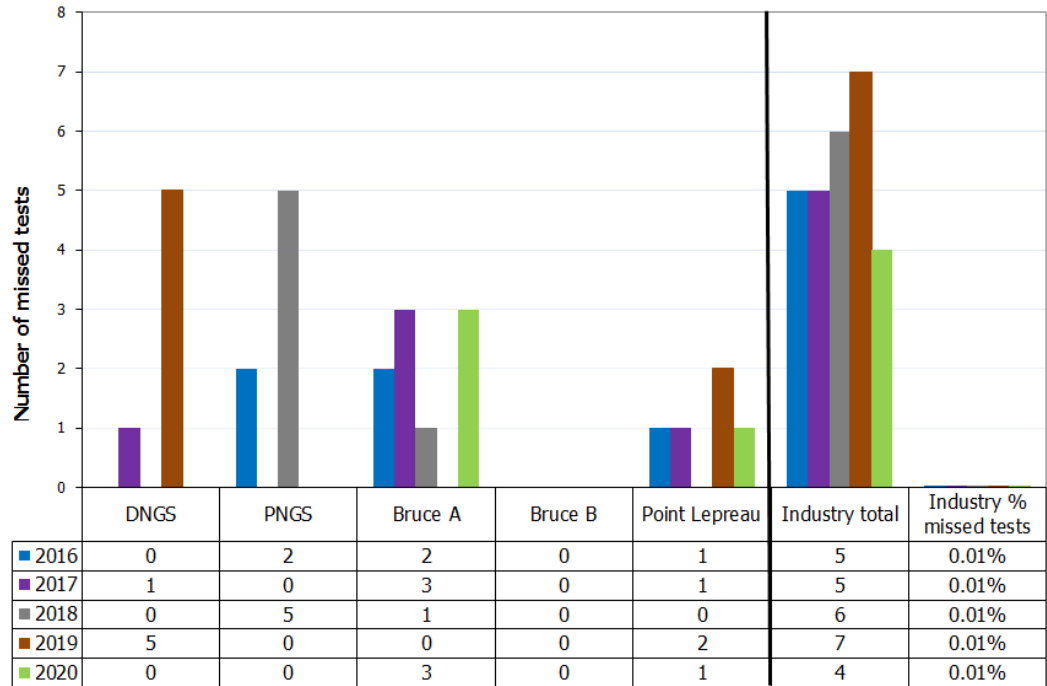
Equipment fitness for service / equipment performance

Overall, the special safety systems (SSSs) performed well in 2020 and met their unavailability targets, with some exceptions as outlined in section 3.

The number of total missed safety system tests remained very low in 2020. In all, 43,333 tests were performed and the percentage of missed tests was 0.01%. 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 indicates that 2 special safety tests were not fully completed before the due date. Since no deferral was processed, the tests were categorized as missed. However, upon identifying the situation, the tests were completed successfully by Bruce Power. No safety impact resulted from these missed tests.

Table 6: Safety system test performance for 2020

Nuclear power plant	Number of annual planned tests	Safety system tests not completed				Percent not completed
		Special safety systems	Standby safety systems	Safety-related process systems	Total	
DNGS	9,374	0	0	0	0	0.00
PNGS	12,486	0	0	0	0	0.00
BNGS A	9,967	2	1	0	3	0.03
BNGS B	7,171	0	0	0	0	0.00
PLNGS	4,335	0	1	0	1	0.002
Industry total	43,333	2	2	0	4	0.01

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

In 2016, OPG initiated a joint fuelling machine reliability project with NB Power through COG with the aim to prevent premature failures of fuelling machine ram seals. OPG has completed installation of new seals (replacement) for several PNGS fuelling machine rams (Unit 5 East, Unit 5 West, Unit 7 East and Unit 8 East, and Unit 8 West). Other fuelling machine rams at PNGS have scheduled seal replacement dates and/or are being monitored on an ongoing basis. Seal replacements improve fuelling machine reliability. While this is an operational issue rather than a safety issue, the Commission previously requested updates on improved fuelling machine reliability [RIB 17557 (item iii)].

Maintenance

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 91% in 2020. This ratio was slightly lower than the 94% of the 2019 industry average mainly due to the COVID-19 pandemic impact on the first quarter scheduling of preventive maintenance work in Bruce Power (see section 3.5.6). However, this ratio was still higher than 90% of CNSC expectations. Therefore, 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 3 performance indicators continuously decreased or were kept low in 2020. Overall, CNSC staff were satisfied with the progress in 2020.

The current levels of the maintenance backlogs and deferrals for critical components for the NPPs represent a negligible risk to the safe operation of the NPPs.

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

Performance indicator	Average quarterly work orders per unit in 2018	Average quarterly work orders per unit in 2019	Average quarterly work orders per unit in 2020	Three-year trending
Corrective maintenance backlog	1	1	1	Steady
Deficient maintenance backlog	16	9	4	down
Deferrals of preventive maintenance	4	2	2	down

Aging management

Pressure tubes and fuel channels – Overall performance

With respect to the pressure tubes in operating NPPs, overall, CNSC staff were satisfied that the life cycle management plans (LCMPs) reflected sound aging management. CNSC staff also continued to review the results from fuel channel inspections that occurred routinely during planned outages in 2020. Where concerns were identified, CNSC staff requested additional supporting information, or in some cases imposed restrictions on operation to ensure that appropriate margins were maintained. CNSC staff are satisfied that operational safety has been demonstrated up to the imposed restrictions. Licensees will have to perform additional work to confirm safe operation of the pressure tubes beyond the established operating limits. CNSC staff confirmed that no new flaw-initiation mechanisms were identified.

CNSC staff were satisfied with the licensees' work to ensure that fuel channel spacers continued to perform their design function.

CNSC staff have enhanced regulatory oversight for licensees' activities to assess and manage the aging of fuel channels for units entering periods of extended operation. The equivalent full power hour operating targets for the extended operation of pressure tubes in the existing licences are based on the current knowledge concerning the rates of change of dimensions and material properties. Licensees are required to monitor the rates of change to confirm that they can safely meet those targets. Licensees are not permitted to operate tubes that do not satisfy safety margins regardless of the operating target specified in a licence.

Recent developments and research in aging management

The licensees demonstrate the ability to maintain safe operations through assessments of the current and expected conditions of the pressure tubes, basing the assessments on an understanding of relevant degradation mechanisms. Research activities as well as inspection and maintenance programs provide data to periodically validate the input parameters for these assessments.

The current revision of the cohesive zone model being used by licensees is only valid for hydrogen equivalent (Heq) concentrations below 120 ppm because of the limitations of the data available at the time it was developed. An additional limitation of 80 ppm Heq concentration was placed on use of the model for front end pressure tube material to account for burst test results performed on pressure tube material from this region. Licensees have made progress over the last year to develop a new fracture toughness model that will incorporate front end material and hydrogen equivalent concentrations above 120ppm. Industry intends to submit this new revision of the fracture toughness model in 2021.

The licensees must seek CNSC staff concurrence for PNGS or Commission approval for BNGS A and BNGS B to operate any pressure tube beyond 120 ppm Heq. Details on the current and anticipated future fuel channel conditions and validity of the fracture toughness model for the NPPs in Ontario are provided in appendix C.

In 2020, CNSC staff actively monitored the industry's progress in research activities to ensure that licensees have sufficient understanding of degradation issues to safely operate pressure tubes, especially those planned for extended operation. Specifically, CNSC staff monitored the fuel channel life confirmation project, which included the following activities in 2020:

- Research focusing on the fracture toughness of front end pressure tube material and changes in toughness occurring as Heq levels exceed 120 ppm
- Collection of additional pressure tube burst-test data, supporting development of a revised version of the fracture toughness model
- Continued development of assessment methodologies:
 - The first probabilistic fracture protection (PFP) assessments were submitted by OPG Darlington and Bruce Power (fracture protection assessments confirm that a pressure tube will continue to meet its design intent if an undetected crack is subject to design basis pressure/temperature transients)
 - A fully deterministic approach for assessing the risk of cracking due to hydrided region overload (that is, when a hydrided area is exposed to greater stress than existed when it was initially created)
- Continued development of an industry-standard set of fitness for service guidelines for Inconel X-750 (a.k.a. “tight-fitting”) annulus spacers

Overall, CNSC staff were satisfied with the licensees' work to demonstrate and support the safe operation of pressure tubes in the near- and medium-terms.

Chemistry control

Figures 6 and 7 show the values of both indices (SPI-19 and SPI-20 in REGDOC-3.1.1) for operating NPPs from 2016 to 2020. Based on these values, CNSC staff determined that chemistry control was acceptable for all licensees. The comparatively low results for the chemistry compliance index for BNGS A and B (Figure 7) were due to a continued downward trend in moderator (heavy water [D₂O]) isotopic purity for all units. However, there was no impact on the safe operation of BNGS A and B, and safety system functions were not impaired. Bruce Power continues to apply corrective actions to bring the moderator isotopic within specification.

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

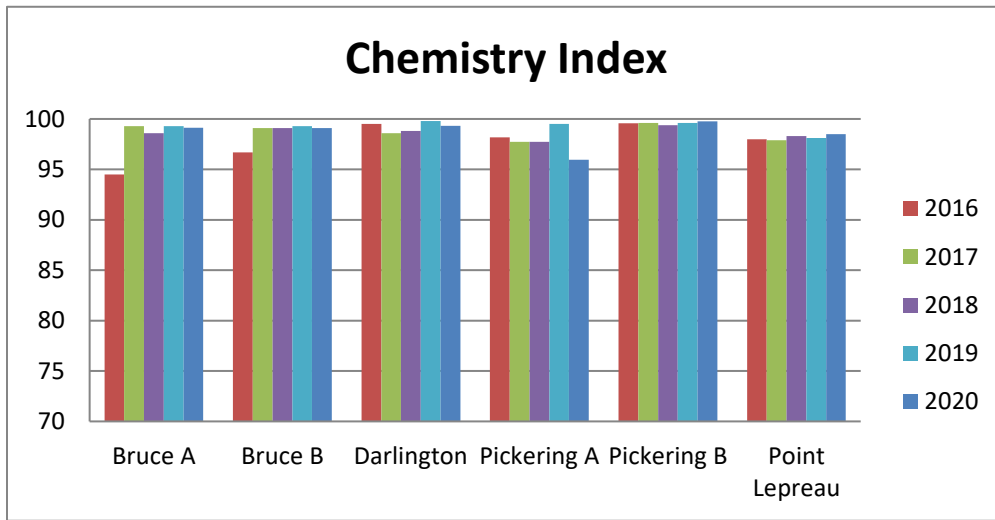
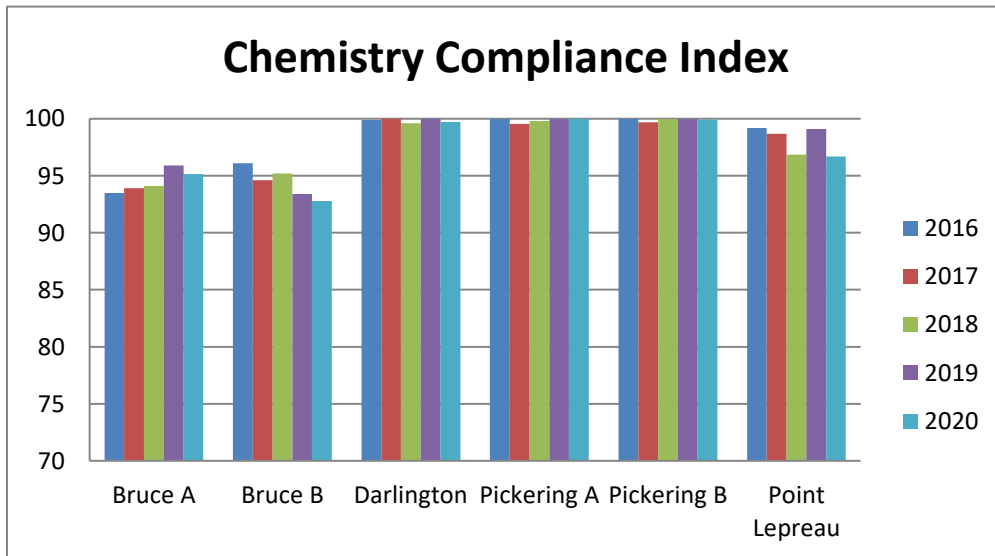


Figure 7: Trend of chemistry compliance index for industry (in percentage)



Periodic inspections and testing

The licensees are updating their periodic inspection programs to comply with CSA N285.7, *Periodic Inspection and CANDU Nuclear Power Plant Balance of Plant Systems and Components*. N285.7 will be adopted as compliance verification criteria in the future for all operating NPPs except PNGS.

Implementation of a program for N285.7 is not practical for PNGS, given the planned shutdown in 2024. If operation of PNGS beyond 2024 is considered, then the need for implementation of N285.7 will be re-evaluated. Furthermore, CNSC staff will apply experience gained from its implementation at other NPPs to PNGS, in order to address potential safety concerns should the need arise.

2.7 Radiation protection

Application of ALARA

The safety performance indicator for the Application of ALARA is the “collective radiation exposure” also known as collective dose. In 2020, the total collective dose for monitored individuals at all Canadian NPPs and WMFs was 27.2 person-sieverts (p-Sv), approximately 33% higher than the industry-wide collective dose reported for the previous year (20.4 p-Sv). The number of persons who received a reportable dose in 2020 (9,624) was slightly lower than 2019 values (9,873). The increase in total collective dose was mainly due to new refurbishment activities at BNGS B and increased outage activities at PNGS and PLNGS. The routine operations dose remained relatively constant between 2020 and 2019.

The vast majority of collective doses for the NPPs and WMFs occur at the NPPs. The collective doses for the individual NPPs are shown in table 8. It illustrates that outages (including refurbishment activities) account for a much greater fraction of the collective dose than routine operations and that external dose is, collectively, much greater than internal dose.

Table 8: Breakdown of collective dose for operating NPPs in 2020 (person-mSv)

NPP	Routine Operations	Outages*	Internal	External	Total
Pickering	810	5,407	1,212	5,005	6,217
Darlington	311	2,375	296	2,390	2,686
PLNGS	211	1,056	252	1,015	1,267
BNGS A	408	3,873	220	4,062	4,282
BNGS B	580	12,437	294	12,722	13,016

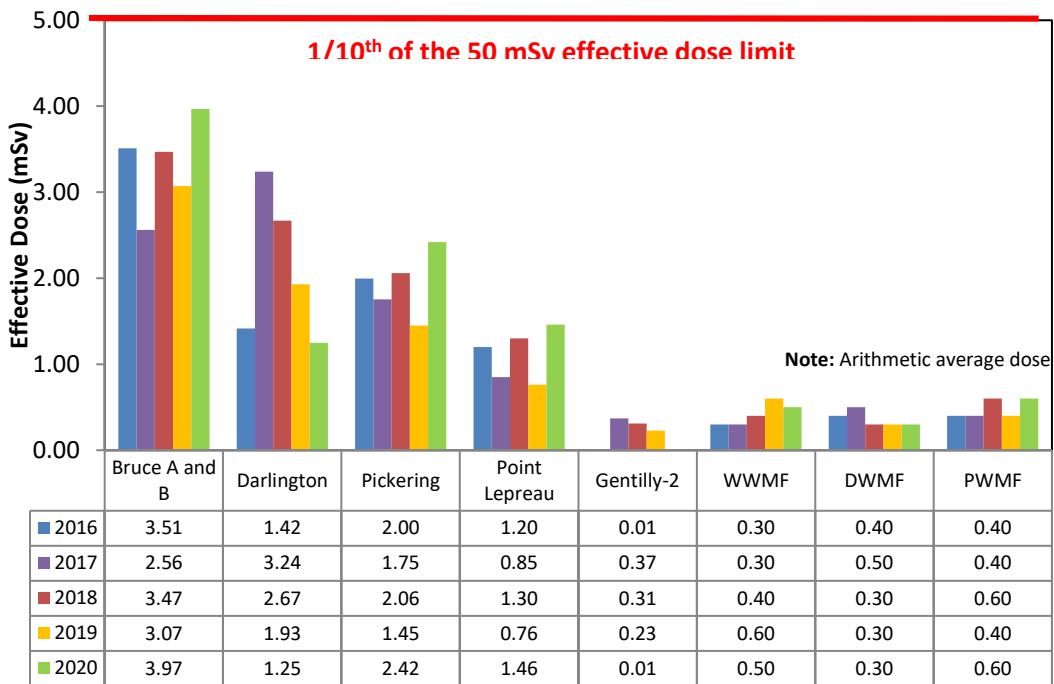
* For 2020, the DNGS and BNGS B had dose attributed to refurbishment activities.

Worker dose control

The annual average effective dose in 2020 for all operating Canadian NPPs was 2.83 millisieverts (mSv), an approximate increase of 36.7% from the 2019 value of 2.07 mSv. As indicated above, the increase is mainly due to outage activities.

Figure 8 shows the average effective doses to monitored persons at each NPP and WMF for the period 2016 to 2020. This figure shows that, for 2020, the average effective dose at each facility ranged from 0.01 to 2.42 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 2020.

Figure 8: Trend of average effective doses of monitored persons



The maximum annual individual effective doses, as reported by each NPP and WMF for 2016 to 2020, are presented in figure 9. In 2020, the maximum individual effective dose received at a single site was 17.78 mSv, received by a worker who performed feeder removal duties at BNGS B during refurbishment activities. In 2020, 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*.

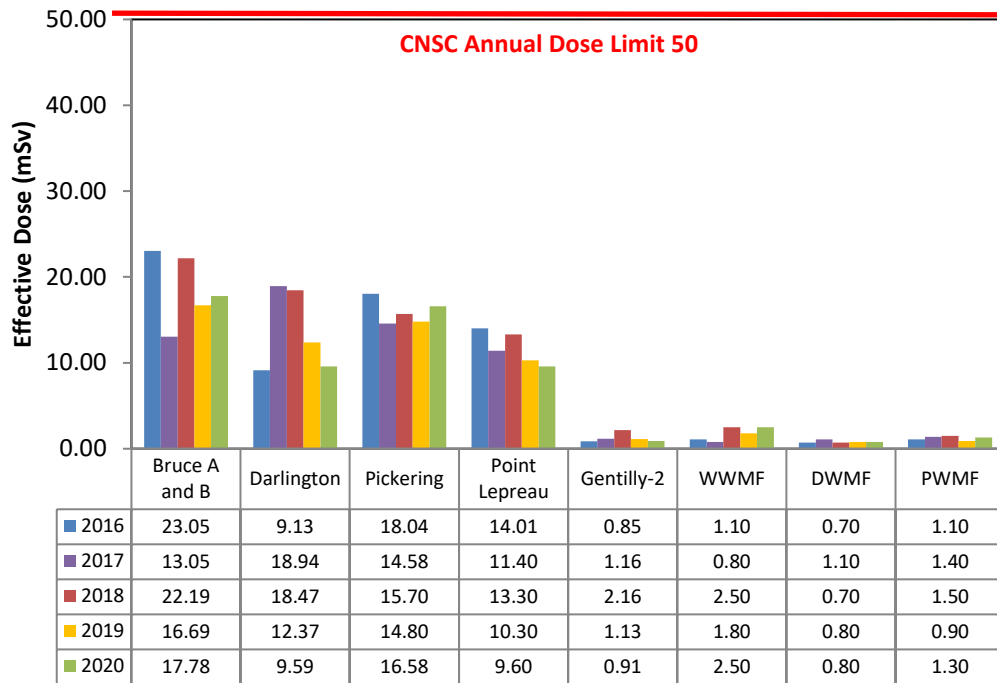
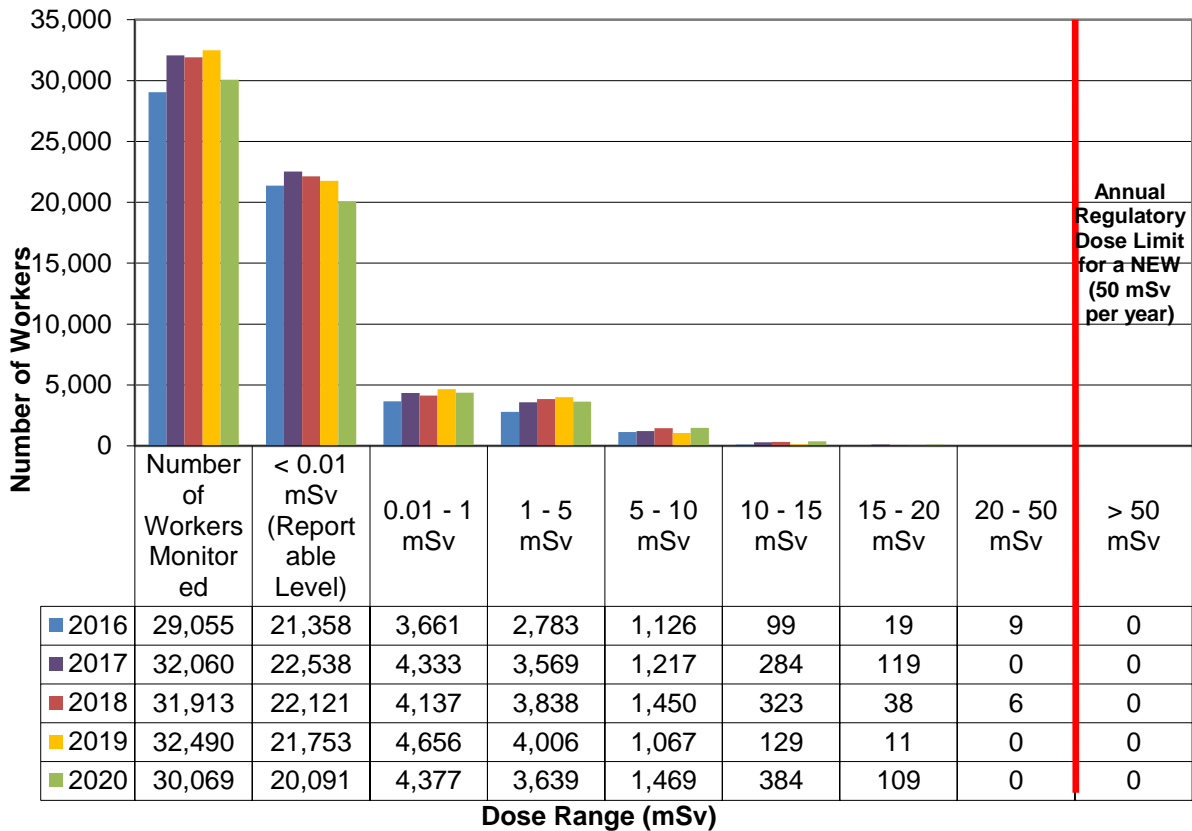
Figure 9: Trend of maximum individual effective doses

Figure 10 provides the distribution of annual effective doses to all monitored persons at all Canadian NPPs from 2016 to 2020. All doses reported over those years were below the annual regulatory dose limit of 50 mSv for nuclear energy workers. In fact, approximately 81% 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 2020.

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



Radiation protection program performance

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

CNSC staff did not observe any failures of radiation protection programs in 2020 and are satisfied with the industries performance.

Radiological hazard control

In 2020, no contamination control action levels were exceeded and CNSC staff did not identify issues of safety significance at any NPP or WMF. CNSC staff note the NPP safety performance indicators “personnel contamination events” and “loose contamination events” were within CNSC staff expectations. Details for each facility are provided further in section 3.

2.8 Conventional Health and Safety

Performance, Practices, and Awareness

The data for 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, AF and ISAR for WMFs were all zero in 2020. CNSC staff observed that no work-related fatalities occurred at Canadian NPPs and WMFs in 2020.

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, 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)

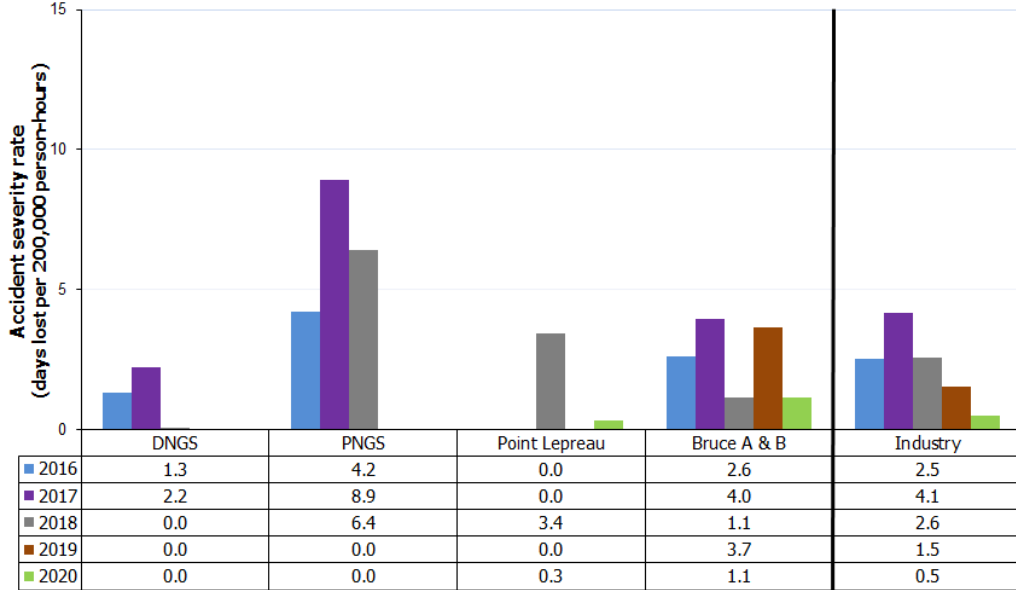


Figure 12: Trend of accident frequency for NPPs and Canadian industry (covers all employees, not including third party contractors)

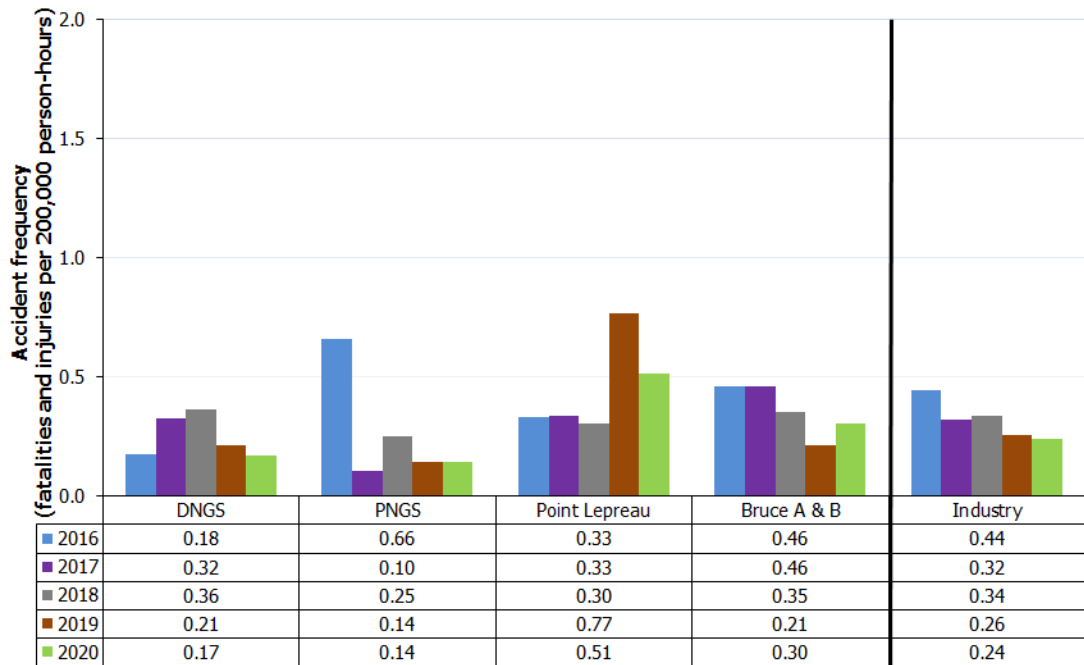
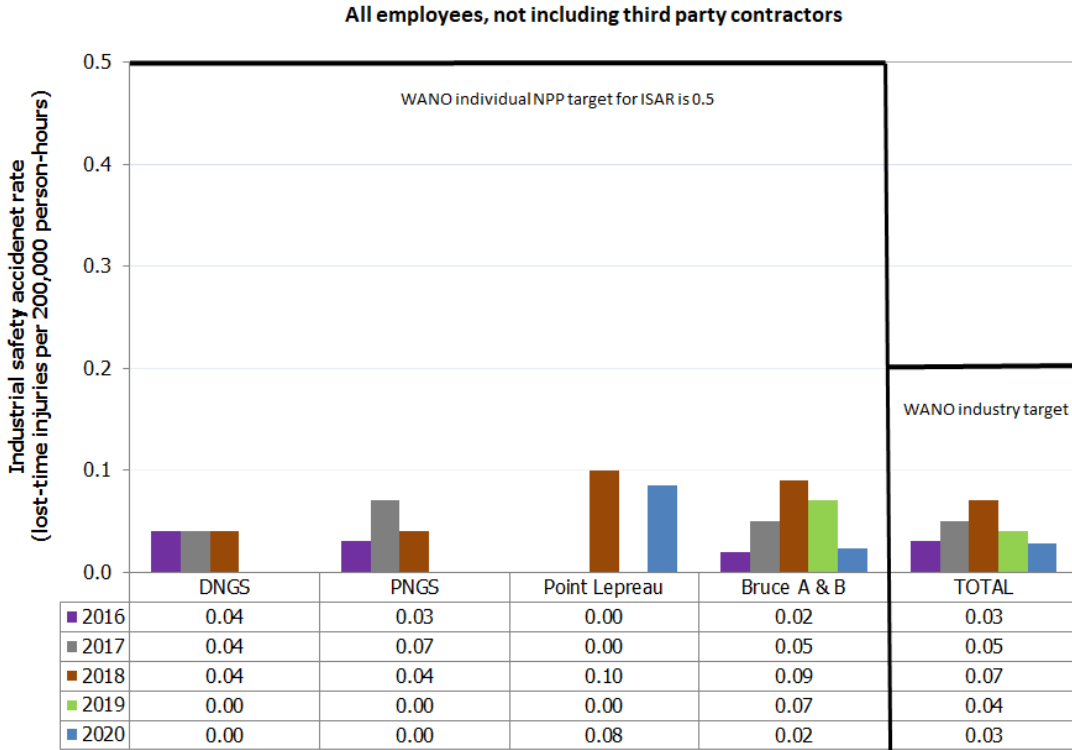


Figure 13: Trend of industrial safety accident rate for NPPs and Canadian industry (covers all employees, not including third party contractors)



2.9 Environmental protection

Effluent and emissions control (releases)

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 PWMF fall under the DRLs for the DNGS and the PNGS, respectively. The WWMF has its own facility-specific DRLs for airborne and liquid releases. The DRLs are provided in Appendix D.

The CNSC publishes annual radionuclides loadings to the environment from nuclear facilities on the CNSC Open Government Portal [4], where the data is available for the facilities covered in this ROR.

Environmental management system

All environmental management systems (EMSs) for operating NPPs and WMFs are registered with the International Standards Organization (ISO) 14001:2015 standard, *Environmental Management Systems – Requirements With Guidance for Use*. As a result of registration, the EMSs are subject to periodic, independent third-party audits and reviews to verify their sufficiency and identify potential improvements.

CNSC staff confirmed through inspections that annual management reviews of the EMS take place and that corrective actions are documented.

Assessment and monitoring

In addition to licensees carrying out required monitoring of their operations, the CNSC carries out its Independent Environmental Monitoring Program (IEMP) to verify and confirm that the public and the environment around licensed nuclear facilities remain safe. Further information on the CNSC's IEMP, including sampling results and associated standards, can be found on the CNSC's Website [5].

CNSC staff had planned to conduct an IEMP campaign around PLNGS in 2020, but due to constraints related to COVID-19, only soil, water and plant samples were taken in 2020. CNSC staff intend to complete the campaign in 2021 with the taking of samples of air, fish, and plants of interest to Indigenous communities. However, based on the IEMP results from previous years (available on [CNSC website](#)), it can be concluded that the public and the environment in the vicinity of all sites are protected. The IEMP results from previous years are in the same numerical range for the same media as the results submitted by licensees, independently confirming that the licensees' environmental protection programs protect the public and the environment.

UPDATE: In June 2021, CNSC staff completed the sampling of food, seafood, and medicinal plants of interest to Indigenous communities.

Estimated dose to the public

The estimated doses to the public for airborne emissions and liquid releases from 2016 to 2020 are provided in table 9. Note that the data for the DWMF, PWMF and WWMF 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 2020 data with that of previous years indicates that the values remained within the same general range (<0.01 mSv) as the values for 2016 to 2019.

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

Year	Darlington Site	Pickering site	Point Lepreau	Bruce Site	Gentilly-2*
2016	0.0006	0.0015	0.0009	0.0016	0.0010
2017	0.0007	0.0018	0.0007	0.0021	0.0070
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

* Gentilly-2 is not considered an NPGS

2.10 Emergency management and fire protection

Conventional emergency preparedness and response

In response to the COVID-19 pandemic, the NPPs and WMFs activated their Pandemic Response Plans and BCPs. Licensees provided daily updates to their staff and the CNSC about any exposures and measures they were taking to prevent an outbreak at their facilities. Licensees have demonstrated that they can safely operate their nuclear facilities while ensuring health and safety for their staff.

Nuclear emergency preparedness and response

Note that OPG has a single, Consolidated Nuclear Emergency Plan that governs both the DNGS and PNGS sites and includes the Darlington and Pickering WMFs. The WWMF is under the nuclear emergency response plan and fire response plan for Bruce Power. The following describes recent developments in 2020 related to off-site emergency planning and also provides, where needed, historical information from previous years related to the provincial nuclear emergency plans and related activities.

Province of Ontario

Provincial Nuclear Emergency Response Plan (PNERP)

As per Office of the Fire Marshal and Emergency Management (OFMEM)'s 5-year cycle, the PNERP Master Plan is currently being reviewed with stakeholders, with consultations on select technical study recommendations being undertaken concurrently. Public consultation will be launched on the updated draft master plan, followed by review and disposition of public comments. The plan will then be finalized and submitted to the Ontario Cabinet for approval in 2022. The revisions to the PNERP Implementing Plans will follow thereafter.

During the 2017 PNERP review, an independent Advisory Group recommended that a technical study should be conducted. The Ontario Ministry of the Solicitor General (SOLGEN) hired ENERCON, a consulting firm located in the United States to perform this technical study.

UPDATE: As of June 30, 2021, a statement has been posted to the [Emergency Management Ontario \(EMO\) website](#) alerting the public that the Technical Study Report on the PNERP is available and to contact them for a copy of the report.

Environmental Radiation and Assurance Monitoring (ERAMG)

In September 2020, the Province of Ontario approved the ERAMG Plan. The ERAMG Plan outlines the membership and structure of the ERAMG, including roles and responsibilities of member organizations. Furthermore, the ERAMG Plan provides the necessary direction on environmental monitoring and supports protective action decision making after a nuclear or radiological emergency. The ERAMG Working Group has continued working on the development of the 8 control strategies that will be included in the Provincial Ingestion Control Plan.

Nuclear Incident Group (NIG):

This is a relatively new group and reports to Nuclear Emergency Management Coordinating Committee (NEMCC). Membership is limited to organizations with a role to play in the NIG during response: OFMEM, OPG, Bruce Power, Canadian Nuclear Laboratories, Ministry of the Environment, Conservation and Parks (MECP), Kinectrics, Health Canada (Federal Nuclear Emergency Plan Technical Assessment Group Lead) and the CNSC. The purpose of the committee is to coordinate preparedness work to support the activities of the NIG during any response to a nuclear emergency. The committee will look to document existing processes and update plans/procedures to reflect current operations.

NEMCC Transportation Management Sub Committee:

The Ministry of Transportation's (MTO) Emergency Management and Planning Office (EMPO) has developed a Nuclear Emergency Management Transportation Program Charter and 3-Year Work Plan to meet the legislated planning responsibilities outlined in the 2017 PNERP. The Charter and Work Plan have been reviewed by the NEMCC Transportation Management Sub Committee at its inaugural meeting on March 31, 2021. The Sub Committee, co-chaired by the MTO and the Ontario Provincial Police, is comprised of municipal, provincial, and federal representatives, as well as facility operators. This Sub Committee is an integral forum to guide and coordinate the development of transportation plans to facilitate the evacuation of Ontario's nuclear planning zones.

UPDATE: The Sub Committee's next meeting was held on May 5, 2021.

Province of New Brunswick

The New Brunswick Emergency Measures Organization (NBEMO), Provincial Nuclear Preparedness Team, enhanced the provincial nuclear preparedness program by updating the Point Lepreau Nuclear Off-site Emergency Plan as well as supporting plans. NBEMO participated in multiple webinars hosted by the IAEA and continue to work diligently on the Emergency Preparedness Review (EPREV), New Brunswick Action Plan. NBEMO actively participates in the Federal Nuclear Environmental Monitoring Strategy (NEMS) Working Group, the Federal Radioactive Waste Working Group (RWWG), the Federal Resource Analysis Project and participates as an associate member on the Technical Committee on the rewrite of the CSA N1600, *General requirements for nuclear emergency management programs*.

UPDATE: The PLNGS Technical Planning Basis was finalized in April, 2021, which allowed the review and issuance of the Point Lepreau Nuclear Off-Site Emergency Plan in June of 2021.

Province of Quebec

The off-site nuclear emergency response plan for Quebec ("Plan des mesures d'urgence nucléaire externe à la centrale nucléaire Gentilly-2", or PMUNE-G2) was abolished in 2016.

However, Quebec's broader emergency plan ("Plan national de sécurité civile" (PNSC)) remained in place to address emergencies in general. The PNSC involves the cooperation of various ministries and governmental organizations that have a defined role to play when responding to an emergency. The directorate for public health under Quebec's Ministry of Health and Social Services will intervene for infectious, chemical, biological or radiological emergencies.

Emergency exercises

OPG held a 1 day full scale nuclear emergency training exercise at the PNGS on October 21, 2020. This exercise tested and validated emergency preparedness, response capabilities and the collaborative and consultation processes of OPG and its stakeholders. Overall, the exercise was successful and met objectives as far as the response itself, exercise control and also COVID-19 protocols for virtual response.

2.11 Waste management

Waste characterization, waste minimization and waste management practices and decommissioning plans

All NPP and WMF licensees continued to employ effective programs for the characterization, minimization, handling, processing, transportation, storage and disposal of radioactive and hazardous wastes during 2020. CNSC staff were able to confirm this through their on-going compliance verification activities at the various NPPs and WMFs.

There were no changes to note for 2020 regarding the preliminary decommissioning plans (PDPs) for the nuclear facilities listed in this report. At the time of their review, CNSC staff found that the documents met or exceeded regulatory requirements and guidance. Note: The PDP for Bruce Power is prepared by OPG, who are the owners of the Bruce Power facility.

The financial guarantees for decommissioning are discussed in section 2.15.

2.12 Security

As a result of the COVID-19 pandemic, both NPPs and WMFs successfully activated their BCPs. All licensees were able to maintain operational effectiveness throughout 2020. The regulatory compliance of licensees were not impacted due to the COVID-19 public health restrictions.

At the onset of the COVID-19 pandemic, several NPP licensees requested regulatory flexibility for some requirements as detailed below. These requests were granted by the CNSC, and all NPP licensees who had requested this regulatory forbearance had complied with regulatory expectations by the third quarter of 2020.

Licensees conducted 1 Force-on-Force exercise under the CNSC's Performance Testing Program at PNGS in 2020, to evaluate each specific area (this does not include the cyber security specific area).

Other planned Force-on-Force exercises were postponed due to the increased risk to both licensee and CNSC staff resulting from the COVID-19 pandemic. Pending Commission approval, all future scheduled Force-on-Force exercises will be pushed back 12 to 24 months in the future to reduce the risk and potential impacts to participants and NPP facilities.

Facilities and equipment

Overall, NPP and WMF licensees met CNSC regulatory requirements in 2020. Licensees continue to maintain their security-related equipment through lifecycle management programs. Only minor equipment related failures were reported to the CNSC in 2020.

Response arrangements

Overall, HSS and WMF licensees met CNSC regulatory requirements in 2020. Licensees continue to maintain implemented procedures to provide guidance to personnel in this specific area.

Security practices

Regulatory document REGDOC-2.12.1, *High Security Facilities, Volume I: Nuclear Response Force, Version 2*, published in 2018, became part of the licensing basis for several NPP licensees in 2020. This regulatory document superseded the first version of this document, published in 2013.

Drills and exercises

Overall, NPP and WMF licensees met CNSC regulatory requirements in 2020. Licensees continue to maintain implemented procedures to provide guidance to personnel in this specific area.

Cyber Security

Over the reporting period, licensees collaborated through the COG cyber security peer group program to share lessons learned and best industry practices of cyber security controls.

2.13 Safeguards and non-proliferation

Nuclear material accountancy and control

CNSC staff concluded that the accountancy and control of nuclear material at all NPPs and WMFs complied with the applicable regulatory requirements in 2020. The licensees submitted their required monthly general ledgers on time, with 1 minor exception, where PWSMF submitted a ledger 6 days late.

The CNSC published [REGDOC-2.13.1, *Safeguards and Nuclear Material Accountancy*](#), in February 2018, superseding RD-336, *Safeguards and Nuclear Material Accountancy* and GD-336, the associated guidance document. REGDOC-2.13.1 sets out requirements and guidance for safeguards programs for applicants and licensees who possess nuclear material, carry out specified types of R&D work related to the nuclear fuel cycle, or carry out specified types of nuclear-related manufacturing activities.

The regulatory document aims to establish a common understanding of the information, access and support that licensees are to provide to the CNSC and to the IAEA in order to facilitate Canada's compliance with its safeguards agreements.

The CNSC requested that the affected licensees provide an implementation plan by July 31, 2018 for meeting the requirements of REGDOC-2.13.1. All NPP and WMF licensees made commitments to comply. NB Power and Bruce Power implemented the new regulatory document by the end of 2019. OPG planned to fully implement the REGDOC by 2021, although it was already making significant progress towards implementation in 2020.

The CNSC determined that Hydro-Québec already met the new requirements and no additional action was required.

Access and assistance to the IAEA

In 2020, the IAEA conducted 18 announced, 5 short-notice and 27 unannounced inspections, and 2 complementary accesses at the NPPs and WMFs. The numbers of activities conducted by the IAEA at each NPP and WMF in 2020 are provided in table 10.

Table 10: IAEA safeguards activities for 2020

Activity	DNG S	DWM F	PNGS	PWM F	BNG S A	BNG S B	WW MF	PLN GS	Gentil ly-2	Total s
Physical inventory verifications	1	1	1	1	1	1	1	1	1	9
Design information verifications	1	1	1	1	1	1	1	1	1	9
Short-notice random inspections	1	N/A	1	N/A	1	1	N/A	1	0	5
Unannounced inspections	4	3	3	2	3	3	4	0*	5	27
Complementary access	0	0	1	0	0	0	1	0	0	2

*There were no unannounced inspections at Point Lepreau in 2020 due to the absence of a campaign to transfer spent fuel to dry storage.

CNSC staff verified that the licensees met the applicable regulatory requirements for access and assistance at the NPPs and WMFs. 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. While the IAEA encountered minor implementation issues during a few inspections, it considered the overall results to be satisfactory. The verification of some irradiated fuel in spent fuel pools continued to be a challenge at PNGS and BNGS A and B. CNSC staff are working with the licensees and the IAEA to find technical and administrative solutions to ensure that the IAEA is able to resolve these issues.

Operational and design information

CNSC staff confirmed that the licensees met the applicable regulatory requirements for operational and design information for the NPPs and WMFs in 2020. The licensees submitted their annual operational programs, with quarterly updates, for their facilities as required. The licensees also submitted their annual updates for the additional protocol to the CNSC, enabling CNSC staff to draft and submit Canada's additional protocol declarations to the IAEA. CNSC staff were satisfied with the information provided.

Safeguards equipment, containment and surveillance

CNSC staff confirmed that the licensees met the applicable regulatory requirements for safeguards equipment, containment and surveillance for the NPPs and WMFs in 2020. 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 2020, the CNSC and licensees continued to engage with the IAEA on a revised equipment-based approach for the verification of spent fuel transfers at the CANDU sites as part of the IAEA's revised State-level approach for Canada.

2.14 Packaging and transport

There were no packaging and transport events reported in 2020 that had any safety significance.

2.15 Other matters of regulatory interest

Public information and disclosure programs

CNSC [REGDOC-3.2.1, *Public Information and Disclosure*](#) sets out the requirements for public information and disclosure programs. The primary goal of the program is to ensure that information related to the health, safety and security of persons and the environment, and other issues associated with the lifecycle of nuclear facilities, is shared with the public in a format relevant to the audience. The program includes a commitment and protocol for ongoing, timely dissemination of information related to the licensed facility.

CNSC staff determined that the public information and disclosure programs for the NPPs and WMFs complied with REGDOC-3.2.1 in 2020. Despite the pandemic in 2020, NPP and WMF operators were able to adapt their programs to ensure continued commitment and relevance to their local audiences. Licensees provided information on the status of their facilities and COVID-19 protective measures through various formats to multiple audiences. OPG, Bruce Power and NB Power met with CNSC staff to present the highlights of their communications programs, areas for improvement and plans for future initiatives.

Some highlights noted among licensees in 2020 included the following.

Ontario Power Generation

OPG continued to communicate regularly with their local communities in Pickering and Clarington with regular newsletter updates printed and delivered to approximately 50,000 residents, municipal council updates, and virtual community and Indigenous engagement programs. In an effort to continue regular engagement with schools through the annual March Break program, OPG pivoted to a virtual classroom rather than the traditional visitor center and had 80,000 students and teachers across the province participate in the online program.

Bruce Power

Bruce Power continued to increase and evolve its online presence through the use of social media after polling in 2020 showed it is now the preferred source of communication in the community. As the pandemic evolved in 2020, Bruce Power worked closely with local Indigenous groups and the community holding regular virtual town hall meetings with the medical officer of health, assisting the local health unit manage the daily COVID-19 communications program and completing regular COVID-19 testing onsite to ensure all employees and contract workers remained safe.

NB Power

NB Power continued to exchange information, knowledge and experiences with Indigenous and local communities. In January 2020, public information sessions were held on a variety of topics ranging from station operations to health, safety and environmental activities. Information was also shared on emergency preparedness, waste management, licensing activities as well as small modular reactor initiatives in New Brunswick.

Although there were limitations to face-to-face meetings given the pandemic, NB Power continued to provide regular station updates and information on upcoming projects to multiple audiences through regular newsletters, virtual meetings, ongoing presence on social media and regular, local traditional media coverage.

Hydro-Québec

As Hydro-Québec completed various final steps before moving into decommissioning the Gentilly-2 facilities, they continued to provide target audiences with regular virtual updates throughout 2020 to the municipal leaders of Bécancour, Indigenous groups and to the public through local media coverage and project updates to the website and social media. Although there were few direct requests for information from the public, key audiences specific interests included waste and the transfer of radioactive fuel, transportation of radioactive waste and the next steps of the decommissioning project.

Indigenous consultation and engagement

General overview

CNSC staff efforts in 2020 supported the CNSC's ongoing commitment to meeting its consultation obligations and building relationships with Indigenous peoples with interests in Canada's nuclear power generating sites. CNSC staff continued to work with Indigenous communities and organizations to identify opportunities for formalized and regular engagement throughout the lifecycle of these facilities, including meetings and facilitated workshops, aiming to discuss and address topics of interest and concern to interested Indigenous communities.

In addition, CNSC staff provided interested communities with notice of the opportunity for funding through the CNSC's Participant Funding Program to review and comment on this report and the opportunity to submit a written intervention and/or appear before the Commission as part of the Commission Meeting.

As part of consultation and engagement obligations with Indigenous communities, the CNSC also confirms that its licensees engage those communities in a meaningful way. In 2020, CNSC staff monitored the NPP and WMF licensees to ensure that they actively engaged and communicated with Indigenous groups who have interest in their facilities. CNSC staff confirmed that the licensees' dedicated Indigenous engagement programs continued to cover their operations at the NPPs and WMFs and were satisfied with the level and quality of Indigenous engagement conducted by the NPP and WMF licensees regarding their operations in 2020.

The following summarizes the engagement activities for each site conducted by CNSC staff and the licensees in 2020.

Pickering and Darlington sites

CNSC Staff engagement activities

The DNGS, DWMF, PNGS and PWMF lie within the treaty territory of the Williams Treaties First Nations (WTFN)¹. The Mohawks of the Bay of Quinte (MBQ) 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 these sites. Due to the pandemic, in 2020, CNSC staff continued to engage virtually with these First Nation and Métis groups in recognition of their longstanding interest in the operation of the DNGS and PNGS. Topics of discussion included the ongoing environmental monitoring activities, fish impingement and entrainment at the DNGS and PNGS, OPG's intent to renew the licence to prepare the site for the Darlington New Nuclear Project, and the proposed DNGS isotope project.

¹ Williams Treaties First Nations (WTFN) include the Mississaugas of Alderville First Nation (MAFN), Curve Lake First Nation (CLFN), Hiawatha First Nation (HFN), Mississaugas of Scugog Island First Nation (MSIFN), Chippewas of Beausoleil First Nation (CBFN), Chippewas of Georgina Island First Nation (CGIFN) and Chippewas of Rama First Nation (CRFN).

In December 2019, the CNSC and the MNO signed a [Terms of Reference](#) to provide a forum through which to collaborate and address areas of interest or concern regarding CNSC-regulated facilities and activities. As the MNO is a province-wide organization, a specific engagement plan was developed between CNSC and the MNO Region 8 consultation committee, whose region includes the Pickering and Darlington sites. In 2020, CNSC staff also started discussions with Curve Lake First Nation to establish a formal long-term relationship with the community, and a Terms of Reference was signed in February 2021.

Licensee engagement activities

Throughout 2020, OPG met and shared information with interested Indigenous communities and organizations including the WTFN, the MNO and the MBQ. Topics of discussion included the ongoing DNGS refurbishment project, environmental monitoring activities, fish impingement and entrainment at the DNGS and PNGS, OPG's intent to renew the licence to prepare the site for the Darlington New Nuclear Project, and the proposed DNGS isotope project.

Bruce Site

CNSC Staff engagement activities

The Bruce site lies within the traditional territory of the Chippewas of Nawash Unceded First Nation and Saugeen First Nation, who together form the Saugeen Ojibway Nation (SON), as well as the asserted traditional harvesting territory of the MNO and Historic Saugeen Métis (HSM). CNSC staff engages with all 3 communities on areas of interest to them. With the pandemic preventing the ability to meet in person, CNSC staff continued to work with each community representatives through virtual forums.

As committed to with each of the communities as part of their respective Terms of Reference for long-term engagement, the updates below were prepared in collaboration with their representatives.

Historic Saugeen Métis (HSM)

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 formally documents the engagement with their community. CNSC staff continued to meet with HSM representatives in 2020 to discuss areas of interest such as the Douglas Point decommissioning licence application and Bruce Power's *Fisheries Act* authorization, the Mitigation Measures Study and the major component replacement project. Results of the CNSC's IEMP were shared with the HSM as the campaign included local plant species important to the HSM community. HSM appreciated the opportunity to provide comments to support the proposed CNSC Indigenous Knowledge Policy Framework. HSM was also encouraged to know that this policy will be an evergreen document and will continue to evolve over time. 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 planned to continue to engage and update HSM on regulatory activities on a semi-annual basis as agreed upon in the Terms of Reference.

Métis Nation of Ontario (MNO)

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.

As per the engagement plan, in 2020, CNSC staff continued to meet with MNO Region 7 representatives to discuss topics such as the CNSC's IEMP, the Douglas Point decommissioning licence application, and Bruce Power's *Fisheries Act* authorization, the Bruce Power Mitigation Measures Study and the Bruce Power Major Component Replacement project.

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. As a result, in 2020, CNSC staff collaborated with the MNO to share the results of environmental monitoring and information on the different risks posed by radiation, how these risks are managed through an article in their newsletter "Métis Voyageur". CNSC staff will continue to collaborate and engage with the MNO Region 7 on areas of interest with regards to the Bruce site.

Saugeen Ojibway Nation (SON)

A [Terms of Reference](#) was signed in 2019 between the SON and CNSC staff, which documents the CNSC's commitment to formalize engagement and collaboration with their communities, as directed by the Commission in the Bruce Power licence renewal record of decision. Under the Terms of Reference, the SON and the CNSC collaborate on a number of areas including:

- 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

A work plan was developed, which sets out detailed tasks and timelines for each of these items.

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 2020, 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 postponed.

CNSC staff have shared the results of the 2019 IEMP and worked with the SON's Environment Office on the best way to reach their community members. A webinar was held in April 2021 where CNSC staff presented the results and were able to answer questions from the community. CNSC staff and SON will continue to work collaboratively in order to address areas under SON's rights and interests. They also included the expansion of the 2019 IEMP sampling program around the BNGS to include areas around the SON communities and involvement of SON members in the sampling, including the procurement of fish species of interest from SON community members, as well as the SON's involvement in Bruce Power's environmental monitoring programs.

In addition, the SON completed the first 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. CNSC staff are also 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.

Licensee engagement activities

Throughout 2020, both Bruce Power and OPG met and shared information with interested Indigenous communities and organizations, including the SON, the MNO and the HSM.

For Bruce Power, information and discussion topics included their operations at the BNGS site, their *Fisheries Act* authorization 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, the MNO and the HSM on the Fisheries Act Authorization (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 2020, OPG continued its regular updates and meetings with Indigenous groups who have an interest in their operations and projects at the Bruce site including the WWMF and the proposed Deep Geologic Repository (DGR). In January 2020, the SON held a community vote regarding OPG's proposed DGR project and a vast majority of the SON community members voted to not support the project. As a result, respecting their commitment to the SON to not go forward with the project without their support, OPG has indicated that it will no longer be pursuing the proposed DGR project at the Bruce site.

Point Lepreau Site

CNSC Staff engagement activities

The Point Lepreau site lies within the traditional territory and/or region of interest to 6 Maliseet communities in New Brunswick represented by the Wolastoqey Nation of New Brunswick (WNNB), 9 Mi'gmaq communities in New Brunswick represented by Mi'gmawe'l Tplu'taqnn (MTI), and the Peskotomuhkati Nation. CNSC staff regularly engages and communicates with the interested First Nations and their representative organizations on areas of interest to them. Due to the pandemic, from March 2020, meetings were held virtually.

In 2020, a major focus of CNSC's engagement activities was to formalize and continue to strengthen the relationship between the interested First Nations and CNSC staff. CNSC staff provided information and updates to MTI, WNNB and Peskotomuhkati leadership and met with them individually to discuss topics of interest, including the CNSC's IEMP, compliance verification activities at the PLNGS, CNSC's response to the COVID-19 pandemic, the potential for small modular reactors in Canada, as well as ongoing engagement relationships. CNSC staff are committed to continue meeting with each First Nation and their representative organizations to provide key updates on nuclear activities and projects in their territory of interest on a regular basis.

Licensee engagement activities

In 2020, NB Power worked with several First Nation's communities and organizations, including the WNNB, MTI, the Peskotomuhkati Nation, Sipekne'katik First Nation, the Union of New Brunswick Indians and Mawiw Council. NB Power maintains on-going dialogue with First Nations consultative bodies and representatives through scheduled monthly meetings. Due to the pandemic, starting in March 2020, monthly meetings were held virtually and when possible, NB Power participated in face to face discussions, practicing physical distancing and wearing facial coverings.

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

As part of community engagement, NB Power worked closely with Indigenous and surrounding communities to obtain cloth face masks for essential staff at the Point Lepreau.

In 2020, NB Power was engaged in a variety of activities to support First Nations as well as to help increase the awareness of First Nation's history and culture amongst NB Power staff and local communities. Activities in 2020 included partnering with First Nations Communities on the red dress campaign (which aims to increase awareness of missing and murdered Indigenous women and Girls), as well as organizing a yearly moose hide campaign which recognizes the missing and murdered women and children. NB Power is also working to educate its own staff regarding First Nation's history and culture and has been working with First Nations representatives to develop their own programs focused on cultural education.

NB Power employs First Nations field monitors to participate in all field related activities related to monitoring the Point Lepreau site, which has led to an increased awareness of the perspectives, knowledge and worldviews of First Nations amongst NB Power staff. As well, NB Power worked with Indigenous groups to build capacity within their communities to better understand and self-direct learning on nuclear technology and its use in New Brunswick, waste management and new opportunities in nuclear development and its role in a clean electricity mix.

Gentilly-2 site

CNSC Staff engagement activities

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. En 2020, les employés de la CCSN ont continué de tenir les communautés autochtones informées par le biais du Rapport de surveillance réglementaire des sites de centrales nucléaires de 2019, que le GCNWA a révisé.

Licensee engagement activities

En 2020, Hydro-Québec a poursuivi son engagement avec les communautés autochtones intéressées par ses opérations et ses sites, et a rencontré et partagé des informations avec les communautés et les organisations des Premières Nations intéressées, en particulier la GCNWA. Les relations avec la Nation Waban-Aki se font sur une base régulière et touchent les projets en cours et à venir.

En 2020, les discussions ont porté sur la réalisation de travaux de nature archéologique par le GCNWA sur les terrains appartenant à Hydro-Québec près des installations de Gentilly-2.

Une visite au terrain en novembre 2019 avait permis aux représentants du GCNWA de valider leur intérêt pour poursuivre des sondages de ce secteur. Les autorisations nécessaires ont été données par la direction des installations de Gentilly-2, permettant à l'équipe du Bureau du Ndakina d'obtenir les permis requis pour les travaux visés auprès des autorités provinciales. La réalisation des travaux au terrain est prévue au cours de l'été 2021.

Nuclear liability insurance

The *Nuclear Liability and Compensation Act* (NLCA) requires nuclear installations (nuclear facilities that have the potential to undergo a nuclear criticality event) to carry nuclear liability insurance. The NLCA is administered by Natural Resources Canada (NRCan). CNSC staff confirmed with NRCan that the licensees complied with the financial security obligations of the NLCA as of June 30, 2020.

Financial guarantees

CNSC staff reviewed the annual reports for the NPP and WMF licensees Financial Guarantees (FGs). CNSC staff confirmed that the financial guarantee cost estimates were still valid, and that the licensees had sufficient funds to meet decommissioning liabilities in 2020. Note that the FG for the decommissioning of the BNGS is covered underneath OPG's Financial Guarantee.

In response to the COVID-19 pandemic's potential to disrupt financial markets, CNSC staff requested NPP and WMF licensees to provide an update regarding their FGs to ensure that the economic effects caused by the pandemic did not affect the viability of each FG. CNSC staff sent binding requests under Section 12(2) of the *General Nuclear Safety and Control Regulations* for quarterly updates on each licensees' FG position. Through these requests, CNSC staff were able to confirm that all the NPP and WMF licensees maintained sufficient funding to meet their FG obligations.

Prohibition of Asbestos and Asbestos Containing Products Regulations

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

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

- PNGS: To service 1 governor valve and 2 control valves, OPG used 3 products containing asbestos (1 gasket sheet and 2 gaskets) where no technically or economically feasible alternative exists.

- DNGS: No products containing asbestos were used.
- BNGS A and BNGS B: To service a motorized relief valve, a tank drain line, a sight glass cover and a gate valve, Bruce Power used 4 products containing asbestos (1 asbestos compressed fibres, and 3 asbestos spiral wounds) where no technically or economically feasible alternative exists.
- PLNGS: No products containing asbestos were used.
- Gently-2: No products containing asbestos were used.

Where asbestos and asbestos containing products were used to service equipment, the licensees were required to submit an annual report to Environment and Climate Change Canada, as well as their Asbestos Management Plan. OPG and Bruce Power submitted their annual report and Asbestos Management Plans and are in compliance with the Regulations. NB Power and Hydro-Québec were not required to make any submissions as no asbestos or asbestos containing products were used to service equipment in 2020.

Licensees continue to identify technically and economically feasible alternatives to asbestos and asbestos containing products, and where they are unable to do so, will continue to use these products in accordance with the Regulations. There were no non-compliances with the Regulations in 2020.

Ten Year Follow-up to Fukushima by NPP Licensees

This year marks the 10th anniversary since the Fukushima-Daiichi nuclear accident. Lessons learned from the event continue to shape nuclear safety in Canada. In the follow-up to the Fukushima-Daiichi accident, CNSC staff assigned 36 Fukushima Action Items (FAIs) to NPP licensees. By December 2015, CNSC staff had closed all of these FAIs. However, CNSC staff opened 43 station-specific action items to track (through the compliance verification program) individual projects at the NPPs that were necessary to complete enhancements stemming from the Fukushima lessons learned. The station-specific action items varied from facility-to-facility, depending on design and operational considerations. In total, only 2 of the 43 station-specific action items remain open.

The following are the remaining 2 station-specific action items for Bruce Power which will be addressed through separate projects, due for closure by 2022:

Containment filtered venting system

In the event of a severe accident where the containment heat sink is lost (as a result of a loss in electrical power) and containment overpressure occurs, the new containment filtered venting system will maintain the containment pressure below the failure pressure and filter radioactive releases during a severe accident. This is a more robust system than the existing systems in place for emergency filtered venting.

Coolant makeup

For short-term makeup water, Bruce Power has installed connection points to the steam generators, which will provide short and longer-term makeup water to cool the reactor in the event of a severe accident. For longer-term makeup water, a connection point to the shield tank has been installed. The remaining connection points to the heat transport and moderator system for longer-term makeup water will be completed during planned outages.

Although the NPPs station-specific action items are either complete or close to completion, CNSC staff continue to monitor NPP licensees' enhancements to safety through ongoing regulatory activities.

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 kilometers outside the town of Bowmanville and 10 kilometers southeast of Oshawa. 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 (electrical megawatts) each. The TRF, which is housed in the Heavy Water Management Building, is used to remove tritium that builds up gradually 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.

OPG continues to execute its plan to refurbish the 4 reactors at the DNGS. The refurbishment project began with Unit 2 in October 2016, which continued through to June 2020. In September 2020, Ontario Power Generation (OPG) started the lead-in refurbishment activities on Unit 3, with the majority of activities centering around preparing the Unit for refurbishment, such as defueling and dewatering the reactor. Refurbishment of Unit 3 is expected to take until the middle of 2023 to complete. OPG continues to operate the Retube Waste Processing Building, where it is expected to resume volume-reduction activities for wastes generated from refurbishment of its reactors (i.e., fuel channel end-fittings, pressure tubes, and calandria tubes) in the middle of 2021.

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.

The PROL was amended in 2020 to allow for an update to a standardized licence condition related to training and certification of personnel in their PROLs, by referencing CNSC regulatory document [REGDOC-2.2.3, *Personnel Certification, Volume III: Certification of Persons Working at Nuclear Power Plants*](#).

UPDATE: In June 2021, CNSC staff issued a substantive revision of the Darlington Licence Conditions Handbook (LCH). Further details of the changes in this LCH will be provided in the 2021 ROR.

Fisheries Act Authorization

Fisheries and Oceans Canada issued a *Fisheries Act* Authorization (FAA) on June 24, 2015 to OPG for the DNGS. The authorization contains a condition for OPG to report to the staff of Fisheries and Oceans Canada and CNSC on the offset plan (compensation for residual harm to fish and fish habitats). In 2020, OPG submitted the reports.

Integrated Implementation Plan

CNSC RD-360, *Life Extension of Nuclear Power Plants* contained the CNSC requirements applicable to the DNGS Refurbishment Project. In preparation for a life extension or refurbishment project, RD-360 required that a licensee wishing to extend the life of a reactor conduct an integrated safety review (ISR) to address the Safety Factors from the International Atomic Energy Agency Safety Standards Series, as well as the CNSC safety areas and programs. RD-360 also required the licensee to participate 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).

As required, OPG planned and is currently executing the Darlington Refurbishment project in accordance with RD-360. 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 NPPs and to allow for long-term operation. The results of the EA, and ISR assessments were incorporated into the DNGS IIP. In 2015, the IIP was presented to the Commission and, as described in the previous section, implementation of the IIP became a requirement of the Darlington PROL.

The DNGS IIP consists of 625 items, with 3 IIP task items removed from the scope after approval of the Commission. As described in Section 3.1.0 in the ROR, OPG has completed 369 IIP items, including those associated to Unit 2 refurbishment, and are progressing according to the schedule for each IIP item. CNSC staff are satisfied with the progress on the IIP to date.

Refurbishment

The refurbishment project has 4 phases for each reactor:

1. Lead-in – Preparation activities such as defuelling 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.

Throughout the first half of 2020, CNSC staff actively monitored and conducted compliance verification inspections of the project, with emphasis on the lead-out phase and the return to service of DNGS Unit 2, which started its refurbishment outage on October 15, 2016. CNSC staff also focused regulatory oversight efforts on OPG's completion of pre-requisites required for removal of regulatory hold points, including completion of Unit 2 specific IIP items, required for return to service. Unit 2 resumed commercial operation in June 2020. In September 2020, OPG entered its Unit 3 refurbishment outage, with lead-in work progressing to the component removal phase by the end of 2020. For Unit 3 refurbishment, CNSC staff conducted compliance verification activities as established in the Darlington Refurbishment Project Compliance Plan for Unit 3. Unit 3 is expected to be returned to service in 2023.

In 2020, 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 2020, completed by the licensee in 2020 (irrespective of planned completion dates) and IIP items closed by CNSC in 2020.

Table 11: DNGS IIP Status

Total commitments	Overall	2020
Planned by OPG	622	26
Completed by OPG	408	41
Closed by CNSC	369	59

Safety Improvements

Stemming from the 2012 EA for the refurbishment project, OPG identified several safety improvement opportunities (SIOs), which were later incorporated into the IIP to consolidate all the station improvement activities. The SIOs involved features to improve safety of the plant for beyond-design basis accidents. As of the end of 2020, only 1 SIO for Unit 3, 4 and 1 remains to be addressed, while the completed SIOs are described in the regulatory oversight reports for 2018 and 2019 [1].

The remaining SIO is for the provision of make-up water to the heat transport system under emergency conditions, which was the subject of an IIP scope change request approved by the Commission in 2019. For Unit 2, OPG completed the required work to address the remaining SIO and declared the modification available for service in March 2020. OPG plans to make similar modifications in the other units during their respective refurbishment outages.

Periodic Safety Review

In February 2020, OPG notified the CNSC of their 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. Work on this project is expected to continue into 2024 and will contribute to the re-licensing of DNGS beyond 2025.

Compliance Program

The inspections at the DNGS that were considered in the safety assessments in this regulatory oversight report are tabulated in table 12 (inspection reports were included if they were sent to OPG by February 28, 2021).

Table 12: List of Inspections at DNGS

Safety and control area	Inspection title	Inspection report sent date
Management System	Engineering Change Control: DRPD-2020-07373	December 2020
	Management System Program Implementation: DPRD-2020-03408	April 2020
	Completion Assurance Process: DPRD-2020-05940	May 2020
Human Performance	Conduct of Simulator-based Initial CRSS Certification: DPRD-2020-04215	June 2020
Operating Performance	Defueling Operations: DRPD-2020-07764	January 2021
	Quarterly Field Inspection Q1 FY2019/20: DRPD-2020-07229	September 2020
	Quarterly Field Inspection Q2 FY2019/20: DRPD-2020-07534	December 2020

Safety and control area	Inspection title	Inspection report sent date
	Quarterly Field Inspection Q3 FY2019/20: DRPD-2020-08556	February 2021
	Quarterly Field Inspection Q4 FY2018/19: DRPD-2020-04602	July 2020
Physical Design	Commissioning of SSCs: DRPD-2020-06929	September 2020
	Commissioning of SSCs: DRPD-2020-05938	June 2020
Fitness for Service	ESW System: DRPD-2020-06591	May 2020
	SDS 1 System Inspection: DRPD-2020-07182	October 2020
	SDS 2 System Inspection: DRPD-2020-07186	November 2020
Radiation Protection	Source Term Characterization: DRPD-2020-08061	October 2020
	Radiation Protection: DRPD-2020-08036	February 2021

3.1.1 Management System

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Management System at the DNGS in 2020.

Organization

CNSC staff determined that OPG's organizational structure is adequately defined and roles and responsibilities are documented. Based on inspections and compliance assessments during the reporting year, CNSC staff confirmed compliance of this area with applicable regulatory requirements.

Performance Assessment

CNSC staff determined that DNGS continued to meet the applicable regulatory requirements for performance assessment, improvement, and management review.

Operating Experience (OPEX)

CNSC staff determined that DNGS OPEX program met regulatory requirements.

Change Management

CNSC staff determined that DNGS met regulatory requirements applicable to the change management specific area.

OPG has provided the corrective action plan to address a non-compliant finding of low safety significance identified with respect to OPG's engineering change control process for ensuring a complete set of critical characteristics for non-identical component replacements and item equivalency evaluations. CNSC staff review of the corrective action plan is in progress.

Several REGDOC-3.1.1 reportable events detailing some deficiencies in ensuring all change documentation was controlled for changes to Systems, Structures, and Components (SSC). CNSC staff reviewed these reportable events and determined them to be of low safety significance. OPG is working to correct these deficiencies through its corrective action program, and CNSC staff are satisfied with OPG's progress to date.

Safety Culture

CNSC staff determined that DNGS continued to meet applicable regulatory requirements in the safety culture specific area in 2020. Additionally, [REGDOC-2.1.2 Safety Culture](#) has been fully implemented at DNGS.

Configuration Management

CNSC staff determined that DNGS met regulatory requirements and performance expectations applicable to the configuration management specific area. A CNSC staff inspection [DRPD-2020-05940] identified a finding of negligible safety significance with respect to commissioning test results for refurbishment activity completion assurance, which CNSC staff continue to monitor in 2021.

Record Management

CNSC staff determined that DNGS continued to maintain and implement a records and document management system that complied with the requirements of CSA N286-12, *Management System Requirements for Nuclear Facilities*.

Management of Contractors

CNSC staff determined that DNGS met the applicable regulatory requirements for the management of contractors and supply chain in 2020. An inspection focused on refurbishment contractor management is scheduled for 2021.

Business Continuity

CNSC staff determined that OPG met regulatory requirements for the business continuity specific area. OPG has an adequate contingency plan to maintain or restore critical safety and business functions in the event of disabling circumstances such as a pandemic, severe weather, or labour actions. These measures are required to support minimum shift complement.

COVID-19 pandemic response

DNGS demonstrated a good COVID-19 pandemic response, regularly reporting on the pandemic status at its station.

In March 2020, OPG set the following basic measures to prevent the transmission of COVID-19:

1. Detailed employee communications and supervisor guides were developed and routinely updated to increase awareness of COVID-19, minimize potential risks and ensure safe and reliable operations. These guides reinforce Ontario Public Health protocols for reporting symptoms and potential COVID-19 exposure, and self-isolation requirements.
2. A return-to-work protocol was developed to ensure employees are self-isolating due to illness or potential exposure and are medically cleared before resuming regular on-site duties.
3. OPG's Corporate Crisis Management and Communication Centre was stood-up on March 16, 2020, to assist overall site planning and response to the pandemic. OPG informed the CNSC of the stand-up of this organisation through a supplemental REGDOC-3.1.1 event report, under Table A.1 clause 18. Some examples of OPG's mitigation efforts throughout 2020 included:

- Restricted access to the Main Control Rooms to increase social distancing and interactions with duty crews and certified staff.
- Implementation of thermography readings of anyone entering the Protected Area at the station.
- Restriction of overall site access to essential operational and outage personnel.
- Closure or partial closure of some buildings so maintenance crews could focus cleaning efforts on critical workplaces and common touch surfaces.
- Removal of re-usable protective eyewear stations.
- Installation of additional hand sanitizer locations.

As conditions changed throughout the year and additional information became available, OPG updated their COVID-19 protocols; including but not limited to the following measures:

- As of May 2020, face masks were made mandatory for all workers on OPG property.
- Implementing rapid COVID testing for workers at the workplace when rapid testing became readily available.
- As of October 2020, voluntary testing was available for all asymptomatic employees on site. Testing was mandatory for select groups of workers.

CNSC staff determined that OPG's response to the COVID-19 pandemic met all applicable business continuity requirements.

3.1.2 Human Performance

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Human Performance at the DNGS in 2020. OPG continued to implement and maintain an effective human performance program at DNGS.

Human Performance

CNSC staff inspections in the human performance specific area identified some non-compliances of negligible safety significance, related to not having a method to ensure refurbishment work planning meetings consistently met quorum, and related to the inconsistent documentation of required information in the execution of several procedures. CNSC staff are satisfied with OPG's measures put in place to correct these findings.

Personnel Training

CNSC staff determined that, in 2020, DNGS had a well-documented and robust systematic approach to training (SAT) based training system. This was based on a review of the findings from compliance verification activities conducted in 2020 which resulted in 17 compliant findings and 2 non-compliances of negligible safety significance for the training programs at DNGS. The non-compliant findings were related to an absence of subject-matter training addressing the impacts of a specific engineering change on pressure-retaining system boundaries, as well as not ensuring adequate documentation of formal training requirements for hours of work points of contact. CNSC staff were satisfied with DNGS's progress in correcting the non-compliances.

Personnel Certification

DNGS met the applicable certification examination and requalification test program standards and regulatory requirements as specified in [REGDOC-2.2.3, *Personnel Certification, Volume III: Certification of Persons Working at Nuclear Power Plants*](#). OPG's performance met expectations. Ongoing DNGS inspections identified the need for OPG to improve coaching of examination role players for adherence to the approved script in the respective examiners guides, as per document CNSC-Examination Guide 2.

In April 2020, OPG informed CNSC staff that due to the COVID-19 pandemic, OPG would have to postpone their requalification training and testing, thus potentially affecting a number of certified personnel whose certifications might expire by year end. Following further evaluation of the status of certified staff at DNGS, OPG determined that DNGS was up-to-date and the candidates met the requirements for their recertification within their time periods and did not require any extensions with respect to certifications.

In June 2020, DNGS submitted a written notification regarding their intention to implement a pilot multiple choice questions (MCQ) general certification examination in August 2020 in place of the essay-style examination.

CNSC staff conducted a technical assessment to ensure all the relevant exam criteria, forms, trainer and examiner qualifications, questions, reviewers, customization and database security were all in place for the first MCQ-based General certification examination. CNSC staff agreed to a pilot program at DNGS, and the first initial General Certification examination was scheduled for August 28, 2020. CNSC staff conducted 2 reactive inspections of examinations performed under this pilot program, and found that the conduct of the examination criteria met CNSC staff expectations. A technical assessment on the design, development and grading of the 2 MCQ-based General Certification examinations is currently underway with the report to be released in 2021.

CNSC staff review of DNGS's 2020 quarterly reports on NPP personnel confirmed that OPG complied with the applicable certification requirements over this period.

Work Organization and Job Design

DNGS demonstrated adequate control of its measure to maintain minimum shift complement (MSC) during the challenges of the pandemic. There were no reported MSC violations and no compliance findings for this specific area.

Fitness for Duty

CNSC staff determined that DNGS met requirements for managing fitness for duty in 2020.

CNSC staff conducted an inspection at DNGS in February 2020 on OPG's implementation of [REGDOC 2.2.4, *Fitness for Duty: Managing Worker Fatigue*](#). There was 1 non-compliance identified with respect to hours of work limits by certified staff reported to the CNSC. OPG continues to progress towards addressing the non-compliant finding for this specific area and CNSC staff are satisfied with their progress to date.

3.1.3 Operating Performance

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Operating Performance at the DNGS in 2020.

Conduct of Licensed Activity

CNSC staff determined that OPG met the applicable regulatory requirements for the conduct of licensed activities at DNGS.

In 2020, CNSC staff inspections in this area identified 19 compliant findings, and 2 findings of negligible safety significance. The first non-compliance was related to administrative errors in record keeping, and the second non-compliance was related to documentation of the resolution of corrective actions identified in OPG's corrective action database. CNSC staff are satisfied with the prompt response and corrective measures identified and implemented by OPG.

CNSC staff also reviewed routine station performance data submitted by OPG for the 2020 calendar year.

There were no unplanned reactor trips, 3 stepbacks and 4 setbacks. CNSC staff are satisfied that OPG controlled the reactor transients in accordance with their operational procedures.

Procedures

Based on regulatory oversight activities, CNSC staff were satisfied with DNGS procedures and found that they met regulatory requirements and CNSC staff expectations in the area of procedures that were assessed.

OPG has a process to develop, modify, review and validate technical procedures. Findings in this area indicate that OPG has measures in place to ensure the adequacy of its technical procedures.

Reporting and Trending

DNGS was compliant with all regulatory requirements with respect to scheduled reports in REGDOC-3.1.1 in 2020. CNSC staff determined that the reporting and trending specific area at DNGS met regulatory requirements in 2020.

DNGS submitted 54 REGDOC-3.1.1 events reports in 2020; this was comparable with the average number of reports in previous years. In addition, as a result of the COVID-19 pandemic, DNGS reported positive COVID cases occurring at the station and in the refurbishment organisation as a matter of regulatory interest. CNSC staff confirmed that all events were promptly addressed during the reporting year. CNSC staff followed-up on all reportable events in a graded approach based on the risk significance of the event, including any corrective actions taken.

Outage Management Performance

CNSC staff determined that DNGS's outage management performance met regulatory requirements in 2020.

CNSC staff concluded that OPG's management of outages at the DNGS met the applicable regulatory requirements and expectations in 2020. CNSC staff confirmed that during outages, OPG used approved reactor shutdown guarantee states, monitored heat sinks and components, kept equipment in the correct configuration to maintain reactor safety, and operated the main control room in accordance with its operations program.

OPG met the maintenance of sub-criticality and outage heatsink management requirements of CSA N286-12 for the beginning phases of the DNGS Unit 3 refurbishment outage.

Safe Operating Envelope

DNGS met the requirements of CSA N290.15, *Requirements for the safe operating envelope of nuclear power plants*.

CNSC staff inspections of the Group 1 Service Water System, as a representative sample of Safe Operating Envelope (SOE) systems in 2020, concluded that OPG is in compliance with the SOE program requirements.

However, 1 non-compliance of negligible safety significance was observed, which was related to ensuring that the inter-unit tie valves are in the correct position. OPG has updated the relevant test procedure. CNSC staff have verified that DNGS has in place a well-established program to produce, maintain, and implement the SOE program.

Severe Accident Management and Recovery

CNSC staff determined that DNGS maintained a severe accident management program that met the requirements of [REGDOC-2.3.2, *Accident Management: Severe Accident Management Programs for Nuclear Reactors* \(2013\)](#).

CNSC staff have reviewed OPG's responses related to the Emergency Mitigating Equipment Portable Uninterruptible Power Supply (PUPS) unavailability and concluded that the corrective actions put in place by OPG are acceptable.

A documentation inspection performed in 2020 for the implementation of the Severe Accident Management Guides (SAMGs) at DNGS identified 1 non-compliant finding of negligible safety significance, related to the completeness of information found in the SAMGs documents.

3.1.4 Safety Analysis

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Safety Analysis at the DNGS in 2020.

Deterministic Safety Analysis

CNSC staff determined that OPG met applicable regulatory requirements through the conduct of several system inspections (Shutdown System Number 1, Shutdown System Number 2 and Unit 3 core defueling for refurbishment) at DNGS in 2020.

Probabilistic Safety Analysis

CNSC staff determined that OPG's performance met the expectations for probabilistic safety assessment (PSA) in 2020. As part of its transition to compliance with [REGDOC-2.4.2, *Probabilistic Safety Assessment \(PSA\) for Nuclear Power Plants*](#), OPG continued to submit revised PSA methodologies, to meet the requirements of REGDOC-2.4.2. OPG has submitted all PSAs for the 2020 DNGS PSA update.

CNSC staff completed the reviews of the 2020 DNGS Level 1 Internal Events At-power PSA, and Level 1 and Level 2 Outage Internal Events PSA. CNSC staff determined that these PSA elements complied with REGDOC-2.4.2. CNSC staff will complete the review of remaining DNGS PSA submissions by the end of 2021.

3.1.5 Physical Design

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Physical Design at the DNGS in 2020.

Design Governance

Environmental Qualification

CNSC staff concluded that OPG continued to meet applicable Environmental Qualification (EQ) regulatory requirements, based on the compliance verification activities performed throughout 2020. A non-compliance related to environmental qualification, was identified during an inspection. OPG subsequently took corrective measures to comply with steam barrier requirements. CNSC staff are satisfied with corrective measures identified and implemented by OPG.

Seismic Qualification

OPG continued to implement measures to ensure adequate seismic qualification of components and systems at DNGS in 2020.

Pressure Boundary Design

In 2020, CNSC staff concluded that the implementation of the pressure boundary program, for both code classification and design registration reconciliation processes, met regulatory requirements.

Fire Protection

The fire protection measures at DNGS are controlled and coordinated to meet regulatory requirements. CNSC staff concluded that DNGS continued to implement its fire protection program in accordance with the CSA N293, *Fire protection for CANDU nuclear power plants* requirements.

Structure Design

There were no observations to report on structure design for the DNGS site in 2020; however, CNSC staff note that design deficiencies were identified in the original design of the Heavy Water Management Building West Annex (HWMB-WA) at DNGS. OPG initiated an internal process aimed at demonstrating the compliance of the structure with applicable codes and standards, with a particular emphasis in the area of seismic resistance. CNSC staff reviewed this additional work and determined it was sufficient to demonstrate that the HWMB-WA meets the applicable design requirements, enabling the HWMB-WA to proceed to the final Available for Service (AFS) process of commissioning the building.

UPDATE: In June 2021, CNSC staff confirmed that OPG declared the HWMB-WA available for service in the first calendar quarter of 2021.

System Design

Electrical Power Systems and Instrumentation and Control

Based on compliance verification activities performed in 2020, including reportable events, quarterly reports, and technical assessments, CNSC staff determined that electrical power systems and instrumentation and control systems met CNSC staff performance expectations at the DNGS.

Process and Mechanical Systems

Based on a review of compliance verification activities performed in 2020, including reportable events, quarterly reports, and technical assessments, CNSC staff determined that process and mechanical systems met CNSC staff expectations at the DNGS.

Component Design

Fuel Design

The DNGS fuel design and inspection program met regulatory requirements and CNSC staff performance expectations. CNSC staff determined that DNGS has met the minimum expectations for fuel bundle inspections and continue to have a low defect rate. DNGS Unit 2 was successfully hot conditioned and returned to service without the creation of fuel deposits. CNSC staff have determined that the overall fuel condition was satisfactory and fuel was operated safely in 2020.

Cables

OPG has a mature surveillance program at DNGS that includes cable condition monitoring and aging management programs. CNSC staff confirmed that OPG completed the outstanding tests for cables from 2019 in 2020. Overall, CNSC staff were satisfied with OPG's performance in the area of cable systems in 2020.

3.1.6 Fitness for Service

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Fitness for Service at the DNGS in 2020.

Equipment Fitness for Service/Equipment Performance

CNSC staff determined that the overall equipment fitness for service and performance at DNGS met the applicable regulatory requirements.

Reliability of systems important to safety

CNSC staff determined that the reliability program at DNGS met the requirements described in [REGDOC-2.6.1, Reliability Programs for Nuclear Power Plants](#). CNSC staff conducted a reliability program inspection [DRPD-2020-03408] at DNGS in 2020 with all compliant findings.

CNSC staff confirmed that all special safety systems for DNGS Units 1-4 met their unavailability targets in 2020.

Maintenance

CNSC staff determined that DNGS's maintenance program met the applicable regulatory requirements and performance expectations. The critical corrective maintenance backlog and the number of critical preventive maintenance deferrals were maintained at a very low level in 2020. The critical deficient maintenance backlog was continuously reduced and was better than the industry average. The average preventive maintenance completion ratio was 93%, which was better than the industry average of 91%. There were no safety significant findings related to maintenance based on the review of the events reported by the licensee.

CNSC staff also conducted several maintenance related inspections in 2020 that confirmed that DNGS'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 for DNGS in 2020 are given in table 13.

Table 13: Trend of maintenance backlogs and deferrals for critical components for DNGS, 2018 to 2020

Parameter	Average quarterly work orders per unit			Three year trending	Quarterly 2020 work orders				Industry average for 2020
	2018	2019	2020		Q1	Q2	Q3	Q4	
Corrective maintenance backlog	0	1	0	steady	0	0	0	0	1
Deficient maintenance backlog	11	5	1	down	1	1	1	2	4
Deferrals of preventive maintenance	0	2	1	steady	2	0	1	1	2

Structural Integrity

Based on regulatory oversight activities, CNSC staff determined that SSCs continued to meet structural integrity requirements for DNGS.

CNSC inspections of structural integrity in 2020 identified 8 compliant findings. In addition, CNSC compliance verification activities identified 3 compliant findings, 1 negligible and 2 low safety significant findings. The 2 low safety significant findings were related to the performance of feeder fitness for service assessments. CNSC staff have provided OPG with recommendations to address the deficiencies identified in the low findings, and OPG is working to address these findings.

Aging Management

CNSC staff determined that DNGS's aging management program met regulatory requirements. OPG is compliant with [REGDOC-2.6.3, Fitness for Service: Aging Management](#).

CNSC staff compliance verification activities for aging management resulted in 6 compliant findings, 2 negligible and 2 low safety significant findings. The first negligible and 1 of the low safety significant finding were related to probabilistic fracture protection (PFP) assessments.

OPG and CNSC staff are working to address the remaining issues with performing PFP assessments. CNSC staff are satisfied with the priority being given to PFP by DNGS. The second negligible finding was related to Heq measurements not matching the applicable Heq models. OPG is actively working to address CNSC staff concerns. The second low finding is related to the submission schedule for revising core assessments. CNSC staff have communicated recommendations to address deficiencies and OPG is working to address them.

Chemistry Control

CNSC staff determined that DNGS's chemistry control program met the applicable regulatory requirements. DNGS maintained acceptable system chemistry performance in 2020. DNGS Unit 2 returned to service after refurbishment in 2020. Chemistry control was well maintained during the transition from refurbishment back to operation. The concentration of iron in the Unit 2 feed water system was out of specification for 638 hours (out of 758 hours the unit was in service) due to unit start-up after refurbishment. CNSC staff were satisfied with the actions that OPG took as required by their chemistry control program to bring this parameter back within specifications. There were no adverse consequences as a result of this high iron concentration.

Periodic Inspection and Testing

During the reporting year, DNGS performed the appropriate inspection and testing program to meet the applicable regulatory requirements. There was a negligible finding related to indications noted on fuel channels in DNGS Unit 2 before restart. The second was related to reducing feeder inspection scope in Unit 1. The third negligible finding was related to testing and material surveillance of X-750 annulus spacers. CNSC staff note that OPG has made good progress on testing methodologies and discussions will continue between CNSC and OPG staff. The final negligible finding was related to baseline inspections of the replacement feeders in Unit 2. OPG provided additional information that was acceptable to CNSC staff to address the finding. The 1 low finding is related to the most recent N285.8, *Effluent monitoring programs at Class I nuclear facilities and uranium mines and mills* compliance plan. The compliance plan has been conditionally accepted, with CNSC and OPG staff are actively working on addressing the issues.

3.1.7 Radiation Protection

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Radiation Protection at the DNGS in 2020.

Application of ALARA

CNSC staff compliance verification activities for the Application of ALARA at the DNGS in 2020 found that OPG was compliant with requirements and met CNSC staff performance expectations.

OPG demonstrated continuous tracking of collective dose performance during operations, unit outages and refurbishment, as well as ongoing monitoring of unplanned exposures, personal contamination events, worker dose and dose rate alarms, low-level tritium exposures and alpha uptakes. OPG conducted monitoring for individuals, Work Groups, tasks, and the overall station. To aid in keeping doses ALARA, OPG reported on these metrics to various stakeholders daily, weekly, monthly and annually. OPG achieved its 2020 year end collective dose targets for both DNGS and DNGS Refurbishment activities.

In 2020, OPG approved a plan for DNGS, called the “Darlington Nuclear Long Range ALARA Plan (2018-2026),” that incorporated lessons-learned and OPEX to develop challenging dose targets for future years, with the goal of reducing worker doses. Various ALARA initiatives were being planned to further reduce occupational exposures.

Worker Dose Control

CNSC staff determined that OPG met applicable regulatory requirements for worker dose control at the DNGS in 2020.

Radiation doses to workers at the DNGS were below the regulatory dose limits, as well as the action levels in OPG’s radiation protection program. CNSC staff did not observe any adverse trends or safety significant unplanned exposures at the DNGS in 2020.

Radiological Hazard Control

CNSC staff determined that OPG implemented effective controls for radiological hazards that met the applicable regulatory requirements. Of note, in the 2018 regulatory oversight report, CNSC staff identified a downward trend in OPG’s radiological hazard control at DNGS. In 2019, CNSC staff concluded that OPG had implemented measures to reverse this trend. In 2020, CNSC staff noted a clear improvement in the area of radiological hazard control. Of the 24 inspection findings related to this specific area, 23 were compliant; the 1 non-compliant finding dealt with review and timely approval of radiological surveys, and this was resolved to CNSC staff satisfaction. There were no action level exceedances for surface contamination or contamination control at DNGS in 2020.

3.1.8 Conventional Health and Safety

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Conventional Health & Safety at the DNGS in 2020.

OPG has appropriate procedures in place to ensure the protection of its workers against hazardous conditions in the workplace. OPG adequately identified workplace hazards in 2020.

DNGS was compliant with the relevant provisions of the *Occupational Health and Safety Act* of Ontario and the *Labour Relations Act*.

DNGS achieved over 4.8 million person-hours without a lost time accident. OPG recorded an accident frequency of 0.17 in 2020, as a result of 4 medically-treated injuries in Q3. For 2020, at DNGS, the accident severity rate was unchanged at 0.0, which 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.

3.1.9 Environmental Protection

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Environmental Protection at the DNGS in 2020.

Effluent and Emissions Control (releases)

In 2020, releases from the DNGS site were below the Derived Release Limits (DRL). No radiological releases to the environment from the facility exceeded the regulatory limits and no action levels were approached or exceeded. Results from CNSC compliance verification activities and compliance assessments of submitted data from OPG revealed that OPG met regulatory requirements and performance expectations at the DNGS.

Environmental Management System

OPG has implemented and maintained a corporate Environmental Management System that is compliant with CNSC regulatory requirements and performance expectations. OPG is implementing the 2017 revision of [REGDOC-2.9.1 *Environmental Protection: Environmental Principles, Assessments and Protection Measures*](#), and has committed to provide CNSC staff with a status update by March 31, 2023.

UPDATE: CNSC staff provided a response to OPG acknowledging their statement of compliance with REGDOC-2.9.1, with expected compliance with CSA N288.7 *Groundwater protection programs at class I nuclear facilities and uranium mines and mills*, which is included in REGDOC-2.9.1, to be achieved in December 2022. CNSC staff accepted OPG's target completion date for implementation of N288.7 and REGDOC-2.9.1.

Assessment and Monitoring

The field inspections and technical assessment of quarterly and annual scheduled compliance reports for DNGS indicated that OPG met the applicable regulatory requirements in 2020.

Based on the review of 2020 environmental monitoring data, CNSC staff concluded that people and the environment in the vicinity of the site (including DWMF) were protected and that no health impacts were expected to result from the operations of the DNGS site in 2020.

Protection of People

In 2020, hazardous substances releases to the environment from DNGS were below the regulatory limits. The events documented in 2020 were determined to be of low safety significance.

CNSC staff concluded that people were protected from the impacts of the non-radiological substances released from the facility in 2020.

Performance information from technical reviews of quarterly and annual reports met expectations in the area of the protection of people.

Environmental Risk Assessment

CNSC staff reviewed the results of the environmental monitoring program at the DNGS in 2020, which includes the DWMF, and confirmed that OPG met the applicable regulatory requirements for the environmental risk assessment specific area.

Estimated Dose to the Public

DNGS continued to ensure the protection of people in accordance with the *Radiation Protection Regulations*.

Performance information from the technical assessments of the 2020 quarterly and annual scheduled reports and the OPG report of the environmental monitoring program in 2020 indicated that the dose to the public at the DNGS remained low (0.4 μSv) and in the range of the previous year, well below the regulatory dose limit of 1 mSv/y.

3.1.10 Emergency Management and Fire Protection

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Emergency Management and Fire Protection at the DNGS in 2020.

CNSC staff concluded that DNGS 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.

Conventional Emergency Preparedness & Response

From the onset of the COVID-19 pandemic, OPG mobilized their Corporate Crisis Management and Communication Centre (CMCC) to allow for planning and execution of the overall response to COVID-19. CNSC staff were informed of OPG's actions and monitored them to ensure that safety is maintained at the DNGS.

Nuclear Emergency Preparedness & Response

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff performance expectations for nuclear emergency preparedness and response at the DNGS in 2020. CNSC staff conducted several field inspections in 2020 regarding nuclear emergency preparedness at the DNGS, and identified no non-compliant findings.

OPG requested regulatory flexibility to defer the planned corporate exercise that was scheduled for February 8, 2021 to March 2022, due to the ongoing COVID-19 pandemic. CNSC staff approved OPG's request, and the corporate exercise is currently planned for February 23-25, 2022.

Fire Emergency Preparedness & Response

CNSC staff determined that OPG continued to maintain an adequate Fire Protection Program (FPP) to minimize both the probability of occurrence and the consequences of fire at DNGS. The FPP complies with the CSA N293-12 *Fire protection for CANDU nuclear power plants* requirements.

DNGS has an extensive fire drill and training program, including the Wesleyville Fire Training Academy where live fire training is conducted for DNGS Emergency Response Team (ERT) and with the participation of the Clarington Municipal Fire Department.

In 2020, CNSC staff conducted a number of inspections at DNGS that verified compliance with the fire protection program. During the verification activities, CNSC found 1 non-compliance which had no safety significance and occurred during the conduct of a fire drill.

In addition to CNSC staff compliance verification activities, DNGS is required to conduct expert Third Party Reviews (TPR) of an annual plant condition, bi-annual fire drill audit and tri-annual fire program audit.

By incorporating the results of the CNSC staff compliance findings and TPR observations and recommendations into the drill and training program, the implementation of the fire protection program meets regulatory requirements and the emergency response team performance continued to improve.

3.1.11 Waste Management

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Waste management at the DNGS in 2020. OPG's reporting on their quarterly operations report met the expectations of CNSC staff.

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

CNSC staff review of the data from OPG's reporting on radioactive waste safety performance indicators, for 2020 met performance expectations.

In 2017, OPG revised the Preliminary Decommissioning Plans (PDPs) for all of its facilities for the period up to 2022. OPG selected a deferred decommissioning strategy for the decommissioning of the DNGS and an immediate decommissioning strategy for the DWMF, following the completion of DNGS decommissioning.

There were no changes made to the PDPs for the DNGS in 2020. The associated financial guarantee is discussed in section 2.11.

3.1.12 Security

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Security at the DNGS in 2020.

CNSC staff reviewed the annual site security report and threat and risk assessment, as well as 4 quarterly safety reports for DNGS, and confirmed that OPG met all the applicable regulatory requirements.

Facilities and Equipment

CNSC inspections of the specific area of facilities and equipment identified that DNGS was compliant with applicable regulatory requirements that were verified. DNGS also reported 1 event pertaining to this specific area that was deemed to be negligible with no safety or security significance.

DNGS continued to maintain security equipment through lifecycle management; however, some non-safety significant equipment failures were reported during 2020. CNSC staff are satisfied with the corrective actions proposed by OPG and CNSC staff will verify the implementation of the corrective actions.

Response Arrangements

CNSC staff inspections of the specific area of response arrangements identified that DNGS was compliant with applicable regulatory requirements that were verified. DNGS also reported 1 event pertaining to this specific area that was deemed to be negligible with no safety or security significance.

Security Practices

CNSC staff did not conduct any inspections and there were no reported events from DNGS related to the specific area of security practices.

Drills and Exercises

There were no reported events from DNGS related to the specific area of drills and exercises.

DNGS maintains a drill and exercise program that tests the effectiveness of its physical protection system at DNGS, consistent with the design basis threat (DBT). CNSC staff concluded that there were no safety significant issues for this specific area.

Cyber Security

CNSC staff determined that DNGS met their licence requirement to update their cyber security program to meet the requirements and guidance in the CSA N290.7-14 *Cyber security for nuclear power plants and small reactor facilities*.

CNSC staff reviewed updated OPG governance documentation related to cyber security and found they met their purpose and objective in this specific area. CNSC staff review found that OPG's updates to the cyber security program documentation did not impact the purpose and use of the program for cyber security.

3.1.13 Safeguards and Non-Proliferation

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Safeguards and Non-Proliferation at the DNGS in 2020.

Nuclear Material Accountancy and Control

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

In 2020, OPG provided the required nuclear material accountancy and control reports to the CNSC and the IAEA for safeguards activities, including inspections.

OPG initially committed to full implementation of CNSC regulatory document [REGDOC-2.13.1, *Safeguards and Nuclear Material Accountancy*](#) by March 31, 2021. In 2020, OPG provided confirmation that, as of March 31, 2020, it was compliant with the requirements of REGDOC-2.13.1, with the exception of the aspects related to non-fuel nuclear material inventory. Due to COVID-19 pandemic response efforts, OPG requested a 6 month extension to October 29, 2021 for the implementation of these remaining requirements. CNSC staff found OPG's request reasonable and informed OPG that the LCH would be updated accordingly.

Access and Assistance to the IAEA

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. Details of the IAEA inspection activities are provided in section 2.13.

Operational and Design Information

CNSC staff determined that OPG met the applicable regulatory requirements for operational and design information in 2020 at the DNGS. OPG provided the required operational and design information to facilitate IAEA safeguards activities.

Safeguards Equipment, Containment and Surveillance

CNSC staff determined that OPG met the applicable regulatory requirements for safeguards equipment, containment and surveillance in 2020 at the DNGS.

In 2020, OPG provided the assistance required for the IAEA's safeguards equipment, containment, and surveillance activities, including inspections at the DNGS.

3.1.14 Transport and Packaging

CNSC staff concluded that OPG has implemented a packaging and transport program that ensures compliance with the *Packaging and Transport of Nuclear Substances Regulations, 2015* (PTNSR), and the *Transportation of Dangerous Goods Regulations*, and that the transport of nuclear substances to and from the facility was conducted safely in 2020.

In 2020, CNSC staff conducted 2 inspections of packaging and transport. CNSC staff verified that all employees who were engaged in transport-related activities were adequately trained, radioactive materials to be transported were appropriately classified and packaged, all safety markings were appropriately displayed on packages and the documentation accompanying the shipments was properly completed.

No non-compliant findings were identified during the inspections.

There was 1 packaging and transport related event reported by OPG. CNSC staff determined that the event had a negligible safety significance, and CNSC staff are satisfied with OPG's actions to prevent recurrence.

3.2 Darlington Waste Management Facility

3.2.0 Introduction

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, 1 DSC processing building, 2 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 2 additional DSC storage buildings (Storage Buildings #3 and #4), which would allow for an additional storage capacity of 1,000 DSCs.

Licensing

The Commission renewed the WFOL for the DWMF in March 2013, with an expiry date of April 30, 2023.

Compliance Program

The inspections at the DWMF that were considered in the safety assessments in this regulatory oversight report are tabulated in table 14 (inspection reports were included if they were sent to OPG by February 28, 2021).

Table 14: List of Inspections at DWMF

Safety and control area	Inspection title	Inspection report sent date
Operating Performance	General Inspection: OPG-DWMF-2020-02	May 2020
Fitness for Service	Fitness for Service Inspection: OPG- DWMF-2020-01	May 2020

3.2.1 Management System

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Management System at the DWMF in 2020.

Management System

In 2020, OPG revised their Nuclear Waste Management Program. CNSC staff are satisfied with the revised program document, and the changes met CNSC staff expectations.

Business Continuity

CNSC staff concluded that OPG met regulatory requirements for the business continuity specific area. OPG has an adequate contingency plan to maintain or restore critical safety and business functions in the event of disabling circumstances such as a pandemic, severe weather, or labour actions.

In light of the COVID-19 pandemic, CNSC staff confirmed that OPG had sufficient business continuity plans in the event of a wide-scale outbreak across Canada. During this pandemic, OPG has implemented mitigation steps as part of their plans to combat the spread of the COVID-19 virus. This includes:

- Detailed and on-going employee communications to increase awareness of COVID-19, minimize potential risks, and ensure safe and reliable operations.
- Initial shutdown of DWMF during the onset of the COVID-19 pandemic.
- After the shutdown, implementing a 1 week on, 1 week off schedule for personnel working at the facilities – this helps to minimize the total number of personnel at the facility at a given time.
- Utilization of health and safety measure such as masks, hand sanitization stations and sanitation of work areas.
- Protocol developed for visitors (i.e. questionnaire required for all visitors).
- Continuous evolution of enhanced personal protective equipment (PPE) as information becomes available (such as a transition to triple layer masks).
- OPG screens all workers into the facility for COVID-19 symptoms, recent travel, and orders to self-isolate. Thermal imaging is conducted on all personnel entering the protected area.

3.2.2 Human Performance

There were no significant observations in the SCA Human Performance to report for the DWMF in 2020. CNSC staff concluded that DWMF continued to implement its human performance program in accordance with requirements.

3.2.3 Operating Performance

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Operating Performance at the DWMF in 2020.

Conduct of Licensed Activity

In total, OPG processed 59 DSCs at the DWMF in 2020. CNSC staff review 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/clarification, met CNSC staff expectations.

Reporting and Trending

In 2019, CNSC staff review determined that OPG's annual compliance report did not meet the specific regulatory requirements of [REGDOC-3.1.2, Reporting Requirements, Volume I: Non-Power Reactor Class I Facilities and Uranium Mines and Mills](#); however, OPG's follow-up activities, which included submitting an addendum to the annual compliance report, met the requirements of REGDOC-3.1.2 and CNSC staff expectations. In 2020, OPG submitted all scheduled quarterly and annual reports as required within the appropriate timelines.

3.2.4 Safety Analysis

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Safety Analysis at the DWMF in 2020.

3.2.5 Physical Design

CNSC staff concluded that OPG met the applicable regulatory requirements, and its performance met CNSC staff expectations, for the SCA Physical Design at the DWMF in 2020.

Design Governance

Fire Protection

CNSC staff concluded that the DWMF 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*.

3.2.6 Fitness for Service

CNSC staff concluded that OPG met the applicable regulatory requirements, and its performance met CNSC staff expectations, for the SCA Fitness for Service at the DWMF in 2020.

Aging Management

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.

Periodic Inspection and Testing

CNSC inspections found that the DWMF met the requirements for periodic inspection and testing. CNSC staff noted 2 recommendations during their inspections (OPG-DWMF-2020-01/02), regarding some of the facilities inspection procedures. The recommendations were provided to the licensee for further consideration.

3.2.7 Radiation Protection

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Radiation Protection at the DWMF in 2020.

Application of ALARA

CNSC staff determined that OPG implemented an effective and well-documented program, based on industry best practices, to keep doses to persons as low as reasonably achievable (ALARA) at the DWMF.

Worker Dose Control

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. There were no event reports related to worker dose control at the DWMF in 2020.

Radiological Hazard Control

CNSC staff determined that OPG implemented radiological hazard controls that met the applicable regulatory requirements for control of radiological hazards and the protection of workers at the DWMF in 2020. OPG did not exceed any action levels for contamination control.

3.2.8 Conventional Health and Safety

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Conventional Health and Safety at the DWMF in 2020.

OPG did not report any lost-time accidents at the DWMF in 2020 or any other events related to conventional health and safety. CNSC staff compliance verification activities did not identify any non-compliant findings relevant to conventional health and safety in 2020.

3.2.9 Environmental Protection

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Environmental Protection at the DWMF in 2020.

Effluent and Emissions Control (releases)

CNSC staff compliance verification activities had resulted in comments regarding effluent and emission control. CNSC staff found OPG's response to be acceptable, thus resolving the comments. DWMF releases remained below the action levels and DRLs. DWMF implemented and maintained an effluent monitoring program that met CNSC requirements and expectations.

Protection of People

In 2020, hazardous substances releases to the environment from DWMF were below the regulatory limits. People were protected from the impacts of the non-radiological substances released from the facility in 2020.

Performance information from technical reviews of quarterly and annual reports met CNSC staff expectation in the area of protection of people.

3.2.10 Emergency Management and Fire Protection

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Emergency Management and Fire Protection at the DWMF in 2020.

Conventional Emergency Preparedness & Response

From the onset of the COVID-19 pandemic, OPG mobilized their Corporate Crisis Management and Communication Centre (CMCC) to allow for planning and execution of the overall response to COVID-19. CNSC staff were informed of the OPG's actions and monitored them to ensure that safety is maintained at the waste management facility.

Fire Emergency Preparedness & Response

OPG has a facility emergency program for the DWMF that includes basic fire response for facility staff to respond to small fires with fire extinguishers. Main fire response is done by Clarington Emergency and Fire Services (CEFS). The annual fire drill with CEFS participation was completed in 2020. CEFS staff are given orientation tours at the DWMF and training with Darlington Emergency Response Team (ERT) at the live fire training facility near Wesleyville, Ontario. In 2019 during the conduct of the annual fire drill at DWMF, a finding of medium safety significance was observed in regards to a worker not being accounted for 20 minutes after the fire alarm had sounded. OPG addressed this by updating their training and requiring that OPG staff complete the updated training. During the 2020 annual fire drill, CNSC staff confirmed that the training has been successful.

CNSC staff noted 1 non-compliance with negligible safety significance during inspections at the DWMF in 2020. This was regarding an out-of-date posting of the Fire Safety Plans at the DWMF. OPG immediately resolved the issue, and CNSC staff found the actions to be acceptable.

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 comply with the CSA N393-13 *Fire protection for facilities that process, handle, or store nuclear substances* requirements.

3.2.11 Waste Management

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Waste Management at the DWMF in 2020. OPG's quarterly operations reports met CNSC staff expectations.

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

In 2017, OPG revised the Preliminary Decommissioning Plan (PDPs) for all of its facilities for the period up to 2022. OPG selected a deferred decommissioning strategy for the decommissioning of the DNGS and an immediate decommissioning strategy for the DWMF, following the completion of DNGS decommissioning.

There were no changes made to the PDPs for the DWMF in 2020. The associated financial guarantee is discussed in section 2.11.

3.2.12 Security

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Security at the DWMF in 2020.

CNSC staff reviewed the annual site security report and threat and risk assessment, as well as 4 quarterly safety reports, for DWMF, and confirmed that OPG met all the applicable regulatory requirements.

Facilities and Equipment

CNSC staff inspections of the specific area of facilities and equipment identified that DWMF was compliant with applicable regulatory requirements that were verified. DWMF also reported 1 event pertaining to this specific area, which was deemed to be negligible without a safety or security significance.

Security Practices

CNSC inspections of the specific area of security practices identified that DWMF was compliant with applicable regulatory requirements that were verified.

3.2.13 Safeguards and Non-Proliferation

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Safeguards and Non-Proliferation at the DWMF in 2020.

Nuclear Material Accountancy and Control

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

Access and Assistance to the IAEA

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. Details of the IAEA inspection activities are provided in section 2.13.

Operational and Design Information

CNSC staff determined that OPG met the applicable regulatory requirements for operational and design information in 2020 at the DWMF. OPG provided the required operational and design information to facilitate IAEA safeguards activities.

Safeguards Equipment, Containment and Surveillance

CNSC staff determined that OPG met the applicable regulatory requirements for safeguards equipment, containment and surveillance in 2020 at the DWMF.

In 2020, OPG provided the assistance required for the IAEA's safeguards equipment, containment, and surveillance activities, including inspections at the DWMF.

OPG hosted an IAEA technician for a site survey for the implementation of the IAEA's laser mapping for containment verification (LMCV) tool at the DWMF.

Separately, OPG reported on the potential damage to the IAEA safeguards fiber optic seal cables on a few DSCs. CNSC staff confirmed that OPG took appropriate corrective actions and worked with IAEA inspectors to verify and replace the safeguards cables and seals. CNSC staff were satisfied with OPG's response to the event.

3.2.14 Transport and Packaging

CNSC staff concluded that OPG has implemented a packaging and transport program that ensures compliance with the *Packaging and Transport of Nuclear Substances Regulations, 2015* (PTNSR), and the *Transportation of Dangerous Goods Regulations*. The transport of nuclear substances to and from the facility was conducted safely in 2020.

There were no packaging and transport events reported in 2020 at the DWMF.

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 kilometers northeast of Toronto and 21 kilometers southwest of Oshawa. 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 2 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. 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.

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. The PNGS PROL expires on August 31, 2028. OPG requires Commission approval to operate PNGS beyond December 31, 2024. 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. This phase will begin in 2028.

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 3 phases of operational activities:

- Continued commercial operation until December 31, 2024
- Stabilization phase (post-shutdown de-fuelling and de-watering), which lasts approximately 3 to 4 years
- Beginning of safe storage for Units 1 and 4 and Units 5–8

OPG requires Commission approval to operate PNGS beyond December 31, 2024.

The PROL was amended in 2020 to allow for an update to a standardized licence condition related to training and certification of personnel in their PROLs, by referencing CNSC regulatory document [REGDOC-2.2.3, Personnel Certification, Volume III: Certification of Persons Working at Nuclear Power Plants](#).

Fisheries Act Authorization

CNSC staff completed the review of OPG's PNGS Fish Impingement Monitoring Report for 2019. The report states that no *Species at Risk Act* (SARA) Schedule 1 fish species were observed as impinged and that the biomass of fish impinged was 15,114.5 kg. OPG attributed the elevated fish impingement primarily to weather and environmental influences, which is outside of PNGS operational control. Sporadic large fish impingement events often occur between November 1 and May 1 2020, when the Fish Diversion System is not in place. The purpose of the Fish Diversion System is to create a barrier to fish movement into the PNGS lake water intake channel.

CNSC staff note that the 2019 report also evaluated causes and means to mitigate nuisance algae blooms that could affect the effectiveness of the Fish Diversion System and station operations. OPG created and tested an advanced algae warning system for this reason, and assessed the feasibility of additional in-water mitigation measures (e.g., installation of an air bubble curtain on the lake bed).

As per the *Fisheries Act* authorization, in 2020, OPG engaged Fisheries and Oceans Canada to determine potential follow-up requirements given that OPG reported 2 consecutive years (2018 and 2019) where the annual weight of fish impinged was above 3,619 kg.

UPDATE: In 2021, CNSC staff completed the review of OPG's PNGS Fish Impingement Monitoring Report for 2020. The biomass of all species and ages impinged in 2020 was 3,573 kg, reflecting the lowest value since 2016.

Thermal Plume Monitoring

In 2021, OPG submitted the "Potential Effects of the Pickering Nuclear Generating Station Thermal Plume on the Survival of Round Whitefish Embryos, 2018-2020" report. This report provides results of thermal plume monitoring over 2 periods (2018 to 2019 and 2019 to 2020), as directed by the Commission in the [Record of Decision](#) for the PNGS PROL renewal application.

OPG concluded that the thermal plume monitoring report supports the 2018 Pickering Environmental Risk Assessment (ERA) conclusion that there is no adverse effect on Round Whitefish embryo survival or on the local or regional Round Whitefish population from thermal plume at PNGS. CNSC staff and Environment and Climate Change Canada (ECCC) are reviewing OPG's report.

Integrated Implementation Plan

OPG developed an IIP for the PNGS that defines resolution actions to address issues identified through the periodic safety review conducted in support of the 2018 licence renewal. Each IIP resolution action is completed through the execution of 1 or more IIP actions. OPG established a schedule to manage the completion of the 35 IIP resolution actions and the 63 supporting IIP actions. According to this schedule, all actions must be completed by December 31, 2020, and deviation to this date would require approval by the Commission.

In 2020, the IIP was progressing according to schedule, and CNSC staff were satisfied with this progress. Table 15 indicates the overall planned, completed, and closed IIP commitments. It also indicates IIP tasks planned for completion in 2020, completed by the licensee in 2020 (irrespective of planned completion dates) and IIP items closed by CNSC in 2020.

Table 15: PNGS IIP Status

Total commitments	Overall	2020
Planned by OPG	98*	20
Completed by OPG	91	17
Closed by CNSC	69	27

* Includes 63 IIP actions and 35 IIP resolution actions

In 2020, OPG completed 17 IIP commitments (9 IIP actions and 8 IIP resolution actions). In addition, OPG requested the Commission to extend the due date to 2021 for 5 IIP commitments (3 IIP actions and 2 IIP resolution actions) and to de-scope 2 IIP commitments (1 IIP action and 1 IIP resolution action) from the IIP. The extensions and de-scope was approved by the Commission on April 13, 2021.

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

Compliance Program

The inspections at the PNGS that were considered in the safety assessments in this regulatory oversight report are tabulated in table 16 (inspection reports were included if they were sent to OPG by February 28, 2021).

Table 16: List of Inspections at PNGS

Safety and control area	Inspection title	Inspection report sent date
Management System	Aging Management : PRPD-2020-05250	October 2020
	Management System Program Implementation : PRPD-2020-05248	April 2020

Safety and control area	Inspection title	Inspection report sent date
	REGDOC-2.24 Implementation : PRPD- 2020-05333	May 2020
	Engineering Change Control : PRPD-2020- 04618	April 2020
Human Performance	Simulator Certification Examination : PRPD- 2020-04269	May 2020
	Simulator Certification Examination and Requalification Test : PRPD-2020-04270	February 2021
	Simulator Certification Exam: PRPD-2020-08418	January 2021
	Managing Worker Fatigue: PRPD-2020- 06899	May 2020
Operating Performance	Quarterly Field Inspection Q1 FY2019/20: PRPD- 2020-07273	August 2020
	Quarterly Field Inspection Q2 FY2019/20: PRPD- 2020-07758	September 2020
	Quarterly Field Inspection Q3 FY2018/19: PRPD- 2019-04285	March 2020
	Quarterly Field Inspection Q4 FY2018/19: PRPD- 2020-04286	June 2020
	Unit 5 planned Outage: PRPD-2020-04660	April 2020
	Unit 5 planned Outage: PRPD-2020-04591	April 2020
	Unit 1 planned Outage: PRPD-2020-05710	September 2020

Safety and control area	Inspection title	Inspection report sent date
Fitness for Service	System Inspection – Fuel Handling: PRPD-2020-03380	February 2020
	System Inspection – Instrument Air: PRPD-2020-07549	December 2020
Emergency Preparedness and Fire Protection	Full Scale Emergency Exercise: PRPD-2020-08303	January 2021

3.3.1 Management System

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Management System at the PNGS in 2020.

Organization

CNSC staff determined that OPG’s organizational structure is adequately defined and roles and responsibilities are documented. For 2020, CNSC staff concluded that OPG met applicable regulatory requirements.

Performance Assessment

CNSC staff determined that OPG met regulatory requirements, and this was supported by the conduct of inspections and reviews of OPG self and independent assessments, and the program performance reports.

In 2020, CNSC staff inspections identified 14 compliant findings. However, 1 non-compliant finding of low safety significance was observed in relation to periodic assessments of the effectiveness of the management system in managing risks associated with worker fatigue [PRPD-2020-05333]. CNSC staff were satisfied with the manner in which OPG addressed this finding.

Operating Experience (OPEX)

CNSC staff determined that the PNGS OPEX program met regulatory requirements. In 2020, elements of the OPEX program were reviewed through 14 inspections. CNSC staff identified 18 compliant findings and 2 non-compliant findings. A non-compliant finding was of negligible safety significance due to OPG not consistently using and sharing OPEX related to the Fuel Handling System. The other non-compliance was of low safety significance and related to ensuring that hours of work non-compliances and other problems related to worker fatigue were identified, documented and resolved. CNSC staff were satisfied with how OPG addressed these findings.

Change Management

CNSC staff inspections identified 6 compliant findings applicable to the change management specific area, based on 5 CNSC inspections. However, 1 non-compliant finding of low safety significance was identified in OPG's engineering change control process for ensuring limited temporary modifications were systematically evaluated based on risk. CNSC staff were satisfied with how OPG addressed this finding.

Safety Culture

CNSC staff determined that PNGS continued to meet applicable regulatory requirements in the safety culture specific area in 2020. Additionally, [REGDOC-2.1.2 Safety Culture](#) has been fully implemented at PNGS.

Configuration Management

Elements of the configuration management program at PNGS were looked at during 3 CNSC staff inspections in 2020. CNSC staff identified 1 compliant finding and 2 non-compliant findings of negligible safety significance in relation to maintaining the physical configuration of equipment in accordance with station documentation. Both non-compliant findings were addressed by OPG during the inspection, thereby satisfying the applicable regulatory requirements for the configuration management specific area.

Record Management

CNSC staff determined that PNGS continued to maintain and implement a records and document management system that complied with the requirements of CSA N286-12, *Management system requirements for nuclear facilities*. The control of the documentation and records are assessed during each CNSC staff inspection. Among the documentation and records reviewed in 2020, CNSC staff identified a repeat finding from 2019 for obsolete documents that were not withdrawn from use in the stack monitoring rooms. As such, CNSC staff expectations were not met, however OPG addressed the deficiency during the inspection.

Business Continuity

CNSC staff determined that OPG met regulatory requirements in this area. OPG has an adequate contingency plan to maintain and restore critical safety and business functions in the event of disabling circumstances such as a pandemic, severe weather, or labour actions. These measures are required to support minimum shift complement.

The ongoing COVID-19 pandemic provided a unique opportunity for CNSC staff to assess OPG's governance, implementation strategies and response therein. OPG's Business Continuity Program provides assurance that OPG management has defined plans and controls, and ensures alignment and integration with internal and external interfacing programs and activities.

Prior to the COVID-19 pandemic, OPG conducted periodic Infectious Disease Response drills to prepare for any eventual onslaught. At the onset of the pandemic, OPG activated its Corporate Crisis Management Communications Center as its highest emergency response structure as well as its Infectious Disease Incident Response Team. OPG issued “Emergency Response Facility Pandemic Protocol Guideline” to support decision making regarding protocols at Emergency Response Facilities. Measures include COVID-19 self screening, physical distancing, mandatory mask use, increased cleaning of shared equipment and surfaces, removing non-critical roles from the facility to respond from alternate location, use of additional rooms and consideration for select positions to respond remotely. OPG reinstated their emergency response programs with no significant interruption or deterioration of emergency response capability.

OPG relied on its stockpile of PPE to protect its staff and provide supplies to Ontario hospitals. As a result, OPG was able to maintain its operations while keeping its staff healthy and safe during the COVID-19 pandemic. There were no changes to performance standards against which staff were evaluated during the COVID-19 pandemic, and OPG continued to reinforce positive behaviors related to personnel safety. OPG continued to provide service to the people of Ontario while promoting safe practices aligned with medical health guidelines, while effectively ensuring the health and safety of its staff.

3.3.2 Human Performance

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Human Performance at the PNGS in 2020. OPG continued to implement and maintain an effective human performance program at PNGS.

Personnel Training

CNSC staff determined that PNGS have a well-documented and robust systematic approach to training (SAT) based training system. This was based on a review of the findings from compliance verification activities conducted in 2020 that resulted in 11 compliant findings and 1 non-compliance of low safety significance. During an inspection of OPG’s fitness for duty program [PRPD-2020-05333], CNSC staff found that OPG’s Single Point of Contacts had not received training commensurate with their authorities, accountabilities and responsibilities to manage worker fatigue. CNSC staff are satisfied with PNGS’s progress in correcting this non-compliance.

Personnel Certification

CNSC staff determined that PNGS’s personnel certification program met the applicable regulatory requirements in 2020.

In April/May 2020, OPG requested regulatory relief in the form of short-term extensions and/or an exemption from regulatory requirements in respect of the recertification of certified shift workers at the PNGS.

OPG explained that, because of the COVID-19 pandemic, the postponement of their requalification testing programs could result in the expiry of the certifications of certified shift workers, which could subsequently impact the licensees' ability to continue to meet the minimum shift complement requirements. CNSC staff carried out technical assessments of OPG's request and recommended that the Commission grant an exemption from Section 9(4) of the *Class I Nuclear Facilities Regulations*, for a period of 6 months after expiry of the certified workers' certifications. In July 2020, the Commission approved the temporary exemption to subsection 9(4) of the *Class I Nuclear Facilities Regulations* which provides that "A certification expires 5 years after the date of its issuance or renewal". The 3 certified individuals affected by the exemption passed their postponed requalification test within 6 months following the Commission's decision to grant the exemption and were recertified early in 2021.

CNSC staff reviews of PNGS quarterly reports on NPP personnel in 2020 confirmed that OPG generally complied with the applicable certification requirements. A non-compliance was observed with regards to the number of shifts performed by a certified individual over a period of 3 years, that number being below the minimum of 50 required. OPG was requested to provide a detailed corrective action plan for addressing this non-compliance.

Generally, compliance with requirements for examination and testing activities was noted during an inspection of OPG's conduct and grading of a simulator-based requalification test for shift personnel [PRPD-2020-04270], however, a finding of low significance was observed with respect to examination grading. OPG provided a corrective action plan to address the low finding and all but one corrective action have been completed. CNSC staff are satisfied with the actions taken by OPG and continue to monitor the progress of the last corrective action.

A desktop inspection of the design and development of a PNGS Unit 5-8 comprehensive simulator-based test and a PNGS Unit 1-4 diagnostic simulator-based test [PRPD-2020-04269] found 1 non-compliant finding of low safety significance was observed in the area of comprehensive simulator-based test design. CNSC staff are satisfied with OPG's corrective actions and consider the inspection report findings to have been adequately addressed.

Based on the inspections performed by CNSC staff, OPG did not meet all CNSC requirements in 2020. However, none of the findings from these inspections had an impact on the validity of the examinations and tests assessed by CNSC staff. Due to their low significance, the non-compliances did not have an impact on the overall performance of the examination and requalification testing program at PNGS.

Work Organization and Job Design

PNGS demonstrated adequate control of its measures to maintain minimum shift complement during the challenges of the pandemic, and took precautions to mitigate against staff sickness amongst security and fire protection personnel.

In 2020, 3 violations related to minimum shift complement were identified. All 3 events were of short duration and all applicable plant processes were followed. CNSC staff confirmed that OPG took appropriate corrective actions and were satisfied with OPG's response to the event.

Fitness for Duty

CNSC determined that PNGS met requirements for managing fitness for duty in 2020.

There were 9 Hours of Work Violations during 2020 at PNGS. PNGS is committed to continuous improvement in this area.

In 2020, CNSC staff verified that OPG conducted 3 self-assessments, while CNSC staff conducted an inspection of OPG's management of worker fatigue [PRPD-2020-05333]. The inspection focused on verifying that OPG had adequately developed and established provisions for managing worker fatigue pursuant to Licence Condition 2.1 and [REGDOC-2.2.4, *Fitness for Duty: Managing Worker Fatigue*](#).

CNSC staff identified 10 compliant findings and issued 4 notices of non-compliance that correspond with low safety significance. The non-compliances pertain to managing risks associated with worker fatigue and recovery periods, particularly for Safety Sensitive Positions and contract staff who perform functions that may affect nuclear safety or security. OPG submitted corrective action plans for the non-compliances and all but 1 remain open, with review by CNSC staff underway.

3.3.3 Operating Performance

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Human Performance at the PNGS in 2020.

Conduct of Licensed Activity

CNSC staff determined that OPG met the applicable regulatory requirements for the conduct of licensed activities at PNGS.

In 2020, within the conduct of licensed activities specific area, CNSC staff identified 14 compliant findings arising from 9 different inspections at PNGS. There were no non-compliant findings identified.

CNSC staff conducted an inspection [PRPD-2020-04660] of the PNGS operations program. The inspection scope included the evaluation of the operations program associated with a running unit, as well as a unit undergoing a planned outage. This included verifying execution of operational elements such as infrequently performed tests and evolutions, reactivity management, position assured components and plant status control. Overall, CNSC staff identified 14 compliant findings and no non-compliant findings. Based on the findings of this inspection, CNSC staff concluded that OPG has adequately defined, developed, implemented, and maintained the Nuclear Operations Program at PNGS.

Procedures

Based on the regulatory oversight activities, CNSC staff were satisfied with PNGS procedures and found that they met regulatory requirements and CNSC staff expectations in the area of procedures that were assessed.

OPG has a process to develop, modify, review and validate technical procedures. The compliance findings indicate that OPG has measures in place to ensure the adequacy of its technical procedures.

Reporting and Trending

All scheduled reports were submitted to CNSC in a timely manner. PNGS was compliant with the regulatory requirements in [REGDOC-3.1.1 Reporting Requirements for Nuclear Power Plants](#), in 2020. CNSC staff determined that reporting and trending area PNGS met regulatory requirements in 2020.

PNGS submitted 52 REGDOC-3.1.1 reportable events to the CNSC. As a result of the COVID-19 pandemic, OPG also reported positive COVID cases occurring at the station. CNSC staff followed up on all reportable events in a graded approach based on the risk significance of the event. For the event reviews that are now considered complete, CNSC staff confirmed that OPG promptly addressed all events and took appropriate corrective actions.

Outage Management Performance

CNSC staff concluded that OPG's management of outages at the PNGS met the applicable regulatory requirements and expectations in 2020. CNSC staff confirmed that during outages OPG used an approved reactor shutdown guarantee state, monitored heat sinks and components, kept equipment in the correct configuration to maintain reactor safety, and operated the main control room in accordance with its operations program. Further, the planned outage inspections noted compliance in the areas of reactivity management, safe operating envelope (SOE), Infrequently Performed Tests and/or Evolutions (IPTE) and regulatory undertakings. There were no actions raised from the outage inspections.

Safe Operating Envelope

PNGS met the requirements of CSA N290.15, *Requirements for the safe operating envelope of nuclear power plants*.

CNSC staff inspections of PNGS's SOE program documentation and implementation in 2020 identified 12 compliant findings and 3 non-compliant findings. A single non-compliance of low safety significance was related to the treatment of uncertainty in the safety related system test procedure. The remaining 2 non-compliances related to documentation discrepancies were of negligible safety significance. No licensing limit was exceeded.

CNSC staff monitor PNGS's SOE program through technical assessments and inspections. CNSC staff have verified that PNGS has in place a hierarchy of documents to produce, maintain, and implement the SOE program.

Severe Accident Management and Recovery

CNSC staff determined that PNGS maintained a severe accident management program that met the requirements of [REGDOC-2.3.2, *Accident Management: Severe Accident Management Programs for Nuclear Reactors \(2013 edition\)*](#).

CNSC staff conducted a field inspection to assess compliance with regulatory requirements and licensee procedures. This inspection measured compliance with regulatory requirements for various licensee programs subject to observations in the field. Document reviews, field inspections and verbal follow-up with licensee staff were also used to collect and verify observations. CNSC staff have reported 1 non-compliance of low safety significance related to racks containing expired polyurethane self-expanding foam used for airlock seal integrity maintenance of emergency mitigating equipment. The safety significance of maintaining emergency equipment is to ensure equipment is available for use in the event of a beyond design basis accident (BDBA) to prevent or mitigate progression to a severe accident. CNSC staff have reviewed the OPG disposition of the finding and are satisfied with the responses.

In 2019, OPG provided an assessment of Passive Autocatalytic Recombiners (PARs) effectiveness over an increased outage cycle interval from 24 to 30 months. Overall, CNSC staff concluded that the potential impact on the PARs effectiveness due to the increased outage interval is low. However, CNSC staff provided recommendations for OPG to confirm PARs behaviour under operating conditions and thus to strengthen the safety analysis demonstrating the efficiency of PARS in accident conditions requiring hydrogen mitigation in the long-term following a design basis accident (DBA). In 2020, OPG responded to the CNSC comments. CNSC staff have reviewed OPG responses and are satisfied with the approach that OPG undertook to determine the impact of extending the planned outage cycle from 24 to 30 months.

3.3.4 Safety Analysis

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Safety Analysis at the PNGS in 2020.

Deterministic Safety Analysis

CNSC staff reviewed the updated PNGS B Safety Report (Part 3) and concluded that the updated safety report continued to meet regulatory requirements. CNSC staff also provided recommendations related to the aging analysis results and Two-Unequal-Fluids (TUF) validation, currently under CNSC staff review, and expect that OPG will update them in the next revision.

CNSC staff have reviewed the OPG submission of the PNGS B Safety Reports Parts 1 and 2, and concluded that the submission satisfies the requirements of Section G.2 of the PNGS LCH. CNSC staff found the OPG response to incorporate all CNSC staff recommendations into the next revision of the Safety Reports (Parts 1 and 2), which will be submitted in 2022, to be acceptable.

Probabilistic Safety Analysis

CNSC staff determined that PNGS met applicable regulatory requirements and its performance met CNSC staff expectations for probabilistic safety assessment (PSA) in 2020.

CNSC staff reviewed OPG's revised PSA methodologies and related PSA reports. The scope of the CNSC staff reviews included a focused review of the PSA reports against the additional updated [REGDOC-2.4.2 *Probabilistic Safety Assessment \(PSA\) for Nuclear Power Plants*](#) requirements, as well as a verification that the submitted PSA reports were prepared in accordance with the accepted REGDOC-2.4.2 compliant methodologies. CNSC staff determined that OPG is compliant with REGDOC-2.4.2, for the PNGS facility, as per the Transition Plan scope and timeline in Section 4.1 of the PNGS LCH.

OPG developed a software package to estimate the source term and doses to members of the public following a reactor accident. CNSC staff assessed the adequacy of calculation assumptions, appropriateness of the input data, and ensured the software package meets the required Quality Assurance documentation based on CSA N286.7 *Quality assurance of analytical, scientific, and design computer programs*.

Additionally, CNSC staff completed the review of an OPG submission requesting CNSC acceptance of an updated computer code used for PSA, in accordance with CNSC regulatory document REGDOC-2.4.2. CNSC staff concluded the use of the updated computer code is acceptable.

3.3.5 Physical Design

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Physical Design at the PNGS in 2020.

Design Governance

Environmental Qualification

CNSC staff concluded that OPG continued to meet applicable EQ regulatory requirements. Based on the compliance verification activities performed throughout 2020, CNSC staff inspections identified 24 compliant findings and no non-compliances related to environmental qualification.

Pressure Boundary Design

CNSC staff concluded that the implementation of the pressure boundary program, for both code classification and design registration reconciliation process, met regulatory requirements. There was a 2020 event related to the Primary Heat Transport System (PHTS) leak that occurred due to a pressure boundary failure of the fueling machine supply system piping. Following the repair of the piping, OPG completed an assessment and undertook 8 corrective actions to prevent recurrence. CNSC staff have reviewed OPG's corrective actions and are satisfied with OPG's response to date.

OPG has completed 6 of the 8 corrective actions and CNSC staff will continue to monitor the progress of the remaining 2 corrective actions.

Seismic Qualification

OPG continued to implement measures to ensure adequate seismic qualification of components and systems at PNGS in 2020.

Fire Protection

OPG continued to maintain fire protection measures at PNGS that meets the requirements defined by CSA N293, *Fire protection for CANDU nuclear power plants*.

System Design

Electrical Power Systems

The performance of OPG at PNGS met expectations in the area of Electrical Power Systems. An SOE inspection was performed on the Electrical Power Systems and did not identify any areas of non-compliance.

Instrumentation and Control

PNGS met all applicable requirements for Instrumentation and Control. Based on the compliance verifications activities performed, OPG PNGS met CNSC staff expectations in the areas of system design of instrumentation and control system.

Component Design

Fuel Design

The PNGS fuel design and inspection program met the regulatory requirements and CNSC staff performance expectations. PNGS operated within the design and operating limits, the Operating Policies & Principles iodine limits, and the bundle power and channel power limits in the PROL. CNSC staff have determined that the overall fuel condition was satisfactory and fuel has been operated safely.

Cables

OPG has a mature surveillance program in place at PNGS that covers cable condition monitoring and cable aging management programs.

CNSC inspection of the PNGS SOE Electrical Power Systems in 2020 did not identify any findings related to cable systems. Furthermore, CNSC staff did not identify any concerns from other compliance verification activities performed in 2020. CNSC staff determined that PNGS met all applicable requirements and met CNSC staff expectations in the area of cable systems in 2020.

3.3.6 Fitness for Service

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Fitness for Service at the PNGS in 2020.

Equipment Fitness for Service/Equipment Performance

CNSC inspections of equipment fitness for service in 2020 identified 2 compliant findings. However, 3 non-compliant findings of negligible safety significance were observed. The first 2 non-compliant findings related to inadequate implementation of the fluid leak management program as 3 minor, inconsequential leaks were observed during CNSC field inspections. OPG took immediate corrective actions, which met CNSC requirements. The third non-compliant finding related to recording of humidity levels in the Digital Control Computer (DCC) storage area. This finding was of negligible safety significance as OPG regularly confirmed that humidity levels were within acceptable range. Overall, OPG met CNSC staff expectations for equipment fitness for service in 2020.

CNSC staff confirmed that all special safety systems for PNGS met their unavailability targets in 2020.

Reliability of systems important to safety

CNSC staff determined that the reliability program at PNGS met the requirements described in [REGDOC-2.6.1, Reliability Programs for Nuclear Power Plants](#). CNSC staff conducted a reliability program inspection at PNGS in 2020 with all compliant findings.

CNSC staff reviewed OPG's submitted annual reliability reports and determined these reports met CNSC staff expectations.

Maintenance

CNSC staff determined that PNGS's maintenance program met the applicable regulatory requirements and CNSC staff expectations. PNGS maintained the critical corrective maintenance backlog very low. PNGS continuously reduced the critical deficient maintenance backlog. The number of critical preventive maintenance deferrals was slightly above the industry average but it was trending downward. OPG maintained the average preventive maintenance completion ratio at 98%. There were no safety significant findings in the maintenance specific area based on the review of the events reported by the licensee. CNSC staff also conducted several maintenance related inspections in 2020 that confirmed that OPG'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 17.

Table 17: Trend of maintenance backlogs and deferrals for critical components for PNGS, 2018 to 2020

Parameter	Average quarterly work orders per unit			Three year trending	Quarterly 2020 work orders				Industry average for 2020
	2018	2019	2020		Q1	Q2	Q3	Q4	
Corrective maintenance backlog	2	1	0	down	0	0	0	0	1
Deficient maintenance backlog	16	7	2	down	4	3	2	1	4
Deferrals of preventive maintenance	11	5	4	down	7	3	2	5	2

Structural Integrity

Based on regulatory oversight activities, CNSC staff determined that Systems, Structures and Components (SSCs) continued to meet structural integrity requirements for PNGS.

CNSC staff compliance verification activities identified 17 compliant findings, 1 negligible finding and 2 low findings.

A single low finding is related to the assessment of structural integrity of X-750 annulus spacers, which serves to maintain a gap between the cold calandria tube and hot pressure tube during normal reactor operation, and thereby ensuring integrity of the pressure tube component. OPG has taken prompt steps to address the low finding, and CNSC staff will continue to monitor corrective actions until full implementation.

OPG has continued to perform the appropriate inspections and assessments to demonstrate fitness for service of the steam generators and feeders at PNGS.

The results of the technical assessments performed on final outage inspection reports and component dispositions show that the pressure tubes at the PNGS units remain fit for service.

Aging Management

CNSC staff determined that PNGS's aging management program met regulatory requirements. PNGS is compliant with [REGDOC-2.6.3, *Fitness for Service: Aging Management*](#).

CNSC staff inspections and compliance verification activities for aging management identified 5 compliant findings, and 1 finding of low safety significance for aging management. The low finding relates to the performance of pressure tube (PT) to calandria tube (CT) contact, where CNSC staff have identified challenges with the assessment methodology along with a number of input models that have the potential to erode the safety margin. OPG is working on addressing the identified challenges, and CNSC staff will continue to ensure the safety case for fuel channels is satisfactory.

CNSC staff review of the inspection and maintenance activities carried out by OPG during the 2019 PNGS Unit 5 planned maintenance outage identified concerns related to available margins for PT-CT contact for the period requested by OPG. CNSC staff are currently reviewing OPG's recent submission of a new evaluation methodology that is intended to be used by OPG to demonstrate satisfactory margins.

Chemistry Control

CNSC staff determined that PNGS's chemistry control program met the applicable regulatory requirements. PNGS maintained acceptable system chemistry performance in 2020.

CNSC staff chemistry inspections identified all compliant findings. A review of the chemistry data in REGDOC-3.1.1 reports and safety performance indicators (SPIs) demonstrated that the PNGS performance was acceptable. Lower ratings for chemistry index (SPI) for parts of the year at PNGS were caused by reactor start-ups following long outages at Units 1 and 4 and are not indicative of a degradation of OPG's chemistry program. The chemistry index quantifies the long-term control of chemistry parameters and determines the long-term risks on safety-related systems.

Periodic Inspection and Testing

During the reporting year, PNGS performed the appropriate inspection and testing program to meet the applicable regulatory requirements.

PNGS identified 1 low finding related to the most recent CSA N285.8 *Effluent monitoring programs at Class I nuclear facilities and uranium mines and mills* compliance plan. The compliance plan has been conditionally accepted, with CNSC staff expecting OPG to transition to latest update to CSA N285.8, which includes more rigorous requirements pertinent to probabilistic core evaluations of pressure tubes.

3.3.7 Radiation Protection

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Radiation Protection at the PNGS in 2020.

Application of ALARA

CNSC staff compliance verification activities for the Application of ALARA at the PNGS in 2020 found that OPG was compliant with requirements and met CNSC staff performance expectations.

OPG demonstrated continuous tracking of collective dose performance during operations, unit outages, as well as ongoing monitoring of unplanned exposures, personal contamination events, worker dose and dose rate alarms, low-level tritium exposures and alpha uptakes. Monitoring was completed for individuals, Work Groups, tasks, and the overall station. To aid in keeping doses ALARA, OPG reported on these metrics to various stakeholders daily, weekly, monthly and annually. OPG achieved its 2020 year end collective dose targets for PNGS.

In 2020, OPG continued to implement its Five-Year ALARA Plan at PNGS that incorporated lessons-learned and OPEX to develop challenging dose targets for future years, with the goal of reducing worker doses.

Worker Dose Control

CNSC staff determined that OPG met applicable regulatory requirements for worker dose control at the PNGS in 2020.

An increasing trend of unplanned internal tritium exposure events was observed and self-identified by OPG in 2020. This was attributed to human performance issues related to unplugged time from breathing air headers. In each instance, OPG implemented corrective actions. Radiation doses to workers at the PNGS were below the regulatory dose limits, as well as the action levels in OPG's radiation protection program. CNSC staff did not observe any safety significant unplanned exposures at the PNGS in 2020.

Radiation Protection Program Performance

CNSC staff determined that OPG met applicable regulatory requirements for Radiation Protection Program Performance at the PNGS in 2020. OPG continued to employ performance metrics and perform self-assessments to monitor and control performance in all aspects of the radiation protection program. Operating experience and benchmarking with industry was used to improve performance. CNSC staff did not observe any failures of the radiation protection program in 2020.

Radiological Hazard Control

CNSC staff determined that OPG implemented effective controls for radiological hazards. In 2020, OPG reported a heat transport leak and a firewater line break in Unit 1 which resulted in the spread of contamination and an increase in personnel contamination events. OPG recognized the increase in personnel contamination events and implemented corrective actions.

There were 10 findings from inspections conducted by CNSC staff of which 8 were compliant and 2 were non-compliant. The non-compliant findings were of low safety significance and dealt with the lack of a contingency plan, and radiological boundaries not being clearly demarcated. These were subsequently resolved to CNSC staff satisfaction. There were no action level exceedances for surface contamination or contamination control at PNGS in 2020.

3.3.8 Conventional Health and Safety

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Conventional Health and Safety at the PNGS in 2020.

OPG has appropriate procedures in place to ensure the protection of its workers against hazardous conditions in the workplace. OPG adequately identified workplace hazards in 2020.

For 2020, at PNGS, the accident severity rate was unchanged at 0.0, which 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.

In 2020, the industrial safety accident rate for PNGS was unchanged at 0.0, which represents the number of accidents that result in fatalities, lost-time, or restricted work for every 200,000 hours worked by NPP personnel.

In 2020, the Accident Frequency (AF) for PNGS was 0.14, the same as the 2019 value. The AF represents the number of fatalities and injuries (lost-time and medically treated) due to accidents for every 200,000 person-hours worked at NPPs.

3.3.9 Environmental Protection

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Environmental Protection at the PNGS in 2020.

Effluent and Emissions Control (releases)

CNSC staff conducted a reactive desktop inspection of OPG's PNGS Environmental Action Level (EAL) characterization and reporting. CNSC staff observed a sole non-compliance of low safety significance during the reactive desktop inspection, in which OPG did not submit an event report when reaching a gross beta-gamma EAL. Upon becoming aware of this non-compliance, OPG initiated corrective actions to CNSC staff satisfaction.

Environmental Management System

OPG has implemented and maintained a corporate environmental management system in accordance with CNSC requirements and CNSC staff expectations.

UPDATE: In March 2021, OPG completed implementation of [REGDOC-2.9.1, Environmental Protection Principles, Assessments and Protection Measures](#) Version 1.1 implementation.

Assessment and Monitoring

The field inspections and technical assessment of quarterly and annual scheduled compliance reports for PNGS indicated that OPG met the applicable regulatory requirements in 2020.

Based on the review of 2020 environmental monitoring data, CNSC staff concluded that people and the environment in the vicinity of the site were protected and that no health impacts were expected to result from the operations of the PNGS site.

Protection of People

In 2020, hazardous substances releases to the environment from PNGS were below the regulatory limits. There was a hazardous substance limit exceedance of the Provincial Environmental Compliance Approval (ECA) limit for intake and outfall temperature difference. CNSC staff reviewed the event and concluded that it was of low safety significance and that people were protected from the impacts of the non-radiological substances released from the facility in 2020.

Performance information from technical reviews of quarterly and annual reports met expectation in the area of the protection of people.

Environmental Risk Assessment

CNSC staff reviewed the results of the environmental monitoring program at the PNGS (including Pickering WMF) in 2020 and confirmed that OPG met the applicable regulatory requirements pertinent to Environmental Risk Assessment.

Estimated Dose to the Public

PNGS continued to ensure the protection of people in accordance with the *Radiation Protection Regulations*.

Performance information from technical assessments of the 2020 quarterly and annual scheduled reports and of the OPG report of the environmental monitoring program in 2020 indicated that the estimated dose to the public at the Pickering site remained low (1.2 $\mu\text{Sv}/\text{y}$), and well below the regulatory dose limit of 1 mSv/y.

3.3.10 Emergency Management and Fire Protection

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Emergency Management and Fire Protection at the PNGS in 2020.

CNSC staff concluded that OPG PNGS 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.

Conventional Emergency Preparedness & Response

OPG adequately activated their Business Continuity Plans, which invoked the implementation of plans and procedures, enabling them to continue safe operations during the COVID-19 pandemic. CNSC staff monitored OPG's actions to ensure that safety was maintained.

Nuclear Emergency Preparedness & Response

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff performance expectations for Nuclear Emergency Preparedness and Response at the PNGS in 2020.

In October 2020, CNSC staff participated in the PNGS full-scale emergency exercise. CNSC staff also conducted an on-site inspection during the exercise. As a result of this inspection, CNSC staff identified 13 compliant findings, 6 non-compliant findings of negligible and low safety significance, 2 of which were resolved during the inspection. The first low safety significant finding was in relation to the conduct of air samples at the target TLD location and the second low safety significant finding was in relation to providing feedback to all participants' post-emergency exercise. OPG immediately addressed these non-compliances. CNSC staff were satisfied with OPG's immediate response and no enforcement actions were required. As a result, there were 4 non-compliant findings, of which 3 have been satisfactorily addressed. These 3 non-compliances focused on OPG's timely submission of exercise information to CNSC staff, timely communication of exercise changes to participants and adherence to exercise schedules. The remaining outstanding non-compliance relates to the Offsite Survey Team (OSST) not wearing their electronic personal dosimeters on the outside of their Tyvek suits. CNSC staff do not consider this to be a safety significant finding. OPG will provide CNSC staff with an update of the OSST procedure to ensure that clear instructions are given to staff to wear their EPDs on the outside of Tyvek suits.

Fire Emergency Preparedness & Response

CNSC staff review of the Third Party Fire Protection Program audit did not identify any issues. Overall, OPG has an adequate Fire Protection Program (FPP) to minimize both the probability of occurrence and the consequences of fire at PNGS. The FPP complies with regulatory requirements.

3.3.11 Waste Management

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Waste Management at the PNGS in 2020.

CNSC staff confirmed that OPG complied with the applicable regulatory requirements for the collection of radioactive waste and the minimization and segregation of conventional waste. However, CNSC staff noted 1 non-compliance of negligible safety significance with regards to the transfer of non-contaminated waste (conventional waste) in which a transfer form was not completed.

OPG took corrective measures in reviewing the form, and concluded that there was no risk of release of contaminated materials. CNSC staff were satisfied with the corrective measures taken by OPG.

In 2017, OPG revised the preliminary decommissioning plans (PDPs) for all of its facilities for the period up to 2022. OPG selected a deferred decommissioning strategy for the decommissioning of the PNGS and an immediate decommissioning strategy for the PWMF, following the completion of the PNGS decommissioning. There were no changes made to the PDPs for the PNGS in 2020. The associated financial guarantee is discussed in section 2.11.

3.3.12 Security

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Security at the PNGS in 2020.

CNSC staff also reviewed the annual site security report, threat and risk assessment, as well as 4 quarterly safety reports for PNGS, and confirmed that OPG met all the applicable regulatory requirements.

Facilities and Equipment

CNSC staff inspections of the specific area of facilities and equipment identified that PNGS was compliant with applicable regulatory requirements that were verified.

In 2020, CNSC staff conducted a field inspection for which 1 non-compliant finding was identified. OPG took immediate measures to correct the non-compliance during the field inspection once identified by CNSC staff.

Response Arrangements

CNSC staff inspections of the specific area of response arrangements identified that PNGS was compliant with applicable regulatory requirements that were verified.

PNGS conducted a Force-on-Force exercise under the CNSC's Performance Testing Program which resulted in PNGS self-identifying 3 areas for improvement within the specific area of response arrangements. PNGS continues to implement corrective actions through a corrective action plan to CNSC staff satisfaction.

Security Practices

A CNSC Performance Testing Program Force-on-Force exercise conducted at PNGS resulted in PNGS self-identifying 2 areas for improvement within the specific area of security practices. PNGS continues to implement corrective actions through a corrective action plan to CNSC staff satisfaction.

Drills and Exercises

A CNSC Performance Testing Program Force-on-Force exercise conducted at PNGS resulted in PNGS self-identifying 1 area for improvement within the specific area of Drills and Exercises. PNGS continues to implement corrective actions through a corrective action plan to CNSC staff satisfaction.

Although working in their Business Continuity Plan due to COVID-19 pandemic, PNGS maintained an effective security drill and exercise program, thereby meeting regulatory requirements and continuing to test the effectiveness of its physical protection system at PNGS, consistent with the design basis threat (DBT). CNSC staff concluded that there were no safety significant issues for this specific area.

Cyber Security

CNSC staff determined that PNGS met their licence requirement to update their cyber security program to meet the requirements and guidance in the CSA N290.7-14 *Cyber security for nuclear power plants and small reactor facilities*.

3.3.13 Safeguards and Non-Proliferation

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Safeguards and Non-Proliferation at the PNGS in 2020.

Nuclear Material Accountancy and Control

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

In 2020, OPG provided the required nuclear material accountancy and control reports to the CNSC and the IAEA for safeguards activities, including inspections.

OPG initially committed to full implementation of CNSC regulatory document [REGDOC-2.13.1, Safeguards and Nuclear Material Accountancy](#) by March 31, 2021. In 2020, OPG provided confirmation that, as of March 31, 2020, it was compliant with the requirements of REGDOC-2.13.1, with the exception of the aspects related to non-fuel nuclear material inventory. Due to COVID-19 pandemic response efforts, OPG requested a 6 month extension to October 29, 2021 for the implementation of these remaining requirements. CNSC staff found OPG's request reasonable and the new date has been included in the latest LCH for PNGS.

Access and Assistance to the IAEA

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. Details of the IAEA inspection activities are provided in section 2.13.

In 2020, the CNSC closed the regulatory action relating to the IAEA's inability to adequately verify some spent fuel due to accessibility issues which was first raised in 2017 as the result of an IAEA inspection in 2016. CNSC staff were satisfied with OPG's corrective actions and were continuing discussions on the resolution of the overall issue with the IAEA as a small number of stacks of irradiated fuel bundles in 2 out of the 3 bays remain inaccessible. The nuclear material will remain under IAEA seal and surveillance until it is available for verification in the future (e.g., during decommissioning activities).

Operational and Design Information

CNSC staff determined that OPG met the applicable regulatory requirements for operational and design information in 2020 at the PNGS. OPG provided the required operational and design information to facilitate IAEA safeguards activities.

Safeguards Equipment, Containment and Surveillance

CNSC staff confirmed that OPG met the applicable regulatory requirements for safeguards equipment, containment and surveillance in 2020 at the PNGS.

In 2020, OPG provided the assistance required for the IAEA's safeguards equipment, containment, and surveillance activities, including inspections at the PNGS.

3.3.14 Transport and Packaging

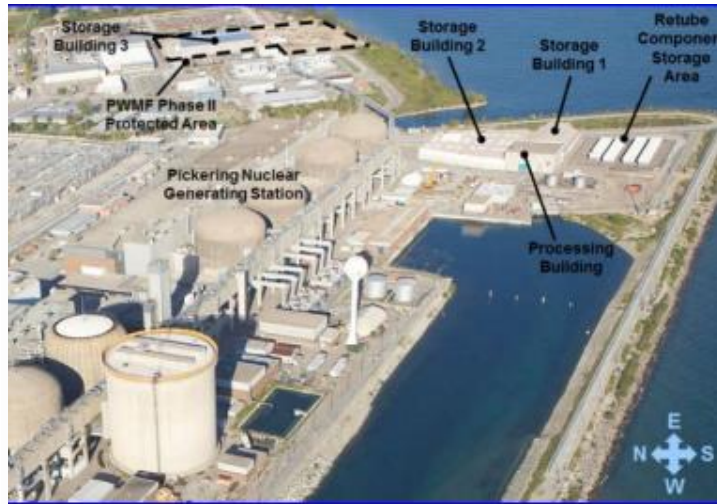
CNSC staff concluded that OPG has implemented a packaging and transport program that ensures compliance with the *Packaging and Transport of Nuclear Substances Regulations, 2015* (PTNSR), and the *Transportation of Dangerous Goods Regulations*, and that the transport of nuclear substances to and from the facility was conducted safely in 2020.

In 2020, CNSC staff conducted 1 field inspection of the PNGS packing and transport program. CNSC staff verified that contractors engaged in transport-related activities were adequately trained, radioactive materials to be transported were appropriately classified and packaged, all safety markings were appropriately displayed on packages and the documentation accompanying the shipments was properly completed. No items of non-compliance were observed during the inspection. There was 1 PNGS Packaging and Transport event in 2020. The event and subsequent corrective actions taken by the licensee are currently being reviewed by CNSC staff.

3.4 Pickering Waste Management Facility

3.4.0 Introduction

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 34 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, 2 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, separate from the protected area of the PNGS, but within the boundary of the Pickering site. Phase II contains Storage Building #3. The PWMF currently has the capacity to store 1,154 DSCs. The transfer route of the loaded DSCs from the PWMF Phase I to the PWMF Phase II is on OPG property.

Under the Waste Facility Operating Licence (WFOL) for the PWMF, OPG is authorized to construct 3 additional DSC storage buildings in Phase II (Storage Buildings #4, #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, and the new DSC processing building would increase OPG's processing capabilities at the PWMF from 50 DSCs per year to approximately 100 DSCs per year. To date, OPG has constructed and commissioned 1 additional storage building, Storage Building #4.

Licensing

In April 2017, the Commission renewed the WFOL for the period April 1, 2018 to August 31, 2028.

3.4.1 Management System

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Management System at the PWMF in 2020.

Management System

In 2020, OPG revised their Nuclear Waste Management Program. CNSC staff are satisfied with the revised program document, and the changes met CNSC staff expectations.

Management of Contractors

CNSC staff found OPG's oversight of vendors for construction and commissioning of PWMF Storage Building #4 to be acceptable.

Business Continuity

CNSC staff concluded that OPG met regulatory requirements for the business continuity specific area. OPG has an adequate contingency plan to maintain and restore critical safety and business functions in the event of disabling circumstances such as a pandemic, severe weather, or labour actions.

In light of the COVID-19 pandemic, CNSC staff confirmed that OPG had sufficient business continuity plans in the event of a wide-scale outbreak across Canada. During this pandemic, OPG has implemented mitigation steps as part of their plans to combat the spread of the COVID-19 virus. This includes:

- Detailed and on-going employee communications to increase awareness of COVID-19, minimize potential risks, and ensure safe and reliable operations
- Initial shutdown of PWMF during the onset of the COVID-19 pandemic
- After the shutdown, implementing a 1 week on, 1 week off schedule for personnel working at the facilities – this helps to minimize the total number of personnel at the facility at a given time
- Utilization of health and safety measure such as masks, hand sanitization stations and sanitation of work areas
- Protocol developed for visitors (i.e. questionnaire required for all visitors)
- Continuous evolution of enhanced personal protective equipment (PPE) as information becomes available (such as a transition to triple layer masks)
- OPG screens all workers into the facility for COVID-19 symptoms, recent travel, and orders to self-isolate. Thermal imaging is conducted on all personnel entering the protected area

3.4.2 Human Performance

There were no significant Human Performance observations to report for PWMF in 2020. CNSC staff concluded that PWMF continued to implement its Human Performance program in accordance with requirements.

3.4.3 Operating Performance

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Operating Performance at the PWMF in 2020.

Conduct of Licensed Activity

In total, OPG processed 54 DSCs at the PWMF in 2020. CNSC staff review 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/clarification, met CNSC staff expectations.

Reporting and Trending

In 2019, CNSC staff review determined that OPG's annual compliance report did not meet the specific regulatory requirements of [REGDOC-3.1.2, Reporting Requirements, Volume I: Non-Power Reactor Class I Facilities and Uranium Mines and Mills](#); however, OPG's follow-up activities, which included submitting an addendum to the annual compliance report, met the requirements of REGDOC-3.1.2 and CNSC staff expectations. In 2020, OPG submitted all scheduled quarterly and annual reports as required within the appropriate timelines.

3.4.4 Safety Analysis

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Safety Analysis at the PWMF in 2020.

Deterministic Safety Analysis

In 2018, CNSC staff had reviewed OPG's update of the PWMF safety analysis report. As of 2020, issues were resolved regarding the decay heat model for used fuel, and CNSC staff were satisfied with OPG's responses. OPG will provide an updated report by the end of 2023.

3.4.5 Physical Design

CNSC staff concluded that OPG met the applicable regulatory requirements and it CNSC staff expectations, for the SCA Physical Design at the PWMF in 2020.

Design Governance

Fire Protection

CNSC staff concluded that 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

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Fitness for Service at the PWF in 2020.

Aging Management

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

3.4.7 Radiation Protection

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Radiation Protection at the PWF in 2020.

Application of ALARA

CNSC staff determined that OPG implemented an effective and well-documented program, based on industry best practices, to keep doses to persons ALARA at the PWF.

Worker Dose Control

OPG did not exceed any action levels for dose to workers. The annual effective doses for all PWF workers were well below the regulatory limit of 50 mSv. There were no event reports related to worker dose control at the PWF in 2020.

Radiological Hazard Control

CNSC staff determined that OPG implemented radiological hazard controls that met the applicable regulatory requirements for control of radiological hazards and the protection of workers at the PWF in 2020. OPG did not exceed any action levels for contamination control.

3.4.8 Conventional Health and Safety

CNSC staff concluded that OPG met the applicable regulatory requirements, and its performance met CNSC staff expectations, for the SCA Conventional Health and Safety at the PWF in 2020.

OPG did not report any lost-time accidents at the PWF in 2020 or any other events related to conventional health and safety. CNSC staff compliance verification activities did not identify any non-compliant findings relevant to conventional health and safety in 2020.

3.4.9 Environmental Protection

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Environmental Protection at the PWF in 2020.

Effluent and Emissions Control (releases)

CNSC staff compliance verification activities had resulted in comments regarding effluent and emission control. CNSC staff found OPG's response to be sufficient, thus resolving the comment. PWMF releases remained below the action levels and DRLs. PWMF implemented and maintained an effluent monitoring program that met CNSC requirements and expectations.

Protection of People

In 2020, hazardous substances releases to the environment from PWMF were below the regulatory limits. People were protected from the impacts of the non-radiological substances released from the facility in 2020.

Performance information from technical reviews of quarterly and annual reports met CNSC staff expectation in the area of protection of people.

3.4.10 Emergency Management and Fire Protection

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Emergency Management and Fire Protection at the PWMF in 2020.

Conventional Emergency Preparedness & Response

From the onset of the COVID-19 pandemic, OPG activated the Corporate Crisis Management and Communication Centre (CMCC) to allow for planning and execution of the overall enterprise-wide response to COVID-19. CNSC staff were informed of OPG's actions and monitored them to ensure that safety was maintained.

Fire Emergency Preparedness & Response

OPG has a facility emergency program for the PWMF that includes basic fire response for facility staff to evacuate the building and notify Emergency Response Team (ERT) who will respond to the fire. Main fire response is performed by the Pickering Fire Department (PFD). Annual fire drills were completed and PFD staff are given orientation tours at the PWMF and train with Pickering ERT at the live fire training facility near Wesleyville, Ontario.

3.4.11 Waste Management

CNSC staff concluded that OPG met the applicable regulatory requirements and met CNSC staff expectations, for the SCA Waste Management at the PWMF in 2020. OPG's quarterly operations reports met CNSC staff expectations.

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

In 2017, OPG revised the Preliminary Decommissioning Plan (PDPs) for all of its facilities for the period up to 2022.

OPG selected a deferred decommissioning strategy for the decommissioning of the PNGS and an immediate decommissioning strategy for the PWMF, following the completion of the PNGS decommissioning. There were no changes made to the PDPs for the PWMF in 2020. The associated financial guarantee is discussed in section 2.11.

3.4.12 Security

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Security at the PWMF in 2020.

CNSC staff reviewed the annual site security report and threat and risk assessment, as well as 4 quarterly safety reports, for PWMF, and confirmed that OPG met all the applicable regulatory requirements.

Facilities and Equipment

CNSC staff inspections of the specific area of facilities and equipment identified that PWMF was compliant with applicable regulatory requirements that were verified.

Security Practices

CNSC staff inspections of the specific area of security practices identified that PWMF was compliant with applicable regulatory requirements that were verified.

3.4.13 Safeguards and Non-Proliferation

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Safeguards and Non-Proliferation at the PWMF in 2020.

Nuclear Material Accountancy and Control

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

Access and Assistance to the IAEA

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. Details of the IAEA inspection activities are provided in section 2.13.

Operational and Design Information

CNSC staff determined that OPG met the applicable regulatory requirements for operational and design information in 2020 at the PWMF. OPG provided the required operational and design information to facilitate IAEA safeguards activities.

Safeguards Equipment, Containment and Surveillance

CNSC staff confirmed that OPG met the applicable regulatory requirements for safeguards equipment, containment and surveillance in 2020 at the PWMF.

In 2020, OPG provided the assistance required for the IAEA's safeguards equipment, containment, and surveillance activities, including inspections at the PWMF.

The licensee hosted an IAEA technician for a site survey for the implementation of the IAEA's laser mapping for containment verification (LMCV) tool at the PWMF. Separately, OPG reported damage to a number of IAEA safeguards seals on DSCs. The licensee took corrective actions and worked with IAEA inspectors to verify and replace the seals. CNSC staff were satisfied with OPG's response.

3.4.14 Transport and Packaging

CNSC staff concluded that OPG has implemented a packaging and transport program that ensures compliance with the *Packaging and Transport of Nuclear Substances Regulations, 2015* (PTNSR), and the *Transportation of Dangerous Goods Regulations*, and that the transport of nuclear substances to and from the facility was conducted safely in 2020.

There were no packaging and transport events reported in 2020 at the PWMF.

3.5 Bruce Nuclear Generating Station

3.5.0 Introduction

Bruce A and Bruce B Nuclear Generating Stations (BNGS) are located on the shores of Lake Huron, in the Municipality of Kincardine, ON. The facilities are operated by Bruce Power under a lease agreement with the owner, Ontario Power Generation (OPG).

BNGS A station has 4 CANDU reactors with a gross power of 831 MWe (megawatts electrical) each (Units 1-4). BNGS B station has 4 CANDU reactors with a gross power of 872 MWe each (Units 5-8). 7 units were operational throughout 2020. Unit 6 at Bruce B was on planned Major Component Replacement (MCR) outage since January 17, 2020.



This report groups the 2 stations together because BNGS A and B have 1 power reactor operating licence (PROL) and Bruce Power uses common programs at both stations. The performance of each station was assessed separately due to the differences in implementation of some programs at BNGS A and BNGS B.

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

Licensing

The PROL for BNGS A and B was renewed by the Commission in 2018 for a period of 10 years. The new licence, combined for both stations, is valid from October 1, 2018 to September 30, 2028. The 10 year licence period will encompass Bruce Power's operation, as well as activities related to the MCR, which was started in 2020 at Unit 6. An amendment was made to the BNGS A and B PROL (PROL 18.01/2028) during the reporting period.

The PROL was amended in 2020 to allow for an update to a standardized licence condition related to training and certification of personnel, by referencing CNSC regulatory document [REGDOC-2.2.3, Personnel Certification, Volume III: Certification of Persons Working at Nuclear Power Plants](#).

Fisheries Act Authorization

In December 2019, Fisheries and Oceans Canada issued a *Fisheries Act* authorization (FAA) for the ongoing operation of BNGS A and B. The authorization covers the death of 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 2020 annual report in accordance with its FAA. The 2020 report was the second in a series of annual reports that Bruce Power will be submitting until the authorization expires on December 31, 2028. The 2020 annual report indicated there were no failures in the avoidance and mitigation structures that required repair in 2020.

CNSC staff reviewed the results of fish impingement monitoring and maintenance of mitigation structures in 2020 and confirmed that Bruce Power met the conditions of the FAA for 2020.

Periodic Safety Review

Bruce Power conducted a periodic safety review in support of its PROL renewal and the planned refurbishment of Units 3 to 8. Bruce Power also implemented its IIP that was developed for safety improvements [RIB 20544].

In 2020, the IIP was progressing according to schedule, and CNSC staff were satisfied with this progress. Table 18 indicates the overall planned, completed, and closed IIP commitments. It also indicates IIP tasks planned for completion in 2020, completed by the licensee in 2020 (irrespective of planned completion dates) and IIP items closed by CNSC in 2020.

Table 18: BNGS IIP Status

IIP Task Status	Overall	2020
Planned by Bruce Power	191	6
Completed by Bruce Power	46	6
Closed by CNSC	44	8*

*This includes 2 IIP Tasks from 2019 that were closed in 2020

Refurbishment

The Major Component Replacement (MCR) project involves Units 3 to 8 and started in January 2020 with Unit 6. The MCR project includes replacing major components such as the steam generators, fuel channels and feeder tubes. MCR project pre-requisite activities for Unit 6 began in January 2019, 1 year prior to the start of the project. CNSC oversight of execution began in January 2020 once the Unit 6 outage had begun [RIB 14753].

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.
- Completion phase - Transition from the end of the installation phase to full-power operation of reactor.

In 2020, CNSC staff conducted all of the planned inspections on the MCR project. CNSC staff observed a declining trend in contractor performance in fire protection, conventional health and safety and foreign material exclusion [BRPD-MCR-2020-07398, BRPD-MCR-2020-07458, BRPD-MCR-2020-07146]. In response to CNSC staff request, Bruce Power has implemented a corrective action plan to improve contractor performance. CNSC staff determined that performance has improved to an acceptable level and will continue to monitor these areas through future compliance verification activities.

UPDATE: Currently, the MCR project is in the removal phase, which is expected to finish in the fall of 2021. As of June 2021, Bruce Power had removed the feeders, end fittings, pressure tubes and is working to remove the calandria tubes. Over the summer of 2021, a number of inspections will be conducted on the calandria vessel and lattice tube sheet before the installation series begins. Replacement of steam generators is scheduled to begin in the summer of 2021. Other work (other than replacement of major components) continues. Work on the primary heat transport system has finished and electrical work is in progress. Moderator and safety system work is scheduled to take place later this calendar year.

Compliance Program

The inspections at the BNGS that were considered in the safety assessments in this regulatory oversight report are tabulated in table 19 (inspection reports were included if they were sent to Bruce Power by February 28, 2021).

Table 19: List of Inspections at BNGS

Safety and control area	Inspection title	Inspection report sent date
Management System	Asset Management Program: BRPD-AB-2020-05889	March 2020
	Pressure Boundary Program Implementation: BRPD-MCR-2020-08579	February 2021

Safety and control area	Inspection title	Inspection report sent date
	Human Factors of Refurbishment Activities and Tooling: BRPD-MCR-2020-05888	February 2020
	Unit 6 Foreign Material Exclusion: BRPD-MCR-2020-07146	November 2020
	Management System Effectiveness Assessment: BRPD-AB-2020-07825	November 2020
Human Performance	ANO Simulator-based Examination and Requalification: BRPD-A-2020-05746	February 2020
	Personnel Training – Bruce Power Training Program: BRPD-AB-2020-08701	February 2021
	Onboarding and Oversight Training Program: BRPD-MCR-2020-07078	August 2020
Operating Performance	Bruce A Unit 4 Planned Outage: BRPD-A-2020-06229	August 2020
	Bruce B Unit 8 Planned Outage: BRPD-B-2020-08316	February 2021
	Bruce B Unit 5 Planned Outage: BRPD-B-2020-07316	August 2020
	Heat Sinks and Reactor Shutdown Guarantees: BRPD-B-2020-06297	April 2020
	Unit 6 Core Defuel: BRPD-MCR-2020-06030	April 2020
	Quarterly Field Inspection Q1 FY2019/20: BRPD-AB-2020-07249	July 2020

Safety and control area	Inspection title	Inspection report sent date
	Quarterly Field Inspection Q2 FY2019/20: BRPD-AB-2020-07832	November 2020
	Quarterly Field Inspection Q3 FY2019/20: BRPD-AB-2020-08509	February 2021
	Quarterly Field Inspection Q4 FY2018/19: BRPD-AB-2020-05826	February 2020
Fitness for Service	Electrical Power Systems: BRPD-AB-2020-04983	February 2020
	Moderator System Inspection: BRPD-B-2020-06784	June 2020
	Bruce B Negative Pressure Containment System: BRPD-B-2020-05574	April 2020
	Moderator System Inspection: BRPD-A-2020-06832	August 2020
	Bruce B Vacuum Building System: BRPD-2020-04991	April 2020
Radiation Protection	Application of ALARA: BRPD-AB-2020-07425	September 2020
	Radiological Hazard Control: BRPD-AB-2020-04493	March 2020
Conventional Health and Safety	Conventional Health and Safety During Bulkhead Installation: BRPD-MCR-2020-07458	September 2020
Emergency Management and Fire Protection	Bruce B 2020 Unit 6 MCR Fire Protection: BRPD-B-2020-07398	February 2021

3.5.1 Management System

CNSC staff concluded that Bruce Power met the applicable regulatory requirements and CNSC staff expectations, for the SCA Management System at the BNGS A and B in 2020.

Management System

Bruce Power complied with the requirements of CSA N286-12, *Management system requirements for nuclear facilities*.

CNSC staff determined that Bruce Power is making significant changes to management system documentation. The hierarchy of the documents are being restructured and more information in the future will be listed into supplementary information. CNSC staff are aware of the changes and are verifying during compliance verification activities, especially technical assessments, how the changes are still meeting the licensing basis.

Organization

CNSC staff determined that the Bruce Power organizational structure is adequately defined and roles and responsibilities are documented. Based on inspections and compliance assessments during the reporting year, CNSC staff confirmed compliance of this area with applicable regulatory requirements.

In 2020, the roles and responsibilities of personnel were verified during compliance inspections. During an inspection [BRPD-AB-2020-07425], CNSC staff found that responsibilities were not clear regarding positions' authorities. CNSC staff continue to monitor the Bruce Power corrective actions until full implementation. Organizational information, provided annually in accordance with [REGDOC-3.1.1 Reporting Requirements for Nuclear Power Plants](#) requirements, was also reviewed by CNSC staff and was determined to be acceptable.

Performance Assessment

CNSC staff determined that Bruce Power continued to meet the applicable regulatory requirements for performance assessment, improvement, and management review.

CNSC staff noted that the management system assessment process has evolved and now has improved participation of Bruce Power senior management. As well as, improvement in the assessment of problems that require corrective actions, which feed into the next year's business plan. CNSC staff determined that the Bruce Power Management System (BPMS) Health Assessment considers the health and performance of all programs.

Operating Experience (OPEX)

CNSC staff determined that Bruce Power's OPEX program met regulatory requirements. The problem identification and resolution process, especially completion of the corrective actions, is a generic requirement in CNSC staff inspections during the reporting year.

In 2020, CNSC staff found that Bruce Power identified the problems and corrected them as per internal documentation requirements.

Change Management

CNSC staff determined that Bruce Power met regulatory requirements applicable to the change management specific area.

Bruce Power's change management program establishes the framework for change management that ensures changes are adequately made, and documents are reviewed before they are implemented.

During 2020, CNSC staff conducted inspections and verified that the changes to Structures, Systems and Components (SSCs) are controlled. CNSC staff also reviewed the changes to the documentation regarding the training program, systems and components (ECC), operational changes and confirmed they were performed as per LCH requirements at both BNGS A and B.

Safety Culture

CNSC staff determined that safety culture at BNGS A and B met applicable regulatory requirements.

Bruce Power continued to follow the established processes for self-assessments of safety culture at planned intervals. Bruce Power's next safety culture self-assessment is planned for 2022. Ongoing regulatory oversight activities will take into consideration the ongoing implementation of [REGDOC-2.1.2, Safety Culture](#), which became effective at Bruce Power during 2020.

Configuration Management

CNSC staff determined that configuration management at BNGS A and B met regulatory requirements in 2020.

Configuration management was verified during a field inspection for multiple SSCs and configuration operation. Minor issues related to documentation of temporary configuration change (TCC), previously observed by CNSC staff, were adequately addressed by Bruce Power in 2020.

Record Management

CNSC staff determined that Bruce Power continued to maintain and implement a records and document management system that complied with the requirements of CSA N286-12 *Management system requirements for nuclear facilities*.

During 2020, CNSC staff performed inspections [BRPD-AB-2020-08701, BRPD-AB-2020-04983, and BRPD-MCR-2020-074580] at BNGS A and B to review the storage and distribution of the records, and to verify document control. CNSC staff identified 10 non-compliances of low and negligible safety significance related to control of the documented information. Corrective actions were put in place by Bruce Power and CNSC staff will monitor progress of their implementation.

Management of Contractors

CNSC staff determined that Bruce Power met the applicable regulatory requirements for the management of contractors and supply chain in 2020.

Bruce Power adequately qualified the contractors and continued to improve their oversight activities of contractors.

Business Continuity

CNSC staff determined that Bruce Power met regulatory requirements for business continuity. There were no negative on-site observations resulting from surveillance of Bruce Power plans for events involving labour actions in 2020. Bruce Power has adequate contingency plans to maintain or restore critical safety and business functions in the event of disabling circumstances such as a pandemic, severe weather, or labour actions. These measures are required to support minimum shift complement.

COVID-19 pandemic response

Bruce Power demonstrated good preparedness related to COVID-19 pandemic response, reporting the pandemic status at BNGS A and B on regular basis. In March 2020, Bruce Power set the following basic measures to prevent the transmission of COVID-19:

1. Detailed employee communications, supervisor guides and a decision matrix have been developed and routinely updated to increase awareness of COVID-19, minimize potential risks, and ensure safe and reliable operations. These guides reinforce Ontario Public Health protocols for reporting symptoms and potential COVID-19 exposure, and self-isolation requirements.
2. A return-to-work protocol has been developed to ensure employees are self-isolating due to illness or potential exposure and are medically cleared before resuming regular on-site duties.
3. The Emergency Management Centre and a COVID-19 Response Team have been stood up to assist overall site planning. Major mitigation efforts included:
 - Restricted access to the Main Control Rooms to increase social distancing and interactions with duty crews and certified staff.
 - Thermography readings of anyone entering BNGS A and BNGS B facility.
 - Implementation of a “Green Zone Protocol” to further separate workforces within the stations through alternate routes, and ingress and egress times.
 - Restricted overall site access to essential operational and outage personnel.
 - Closure or partial closure of some buildings so maintenance crews could focus cleaning efforts on critical workplaces and common touch surfaces.
 - Removal of re-usable protective eyewear stations.

- Installation of additional hand sanitizer locations.

Bruce Power updated their COVID-19 protocols throughout the year as conditions changed and additional information became available, in particular:

- Starting May 2020, mandatory use of the face masks for all workers on site.
- Starting October 2020, voluntary COVID-19 testing for all asymptomatic employees on site. Testing was mandatory for select groups of workers.

CNSC staff determined that Bruce Power's preparation and response to the COVID-19 pandemic met all applicable requirements.

3.5.2 Human Performance

CNSC staff concluded that Bruce Power met the applicable regulatory requirements and CNSC staff expectations, for the SCA Human Performance at the BNGS A and B in 2020.

Human Performance

CNSC staff determined that Bruce Power has implemented and maintained a human performance program that met the applicable regulatory requirements

In 2020, Bruce Power continued the implementation of the initiative "You Can Count on Me. Every Step. Every Time. Every Day" to improve human performance programs at BNGS A and B.

CNSC staff conducted compliance verification activities in 2020 and found compliant findings related primarily to effective communications and completion of pre- and post-job briefs. Based on these findings, CNSC staff confirmed Bruce Power's compliance with applicable regulatory requirements in this area.

Personnel Training

CNSC staff determined that, in 2020, Bruce Power had a well-documented and robust systematic approach to training (SAT) based training system. This determination was based on a review of the findings from compliance verification activities conducted in 2020 which resulted in mainly compliant findings. However, non-compliances of negligible safety significance for the training programs at BNGS A and B were identified. These non-compliances are related to the improvement of qualification assessments regarding some contractor trainers [BRPD-MCR-2020-07078], training program changes [BRPD-MCR-2020-07146] and for the use of a performance-oriented training system [BRPD-AB-2020-08701]. CNSC staff were satisfied with Bruce Power's progress in correcting all these non-compliances.

Personnel Certification

CNSC staff determined that Bruce Power's personnel certification program met the applicable regulatory requirements in 2020. Based on the review of staffing reports for certified personnel and the applications for initial and renewal certification, CNSC staff confirmed that Bruce Power has a sufficient number of personnel at BNGS A and B for all certified positions. All certified workers at BNGS A and B possessed the knowledge and skills required to perform their duties safely and competently.

In 2020, CNSC staff performed an inspection of Authorized Nuclear Operator (ANO) simulator-based certification examination [BRPD-A-2020-05746], a desktop inspection of a written certification examination [BRPD-AB-2019-03077] and 2 desktop inspections on the design, development and grading of a simulator-based certification examination [BRPD-A-2020-05912, BRPD-A-2019-02183]. The desktop inspection BRPD-A-2020-05912 identified 2 areas for improvement related to compiling of all concerns and misconceptions recorded during the conduct of the examination and documentation of the criteria used by examiners to qualify problematic candidate. CNSC staff were satisfied with Bruce Power's response to these areas for improvement.

CNSC staff concluded that the initial certification examination and the requalification test programs for all certified positions at BNGS A and B met the applicable regulatory requirements in 2020.

Work Organization and Job Design

Bruce Power was compliant with the minimum complement resourcing requirements of Licence Condition 2.2. CNSC staff determined that the minimum shift complement at BNGS A and B was capable of responding to the most resource-intensive conditions under all operating states. Based on the information reviewed from reported events concerning the minimum shift complement and findings from field inspections, CNSC staff concluded that the practices Bruce Power has in place to ensure the minimum shift complement were effective in 2020.

Bruce Power maintains an updated certified operator staffing plan that projects the number of certified staff that will be available at BNGS A and B for the next 5 years. This staffing plan is submitted to the CNSC annually and provides evidence that Bruce Power has a plan for ensuring they have a sufficient number of certified staff available in the future.

Fitness for Duty

CNSC determined that BNGS A and B met requirements for managing fitness for duty in 2020.

Bruce Power reports non-compliances with hours of work limits by certified staff to the CNSC quarterly. In addition, from 2019 until July 31, 2020, Bruce Power was requested to report shifts in excess of 16 hours and recovery periods less than 8 hours for all safety-sensitive positions (SSPs). Bruce Power took corrective actions at the end of 2019 to improve compliance with hours of work limits.

CNSC staff determined that for 2020, BNGS A and B met requirements for managing fitness for duty and worker fatigue. In 2020, Bruce Power continued to demonstrate significant improvement regarding their efforts to manage worker fatigue; reporting 10 exceedances by certified staff at BNGS A and 4 at BNGS B.

Due to the improvements observed by CNSC staff in Bruce Power's performance, the enhanced reporting was closed in 2020.

3.5.3 Operating Performance

CNSC staff concluded that Bruce Power met the applicable regulatory requirements and CNSC staff expectations, for the SCA Operating Performance at the BNGS A and B in 2020.

Conduct of Licensed Activity

CNSC staff determined that Bruce Power met the applicable regulatory requirements for the conduct of licensed activities at BNGS A and B. Bruce Power continued to operate both stations in a safe manner within the bounds of the operating policies and operational safety requirements. All reactor units operated within the conditions prescribed by the PROL and within the power limits identified in the LCH for BNGS A and B.

Procedures

Based on the regulatory oversight activities performed, CNSC staff were satisfied with Bruce Power's procedures and found they met regulatory requirements and CNSC staff expectations in the area of procedures that were assessed.

Bruce Power has well-defined processes for procedure preparation, issuance and revision. A few minor issues related to procedural adequacy were identified during inspections in 2020 [BRPD-MCR-2020-07458, BRPD-AB-2020-04493]. Bruce Power is implementing corrective actions, and CNSC staff will continue to monitor the implementation of these correction actions to completion.

Reporting and Trending

In 2020, all scheduled reports were submitted to the CNSC in a timely manner. Bruce Power was compliant with the regulatory requirements in REGDOC-3.1.1. CNSC staff determined that the reporting and trending specific area at BNGS A and B met regulatory requirements in 2020.

Bruce Power submitted 94 REGDOC-3.1.1 event reports to the CNSC; that was comparable with the average number (92) for the last 5 years. An increase in the report numbers in 2020 was due to 10 additional COVID-19 response reports. There were 3 late reporting events – 1 at BNGS A and 2 at BNGS B. CNSC staff confirmed that all these events were promptly addressed during the reporting year. All reported events were followed-up by Bruce Power and were supported with adequate root cause analysis, when appropriate. CNSC staff followed-up on all reportable events in a graded approach based on the risk significance of the event, including any corrective actions taken.

Outage Management Performance

CNSC staff determined that Bruce Power's outage management performance met regulatory requirements in 2020.

In 2020, BNGS A experienced 8 forced outages among 4 reactors (2 at Unit 1, 2, 3 and 4). BNGS B experienced 4 forced outages among 4 reactors (1 at Unit 7 and 3 at Unit 8). There were no process failures at either station. All forced outages were manual and they were mainly caused by events related to service equipment (for example, low vacuum trip circuit repairs, unit service transformer relay protection, and grid rejection). All forced outages were adequately followed up by Bruce Power.

In 2020, BNGS A had 1 major planned outage, while BNGS B had 3. CNSC staff conducted inspections on these planned outages and confirmed that all outage-related undertakings, including reactor shutdown guarantees and heat sink strategy management were performed safely by Bruce Power. Bruce Power also reported 3 additional planned outages at BNGS A for minor preliminary planned maintenance of station equipment during the year. CNSC staff determined that all planned outages activities were completed by Bruce Power.

Safe Operating Envelope

Bruce Power met the requirements of CSA N290.15, *Requirements for the safe operating envelope of nuclear power plants*.

In 2020, CNSC staff performed a safe operating envelope (SOE) field inspection of BNGS A and BNGS B containment parameters [BRPD-AB-2020-FIR-04882]. Several Safety System Tests (SST) related to containment parameters were retrieved from records and reviewed. CNSC staff determined that they were all the current revision, and filled out completely. SOE limits related to containment parameters were verified in the field and the main control rooms were found to be compliant with SOE limits and conditions. However, the inspection has identified some delays in the scheduled issuance of SOE-related documentations.

CNSC staff have verified that Bruce Power has a well-established SOE program to produce, maintain, and implement the SOE program.

Severe Accident Management and Recovery

In 2020, CNSC staff started the review of the integrated accident management program (IAMP) for BNGS. The SAMGs and EMEGs technical assessment is ongoing. This assessment is performed to ensure that requirements of [REGDOC-2.3.2, Accident Management: Severe Accident Management Programs for Nuclear Reactors \(2013\)](#) are met.

In 2020, CNSC staff conducted field inspections at BNGS A and B [BRPD-AB-2020-FIR-08975] to verify compliance with regulatory requirements for the Bruce Emergency Management Center and Remote Technical Support Group. CNSC staff determined that Bruce Power was compliant with the SAMG drill execution requirements of REGDOC-2.3.2 and Bruce Power's staff demonstrated awareness of SAMG exit criteria for the observed exercises.

3.5.4 Safety Analysis

CNSC staff concluded that Bruce Power met the applicable regulatory requirements and CNSC staff expectations, for the SCA Safety Analysis at the BNGS A and B in 2020.

Deterministic Safety Analysis

CNSC staff determined that Bruce Power had a well-managed program for conducting deterministic safety analysis and that the existing deterministic safety analysis remained adequate during continued implementation of [REGDOC-2.4.1, *Deterministic Safety Analysis*](#).

In 2020, CNSC staff reviewed Bruce Power's response to the comments on the BNGS B safety analysis technical basis documents, along with newly submitted technical basis documents and safety analysis updates for Loss Of Flow and Small Break-LOCA, and determined that they are acceptable. CNSC staff also noted the areas for further improvement related to outstanding generic issues associated with uncertainties in modelling and computer code accuracy.

CNSC staff also reviewed the updated Slow Loss of Regulation (SLOR) accident analysis for the BNGS A Units 1 and 2 using the Enhanced Neutron Overpower Protection (eNOP) methodology and determined that the analysis met the high-level requirements of REGDOC-2.4.1.

CNSC staff conducted several inspections at BNGS A and B related to moderator system, vacuum building system and negative pressure containment system [BRPD-A-2020-06832, BRPD-B-2020-04991, BRPD-B-2020-05574] and concluded that the Bruce Power met the applicable requirements.

Probabilistic Safety Analysis

CNSC staff determined that Bruce Power's performance met CNSC staff expectations for probabilistic safety assessment (PSA) in 2020.

Bruce Power completed their submissions of BNGS A and B PSA updates for compliance with [REGDOC-2.4.2, *Probabilistic Safety Assessment \(PSA\) for Nuclear Power Plants*](#). In 2020, CNSC staff completed the reviews of the BNGS A and B PSA elements such as internal flood, internal fire, seismic and high wind. CNSC staff determined that these PSAs are compliant with REGDOC-2.4.2. CNSC staff review of the remaining PSA elements will be completed by the end of 2021.

Criticality Safety

CNSC staff determined that Bruce Power's criticality safety program is comprehensive, complete and compliant with the requirements of RD-327, *Nuclear Criticality Safety*. There were no criticality events and no ongoing issues identified at BNGS A and B during 2020. There have been no changes to the booster fuel assemblies or low-void reactivity fuel demonstration bundles, which have remained in storage. CNSC staff have found that Bruce Power's criticality safety program satisfactorily complies with the applicable regulatory requirements and will continue to monitor the efficacy of the program.

3.5.5 Physical Design

CNSC staff concluded that Bruce Power met the applicable regulatory requirements and CNSC staff expectations, for the SCA Physical Design at the BNGS A and B in 2020.

Design Governance

Environmental qualification

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 in 2020. No area of concern were identified during compliance verification activities performed in this area during the reported year.

Pressure boundary design

In 2020, CNSC staff concluded that the implementation of the pressure boundary program, for both code classification and design registration reconciliation processes, met regulatory requirements.

Seismic Qualification

Bruce Power was compliant with the requirements of CSA N289.1 *General requirements for seismic design and qualification of CANDU nuclear power plants*, and Licence Condition 5.3 for seismic control areas observed during field inspections.

Human factors in design

Bruce Power's human factors in design met applicable regulatory requirements. In 2020, CNSC staff conducted a MCR desktop inspection on human factors of refurbishment activities and tooling [BRPD-MCR-2020-05888] and concluded that Bruce Power was compliant with the planning and control requirements of CSA N290.12-14, *Human factors in design for nuclear power plants*.

Fire protection design

The fire protection measures at Bruce Power are controlled and coordinated to meet regulatory requirements. 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 CANDU nuclear power plants*. In 2020, CNSC staff conducted a compliance verification activity on MCR fire protection at BNGS B [BRPD-MCR-2020-07398] and concluded that Bruce Power was compliant with Fire Hazard Assessment and Fire Safe Shutdown Analysis requirements.

In 2020, BNGS A experienced 1 reportable event of a small fire in Unit 1 and BNGS B experienced 2 reportable events of small fires at Units 6 and 8. CNSC staff have reviewed the event reports, and were satisfied with Bruce Power's corrective actions in response on these events.

System Design

Electrical Power and Instrumentation and Control systems

Based on all of the compliance verification activities performed in 2020, including reviews of reportable events, quarterly reports, and technical assessments, CNSC staff determined that electrical power systems and instrumentation and control systems met CNSC staff performance expectations at BNGS A and B.

Component Design

Fuel design

The BNGS A and B fuel design and inspection program met the regulatory requirements and performance expectations. CNSC staff confirmed that Bruce Power operated its units within the applicable fuel power limits, the fuel condition was satisfactory and fuel has been operated safely in 2020. Both stations met the minimum expectations for fuel bundle inspections. A modification to the fuel design is being investigated as an updated strategy to address the long-standing acoustic channel issue at BNGS B. To address this issue, Bruce Power performed testing of fuel subcomponents to support the design modification and submitted the result to CNSC in 2020. CNSC staff reviewed this submission and found it acceptable.

Cables

Bruce Power has a surveillance program in place that covers cable condition monitoring and cable aging management programs.

In 2020, CNSC staff had no concerns associated with the cable system. CNSC staff concluded that the cable aging management programs met CNSC staff performance expectations at BNGS A and B in 2020.

Instrumentation & Control

Bruce Power met all applicable requirements for I&C. Bruce Power also met performance expectations in the areas of system design of instrumentation and control systems.

3.5.6 Fitness for Service

CNSC staff concluded that Bruce Power met the applicable regulatory requirements and CNSC staff expectations, for the SCA Fitness for Service at the BNGS A and B in 2020.

Equipment Fitness for Service/Equipment Performance

CNSC staff determined that the overall equipment fitness for service and performance at BNGS A and B met the applicable regulatory requirements. System health reports and component health reports are produced on a routine basis.

In 2020, CNSC staff conducted inspections of equipment fitness for service and identified 2 compliant findings. However, several procedural non-compliances related to environmental qualification, system health monitoring of electrical systems, environmental qualification of the equipment, and pressure component leaks containing were observed [BRPD-AB-2020-04983, BRPD-AB-2020-07249, BRPD-AB-2020-07832]. Bruce Power took immediate corrective actions, which CNSC staff found to be acceptable.

Reliability of systems important to safety

CNSC staff determined that the reliability program at BNGS A and B met the requirements described in [REGDOC-2.6.1, Reliability Programs for Nuclear Power Plants](#).

For BNGS A, all special safety systems met their unavailability targets in 2020.

All special safety systems for BNGS B met their unavailability targets in 2020, with the exception of Negative Pressure Containment (NPC). NPC exceeded its target in 2020 mainly due to a water leak that occurred on a D₂O recovery tank while replacing a D₂O recovery pump seal on Unit 5.

The containment breach was resolved by closing all pathways from containment to the tank. During the event, no environmental release occurred and there was no dose to the public. Worker dose due to the event was negligible, as total worker dose during the shift was 0.21 mSv, well below the action level (2 mSv).

Bruce Power's corrective actions included isolating the tank from containment and repositioning the tank lid to fix the leak prior to returning it to service. CNSC staff are satisfied with Bruce Power's corrective actions. There was no impact to nuclear safety due to this event.

Maintenance

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 and B continuously reduced the critical deficient maintenance backlog and reached the industry average. In 2020, the average preventive maintenance completion ratio fell from 90% to approximately 87% and 85% for BNGS A and B respectively, due to the impact of the COVID-19 pandemic in the second quarter of 2020. The pandemic caused the delayed execution of a number of preventive maintenance work orders. During the same quarter, Bruce Power completed a higher than normal number of corrective maintenance work orders as part of a backlog reduction initiative. CNSC staff noted that the preventive maintenance completion ratio at both BNGS A and B has recovered to above 94% since the third quarter of 2020.

In 2020, CNSC staff conducted maintenance-related inspections [BRPD-MCR-2020-07146, BRPD-MCR-2020-07398] that confirmed that maintenance program at BNGS A and B consistently met the applicable regulatory requirements and CNSC staff expectations. There were no safety significant findings in the maintenance specific area based on the review of the events reported by Bruce Power. 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 table 21 for BNGS B.

Table 20: Trend of maintenance backlogs and deferrals for critical components for Bruce A, 2018 to 2020

Parameter	Average quarterly work orders per unit			Three year trending	Quarterly 2020 work orders				Industry average for 2020
	2018	2019	2020		Q1	Q2	Q3	Q4	
Corrective maintenance backlog	0	1	1	steady	0	0	1	0	1
Deficient maintenance backlog	13	10	5	down	4	3	4	8	4
Deferrals of preventive maintenance	1	0	1	steady	0	2	0	0	2

Table 21: Trend of maintenance backlogs and deferrals for critical components for Bruce B, 2018 to 2020

Parameter	Average quarterly work orders per unit			Three year trending	Quarterly 2020 work orders				Industry average for 2020
	2018	2019	2020		Q1	Q2	Q3	Q4	
Corrective maintenance backlog	0	0	0	steady	0	0	0	0	1
Deficient maintenance backlog	19	11	2	down	1	1	3	1	4
Deferrals of preventive maintenance	0	0	0	steady	0	0	0	1	2

Structural Integrity

Based on regulatory oversight activities, CNSC staff determined that SSCs continued to meet structural integrity requirements for both BNGS A and B.

Bruce Power provided its work plan for a pilot study on the uncertainty analysis for the PFP Assessment. CNSC staff have reviewed Bruce Power's proposed work plan and concluded that it aligns with CNSC staff expectations.

In 2020, CNSC staff conducted inspections of the moderator system at BNGS A [BRPD-A-2020-06832], and negative pressure containment system and vacuum building system at BNGS B [BRPD-B-2020-05574, BRPD-B-2020-04991]. CNSC staff concluded that Bruce Power was compliant with the surveillance testing requirements of CSA N286-12 for these BNGS B inspections. However, at the BNGS A moderator system inspection, an opportunity for improvement was observed due to partially complete commitments to update the Bruce A Safety Report. CNSC staff recommended Bruce Power to review the document approval process, and Bruce Power's responses was found to be acceptable by CNSC staff.

CNSC staff conditionally approved a delay of the main containment positive pressure test at BNGS B from 2021 to 2024. CNSC staff continue to monitor Bruce Power's compliance with the conditions concerning station containment and vacuum building outage alignment.

CNSC staff also reviewed and accepted the results of the Unit 6 MCR bulkheads pressure test, submitted by Bruce Power. Bruce Power was requested to improve the leak tightness of the Unit 6 reactor vault for the return to service (RTS) phase of the Unit 6 MCR project, and CNSC staff are monitoring Bruce Power's response.

Aging Management

CNSC staff determined that Bruce Power's aging management program met regulatory requirements. Bruce Power is compliant with [REGDOC-2.6.3, *Fitness for Service: Aging Management*](#).

CNSC staff inspections [BRPD-AB-2020-05889, BRPD-AB-2020-049830] indicated compliance with the aging management requirements in 2020.

Bruce Power is adequately addressing the remaining issues by performing Probabilistic Fracture Protection (PFP) assessments and CNSC staff are satisfied with the priority being given to PFP. Bruce Power started to address CNSC staff concerns related to the performance of Probabilistic Core Assessments and submitted their first PFP assessments in 2020. CNSC staff reviewed this submission and are satisfied that operating margin remains for BNGS A and B.

In 2020, Bruce Power continued addressing CNSC staff concerns related to measured pressure tube (PT) to calandria tube (CT) to gaps by performing maintenance on the 2 channels in question to eliminate the possibility of PT-CT contact at BNGS B. However, challenges remain with demonstrating no contact prior to the outage. Bruce Power has submitted supporting information to qualify the gap measurement tool to measure smaller gaps. CNSC staff reviewed this submission and are satisfied with Bruce Power's progress.

Chemistry Control

CNSC staff determined that Bruce Power's chemistry control program met the applicable regulatory requirements. Bruce Power maintained acceptable system chemistry performance in 2020.

The findings from BNGS A inspection on Unit 4 planned outage [BRPD-A-2020-06229], performed in 2020, indicated compliance with the chemistry control for Over Poison Guaranteed Shutdown State (OPGSS) requirements.

The findings from BNGS B inspections on Unit 5, 6 and 8 planned outages [BRPD-B-2020-7316, BRPD-MCR-2020-06297, and BRPD-B-2020-08316], performed in 2020, indicated compliance with the chemistry control for OPGSS requirements.

Both BNGS A and B experienced challenges in maintaining the moderator isotopic concentration within the specified target in 2020. These challenges have been the primary driver for a lower Chemistry Compliance Index (CCI) from the previous year and the overall downward trend shown for BNGS B. Other safety significant parameters that rely on the moderator isotopic purity at BNGS A and B (i.e., isotopic purity differential between the moderator and the PHT) were maintained within specification throughout 2020.

Periodic Inspection and Testing

During the reporting year, Bruce Power performed the appropriate inspection and testing program to meet the applicable regulatory requirements.

CNSC staff determined that Bruce Power has adequate and well maintained periodic inspection programs (PIPs) in place at BNGS A and B for pressure boundary systems, containment components and containment structures.

In 2020, CNSC staff inspections and compliance assessments identified mainly compliant findings. A procedural non-compliance with low safety significance was observed during the Unit 7 inspection [BRPD-AB-2020-04983] for the performance of load tests related to 1 battery bank. Bruce Power is actively working to address this non-compliance and CNSC staff are satisfied with the progress being made.

3.5.7 Radiation Protection

CNSC staff concluded that Bruce Power met the applicable regulatory requirements and CNSC staff expectations, for the SCA Radiation Protection at the BNGS A and B in 2020.

Application of ALARA

CNSC staff compliance verification activities for the Application of ALARA at the BNGS A and B sites in 2020 found that Bruce Power was compliant with requirements and met CNSC staff performance expectations.

Bruce Power achieved its year end collective dose targets in 2020 for BNGS A and BNGS B. Bruce Power's commitment to the ALARA principle has been demonstrated through the ALARA program implemented at BNGS A and B. Shielding and specialized tooling are used to reduce occupational exposures, and to maintain worker dose ALARA.

In 2020, Bruce Power continued to implement a Five-Year Dose Reduction Plan for BNGS A and B that incorporates ALARA initiatives both planned and currently underway that are expected to reduce collective dose. On-going ALARA initiatives are documented, tracked and have assigned owners.

Worker Dose Control

CNSC staff determined that Bruce Power met applicable regulatory requirements for worker dose control at the BNGS A and B in 2020.

In 2020, Bruce Power maintained worker doses below the regulatory dose limits, during normal operation and during the execution of outages. CNSC staff noted that there were no adverse trends or safety significant unplanned exposures at BNGS A and B. There were no action level exceedances at BNGS A and B due to unplanned exposures.

The overall performance in the area of worker dose control met or exceeded expectations during the execution of Unit 6 MCR activities in 2020, in that there have been no unplanned external exposures, no unplanned internal exposures, and no alpha internal exposures.

Radiological Hazard Control

CNSC staff determined that Bruce Power implemented effective controls for radiological hazards at BNGS A and BNGS B that met the regulatory requirements.

CNSC staff determined that Bruce Power's radiation protection program ensures that there are measures in place to monitor and control radiological hazards. This includes contamination control, dose rate control, and airborne radiation monitoring and control. There were no action level exceedances for surface contamination or contamination control at BNGS A and B in 2020.

In 2020, the overall performance in the area of radiological hazard control met or exceeded expectations during the execution of Unit 6 MCR activities with minimal personal contamination events and no alpha personal contamination events.

3.5.8 Conventional Health and Safety

CNSC staff concluded that Bruce Power met the applicable regulatory requirements and CNSC staff expectations, for the SCA Conventional Health and Safety at the BNGS A and B in 2020.

Bruce Power has appropriate procedures in place to ensure the protection of its workers against hazardous conditions in the workplace in 2020.

Bruce Power is compliant with the relevant provisions of the *Occupational Health and Safety Act* of Ontario and the *Labour Relations Act*.

Bruce Power achieved over 7 million hours without a lost time accident. The accident severity rate for the BNGS A and B decreased from 3.66 in 2019 to 1.1 in 2020 and it is notably less than 5-year average value of 2.24. The accident frequency for the BNGS A and B increased from 0.23 in 2019 to 0.3 in 2020 but it is still less than 5-year average value of 0.32. In 2020, the industrial safety accident rate for BNGS A and B was 0.02, an improvement in comparison to 0.07 in 2019.

3.5.9 Environmental Protection

CNSC staff concluded that Bruce Power met the applicable regulatory requirements and CNSC staff expectations, for the SCA Environmental Protection at the BNGS A and B in 2020.

Effluent and Emissions Control (releases)

In 2020, the releases from BNGS A and B sites were well below the Derived Release Limits (DRLs). No radiological releases to the environment from the facility exceeded the regulatory limits. No action levels were approached or exceeded.

Performance information from technical reviews of quarterly and annual reports, as well as the results of a field inspection in 2020 met expectations in the area of effluent and emissions control (releases).

Environmental Management System

CNSC staff determined that Bruce Power was compliant with the requirements of [REGDOC-2.9.1, *Environmental Protection Policies, Programs and Procedures*](#) for environmental management system in conducting annual management reviews of their program.

Assessment and Monitoring

The field inspections and technical assessment of the 2020 quarterly and annual scheduled compliance reports for BNGS A and B indicated that Bruce Power met the applicable regulatory requirements in 2020.

Based on the review of 2020 environmental monitoring data, CNSC staff concluded that people and the environment in the vicinity of the site were protected and that no health impacts were expected to result from the operations of the BNGS A and B in 2020.

Protection of People

In 2020, hazardous substances releases to the environment from BNGS A and B were below the regulatory limits. CNSC staff concluded that people were protected from the impacts of the facility non-radiological substances in 2020.

Performance information from technical reviews of quarterly and annual scheduled reports, as well as the results of field inspections in 2020 met expectation in the area of protection of people at both stations.

Environmental Risk Assessment

In 2020, CNSC staff reviewed Bruce Power's 2018 revised environmental risk assessment (ERA) and confirmed that Bruce Power met the applicable regulatory requirements. CNSC staff concluded that the 2018 ERA is compliant with CSA N288.6-12, *Environmental risk assessments at Class I nuclear facilities and uranium mines and mills* and that there is no unreasonable risk to the environment posed by the operation of BNGS A and B. Bruce Power continued to implement and maintain an effective ERA program.

Bruce Power completed full implementation of CSA N288.7-15, *Groundwater protection programs at Class I nuclear facilities and uranium mines and mills*, in December 2020.

Estimated Dose to the Public

Bruce Power continued to ensure the protection of the public in accordance with the *Radiation Protection Regulations*.

Performance information from technical assessments of the 2020 quarterly and annual scheduled reports and of the Bruce Power report of the environmental monitoring program in 2020 indicated that the estimated dose to the public was low ($<1.8 \mu\text{Sv/y}$), representing 0.18% of the regulatory dose limit of 1 mSv/y.

3.5.10 Emergency Management and Fire Protection

CNSC staff concluded that Bruce Power met the applicable regulatory requirements and CNSC staff expectations, for the SCA Emergency Management and Fire Protection at the BNGS A and B in 2020.

CNSC staff concluded that 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 maintain the health and safety of persons and the national security.

Conventional Emergency Preparedness & Response

Bruce Power adequately activated their pandemic plans, which invoked the implementation of plans and procedures, which enabled them to continue safe operations during the COVID-19 pandemic. CNSC staff monitored Bruce Power's actions to ensure that safety was maintained.

Nuclear Emergency Preparedness & Response

CNSC staff concluded that Bruce Power met the applicable regulatory requirements for nuclear emergency preparedness and response at BNGS A and B in 2020.

Bruce Power's capital project for radio system replacement, which will enhance radio communication reliability for emergency response team members, continued in 2020. It included the replacement of all handheld radios and hardware infrastructure (antennas, cabling, repeaters, networking, etc.); refurbishment of the distributed antenna system; and construction of a replacement radio tower and associated equipment. CNSC staff were satisfied with the project's progress in 2020, which entailed completion of the design and work control packages for the whole site. The site wide radio system project is scheduled for completion in December 2021.

In response to a CNSC staff request, Bruce Power performed a feasibility assessment to investigate options for automatic connectivity between its plant data systems and its disaster local area network (DLAN) electronic data management system. Bruce Power phased out DLAN at the end of 2019 and implemented an application that provides web-based access as a solution for automatic plant data transfer. CNSC staff accepted this solution and concluded that the web-based data transfer system was consistent with CNSC staff expectations.

CNSC staff confirmed the system workability at its test trial. As per CNSC staff request, Bruce Power provided quarterly updates on the automatic plant data transfer system implementation in 2020. CNSC staff were satisfied with Bruce Power's progress [RIB 14755].

UPDATE: Based on the review of the update in March 2021, CNSC staff concluded that Bruce Power has made sufficient progress in implementing a plant data transfer system such that regular quarterly update submissions are no longer required.

Fire Emergency Preparedness & Response

CNSC staff determined that Bruce Power maintains comprehensive fire response capability and fire protection program that met the applicable regulatory requirements in 2020.

Bruce Power has an extensive fire drill and training program that includes a new Emergency and Protective Services Training Facility, where live fire training is conducted, located on the Bruce Power site.

In 2020, CNSC staff reviewed Bruce Power's submission of an annual plant condition inspection, bi-annual fire drill review and tri-annual fire program audit conducted by an external Third Party in 2019. Based on the results, CNSC staff observed that the emergency response team performance continued to improve. The drill format and results satisfied the performance criteria prescribed in CSA N293-12, *Fire protection for CANDU nuclear power plants*.

Based on the inspection conducted [BRPD-MCR-2020-07398], CNSC staff concluded that Bruce Power complies with the regulatory requirements in 2020; however, procedural non-compliances with the governance were observed. CNSC staff found no evidence of undue risk to the health and safety of persons and the environment. Bruce Power's Corrective Action Plan to address procedural non-compliances was accepted by CNSC staff.

3.5.11 Waste Management

CNSC staff concluded that Bruce Power met the applicable regulatory requirements and CNSC staff expectations, for the SCA Waste Management at the BNGS A and B in 2020.

CNSC staff confirmed that Bruce Power complied with the applicable regulatory requirements for waste management practices associated with waste transfer documents.

Bruce Power continued to implement effective programs for the characterization of radioactive and hazardous wastes during 2020.

CNSC staff were satisfied with the safety performance indicator SPI 25 (Low and Intermediate level Radioactive Solid Waste Generated) for BNGS A and B in 2020. However, CNSC staff also identified a small number of non-compliances in relation to radioactive waste control with negligible safety significance.

Bruce Power immediately took corrective action and adequately addressed all items to CNSC staff satisfaction.

OPG holds the liability for the Bruce Power site and is responsible for the preliminary decommissioning plans (PDPs) and associated financial guarantee for BNGS A and B. In 2017, OPG revised the PDPs for all of its facilities for the period up to 2022. OPG selected a deferred decommissioning strategy for the decommissioning of the BNGS and an immediate decommissioning strategy for the WWMF, following the completion of the BNGS decommissioning. There were no changes made to the PDPs for the BNGS in 2020. The associated financial guarantee is discussed in section 2.11.

3.5.12 Security

CNSC staff concluded that Bruce Power met the applicable regulatory requirements and CNSC staff expectations, for the SCA Security at the BNGS A and B in 2020.

CNSC staff reviewed the annual site security report and threat and risk assessment, as well as 4 quarterly safety reports for Bruce Power, and confirmed that Bruce Power met all the applicable regulatory requirements.

Facilities and Equipment

CNSC staff inspections of facilities and equipment identified that Bruce Power was compliant with applicable regulatory requirements. Bruce Power also reported 4 events that were deemed not safety or security significant.

Response Arrangements

CNSC staff inspections response arrangements identified that Bruce Power was compliant with applicable regulatory requirements.

Security Practices

CNSC staff inspections of security practices identified that Bruce Power was compliant with applicable regulatory requirements, and in some cases exceeded CNSC expectations. Bruce Power also reported 2 events that were deemed to be negligible with no safety or security significance. Bruce Power has a fully integrated Security Awareness program in their program documentation, and its implementation is reflected in the compliant findings within this specific area.

Drills and Exercises

Working in accordance with their Business Continuity Plan, Bruce Power was able to maintain an effective drill program. Performance information from the quarterly reports and the licensee's drill and exercise program met CNSC staff expectations. Bruce Power maintains a drill and exercise program that meets regulatory requirements and tests the effectiveness of its physical protection system, consistent with the design basis threat (DBT). CNSC staff concluded that there were no safety significant issues for this specific area.

Cyber Security

CNSC staff determined that BNGS A and B met their licence requirement to update their cyber security program to meet the requirements and guidance in the CSA N290.7-14, *Cyber security for nuclear power plants and small reactor facilities*. CNSC staff determined that the major milestones for the implementation of CSA N290.7-14, *Cyber security for nuclear power plants and small reactor facilities* were completed in 2020 and remaining field work is in progress.

3.5.13 Safeguards and Non-Proliferation

CNSC staff concluded that Bruce Power met the applicable regulatory requirements and CNSC staff expectations, for the SCA Safeguards and Non-Proliferation at the BNGS A and B in 2020.

Nuclear Material Accountancy and Control

CNSC staff determined that Bruce Power's accountancy and control of nuclear material complied with the applicable regulatory requirements at both BNGS A and B in 2020.

In 2020, Bruce Power provided the required nuclear material accountancy and control reports to the CNSC and the IAEA for safeguards activities, including inspections.

Access and Assistance to the IAEA

Bruce Power granted the required access and assistance to the IAEA for safeguards activities, including inspections and for the maintenance of IAEA equipment. Details of the IAEA inspection activities are provided in section 2.13.

During the IAEA's annual physical inventory verifications, the inspectors were not able to meet their objectives for some spent fuel assemblies as several stacking frames randomly selected in the secondary bays were only partially accessible by the IAEA's verification equipment. The IAEA requested the CNSC and the facility to make necessary arrangements for the IAEA to access this nuclear material for verification in the future.

UPDATE: In April 2021, CNSC staff met with Bruce Power and the IAEA to discuss the results of the inspection, the stacking frames, and potential factors affecting the IAEA's verification equipment. The IAEA performed additional verification activities during their planned 2021 inspection to close-out this action. The results of the inspection are expected later this year.

Operational and Design Information

CNSC staff determined that Bruce Power met the applicable regulatory requirements for operational and design information in 2020. Bruce Power provided the required operational and design information to facilitate IAEA safeguards activities.

Safeguards Equipment, Containment and Surveillance

CNSC staff confirmed that Bruce Power met the regulatory requirements for safeguards equipment, containment and surveillance in 2020 at BNGS A and B.

In 2020, Bruce Power provided the assistance required for the IAEA's safeguards equipment, containment and surveillance activities, including inspections.

3.5.14 Transport and Packaging

CNSC staff concluded that Bruce Power has implemented a packaging and transport program that ensured compliance with the *Packaging and Transport of Nuclear Substances Regulation, 2015 (PTNSR)* and the *Transportation of Dangerous Goods (TDG) Regulations*, and that the transport of nuclear substances to and from the facility was conducted safely in 2020.

There was 1 packaging and transport related event reported by Bruce Power in 2020. The event had no safety significance. CNSC staff are satisfied with the actions taken to prevent no re-occurrence.

3.6 Western Waste Management Facility

3.6.0 Introduction

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 receipts 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 Bruce A 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 2 separate areas - the L&ILW Storage Facility and the Western Used Fuel Dry Storage Facility (WUFDSE) - within the overall boundary of the Bruce site.

The L&ILW Storage Facility consists of the Waste Volume Reduction Building; the Transportation Package Maintenance Building; 14 above-ground, low-level storage buildings (LLSBs), 2 above-ground, refurbishment waste storage buildings; and, various in-ground containers, trenches, and tile holes for the storage of ILW.

The WUFDSE 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, and #4). The WWMF currently has the capacity to store 2,000 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 4 additional DSC storage buildings (Storage Buildings #5, #6, #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 has been placed 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 under a Designated Officer, is valid until October 31, 2029.

Compliance Program

The inspections at the WWMF that were considered in the safety assessments in this regulatory oversight report are tabulated in table 22 (inspection reports were included if they were sent to OPG by February 28, 2021).

Table 22: List of Inspections at WWMF

Safety and control area	Inspection title	Inspection report sent date
Management System	Management System Inspection: OPG-WWMF-2020-02	January 2021
Operating Performance	General Inspection: OPG-WWMF-2020-01	January 2021

3.6.1 Management System

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Management System at the WWMF/RWOS-1 in 2020.

Management System

In 2020, OPG revised their Nuclear Waste Management Program. CNSC staff are satisfied with the revised program document, and the changes met CNSC staff expectations.

Management of Contractors

CNSC staff determined OPG's documentation, for oversight of vendors for construction of WWMF Used Fuel Dry Storage Buildings #5 and #6, to be acceptable.

Business Continuity

CNSC staff determined that OPG met regulatory requirements for the business continuity specific area. OPG has an adequate contingency plan to maintain or restore critical safety and business functions in the event of disabling circumstances such as a pandemic, severe weather, or labour actions.

In light of the COVID-19 pandemic, CNSC staff confirmed that OPG had sufficient business continuity plans in the event of a wide-scale outbreak across Canada. During this pandemic, OPG has implemented mitigation steps as part of their plans to combat the spread of the COVID-19 virus. This includes:

- Detailed and on-going employee communications to increase awareness of COVID-19, minimize potential risks and ensure safe and reliable operations.
- Utilization of health and safety measures such as masks, hand sanitization stations and sanitation of work areas.
- Protocol developed for visitors (i.e. questionnaire required for all visitors).
- Continuous evolution of enhanced personal protective equipment (PPE) as information becomes available (such as a transition to triple layer masks).
- OPG screens all workers entering the facility for COVID-19 symptoms, recent travel, and orders to self-isolate. Thermal imaging is conducted on all personnel entering the protected area.

3.6.2 Human Performance

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Human Performance at the WWMF/RWOS-1 in 2020.

3.6.3 Operating Performance

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Operating Performance at the WWMF/RWOS-1 in 2020.

Conduct of Licensed Activity

In 2020, OPG processed a total of 110 DSCs at the WUFDSF. The total volume of radioactive waste received at the Western Low and Intermediate Level Waste Storage Facility in 2020 was 2476 m³. During 2020, the incinerator operated for 143 days on solids and 147.5 days on liquids. CNSC staff review of OPG's operational 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/clarification, met CNSC staff expectations.

Reporting and Trending

In 2019, CNSC staff review determined that OPG's annual compliance report did not meet the specific regulatory requirements of [REGDOC-3.1.2, Reporting Requirements, Volume I: Non-Power Reactor Class I Facilities and Uranium Mines and Mills](#); however, OPG's follow-up activities, which included submitting an addendum to the annual compliance report, met the requirements of REGDOC-3.1.2 and CNSC staff expectations. In 2020, OPG submitted all scheduled quarterly and annual reports as required within the appropriate timelines.

3.6.4 Safety Analysis

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Safety Analysis at the WWMF in 2020.

3.6.5 Physical Design

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Physical Design at the WWMF in 2020.

Design Governance

There were no significant observations to report on design governance for the WWMF in 2020. CNSC staff concluded that WWMF continued to implement its fire protection program in accordance with the CSA N393 *Fire protection for facilities that process, handle, or store nuclear substances* requirements.

3.6.6 Fitness for Service

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Fitness for Service at the WWMF/RWOS-1 in 2020.

Aging Management

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 found that it complied with OPG's aging management program.

3.6.7 Radiation Protection

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Radiation Protection at the WWMF/RWOS-1 in 2020.

Application of ALARA

CNSC staff determined that OPG implemented an effective and well-documented program, based on industry best practices, to keep doses to persons as low as reasonably achievable (ALARA) at the WWMF and at RWOS-1.

Worker Dose Control

OPG did not exceed any action levels for dose to workers. The annual effective doses for all WWMF/RWOS-1 workers were well below the regulatory limit of 50 mSv. There were no event reports related to worker dose control at the WWMF/RWOS-1 in 2020.

Radiological Hazard Control

CNSC staff determined that OPG implemented radiological hazard controls that met the applicable regulatory requirements for control of radiological hazards and the protection of workers at the WWMF/RWOS-1 in 2020. There were no recordable radiological exposures for OPG staff performing caretaking duties at RWOS-1.

3.6.8 Conventional Health and Safety

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Conventional Health and Safety at the WWMF/RWOS-1 in 2020.

OPG did not report any lost-time accidents at the WWMF in 2020; however, OPG reported one MTI in Q1. CNSC staff compliance verification activities did not identify any non-compliant findings relevant to conventional health and safety in 2020.

3.6.9 Environmental Protection

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Environmental Protection at the WWMF/RWOS-1 in 2020.

Effluent and Emissions Control (releases)

WWMF releases were well below the action levels and Derived Release Limits (DRLs). No radiological releases to the environment from the facility exceeded the regulatory limits. No action levels were approached or exceeded.

WWMF implemented and maintained an effluent monitoring program that met CNSC requirements and expectations.

Environmental Management System

OPG has implemented and maintained a corporate environmental management system (EMS) in accordance with CNSC requirements and expectations.

CNSC staff determined that OPG was compliant with the requirements of [REGDOC-2.9.1, *Environmental Protection Policies, Programs and Procedures*](#) for environmental management system in conducting annual management reviews of their program.

Assessment and Monitoring

Based on the review of 2020 environmental monitoring data, CNSC staff concluded that people and the environment in the vicinity of the WWMF were protected and that no health impacts were expected to result from the operations of the WWMF.

Protection of People

In 2020, 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 in 2020.

Performance information from technical reviews of quarterly and annual reports met expectation in the area of protection of people.

Environmental Risk Assessment

CNSC staff confirmed that OPG met the applicable regulatory requirements for their Environmental Risk Assessment.

Estimated Dose to the Public

WWMF continued to ensure the protection of the public in accordance with the *Radiation Protection Regulations*.

Performance information from technical assessments of the 2020 quarterly reports and the estimated maximum dose to the public (as per Bruce Power's annual environmental reports) remained low in 2020 (1.8 $\mu\text{Sv/y}$).

CNSC staff concluded that WWMF met expectation in the area of Estimated Dose to the Public.

3.6.10 Emergency Management and Fire Protection

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Emergency Management and Fire Protection at the WWMF/RWOS-1 in 2020.

Conventional Emergency Preparedness & Response

OPG activated the Corporate Crisis Management and Communication Centre (CMCC) to allow for planning and execution of the overall enterprise-wide response to COVID-19. CNSC staff were informed of OPG's actions and monitored them to ensure that safety was maintained.

Fire Emergency Preparedness & Response

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. An annual fire drill was conducted in 2020 and main fire response is provided by Bruce Power Emergency and Protective Services (BP EPS). BP EPS staff are given orientation tours at the WWMF.

CNSC staff also reviewed the Follow-up Response to the Low Level Storage Buildings 1-11 Fire Hazard Assessment. There were no issues identified during CNSC staff review, and the document was found to be acceptable.

3.6.11 Waste Management

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Waste Management at the WWMF/RWOS-1 in 2020. OPG's quarterly operations reports met CNSC staff expectations.

In 2017, OPG revised the Preliminary Decommissioning Plan (PDPs) for all of its facilities for the period up to 2022. An immediate decommissioning strategy was selected for the decommissioning of the WWMF, once all low and intermediate-level radioactive waste and used fuel is transferred to an appropriate repository.

The Commission accepted the PDP and associated financial guarantee. There were no changes made to the PDP for the WWMF in 2020. The associated financial guarantee is discussed in section 2.11.

3.6.12 Security

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Security at the WWMF in 2020.

CNSC staff reviewed the annual site security report and threat and risk assessment, as well as 4 quarterly safety reports, for WWMF, and confirmed that OPG met all the applicable regulatory requirements.

3.6.13 Safeguards and Non-Proliferation

CNSC staff concluded that OPG met the applicable regulatory requirements and CNSC staff expectations, for the SCA Safeguards and Non-Proliferation at the WWMF/RWOS-1 in 2020.

Nuclear Material Accountancy and Control

CNSC staff determined that OPG's accountancy and control of nuclear material complied with the applicable regulatory requirements at WWMF in 2020.

In 2020, OPG provided the required nuclear material accountancy and control reports to the CNSC and the IAEA for safeguards activities, including inspections.

OPG initially committed to full implementation of [REGDOC-2.13.1, Safeguards and Nuclear Material Accountancy](#) by March 31, 2021.

In 2020, OPG provided confirmation that, as of March 31, 2020, it was compliant with the requirements of REGDOC-2.13.1, with the exception of the aspects related to non-fuel nuclear material inventory. Due to COVID-19 pandemic response efforts, OPG requested a 6 month extension to October 29, 2021 for the implementation of these remaining requirements. CNSC staff found OPG's request reasonable and informed OPG that the LCH would be updated accordingly.

Access and Assistance to the IAEA

OPG granted the required access and assistance to the IAEA for safeguards activities, including inspections and for the maintenance of IAEA equipment at WWMF. Details of the IAEA inspection activities are provided in section 2.13.

Operational and Design Information

CNSC staff determined that OPG met the applicable regulatory requirements for operational and design information in 2020 at WWMF. OPG provided the required operational and design information to facilitate IAEA safeguards activities.

Safeguards Equipment, Containment and Surveillance

CNSC staff confirmed that OPG met the regulatory requirements for safeguards equipment, containment and surveillance in 2020 at the WWMF.

In 2020, OPG provided the assistance required for the IAEA's safeguards equipment, containment, and surveillance activities, including inspections at the WWMF.

3.6.14 Transport and Packaging

CNSC staff concluded that OPG has implemented a packaging and transport program that ensures compliance with the *Packaging and Transport of Nuclear Substances Regulations, 2015* (PTNSR), and the *Transportation of Dangerous Goods Regulations*, and that the transport of nuclear substances to and from the facility was conducted safely in 2020.

There were no packaging and transport events reported in 2020 at the WWMF.

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 facilities are owned and operated by New Brunswick Power Corporation (NB Power) and include a single CANDU reactor with a rated capacity of 705



megawatts electrical (MWe). 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 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 PLNGS.

The SRWMF is comprised of 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 commissioning and use.
- Phase III of the facility stores waste from fuel channel replacement and other operations completed during the refurbishment outage.

Licensing

In 2017, the Commission renewed the PROL for a period of 5 years, authorizing NB Power to operate the PLNGS and the SRWMF until June 2022. The PROL was amended in 2020 to allow for an update to a standardized licence condition related to training and certification of personnel in their PROLs, by referencing CNSC regulatory document [REGDOC-2.2.3, *Personnel Certification, Volume III: Certification of Persons Working at Nuclear Power Plants*](#).

Fisheries Act Authorization

In October 2019, NB Power submitted an application to Department of Fisheries and Oceans Canada (DFO). In December 2019, DFO deemed the Fisheries Act Authorization (FAA) to be complete; however, the 90-day time limit within which a decision with respect to the application must be made has ceased to apply due to Indigenous consultation requirements. As DFO is the primary regulatory agency, CNSC staff intend to meet with DFO and NB Power in Fall 2021 to discuss the progress of Indigenous consultation to date.

Periodic Safety Review

The PROL requires NB Power to perform a PSR in accordance with [REGDOC-2.3.3, *Periodic Safety Reviews*](#). NB Power submitted a high-level project execution plan and a PSR basis document in support of a 10-year licensing period from 2022 to 2032.

In February 2020, NB Power submitted the Global Assessment Report for CNSC staff review. Once CNSC staff comments were addressed, NB Power submitted the IIP for CNSC staff acceptance. CNSC staff reviewed the IIP and provided comments to NB Power to address in the revision of the IIP.

UPDATE: CNSC staff accepted the revised IIP on June 30, 2021.

Compliance Program

The inspections at the PLNGS that were considered in the safety assessments in this regulatory oversight report are tabulated in table 23 (inspection reports were included if they were sent to NB Power by February 28, 2021).

Table 23: List of Inspections at PLNGS

Safety and control area	Inspection title	Inspection report sent date
Management System	Operational Experience: GPLRPD-2020-05585	April 2020
	Management System Program Implementation: GPLRPD-2020-07066	October 2020
	Self-Assessment: GPLRPD- 2020-08356	January 2021

Safety and control area	Inspection title	Inspection report sent date
Human Performance	Conduct of Simulator Examinations: GPLRPD-2020-06557	November 2020
	Design, Development and Grading of Simulator-based Examinations: GPLRPD-2020-08315	December 2020
	Training Program – SAT Review: GPLRPD-2020-06512	April 2020
	Certified Training Programs: GPLRPD-2020-06966	September 2020
	SAT Review of Training Program: GPLRPD-2020-08799	February 2021
	Written Certification Examination: GPRLPD-2020-06387	November 2020
	Dousing Chemistry SOE: GPLRPD-2020-06833	April 2020
Operating Performance	Quarterly Field Inspection Q1 FY2019/20: GPLRPD-2020-07501	September 2020
	Quarterly Field Inspection Q2 FY2019/20: GPLRPD-2020-08415	December 2020
	Quarterly Field Inspection Q3 FY2019/20: GPLRPD-2020-08771	February 2021

Safety and control area	Inspection title	Inspection report sent date
	Quarterly Field Inspection Q4 FY2018/19: GPLRPD- 2020-06298	May 2020
Fitness for Service	SSC Monitoring: GPLRPD- 2020-05712	June 2020
	System Inspection – Moderator: GPLRPD-2020- 06575	April 2020
Radiation Protection	Worker Dose Control: GPLRPD-2020-07900	January 2021
Environmental Management	Effluent Monitoring: GPLRPD-2020-05654	July 2020
	Hazardous Waste: GPLRPD-2020-07813	October 2020

3.7.1 Management System

CNSC staff concluded that NB Power met the applicable regulatory requirements and CNSC staff expectations, for the SCA Management System at the PLNGS in 2020.

Management System

NB Power complied with the requirements of CSA N286-12, *Management system requirements for nuclear facilities*.

CNSC staff inspections identified 6 compliant findings in the area of management system. However, the results of the operating experience inspection identified 1 non-compliance of negligible safety significance related to the documented approval process to share station operational experience with industry. NB Power updated the operating experience process to include additional responsibilities to address this non-compliance. CNSC staff are satisfied with NB Power's response to this item.

Organization

CNSC staff determined that NB Power's organizational structure is adequately defined and roles and responsibilities are documented. Based on CNSC staff inspections and compliance assessments during the reporting year, CNSC staff confirmed compliance of this area with applicable regulatory requirements.

CNSC staff inspections identified several compliant findings in the area of organization. However, the results of the work protection training inspection identified 1 non-compliance of negligible safety significance related to misalignments identified with the work clearance roles and related training documents. NB Power provided corrective actions in response to the finding. CNSC staff have reviewed NB Power's response and were satisfied with the corrective actions implemented.

Performance Assessment

CNSC staff determined that NB Power continued to meet the applicable regulatory requirements for Performance Assessment, Improvement, and Management Review.

Operating Experience (OPEX)

CNSC staff determined that NB Power's OPEX program met regulatory requirements.

Change Management

CNSC staff determined that NB Power met regulatory requirements applicable to the change management specific area.

CNSC inspections identified several compliant findings in the area of change management. However, the results of the certified training programs inspection identified 1 non-compliance of low safety significance related to the alignment of the control room operator/shift supervisor training program with the requirements of NB Power processes. NB Power provided a response to this non-compliance in April 2021. CNSC staff have reviewed NB Power's response and determined that the corrective actions taken met CNSC staff expectations.

Safety Culture

NB Power provided an implementation plan for [REGDOC-2.1.2, Safety Culture](#) in May 2019. CNSC staff reviewed NB Power's implementation plan and were satisfied that it had the required information to meet the requirements of REGDOC-2.1.2. NB Power has committed to updating its governance to meet the requirements of REGDOC 2.1.2 by August 31, 2021, and to conducting their next safety culture self-assessment by December 2021 in accordance with REGDOC 2.1.2.

Configuration Management

CNSC staff determined that NB Power met regulatory requirements and performance expectations applicable to the configuration management specific area.

CNSC inspections only identified compliant findings in the area of configuration management. This indicates a high commitment toward the alignment of the as-built configuration with design and safety analysis at PLNGS.

Record Management

CNSC staff determined that NB Power continued to maintain and implement a records and document management system that complied with the requirements of CSA N286-12, *Management system requirements for nuclear facilities*.

CNSC staff inspections identified several compliant findings in the area of records management. However, the results of the Worker Dose Control, Structure, Systems and Components Monitoring and Independent Assessments inspections identified 3 non-compliances of negligible safety significance related to forms not being controlled, a draft document not being formally recorded and a log book not traceable to the NB Power management system. NB Power is currently working to address these findings. CNSC staff will continue to monitor NB Power's response to these non-compliances.

Management of Contractors

CNSC staff determined that NB Power met the applicable regulatory requirements for the management of contractors and supply chain in 2020.

CNSC staff inspections only identified compliant findings in the area of management of contractors. This indicates a high commitment toward the supply chain at PLNGS.

Business Continuity

NB Power demonstrated sufficient preparedness for the COVID-19 pandemic response. Mitigating strategies were put in place at PLNGS to prevent the spread of COVID-19. Station expectations were adjusted accordingly and on a regular basis, as new information became available on the virus. Regular communications were provided to PLNGS site staff on the COVID-19 protocols and station expectations. In order to better prepare resources to mitigate the spread of the virus, NB Power delayed the spring 2020 outage to the fall of 2020.

At PLNGS protocols were put in place to clearly identify the expectations related to COVID-19. These COVID-19 protocols included:

- During the initial response to the pandemic, the PLNGS Incident Command Section was partially stood up to minimize the impact of the COVID-19 outbreak and ensure continued safe operation of the Station while staying aligned with the corporate response.
- Initially, NB Power only allowed essential staff including those required to maintain minimum shift complement on-site.
- Prior to staff returning to work at site, a return to site policy was put in place.
- Asking individuals reporting to site to pre-screen prior to arrival and not to come to work if unwell. Additionally, once on-site, to immediately proceed to be physically screened including questions regarding signs of illness and travel prior to proceeding to work location.

- Asking individuals to wear facial coverings including when and where they were to be worn and how they should be worn.
- Applying occupancy signage on entrances to offices and meeting rooms, and floor stickers indicating physical distancing requirements in high traffic areas and hallways.
- Installing sanitization stations throughout all buildings and providing guidance on sanitization use, prior to and after, the use of certain equipment such as radiation monitors.
- Providing guidelines for carpooling and workspaces.
- Setting up a COVID Response Team (CRT) including a phone number and e-mail to contact with COVID-19 related questions.

CNSC staff determined that NB Power's response to the COVID-19 pandemic met all applicable business continuity requirements.

3.7.2 Human Performance

CNSC staff concluded that NB Power met the applicable regulatory requirements and CNSC staff expectations, for the SCA Human Performance at the PLNGS in 2020.

Human Performance

CNSC staff determined that NB Power has implemented and maintained a human performance program that met the applicable regulatory requirements.

CNSC staff identified 8 findings in 2020 applicable to NB Power's human performance program. Of the 8 findings, 7 were compliant and addressed procedural use and adherence, and use of human performance tools. There was 1 non-compliant finding of negligible safety significance related to frequency of self-assessments. No enforcement action was raised as NB Power had already taken acceptable corrective actions during the inspection [GPLRPD-2020-05712]. An inspection on human performance programs was conducted in 2019 [GPLRPD-2019-002] resulting in a non-compliant finding of negligible safety significance related to procedural adherence. CNSC staff reviewed 2 submissions provided by NB Power in 2020, and determined that the actions taken were acceptable.

Personnel Training

CNSC staff determined that, in 2020, NB Power had a well-documented and robust systematic approach to training (SAT) based training system. This was based on a review of the findings from compliance verification activities conducted in 2020 which resulted in mainly compliant findings. However, non-compliances of negligible safety significance were identified related to some SAT elements being applied inconsistently. CNSC staff were satisfied with NB Power's progress in correcting all non-compliances.

Personnel Certification

CNSC staff determined that NB Power's personnel certification program met the applicable regulatory requirements in 2020. CNSC staff reviewed the staffing reports for certified personnel and the applications for initial certification and renewal of certification, and confirmed that NB Power had a sufficient number of personnel at PLNGS for all certified positions. All certified workers at PLNGS possessed the knowledge and skills required to perform their duties safely and competently.

CNSC staff concluded that the initial certification examination and the requalification test programs for all certified positions at PLNGS met the applicable regulatory requirements in 2020.

CNSC staff inspection activities revealed 3 non-compliances with applicable regulatory requirements with no consequence on the validity of the subject examinations. The non-compliances were related to simulator-based certification examinations, and written certification examination and requalification test. NB Power's response to address these non-compliances is forthcoming and will be reviewed by CNSC staff for acceptability.

In 2020, CNSC staff reviewed NB Power's IIP as it relates to the sufficiency of certified staff levels in the Control Room. CNSC staff noted that NB Power established a "Succession plan" spanning from 2018 to 2025 that will see the staffing levels for Control Room Operators (CRO) and Shift Supervisors (SS) exceed more than double the minimum staffing compliment by 2025. CNSC staff requested a semi-annual update of the implementation of this plan starting in January 2021 until desired levels of certified staff are reached at PLNGS. As NB Power increases its contingent of certified staff, reliance on previously certified staff acting as contractors to ensure adequate resources in operationally focused assignments will be eliminated.

Work Organization and Job Design

In 2020, there were 2 minimum shift complement (MSC) violations at PLNGS. Both events were of short duration (4.5 & 1.5 hours) and involved emergency response team (ERT) members calling in as 'unavailable' for their scheduled shift. Plant processes were followed and the Fire Protection Impairment Record was activated until MSC was re-established.

Fitness for Duty

CNSC staff determined that NB Power met requirements for managing fitness for duty in 2020 and performance in this area met CNSC expectations.

There were no hours of work violations or exceedances by certified staff in 2020.

3.7.3 Operating Performance

CNSC staff concluded that NB Power met the applicable regulatory requirements and CNSC staff expectations, for the SCA Operating Performance at the PLNGS in 2020.

Conduct of Licensed Activity

CNSC staff determined that NB Power met the applicable regulatory requirements for the conduct of licensed activities at PLNGS. NB Power continued to operate the station in a safe manner within the licensing basis. NB Power continued to operate its reactor unit within the conditions prescribed by the PROL and within the power limits identified in the LCH. The findings indicated compliance with the relevant requirements over this specific area. No unusual trends were identified and no regulatory follow-up was required based on CNSC staff review of NB Power's Quarterly Reports on Safety Performance Indicators.

Procedures

Based on the regulatory oversight activities conducted, CNSC staff found that NB Power met regulatory requirements and CNSC staff expectations in the area of procedures.

CNSC staff identified 6 compliant findings in 2020 related to NB Power's procedural adequacy, and use and adherence during compliance verification activities. In addition, CNSC staff reviewed and accepted actions taken by NB Power to address the non-compliances raised in an inspection conducted in 2019 [GPLRPD-2019-04221]. These non-compliances were related to misalignment between current practices and procedural expectations.

Reporting and Trending

All scheduled reports were submitted to 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 2020. CNSC staff determined that the reporting and trending specific area at PLNGS met regulatory requirements in 2020.

Although there were no significant issues related to NB Power's reporting and trending, there were 2 instances where NB Power did not originally follow-up with a written Preliminary Event Report to the CNSC within 5 business days after being immediately reported orally as per the requirement of REGDOC-3.1.1. This was a result of misinterpretation of the reporting requirements subsequent to the verbal report. NB Power completed a review of the applicable requirements to ensure lessons learned are instilled to prevent future misinterpretation.

Outage Management Performance

CNSC staff determined that NB Power's outage management performance met regulatory requirements in 2020.

During the PLNGS planned outage in 2020, CNSC staff conducted compliance verification activities in the areas of radiation protection, conventional health and safety, procedural use and adherence, training, maintenance & operations, and adherence to COVID protocols. As a result, CNSC staff generated 1 compliant finding specific to outage management [GPLRPD-2020-08771]. CNSC staff concluded that NB Power executed a safe outage and met all of the regulatory undertakings and commitments.

Safe Operating Envelope (SOE)

NB Power met the requirements of CSA N290.15, *Requirements for the safe operating envelope of nuclear power plants*.

In 2020, CNSC staff conducted a field inspection of the safe operating envelope of the dousing system water chemistry. The inspection identified 1 compliant finding and 3 non-compliant findings. The compliant finding is related to treatment of uncertainty in the low dousing pH safe operating envelope limit. The non-compliant findings are related to the technical basis of the dousing system water chemistry, the operation outside the dousing water chemistry SOE limits, and the documentation of the SOE chemistry limits. CNSC staff are satisfied with actions taken by NB Power to address these non-compliance.

CNSC staff reviewed a few updated SOE documents related to the emergency filtered venting system, moderator and cover gas system, and end shield cooling system. All reviews concluded that NB Power remained within the licensing basis.

CNSC staff monitor PLNGS SOE activities through technical assessments and inspections. CNSC staff have verified that PLNGS has in place a hierarchy of documents to produce, implement, and maintain the SOE.

3.7.4 Safety Analysis

CNSC staff concluded that NB Power met the applicable regulatory requirements and CNSC staff expectations, for the SCA Safety Analysis at the PLNGS in 2020.

Deterministic Safety Analysis

CNSC staff reviewed NB Power's response to CNSC staff comments on the Loss of Reactivity Control (LORC) Analysis and found that NB Power has addressed the majority of CNSC staff comments. For a few items, NB Power responses are still inadequate. NB Power is working to address the remaining items. However, since CNSC staff accepted that the results of LORC DBA analysis demonstrate adequate trip coverage for the postulated event, CNSC staff have approved NB Power's request to include the analysis into the licensing basis.

CNSC staff conducted an inspection to assess compliance with the licence and associated codes and standards for the PLNGS Moderator system. CNSC staff concluded that NB Power met the regulatory requirements.

CNSC staff reviewed NB Power's submission on boiler feedwater system failure events safety analysis basis and concluded that the submission is generally consistent with the requirements outlined in the regulatory document [REGDOC-2.4.1, *Deterministic Safety Analysis*](#).

CNSC staff reviewed the LOF safety analysis submission and concluded that it was generally consistent with the requirements of REGDOC-2.4.1. Areas for follow-up were identified, communicated to NB Power, and have been dispositioned.

CNSC staff reviewed the revised PLNGS REGDOC 2.4.1 implementation plan submitted by NB Power to fulfill the submission requirement in section 4.1 of the current PLNGS LCH and provided comments to NB Power.

Probabilistic Safety Analysis

CNSC staff determined that NB Power's performance met their expectations for probabilistic safety assessment (PSA) in 2020, and the PSA update is consistent with Section 4.1 of PLNGS LCH (LCH-PR-17.00/2022-R001). In 2020, CNSC staff concluded that the new and revised PLNGS PSA methodologies met the applicable regulatory requirements and found them acceptable. In addition, NB Power submitted Level 1 and 2 Internal Event at-power and shutdown PSAs in 2020 as part of the 2021 PSA update. CNSC staff review of these PSA elements will be completed by the end of 2021. NB Power will submit other PSA elements by November 2021, as per the LCH and CNSC staff review will be completed by the end of 2022.

3.7.5 Physical Design

CNSC staff concluded that NB Power met the applicable regulatory requirements and CNSC staff expectations, for the SCA Physical Design at the PLNGS in 2020.

Design Governance

Environmental Qualification (EQ)

NB Power continued to meet the applicable EQ requirements in 2020. There was no EQ inspection performed at PLNGS in 2020.

Fire Protection

The results of the CNSC staff compliance verification activities and PLNGS continual implementation of the fire protection program confirms that PLNGS meets regulatory requirements.

Seismic Qualification

NB Power was compliant with the requirements of CSA N289.1 *General requirements for seismic design and qualification of CANDU nuclear power plants* clause 5.3.10 and Licence Condition 5.3 for seismic control areas observed during field inspections.

System Design

Electrical Power Systems

Based on all the compliance verification activities performed including reviews of reportable events, quarterly reports, and technical assessments, there is no concern with the performance of Electrical Power Systems (EPS). There was an event that occurred which was related to the unavailability of the emergency diesel generators (DGs).

While the EPS system has two DGs, DG2 generator was out of service for scheduled planned maintenance and one of the two DG1 starters failed to start. NB Power took action to replace the failed components and successfully restarted DG1.

Instrumentation and Control

Based on all the compliance verification activities performed including reviews of reportable events, quarterly reports, and technical assessments, there is no concern with the performance of the Instrumentation and Control System. NB Power met performance expectations in the area of Instrumentation and Control System.

Component Design

Cables

NB Power has a cable preservation program at PLNGS that covers cable condition monitoring and cable aging management programs. This program met CNSC performance expectations at PLNGS in 2020.

Fuel Design

The PLNGS fuel design and inspection program met the regulatory requirements and performance expectations. PLNGS has met the minimum expectations for fuel bundle inspections and has an established strategy to address the recent elevated defects levels.

Overall, the fuel condition was satisfactory and fuel has been operated safely.

3.7.6 Fitness for Service

CNSC staff concluded that NB Power met the applicable regulatory requirements and CNSC staff expectations, for the SCA Fitness for Service at the PLNGS in 2020.

Equipment Fitness for Service/Equipment Performance

CNSC staff determined that the overall equipment fitness for service and performance at NB Power met the applicable regulatory requirements. System health reports and component health reports are produced on a routine basis.

There were 2 compliant findings as a result of CNSC inspections of equipment fitness for service program in 2020. All inspections and additional reviews confirmed expected performance by NB Power in this specific area. Overall, NB Power met CNSC staff expectations for equipment fitness for service in 2020.

CNSC staff confirmed that all special safety systems for PLNGS met their unavailability targets in 2020.

Reliability of systems important to safety

CNSC staff determined that the reliability program at PLNGS met the requirements described in [REGDOC-2.6.1, Reliability Programs for Nuclear Power Plants](#). CNSC staff conducted a reliability program inspection at PLNGS in 2020 with all compliant findings.

Maintenance

CNSC staff determined that NB Power’s maintenance program met the applicable regulatory requirements and performance expectations. NB Power maintained both the critical corrective maintenance backlog and the number of critical preventive maintenance deferrals very low. The critical deficient maintenance backlog was continuously trending downward but was still above the industry average (noting that the industry average also improved in 2020). The average preventative maintenance completion ratio was around 93%, which was slightly improved from the 92% of the 2019 average ratio. There were no safety significant findings in the maintenance specific area based on the review of the events reported by the licensee. CNSC staff also conducted several maintenance-related inspections. The corrective critical maintenance backlog, deficient critical maintenance backlog, and the number of critical preventive maintenance deferrals are provided in table 24.

Table 24: Trend of maintenance backlogs and deferrals for critical components for PLNGS, 2018 to 2020

Parameter	Average quarterly work orders per unit			Three year trending	Quarterly 2020 work orders				Industry average for 2020
	2018	2019	2020		Q1	Q2	Q3	Q4	
Corrective maintenance backlog	1	1	1	steady	1	1	1	1	1
Deficient maintenance backlog	27	15	17	down	20	16	14	18	4
Deferrals of preventive maintenance	0	1	1	steady	0	1	1	0	2

Structural Integrity

Based on regulatory oversight activities, CNSC staff determined that SSCs continued to meet structural integrity requirements.

CNSC staff inspections and compliance assessments for structural integrity at PLNGS identified 2 compliant findings and no non-compliances. The updated Probabilistic Leak Before Break assessment met the appropriate standards.

Chemistry Control

CNSC staff determined that NB Power's chemistry control program met the applicable regulatory requirements. NB Power maintained acceptable performance in the area of system chemistry in 2020.

CNSC staff reviewed NB Power's quarterly submission of the Safety Performance Indicators (SPIs 19 and 20) as part of REGDOC-3.1.1 reporting requirements and consider NB Power's chemistry control program to be acceptable.

Periodic Inspection and Testing

During the reporting year, NB Power performed the appropriate inspection and testing program to meet the applicable regulatory requirements.

There was 1 negligible finding related to online periodic inspections when not all of the required information was provided along with a component disposition. NB Power promptly provided all of the necessary information when requested by CNSC staff. NB Power performed the appropriate analysis to demonstrate that the affected component remained fit for service and has put in place a replacement strategy. CNSC staff were satisfied with the corrective actions taken by NB Power.

3.7.7 Radiation Protection

CNSC staff concluded that NB Power met the applicable regulatory requirements and CNSC staff expectations, for the SCA Radiation Protection at the PLNGS in 2020.

Application of ALARA

CNSC staff compliance verification activities for the Application of ALARA at the PLNGS in 2020 found that NB Power was compliant with the regulatory requirements and met CNSC staff performance expectations.

NB Power demonstrated continuous tracking and reporting of collective dose performance during operations and the planned maintenance outage, as well as ongoing monitoring of personal contamination events, unplanned exposures, individual dose received by workers and loose contamination events. No regulatory follow-up was required for the reported information.

In 2020, NB Power continued to implement its Five-Year ALARA Plan for PLNGS that incorporated lessons-learned and OPEX to develop challenging dose targets for future years, with the goal of reducing worker doses. Various ALARA initiatives are being planned to further reduce occupational exposures, including a tritium mitigation strategy. In addition, a mock-up was created by NB Power for the maintenance activity related to the boiler executed during the 2020 outage where workers were able to practice prior to conducting the radiological work activities. This initiative resulted in reduced time spent by workers in the radiological field.

Worker Dose Control

CNSC staff determined that NB Power met applicable regulatory requirements for worker dose control at the PLNGS in 2020.

Radiation doses to workers at the PLNGS were below the regulatory dose limits, as well as the action levels in NB Power's radiation protection program. CNSC staff did not observe any adverse trends or safety significant unplanned exposures at the PLNGS in 2020.

In 2020, CNSC staff conducted an inspection on worker dose control. The inspection identified 8 compliant findings and 1 non-compliance of low safety significance related to procedural adherence.

UPDATE: In April 2021, NB Power provided their corrective action plan which includes the establishment of an ALARA Committee sub-team and several information technology improvements have been proposed which would improve worker and supervisor's ability to monitor requirements and ensure that they are met. Update on the corrective actions will be provided by NB Power throughout 2021 and CNSC staff will continue to monitor their progress.

Radiation Protection Program Performance

CNSC staff determined that NB Power's RP program performance met expectations at the PLNGS in 2020. NB Power continued to employ performance metrics and perform self-assessments to monitor and control performance in all aspects of the radiation protection program. Operating experience and benchmarking with industry was used to improve performance. CNSC staff did not observe any failures of the radiation protection program in 2020.

Radiological Hazard Control

CNSC staff determined that NB Power implemented effective controls for radiological hazards at PLNGS that met the regulatory requirements.

NB Power implemented its radiation protection program to ensure that measures are in place to monitor and control radiological hazards in their facility. This includes contamination control, dose rate control, and airborne radiation monitoring and control. Radiological hazards are eliminated or controlled with engineered barriers and signage identifying the level and extent of hazard areas. Shielding and specialized tooling are also used to reduce radiation exposures to workers during operational and maintenance activities. Specialized tooling was utilized for the vertical flux detector removal during 2020 outage. This included a lead shielded container, which immediately contained the extracted detectors and supported safe removal from the reactor building.

There were no action level exceedances for surface contamination or contamination control at PLNGS in 2020.

3.7.8 Conventional Health and Safety

CNSC staff concluded that NB Power met the applicable regulatory requirements and CNSC staff expectations, for the SCA Conventional Health and Safety at the PLNGS in 2020.

NB Power reported 1 lost-time accident which resulted in 4 lost days at PLNGS in 2020. There were 5 accidents that resulted in minor injuries. CNSC staff compliance verification activities did not identify any non-compliant findings relevant to conventional health and safety in 2020.

For 2020, at PLNGS, the accident severity rate was 0.34, in comparison to the 2019 value of 0.0, which 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.

In 2020, the Accident Frequency (AF) for PLNGS was 0.51, in comparison to the 2019 value of 0.77. The AF represents the number of fatalities and injuries (lost-time and medically treated) due to accidents for every 200,000 person-hours worked at NPPs.

3.7.9 Environmental Protection

CNSC staff concluded that NB Power met the applicable regulatory requirements and CNSC staff expectations, for the SCA Environmental Protection at the PLNGS in 2020.

Effluent Emissions and Control (releases)

In 2020, the releases from the PLNGS site were well below the Derived Release Limits (DRLs). No radiological releases to the environment from the facility exceeded the regulatory limits and no action levels were approached or exceeded.

Performance information from technical reviews of quarterly and annual reports, as well as the results of inspections in 2020 met CNSC staff expectations in the area of effluent and emissions control (releases).

Environmental Management System

CNSC staff determined that NB Power was compliant with the requirements of [REGDOC-2.9.1, Environmental Protection Policies, Programs and Procedures](#) for environmental management system in conducting annual management reviews of their program.

Assessment and Monitoring

The field inspections and technical assessment of quarterly and annual scheduled compliance reports for PLNGS indicated that NB Power met the applicable regulatory requirements in 2020.

CNSC staff concluded that the monitoring, analysis and reporting of environmental data are well developed and consistently implemented.

Protection of People

In 2020, hazardous substances releases to the environment from PLNGS were below the regulatory limits. CNSC staff concluded that people were protected from the impacts of the non-radiological substances released from the facility in 2020.

Performance information from technical reviews of quarterly and annual reports, as well as the results of inspections in 2020 met expectation in the area of the protection of people.

Environmental Risk Assessment

CNSC staff reviewed the NB Power PLNGS groundwater monitoring program and confirmed that NB Power is compliant with N288.7-15 *Groundwater protection programs at Class I nuclear facilities and uranium mines and mills* and that in general the 2020 PLNGS environmental risk assessment (ERA) met the applicable regulatory requirements.

UPDATE: In June 2021, NB Power submitted an updated ERA for PLNGS that is consistent with CSA N288.6-12 *Environmental risk assessments at Class I nuclear facilities and uranium mines and mills*.

Estimated Dose to the Public

NB Power continued to ensure the protection of the public in accordance with the *Radiation Protection Regulations*.

Performance information from technical assessments of the 2020 quarterly reports and the NB Power report on the environmental monitoring program in 2020 indicated that the estimated dose to the public was very low (1.32 μSv), representing 0.13% of the regulatory dose limit of 1 mSv/y.

3.7.10 Emergency Management and Fire Protection

CNSC staff concluded that NB Power met the applicable regulatory requirements and CNSC staff expectations, for the SCA Emergency Management and Fire Protection at the PLNGS in 2020.

CNSC staff concluded that NB 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 maintain the health and safety of persons.

Conventional Emergency Preparedness & Response

NB Power activated their Pandemic Response Plan for PLNGS at the onset of the COVID-19 pandemic. CNSC staff were informed of NB Power's actions and monitored them to ensure that safety was maintained. Overall, CNSC staff was satisfied with NB Power's response to the COVID Pandemic.

Nuclear Emergency Preparedness & Response

CNSC staff concluded that NB Power met the applicable regulatory requirements, and its performance met CNSC staff expectations for Nuclear Emergency Preparedness and Response at PLNGS in 2020.

Fire Emergency Preparedness & Response

Through licensing and CNSC compliance verification activities performed during the reporting period, CNSC staff 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 the PLNGS site.

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

By incorporating the results of the CNSC compliance activity findings and TPR observations and recommendations into the drill and training program, the emergency response team performance continued to improve.

In 2020, CNSC staff completed a number of compliance verification activities and had no non-compliant findings. CNSC staff continue to follow-up on a 2019 action item that was issued to NB Power in regards to the testing of foam concentrates used for fire protection. NB Power has put in place a number of interim measures while work is being done to determine a permanent solution for their foam concentrate testing capabilities. CNSC staff are satisfied with these measures.

3.7.11 Waste Management

CNSC staff concluded that NB Power met the applicable regulatory requirements and CNSC staff expectations, for the SCA Waste Management at the PLNGS in 2020.

CNSC confirmed that NB Power complied with the applicable regulatory requirements for the collection of radioactive waste as well as the minimization and segregation of 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 2020.

In 2020, no spent fuel was transferred to Phase II of the SRWMF from the Point Lepreau NGS. The spent fuel inventory at the SRWMF remains at 225 canisters filled (121,498 bundles).

NB Power holds the liability for the PLNGS site and is responsible for PDPs and associated financial guarantees. The PDPs and associated financial guarantees were revised in 2015, and accepted by the Commission in 2016. NB Power submitted their updated PDP/FG to CNSC staff in 2020, and these are currently under review.

3.7.12 Security

CNSC staff concluded that NB Power met the applicable regulatory requirements and CNSC staff expectations, for the SCA Security at the PLNGS in 2020.

CNSC staff reviewed the annual site security report and threat and risk assessment, as well as 4 quarterly safety reports for PLNGS, and confirmed that NB Power met all the applicable regulatory requirements.

Facilities and Equipment

CNSC staff inspections of facilities and equipment identified that NB Power was generally compliant with applicable regulatory requirements, however some negligible findings were identified within this specific area. NB Power reported 4 events pertaining to this specific area that were deemed to be negligible without a safety or security significance.

NB Power continues to work collaboratively with CNSC staff to address the negligible findings in this specific area.

Response Arrangements

CNSC staff inspections of response arrangements identified that PLNGS was compliant with applicable regulatory requirements.

A MOU was signed between NB Power and the off-site response force of jurisdiction (Royal Canadian Mounted Police) which reinforces response arrangements throughout 2020.

Security Practices

CNSC staff inspections of security practices identified that NB Power was compliant with applicable regulatory requirements. NB Power also reported 1 event pertaining to this specific area that was deemed to be negligible with no safety or security significance.

Drills and Exercises

Due to the COVID-19 pandemic and PLNGS activating their Business Continuity Plan, the licensee modified their 30-day drill program, summaries of which were provided in the quarterly reports. The modified drills met regulatory expectations. NB Power maintains a drill and exercise program that tests the effectiveness of its physical protection system, consistent with the design basis threat (DBT). CNSC staff concluded that there were no safety significant issues for this specific area.

Cyber Security

CNSC staff determined NB Power met their licence requirement to update their cyber security program to meet the requirements in CSA N290.7-14 *Cyber security for nuclear facilities*. Overall, NB Power performance for this area met CNSC staff expectations.

3.7.13 Safeguards and Non-Proliferation

CNSC staff concluded that NB Power met the applicable regulatory requirements and CNSC staff expectations, for the SCA Safeguards and Non-Proliferation at the PLNGS in 2020.

Nuclear Material Accountancy and Control

CNSC staff determined that NB Power's accountancy and control of nuclear material complied with the applicable regulatory requirements at PLNGS in 2020.

NB Power provided the required nuclear material accountancy and control reports to the CNSC and the IAEA for safeguards activities, including inspections.

Access and Assistance to the IAEA

NB Power granted the required access and assistance to the IAEA for safeguards activities, including inspections and for the maintenance of IAEA equipment. Details of the IAEA inspection activities are provided in section 2.13.

Operational and Design Information

CNSC staff determined that NB Power met the applicable regulatory requirements for operational and design information in 2020 at PLNGS.

NB Power provided the required operational and design information to facilitate IAEA safeguards activities.

Safeguards Equipment, Containment and Surveillance

CNSC staff confirmed that NB Power met the regulatory requirements for safeguards equipment, containment and surveillance in 2020 at PLNGS.

In 2020, NB Power provided the assistance required for the IAEA's safeguards equipment, containment and surveillance activities, including inspections.

3.7.14 Transport and Packaging

CNSC staff concluded that NB Power has implemented a packaging and transport program that ensures compliance with the *Packaging and Transport of Nuclear Substances Regulations, 2015* (PTNSR), and the *Transportation of Dangerous Goods Regulations*, and that the transport of nuclear substances to and from the facility was conducted safely in 2020.

CNSC staff conducted a field inspection of packaging and transport. CNSC staff verified that all employees who were engaged in transport-related activities were adequately trained, radioactive materials to be transported were appropriately classified and packaged, and the documentation accompanying the shipments was properly completed.

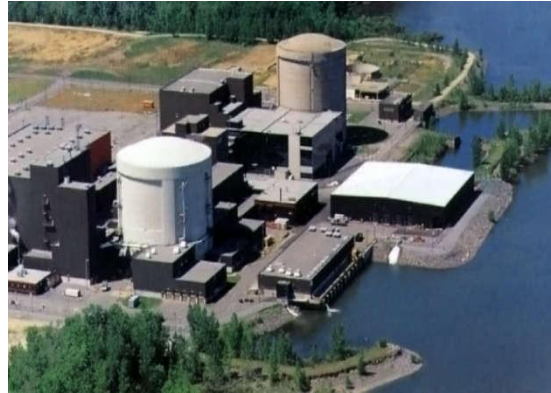
CNSC staff noted 1 item of non-compliance during the field inspection. The item of non-compliance was related to the markings for an excepted package, and had no safety significance. CNSC staff are satisfied with NB Power's actions to prevent recurrence of this non-compliance.

There were no packaging and transport events reported in 2020.

3.8 Gentilly-2

3.8.0 Introduction

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, 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 1^{er} juillet 2016 au 30 juin 2026.

Autorisation en vertu de la Loi sur les pêches

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

Programme de vérification de la conformité

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 25. (Les rapports d'inspections envoyés avant le 28 février 2021 ont été inclus.)

Tableau 25: Liste des inspections aux installations de Gentilly-2

Domaine de sûreté et de réglementation	Titre de l'inspection	Envoi du rapport d'inspection
Gestion des urgences et protection-incendie	Exercice incendie – aide mutuelle entre: GPLRPD-2020-08473	19 novembre 2020

3.8.1 Système de gestion

Le personnel de la CCSN a conclu qu'Hydro-Québec respectait les exigences réglementaires applicables et aux attentes du personnel de la CCSN en ce qui concerne le DSR Système de gestion aux installations de Gentilly-2 en 2020.

Aucun écart concernant le domaine particulier de la culture de sûreté n'était énuméré dans la liste du document traitant des écarts. Le personnel de la CCSN a revu et analysé les deux correspondances et a conclu qu'Hydro-Québec a complété la mise en œuvre de REGDOC-2.1.2, Culture de sûreté, section 2. Une lettre de fermeture a été envoyée le 20 février 2020.

3.8.2 Gestion de la performance humaine

Le personnel de la CCSN a conclu qu'Hydro-Québec respectait les exigences réglementaires applicables et aux attentes du personnel de la CCSN en ce qui concerne le DSR Gestion de la performance humaine aux installations de Gentilly-2 en 2020.

Programme de performance humaine

Le personnel de la CCSN est satisfait du progrès accompli sur le plan de mesures correctives du titulaire de permis.

Formation du personnel

Les personnes agissant à titre de responsable technique de la radioprotection (RTR) sont les seules personnes encore accréditées aux installations de Gentilly-2. Aucune demande d'accréditation ou de renouvellement d'une accréditation en tant que RTR n'a été soumise à la CCSN en 2020. Hydro-Québec ne maintient plus de programmes d'examens initiaux et de tests de requalification du personnel accrédité aux installations de Gentilly-2 puisque les personnes agissantes comme Responsable technique de la radioprotection (RTR) sont évaluées directement par le personnel de la CCSN.

Aptitude au travail

En 2020, le personnel de la CCSN a déterminé que la mise en œuvre des nouvelles exigences dans le domaine d'aptitude au travail a rencontré les attentes du personnel de la CCSN. Le rapport annuel des dépassements des heures de travail était soumise en 2020 et le personnel de la CCSN ont revu cette correspondance et confirmé que ces données étaient acceptables.

3.8.3 Conduite de l'exploitation

Le personnel de la CCSN a conclu qu'Hydro-Québec respectait les exigences réglementaires applicables et aux attentes du personnel de la CCSN en ce qui concerne le DSR Conduite de l'exploitation aux installations de Gentilly-2 en 2020.

Rapport et établissement de tendances

En ce qui concerne la revue par le personnel de la CCSN des rapports (annuels et trimestriels) qui devaient être soumis selon [REGDOC-3.1.1 Rapports à soumettre par les exploitants de centrales nucléaires](#), Hydro-Québec a fait le suivi et répondu adéquatement et dans un délai acceptable aux questions posées et aux demandes d'informations par le personnel de la CCSN.

Aucuns problèmes majeurs n'ont été signalés dans ces rapports et ces derniers rencontraient les exigences réglementaires ainsi que les attentes du personnel de la CCSN.

Gestion des accidents graves et rétablissement

Le personnel de la CCSN a examiné la correspondance d'Hydro-Québec concernant les équipements relatifs à la mitigation des urgences et conclu que la motopompe diesel destinée à l'appoint d'urgence d'eau à la piscine de stockage de combustible n'est plus requise depuis que tout le combustible irradié a été transféré dans les modules CANSTOR. Hydro-Québec n'effectue plus les essais, ni l'entretien de la pompe depuis l'atteinte de cet état en décembre 2020.

3.8.4 Analyse de la sûreté

Le personnel de la CCSN a conclu qu'Hydro-Québec respectait les exigences réglementaires applicables et aux attentes du personnel de la CCSN en ce qui concerne le DSR Analyse de la sûreté aux installations de Gentilly-2 en 2020.

Analyse déterministe de la sûreté

Il n'y a pas eu de mise à jour du rapport de sûreté des installations de Gentilly-2 en 2020. Hydro-Québec devra soumettre en 2021 la mise à jour complète afin de refléter le risque associé au nouvel état (état de stockage sûr à sec).

3.8.5 Conception matérielle

Le personnel de la CCSN a conclu qu'Hydro-Québec respectait les exigences réglementaires applicables et aux attentes du personnel de la CCSN en ce qui concerne le DSR Conception matérielle aux installations de Gentilly-2 en 2020.

Conception du système

Les informations sur le rendement des examens techniques, des rapports trimestriels et des rapports annuels ont répondu aux attentes du personnel de la CCSN pour ce qui des systèmes électriques. Par exemple, il n'y avait aucune préoccupation majeure à noter en ce qui concerne les revues suivantes :

- travaux sur les équipements d'une ligne reliant les installations de Gentilly-2 au réseau d'électricité

3.8.6 Aptitude fonctionnelle

Le personnel de la CCSN a conclu qu'Hydro-Québec respectait les exigences réglementaires applicables et aux attentes du personnel de la CCSN en ce qui concerne le DSR Aptitude fonctionnelle aux installations de Gentilly-2 en 2020.

3.8.7 Radioprotection

Le personnel de la CCSN a conclu qu'Hydro-Québec respectait les exigences réglementaires applicables et aux attentes du personnel de la CCSN en ce qui concerne le DSR Radioprotection aux installations de Gentilly-2 en 2020.

Contrôle des doses des travailleurs

La revue par le personnel de la CCSN des indicateurs de performance et de rendement en matière de sûreté en 2020 n'a révélé aucun problème. En effet, l'indicateur de rendement en matière de sûreté relatif à la dose collective n'a rien relevé d'anormal. De plus, au cours de l'année 2020 aux installations de Gentilly-2, il n'y a eu aucun dépassement des limites réglementaires pour les doses reçues aux travailleurs. Également, il n'y a eu aucun dépassement des seuils d'intervention réglementaire rapporté.

Contrôle des risques radiologiques

Aucun événement n'a été déclaré en vertu du REGDOC-3.1.1 de la CCSN en ce qui a trait au contrôle des dangers radiologiques pour 2020.

Il n'y a eu aucun de dépassement des seuils d'intervention liés au contrôle de la contamination.

3.8.8 Santé et sécurité classiques

Le personnel de la CCSN a conclu qu'Hydro-Québec respectait les exigences réglementaires applicables et aux attentes du personnel de la CCSN en ce qui concerne le DSR Santé et sécurité classiques aux installations de Gentilly-2 en 2020.

Le personnel de la CCSN note qu'il n'y a eu aucun rapport déposé en 2020 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 de la CCSN a conclu qu'Hydro-Québec respectait les exigences réglementaires applicables et aux attentes du personnel de la CCSN en ce qui concerne le DSR Protection de l'environnement aux installations de Gentilly-2 en 2020.

Contrôle des effluents et des émissions

Le programme de surveillance de Surveillance des effluents aux installations de Gentilly-2 était conforme aux exigences réglementaires en 2020.

En 2020, Hydro-Québec a soumis à la CCSN les révisions 1.1 et 1.2 de son Programme de surveillance radiologique de l'environnement (PSRE) à l'État de stockage sûr (ÉSS). Le personnel de CCSN a revu et approuvé ces révisions du PSRE. Les informations sur le rendement à l'issues des examens techniques du rapport annuel sur les indicateurs de rendement en matière de sûreté de 2020 ainsi que du rapport annuel 2020 sur la surveillance de l'environnement montrent que les attentes dans le domaine spécifique de 'effluents et émissions' ont été atteintes en 2020.

Système de gestion de l'environnement

Hydro-Québec (HQ) a répondu aux attentes en 2020 en intégrant un système de gestion environnemental acceptable dans les activités réalisées aux Installations de Gentilly-2.

Évaluation et surveillance

En 2020, Hydro-Québec a continué de maintenir une surveillance et une évaluation rigoureuses des programmes mis en place aux Installations de Gentilly-2 et ayant pour but d'assurer la protection de l'environnement et du public.

Protection des personnes

Le personnel de la CCSN a confirmé que le public à proximité du site de Gentilly-2 était protégé des matières dangereuses et qu'aucun impact n'était attendu sur la santé en raison de l'exploitation de l'installation de Gentilly-2 en 2020. Aucun rejet de matières dangereuses dépassant les limites réglementaires provinciales n'a été rapporté en 2020 pour les installations de Gentilly-2.

Évaluation des risques environnementaux

Hydro-Québec a soumis sa dernière analyse des risques environnementaux en 2006 (pour la réfection anticipée de Gentilly-2 et la construction de l'installation de gestion des déchets radioactifs solides). À la suite de la décision d'Hydro-Québec de fermer Gentilly-2, cette analyse avait été jugée acceptable par le personnel de la CCSN pour les activités de déclasserment qui y seraient alors entreprises. De plus, le personnel de la CCSN avait également réalisé une évaluation environnementale en vertu de la Loi sur la sûreté et réglementation nucléaires en 2016 pour la demande de permis de déclasserment de Gentilly-2.

Le personnel de la CCSN a examiné le rapport annuel qui présente les résultats du programme de surveillance de l'environnement aux installations de Gentilly-2 pour 2020 et n'a relevé aucune constatation négative ou préoccupante concernant l'impaction des poissons ou les risques radiologiques et chimiques pour l'environnement.

Dose estimée au publique

En 2020, il y a eu une nette diminution, par rapport à l'année 2019, de la dose annuelle de rayonnements induite aux membres représentatifs de la population la plus exposée, à proximité des installations de Gentilly-2 (1 μ Sv); celle-ci est très inférieure à la limite de dose réglementaire du public de 1 mSv (1 000 μ Sv).

3.8.10 Gestion des urgences et protection-incendie

Le personnel de la CCSN a conclu qu'Hydro-Québec respectait les exigences réglementaires applicables et aux attentes du personnel de la CCSN en ce qui concerne le DSR Gestion des urgences et protection-incendie aux installations de Gentilly-2 en 2020.

Préparation et intervention en cas d'urgence classique

Hydro-Québec a adéquatement activé son plan de réponse à la pandémie. La mise en œuvre du plan et des procédures ont permis de poursuivre des opérations sécuritaires pendant la pandémie mondiale du COVID-19. Plus spécifiquement:

1. Les postes « ressources minimales » ont été identifiés à Gentilly-2.
2. Les employés qui en ont la possibilité, ont été invités à demeurer à la maison et à faire du télétravail.
3. Les mesures d'hygiène pour prévenir la contagion (distanciation sociale, lavage de main, étiquette respiratoire) ont été rappelés à tous les jours. Des affiches ont été installées aux endroits stratégiques.
4. Les employés de retour d'un voyage hors Canada depuis le 12 mars 2020 ou dont un membre de leur famille présente des symptômes de la COVID-19 devaient demeurer en auto-isolement pour 14 jours.
5. Les employés qui présentent 1 des symptômes reliés à la COVID19 doivent en informer leur gestionnaire et se mettre en auto-isolement pour 14 jours.
6. Du soutien psychologique est disponible pour les employés qui en ressentent le besoin par le biais du Programme d'aide aux employés (PAE).

En résumé, les activités de maintenance et spécifiques au déclassement se sont poursuivies en fonction des ressources disponibles.

Préparation et intervention en cas d'urgence nucléaire

Le personnel de la CCSN a fait la revue des indicateurs de performance en matière de sûreté et s'est déclaré satisfait des résultats communiqués par Hydro-Québec en 2020

Préparation et intervention en cas d'incendie

Le personnel de la CCSN confirme qu'Hydro-Québec a continué de maintenir une capacité d'intervention en cas d'incendie et un programme de protection contre les incendies qui répondaient aux exigences réglementaires applicables en 2020. L'intervention d'urgence en cas d'incendie est assurée par les municipalités environnantes, une entente conclue en vertu d'un protocole d'entente avec le Service de Sécurité Incendie de la Ville de Bécancour (SSIB).

Avec un accès limité au site, le personnel de la CCSN et le personnel d'Hydro-Québec ont développé de nouvelles méthodes d'inspection innovantes, y compris l'utilisation d'un système de vidéoconférence à distance, pour être en mesure d'assister et d'évaluer les activités de vérification de la conformité des interventions d'incendie.

Plus précisément, en 2020, le personnel de la CCSN a observé un exercice sur table mené par Hydro-Québec et des intervenants municipaux.

À partir de cet exercice sur table, il y a eu trois (3) recommandations et aucune non-conformité n'a été observée.

Le personnel de la CCSN a conclu que la préparation et l'intervention en cas d'incendie d'Hydro-Québec Gentilly-2 satisfaisaient aux exigences réglementaires applicables en 2020.

3.8.11 Gestion des déchets

Le personnel de la CCSN a conclu qu'Hydro-Québec respectait les exigences réglementaires applicables et aux attentes du personnel de la CCSN en ce qui concerne le DSR Gestion des déchets aux installations de Gentilly-2 en 2020.

Le personnel de la CCSN a examiné les deux rapports semestriels de 2020 pour la gestion des installations des déchets radioactifs solides et du combustible utilisé de Gentilly-2. Ces rapports satisfaisaient les exigences réglementaires et le personnel de la CCSN n'avait pas de commentaires.

Au cours de l'année 2020, Hydro Québec a transféré 5 690 grappes, ou 95 paniers, au module CANSTOR. Ceci a complété le transfert de toutes les grappes de combustible irradié encore présentent dans la piscine de stockage.

À la fin de l'année 2020, il y avait un total de 2 168 paniers de combustible irradié entreposés dans les modules CANSTOR.

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.

Le personnel de la CCSN est satisfait avec les deux rapports.

3.8.12 Sécurité

Le personnel de la CCSN a conclu qu'Hydro-Québec respectait les exigences réglementaires applicables et aux attentes du personnel de la CCSN en ce qui concerne le DSR Sécurité aux installations de Gentilly-2 en 2020.

Le personnel de la CCSN a examiné le rapport de sécurité du site et l'évaluation de la menace et du risque annuels de même que quatre rapports de sécurité trimestriels de G-2 et a confirmé que G-2 respecte toutes les exigences réglementaires applicables au domaine particulier Installations et équipement.

Installations et équipement

Les inspections de la CCSN du domaine particulier Installations et équipement ont permis de déterminer que G-2 respecte les exigences réglementaires applicables vérifiées. L'une des constatations observées lors d'une inspection de la CCSN a été corrigée immédiatement par G-2, à la satisfaction du personnel de la CCSN. G-2 a également déclaré deux événements relatifs à ce domaine particulier; l'un a été jugé négligeable et l'autre a mené à une constatation mineure. G-2 a immédiatement pris des mesures pour donner suite à l'événement.

Pratiques en matière de sécurité

En raison de la pandémie de COVID-19 et des considérations relatives à la santé publique, la CCSN n'a pas été en mesure de réaliser une inspection de site relative à ce domaine particulier.

Entraînements et exercices

Bien qu'elle ait mis en œuvre son plan de continuité des opérations (PCO), Gentilly-2 a été en mesure de maintenir un programme d'entraînement efficace. Les renseignements sur le rendement tirés des rapports trimestriels et du programme d'entraînement et d'exercice du titulaire de permis respectent les attentes réglementaires ainsi que les attentes du personnel de la CCSN.

3.8.13 Garanties et non-prolifération

Le personnel de la CCSN a conclu qu'Hydro-Québec respectait les exigences réglementaires applicables et aux attentes du personnel de la CCSN en ce qui concerne le DSR Garanties et non-prolifération aux installations de Gentilly-2 en 2020.

Contrôle et comptabilité des matières nucléaires

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 applicables en 2020.

Hydro-Québec a fourni à la CCSN et à l'AIEA les rapports de comptabilité et de contrôle des matières nucléaires requis pour les activités de garanties, y compris les inspections.

Accès et assistance à l'AIEA

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. Les détails des activités d'inspection de l'AIEA sont fournis à la section 2.13.

Renseignements sur les activités et la conception

Le personnel de la CCSN a conclu que l'informations opérationnelles et renseignements descriptifs à Gentilly-2 satisfaisait à toutes les exigences réglementaires applicables en 2020. Hydro Québec a fourni les informations opérationnelles et renseignements descriptifs requis pour faciliter les activités de Garanties et non-prolifération de l'AIEA.

Équipement en matière de garanties, confinement et surveillance

Le personnel de la CCSN a conclu que l'équipement de garanties, confinement et surveillance à Gentilly-2 satisfaisait à toutes les exigences réglementaires applicables en 2020.

Hydro-Québec a fourni l'assistance nécessaire pour l'équipement de garanties, confinement et surveillance de l'AIEA, y compris les inspections.

3.8.14 Emballage et transport

Le personnel de la CCSN a conclu qu'Hydro-Québec respectait les exigences réglementaires applicables et aux attentes du personnel de la CCSN en ce qui concerne le DSR Emballage et transport aux installations de Gentilly-2 en 2020.

Au cours de l'année 2020, il n'y a eu aucune inspection de l'emballage et du transport à Gentilly-2 et aucun incident a été rapporté.

4 CONCLUSIONS FOR THE REGULATORY OVERSIGHT OF NUCLEAR POWER GENERATING SITES IN 2020

CNSC staff concluded that the Nuclear Power Plants (NPPs) and the associated Waste Management Facilities (WMFs) on their respective sites operated safely in 2020. 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 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

CNSC staff assessments for 2020 concluded that the licensees complied with the applicable requirements and also met CNSC staff expectations for all safety and control areas at all the NPPs and WMFs.

REFERENCES

- [1] CMD 20-M24, Regulatory Oversight Report for Canadian Nuclear Power Generating Sites: 2019.
- [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>
- [6] CNSC Website, Minutes of the Canadian Nuclear Safety Commission (CNSC) Meeting held on December 8, 9 and 10, 2020:
<http://www.nuclearsafety.gc.ca/eng/the-commission/pdf/Minutes-CommissionMeeting-December2020-e.pdf>

APPENDICES

A. RATING DEFINITIONS AND METHODOLOGY

A.1 Definitions

The assessments of Safety and Control Areas (SCAs) provided in this regulatory oversight report were developed by applying the following definitions to assess the specific areas that comprise the SCAs. While the category Fully Satisfactory was assigned to certain specific areas for certain facilities in 2019, due to the additional workload caused by the COVID-19 pandemic, CNSC staff did not assign Fully Satisfactory ratings at the SCA level in 2019 because of the limited opportunity to ensure the consistent application of criteria for Fully Satisfactory ratings across all SCAs. As per the Minutes of the Commission Meeting of December 8, 9 and 10, 2020 [6], the Commission indicated that the continued removal of the Fully Satisfactory rating for future regulatory oversight reports was a suitable approach. As a result, Fully Satisfactory was not assigned at either the specific area or SCA level. Note that definitions and references to Fully Satisfactory still appear throughout this section to maintain historical context and consistency with previous ROR ratings.

Fully satisfactory (FS)

Safety and control measures implemented by the licensee are highly effective. In addition, compliance with regulatory requirements is fully satisfactory, and compliance within the safety and control area or specific area exceeds requirements and CNSC expectations. Overall, compliance is stable or improving, and any problems or issues that arise are promptly addressed.

Satisfactory (SA)

Safety and control measures implemented by the licensee are sufficiently effective. In addition, compliance with regulatory requirements is satisfactory. Compliance within the SCA meets requirements and CNSC expectations. Any deviation is minor and any issues are considered to pose a low risk to the achievement of regulatory objectives and CNSC expectations. Appropriate improvements are planned.

Below expectations (BE)

Safety and control measures implemented by the licensee are marginally ineffective. In addition, compliance with regulatory requirements falls below expectations. Compliance within the SCA deviates from requirements or CNSC expectations to the extent that there is a moderate risk of ultimate failure to comply. Improvements are required to address identified weaknesses. The licensee is taking appropriate corrective action.

Unacceptable (UA)

Safety and control measures implemented by the licensee are significantly ineffective. In addition, compliance with regulatory requirements is unacceptable and is seriously compromised.

Compliance within the SCA is significantly below requirements or CNSC expectations, or there is evidence of overall non-compliance. Without corrective action, there is a high probability that the deficiencies will lead to unreasonable risk. Issues are not being addressed effectively, no appropriate corrective measures have been taken and no alternative plan of action has been provided. Immediate action is required.

A.2 Rating methodology – general approach

The methodology for rating licensees relies on multiple sources of input and involves the professional judgment of CNSC staff. The methodology involves ratings for both specific areas and SCAs. At the level of specific area, CNSC staff apply the above definitions by assessing both:

- the licensee's level of compliance with the requirements associated with the specific area and
- the degree to which the licensee's performance met CNSC staff expectations associated with the specific area

In order to obtain a certain rating category (e.g., Satisfactory) for a specific area, the licensee must meet the criteria in the definition for both level of compliance and degree of performance.

After rating all the specific areas applicable to the licensee, CNSC staff combine them into composite ratings for the SCAs.

A.3 Detailed Description of Steps in Rating methodology

Step 1: Identifying the findings

Findings are comparisons of observed facts with the applicable regulatory requirements. Findings are identified through CNSC staff inspections and other assessments. Each finding is assigned to the most applicable specific area under an SCA.

Step 2: Assessing the findings

CNSC staff evaluate the safety significance of each finding and assign it to the appropriate category of high, medium, low, negligible or compliant. The safety significance is determined in the context of the compliance verification criteria for the activity that generated the finding and depends on the degree to which a specific area's effectiveness is negatively affected. The 5 categories of safety significance for findings are:

High Licensee's measures are absent, completely inadequate or ineffective in meeting expectations or the intent of CNSC requirements and compliance expectations.

- Medium** Performance significantly deviates from expectations or from the intent or objectives of CNSC requirements and compliance expectations.
- Low** Performance deviates from expectations or from the intent or objectives of CNSC requirements and compliance expectations.
- Negligible** Performance insignificantly deviates from expectations or objectives of CNSC requirements and compliance expectations.
- Compliant** Performance meets applicable CNSC requirements and compliance expectations.

Step 3: Assess the level of compliance of the specific area

CNSC staff consider the safety significance of all relevant findings and assess the overall level of compliance with the applicable regulatory requirements for that specific area. In the absence of findings from regulatory activities in the year in question, CNSC staff may rely on findings from previous years if they are believed to be still applicable. CNSC staff choose 1 of the following statements, which are aligned with the definitions of the rating categories, to summarize the level of compliance for the specific area:

- effectively meets or exceeds all requirements
- meets requirements
- significant non-compliance
- unacceptable state of compliance

Step 4: Identifying additional performance information

CNSC staff identify additional information that, while not necessarily an indicator of compliance, does indicate the degree to which the licensee's performance met CNSC staff expectations for the specific area. Examples of regulatory activities that yield performance information include surveillance, CNSC staff reviews of events, data (e.g., safety performance indicators), licensee quarterly and annual reports, licensee corrective actions and document changes, and various other licensee submissions, such as those related to design, analysis, and many other areas.

Step 5: Assess the level of performance of the specific area

CNSC staff consider all the performance-related information available and choose 1 of the following statements, which are aligned with the definitions of the rating categories, to summarize the level of compliance for the specific area:

- exceeds expectations
- meets expectations
- does not meet expectations
- unreasonable risk

Step 6: Rate the specific area

CNSC staff combine the 2 summary statements – for compliance and performance – and determine the specific area (SpA) rating, using Table A.1.

Table A.1: Minimum compliance and performance criteria for each rating category

Two Criteria Necessary		SpA Rating
Compliance	Performance	
effectively meets or exceeds all requirements	exceeds expectations	FS
meets requirements	meets expectations	SA
significant non-compliance	does not meet expectations	BE
unacceptable state of compliance	unreasonable risk, high probability of hazards	UA

The criteria in both columns (for compliance and performance) must be met in order to receive the rating indicated in the right-hand column. CNSC staff then refine the SpA rating (high, medium, and low, for the assigned category) to allow finer delineation of how well the licensee met the requirements and/or expectations, within the category, for that specific area.

CNSC staff then convert the performance rating to a numerical value, using the grid in Table A.2. No values are identified for Unacceptable ratings, since that rating has not occurred in practice for NPPs and WMFs and would warrant special CNSC attention if it did occur.

Table A.2: Numerical values for rating categories for specific areas

Rating	Specific area values
High FS	9.6
Medium FS	9.0
Low FS	8.3
High SA	7.6
Medium SA	7.0
Low SA	6.3
High BE	5.6
Medium BE	5.0
Low BE	4.3

Step 7: Rating the SCA

CNSC staff average the ratings of the applicable specific areas as a guide for determining the rating of the SCA.

Table A.3: Numerical ranges (guidance) for SCA rating categories

Average of Specific Area Values	Suggested Rating
8-10	FS
6-8	SA
4-6	BE

In the final decision for the SCA rating, CNSC staff use professional judgement in conjunction with the category suggested by the arithmetic average of the specific area ratings.

B. LIST OF REGULATORY REQUIREMENTS AT THE END OF 2020

The following table lists published CNSC regulatory documents and CSA Group standards that contain compliance verification criteria used by CNSC staff for the SCAs covered in this regulatory oversight report. The information was compiled from the various facility Licence Conditions Handbooks (LCHs) as they existed in December 2020. Also, the main body of this report may include additional information related to the implementation of some of these documents, as well as more recently published documents, which were not used for compliance verification purposes in 2020.

In the table, a check mark indicates that the publication was included as compliance verification criteria for the facility at the end of 2020, a dash indicates that the publication was not included as compliance verification criteria, and a date indicates the year when the licensee indicated it plans to fully implement the requirements in the publication.

Regulatory documents and industry standards to be applied as requirements for all applicants (currently as CVC in LCH)

Legend: v = implemented; yyy = to be implemented by year yyyy;
 - = no implementation date

Source	Number	Title	Year	SCA	Bruce	DNGS	DWMF	PNGS	PWMF	PLNGS	Gentilly2	WWMF
CSA	N286	Management system requirements for nuclear power plants, Update 1, 2007	2005	1	v	-	-	-	-	-	-	-
CSA	N286	Management system requirements for nuclear facilities	2012	1	v	v	v	v	v	v	v	v
CNSC	REGDOC-2.2.2	Personnel Training	2014	2	v	v	v	v	v	v	v	v
CNSC	REGDOC-2.2.2	Personnel Training, version 2	2016	2	v	-	-	-	-	-	-	-
CNSC	REGDOC-2.2.3	Personnel Certification, Volume III: Certification of Persons Working at Nuclear Power Plants	2019	2	v	-	-	-	-	-	-	-
CNSC	RD-204	Certification of Persons Working at Nuclear Power Plants	2008	2	v	v	-	-	-	-	-	-
CNSC	EG1*	Requirements and Guidelines for Written and Oral Certification Examinations for Shift Personnel at Nuclear Power Plants	2005	2	v	v	-	-	-	-	-	-
CNSC	EG2*	Requirements and Guidelines for Simulator-Based Certification Examinations for Shift Personnel at Nuclear Power Plants	2004	2	v	v	-	-	-	-	-	-
CNSC	*	Requirements for the Requalification Testing of Certified Shift Personnel at Nuclear Power Plants	2009	2	v	v	-	-	-	-	-	-
CNSC	RD-363	Nuclear Security Officer Medical, Physical and Psychological Fitness	2008	2	v	v	v	v	v	v	v	v
CNSC	REGDOC-2.1.2	Safety Culture	2018	2	v	v ¹	v ¹	v ¹	v ¹	-	-	v ¹
CNSC	REGDOC-2.2.4	Fitness for Duty Volume I: Managing Worker Fatigue	2017	2	v	v	v	v	v	2022	v	v
CNSC	REGDOC-2.2.4	Fitness for Duty Volume II: Managing Alcohol and Drug	2017	2	2021 ²	TBD ²	TBD ²	TBD ²	TBD ²	TBD ²	v	TBD ²
CNSC	REGDOC-2.4	Fitness for Duty Volume III: Nuclear Security Officer Medical, Physical, Psychological Fitness	2018	2	v	v	2020	v	2020	v	v	2020
CNSC	REGDOC-2.3.3	Periodic Safety Reviews	2008	3	-	-	-	-	-	-	-	-
CNSC	REGDOC-2.3.3	Periodic Safety Reviews	2015	3	v	v	-	-	-	-	-	-
CNSC	REGDOC-3.1.1	Reporting Requirements for Nuclear Power Plants	2014	3	-	-	-	-	-	-	-	-
CNSC	REGDOC-3.1.1	Reporting Requirements for Nuclear Power Plants, version 2	2016	3	v	-	-	-	-	-	-	-
CNSC	REGDOC-3.1.2	Reporting Requirements, Volume 1: Non-Power Reactor Class I Nuclear Facilities and Uranium Mines and Mills	2018	3	-	-	-	-	-	-	-	-
CSA	N290.15	Requirements for the safe operating envelope of nuclear power plants	2010	3	v	v	-	-	-	-	-	-
CNSC	REGDOC-2.3.2	Accident Management: Severe Accident Management Programs for Nuclear Reactors	2013	3	v	v	-	-	-	-	-	-
CSA	N290.11	Requirements for reactor heat removal capability during outage of nuclear power plants	2013	3	-	-	-	-	-	-	-	-
CSA	N286.7	Quality Assurance of Analytical, Scientific and Design Computer Programs for Nuclear Power Plants	1999	4	-	-	-	-	-	-	-	-
CSA	N286.7	Quality Assurance of Analytical, Scientific and Design Computer Programs for Nuclear Power Plants	2016	4	v	v	2021	v	2021	-	-	2021
CNSC	S-294	Probabilistic Safety Assessment (PSA) for Nuclear Power Plants	2005	4	v	v	-	-	-	-	-	-
CNSC	REGDOC-2.4.1	Deterministic Safety Analysis	2014	4	v	v	-	-	-	-	-	-
CNSC	REGDOC-2.4.2	Probabilistic Safety Assessment (PSA) for Nuclear Power Plants	2014	4	v	2020	-	-	-	-	-	-
CNSC	RD-327	Nuclear Criticality Safety	2010	4	v	-	-	-	-	-	-	-
CSA	N289.1	General requirements for seismic design and qualification of CANDU nuclear power plants	2008	5	v	v	-	-	-	-	-	-
CSA	N289.2	Ground motion determination for seismic qualification of CANDU nuclear power plants	2010	5	v	-	-	-	-	-	-	-
CSA	N289.3	Design procedures for seismic qualification of CANDU nuclear power plants	2010	5	v	-	-	-	-	-	-	-
CSA	N289.4	Testing procedures for seismic qualification of nuclear power plants structures, systems, and components	2012	5	v	-	-	-	-	-	-	-
CSA	N289.5	Seismic instrumentation requirements for nuclear power plants and nuclear facilities	2012	5	v	-	-	-	-	-	-	-
CSA	N290.13	Environmental Qualification of Equipment for CANDU Nuclear Power Plants (2005/R2015)	2005	5	v	v	-	-	-	-	-	-
CSA	N285.0	General requirements for pressure-retaining systems and components in CANDU nuclear power plants (including updates 1 and 2)	2008	5	-	-	-	-	-	-	-	-
CSA	N285.0	General requirements for pressure-retaining systems and components in CANDU nuclear power plants (including updates 1 and 2)	2012	5	v ³	-	-	-	-	-	-	-
CSA	N290.12	Human factors in design for nuclear power plants	2014	5	v	-	-	-	-	-	-	-
CSA	N290.0	General requirements for safety systems of nuclear power plants	2011	5	v	v	-	-	-	-	-	-
CSA	N291	Requirements for safety related structures for CANDU nuclear power plants	2008	5	-	-	-	-	-	-	-	-
CSA	N291	Requirements for safety related structures for CANDU nuclear power plants	2015	5	v	-	-	-	-	-	-	-
CNSC	RD/GD-98	Reliability Programs for Nuclear Power Plants	2012	6	-	-	-	-	-	-	-	-
CNSC	REGDOC-2.6.1	Reliability Programs for Nuclear Power Plants	2017	6	v	v	-	-	-	-	-	-
CNSC	RD/GD-210	Maintenance Programs for Nuclear Power Plants	2012	6	-	-	-	-	-	-	-	-
CNSC	REGDOC-2.6.2	Maintenance Programs for Nuclear Power Plants	2017	6	v	v	-	-	-	-	-	-
CSA	N285.4	Periodic inspection of CANDU nuclear power plant components	2005	6	v	-	-	-	-	-	-	-
CSA	N285.4	Periodic inspection of CANDU nuclear power plant components	2009	6	v	-	-	-	-	-	-	-

Source	Number	Title	Year	SCA	Bruce	DNGS	DWMF	PNGS	PWMF	PLNGS	Gentilly2	WWMF
CSA	N285.4	Periodic inspection of CANDU nuclear power plant components	2014	6	-	V	-	-	-	-	-	-
CSA	N285.5	Periodic inspection of CANDU nuclear power plant containment components	2008	6	V	V	-	V	-	V	-	-
CSA	N285.5	Periodic inspection of CANDU nuclear power plant containment components	2018	6	2023	2022	-	V	-	-	-	-
CSA	N287.1	General requirements for concrete containment structures for nuclear power plants	2014	6	-	-	-	V	-	-	-	-
CSA	N287.2	Material requirements for concrete containment structures for CANDU nuclear power plants	2008	6	-	-	-	V	-	-	-	-
CSA	N287.7	In-service examination and testing requirements for concrete containment structures for CANDU nuclear power plants	2008	6	V	V	-	V	-	V	-	-
CSA	N285.8	Technical requirements for in-service evolution of zirconium alloy pressure tubes in CANDU reactors	2015	6	-	-	-	V	-	-	-	-
CSA	N285.8	Technical requirements for in-service evolution of zirconium alloy pressure tubes in CANDU reactors	2010	6	V	-	-	-	-	V upd2	-	-
CSA	N285.8	Technical requirements for in-service evolution of zirconium alloy pressure tubes in CANDU reactors	2005	6	-	-	-	-	-	-	-	-
CNSC	RD-334	Aging Management for Nuclear Power Plants	2010	6	-	-	-	-	-	-	-	-
CNSC	REGDOC-2.6.3	Aging Management	2014	6	V	V	V	V	V	V	V	V
CSA	N288.1	Guidelines for calculating derived release limits for radioactive material in airborne and liquid effluents for normal operation of nuclear facilities(include update 1)	2008	9	V	V	V	-	V	-	-	-
CSA	N288.1	Guidelines for calculating derived release limits for radioactive material in airborne and liquid effluents for normal operation of nuclear facilities	2014	9	2021	V	V	V	V	V	V	V
CSA	N288.3.4	Performance testing of nuclear air-cleaning systems at nuclear facilities	2013	9	-	V	V	V	V	-	-	V
CNSC	S-296	Environmental Protection, Policies, Programs and Procedures at Class I Nuclear Facilities and Uranium Mines and Mills	2006	9	-	-	-	-	-	-	-	-
CNSC	REGDOC-2.9.1	Environmental Policies, Programs and Procedures	2013	9	V	V	-	-	-	V	V	-
CNSC	REGDOC-2.9.1	Environmental Policies, Programs and Procedures, section 4.6	2016	9	-	-	V	-	V	-	-	V
CNSC	REGDOC-2.9.1	Environmental Principles, Assessments and Protection Measures, version 1.1	2017	9	V	2022	2022	V	2020	-	2022	2021
CSA	N288.4	Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills	2010	9	V	V	V	V	V	V	V	V
CSA	N288.5	Effluent monitoring programs at Class I nuclear facilities and uranium mines and mills	2011	9	V	V	V	V	V	V	V	V
CSA	N288.6	Environmental risk assessments at Class I nuclear facilities and uranium mines and mills	2012	9	V	V	V	V	V	V	2020	2022
CSA	N288.7	Groundwater protection programs at Class I nuclear facilities and uranium mines and mills	2015	9	V	2022	2022	V	2020	2020	-	2021
CNSC	RD-353	Testing and Implementation of Emergency Measures	2008	10	-	-	-	-	-	-	-	-
CNSC	REGDOC-2.10.1	Nuclear Emergency Preparedness and Response	2014	10	V	-	-	-	-	V	V	-
CNSC	REGDOC-2.10.1	Nuclear Emergency Preparedness and Response, version 2	2016	10	-	V	V	V	V	-	-	V
CSA	N293	Fire protection for nuclear power plants	2007	10	-	-	-	-	-	-	-	-
CSA	N293	Fire protection for nuclear power plants	2012	10	V	V	-	V	-	V	V	-
CSA	N393	Fire protection for facilities that process, handle, or store nuclear substances	2013	10	-	-	-	V	-	V	2022	-
CSA	N292.0	General principles for the management of radioactive waste and irradiated fuel	2014	11	-	-	-	V	-	V	V	V
CSA	N292.2	Interim dry storage of irradiated fuel	2007	11	-	-	-	-	-	-	-	-
CSA	N292.2	Interim dry storage of irradiated fuel	2013	11	-	-	-	V	V	-	V	-
CSA	N292.3	Management of low- and intermediate-level radioactive waste	2008	11	V	V	-	V	V	-	-	-
CSA	N292.3	Management of low- and intermediate-level radioactive waste	2014	11	-	-	-	V	-	-	V	V
CSA	N294	Decommissioning of facilities containing nuclear substances	2009	11	-	V	V	V	V	V	V	V
CSA	N290.7	Cyber Security	2014	12	V ²	V	-	V	V	V	2020	V
CNSC	RD-321	Criteria for Physical Protection Systems and Devices at High-Security Sites	2010	12	V	V	-	V	-	V	V	-
CNSC	RD-361	Criteria for Explosive Substance Detection, X-ray Imaging and Metal Detection at High-Security Sites	2010	12	V	V	-	V	-	V	V	-
CNSC	REGDOC-2.12.1	High-Security Sites: Nuclear Response Force	2013	12	V	V	V	V	V	V	V	-
CNSC	REGDOC-2.12.1	High-Security Facilities, Volume II: Criteria for Nuclear Security Systems and Devices	2018	12	-	-	-	V	-	V	-	V
CNSC	REGDOC-2.12.2	Site Access Security Clearance	2013	12	V	V	V	V	V	V	V	V
CNSC	REGDOC-2.12.3	Security of Nuclear Substances – Sealed Sources	2013	12	V	-	-	V	-	V	-	-
CNSC	RD-336	Accounting and Reporting of Nuclear Material	2010	13	-	V	-	V	-	-	-	-
CNSC	REGDOC-2.13.1	Safeguards and Nuclear Material Accountability	2018	13	V	2021	2021	2021	2021	2021	V	2021
CNSC	REGDOC-3.2.1	Public Information and Disclosure	2018	15	V	V	V	V	V	V	V	V

* CNSC staff documents (not published as regulatory documents)

**C. CURRENT AND PREDICTED STATUS OF KEY PARAMETERS
AND MODELS FOR PRESSURE TUBES IN CANADIAN
POWER REACTORS**

UNIT	Status as of January 1 st 2021			Future situation			
	EFPH	Peak Heq concentration, ppm	Existing fracture toughness model valid?	Key date	Anticipated EFPH	Predicted maximum Heq conc., ppm	Existing fracture toughness model valid?
Darlington Unit 1	221,505	119	Yes	Refurbishment (February 2022)	229,000	~120	No ¹
Darlington Unit 2	n/a – fuel channels replaced during refurbishment			n/a – fuel channels replaced during refurbishment			
Darlington Unit 3	Refurbishment in progress – Started September 2020			n/a – fuel channels replaced during refurbishment			
Darlington Unit 4	210,911	104	Yes	Refurbishment (July 2023)	231,000	112	Yes
Pickering Unit 1	155,675	70	Yes	Dec 2024	192,000	87	No ²
Pickering Unit 4	128,384	56	Yes	Dec 2024	167,500	67	Yes
Pickering Unit 5	251,852	86	Yes	Dec 2024	287,500	97	Yes
Pickering Unit 6	256,600	79	Yes	Dec 2024	289,000	89	Yes
Pickering Unit 7	250,868	82	Yes	Dec 2024	287,000	92	Yes
Pickering Unit 8	237,554	75	Yes	Dec 2024	274,500	87	Yes
Bruce Unit 1	57,731	49	Yes	Jan 2044 (End of Service)	234,000	<120 ppm	Yes
Bruce Unit 2	56,924	49	Yes	Jan 2044 (End of Service)	234,000	<120 ppm	Yes

Unit	Status as of January 1 st 2021			Future situation			
	EFPH	Peak Heq concentration, ppm	Existing fracture toughness model valid?	Key date	Anticipated EFPH	Predicted maximum Heq conc., ppm	Existing fracture toughness model valid?
Bruce Unit 3	230,107	100	Yes	Jan 2023 (Refurbishment)	241,000	<120 ppm	Yes
Bruce Unit 4	222,328	99	Yes	Jan 2028 (Refurbishment)	249,000	<120 ppm	Yes
Bruce Unit 5	253,050	110	Yes	Jul 2026 (Refurbishment)	292,000	>120 ppm	No
Bruce Unit 6	243,773	N/A	N/A	Jan 2020 (Refurbishment)	244,000	N/A	N/A
Bruce Unit 7	245,962	108	Yes	Jul 2028 (Refurbishment)	300,000	>120 ppm	No
Bruce Unit 8	231,045	91	Yes	Jul 2030 (Refurbishment)	299,000	>120 ppm	No
Point Lepreau	58,349	57	Yes	August 2042 (210,000 EFPH)	302,220	99	Yes

1: Industry has issued a revised fracture toughness model with a validity limit of 140ppm for back end material.

2: The current fracture toughness model has been restricted to 80 ppm [Heq] for front end pressure tube material per CSA N285.8-15 Update #1. Pickering Unit 1 contains 50% of tubes oriented with front end material at the outlet location. The revised fracture toughness model has a validity limit of 100ppm for front end material

D. DERIVED RELEASE LIMITS AND RADIOLOGICAL RELEASES TO THE ENVIRONMENT

Derived Release Limits

Licence release limits known as Derived Release Limits (DRLs) are site-specifically calculated rates of release that could, if exceeded, expose an individual of the most highly exposed group to a committed dose equal to the regulatory annual dose limit of 1 mSv/year. DRLs are calculated using CSA N288.1-14, *Guidelines for calculating derived release limits for radioactive materials in airborne and liquid effluents for normal operation of nuclear facilities*.

While it is possible to calculate a specific DRL for each radionuclide, it may not be practical nor necessary to monitor each of these separately. In such cases, emitted radionuclides may be organized into groups that are selected based on factors such as physicochemical properties and method of monitoring. DRLs can then be established for the radionuclide group applying a number of simplifying and conservative (i.e., protective) assumptions such as assuming that the group is composed entirely of the most restrictive radionuclide representative of the group. The most restrictive radionuclide can differ for different nuclear facilities depending on releases, local conditions and the choice of the representative person. Emission monitoring may then be carried out by a non-radionuclide-specific method for the group rather than for specific radionuclides. The most common DRL groupings for airborne releases are noble gases, radio-iodines, particulate beta/gamma, and particulate alpha with those for liquids release being beta/gamma emitters and alpha.

Licenseses are required to demonstrate that their releases are not only below their respective DRLs but that the sum of their release are below 1 mSv/year, the public regulatory dose limit. To ensure these limits are respected, licenseses also are required to develop action levels significantly below their DRLs as a means of detecting elevated releases meriting follow-up investigations and actions to ensure releases are adequately controlled. For nuclear power plants, the action levels are applied to weekly and monthly monitoring results for emissions to atmosphere and for effluent to surface waters, respectively.

Note that the DRLs shown in the tables of this appendix are applicable for 2020 and may not be applicable for previous years.

Total Annual Release of Relevant Radionuclides to the Environment

CNSC staff have commenced publishing annual releases of radionuclides to the environment from nuclear facilities on the CNSC Open Government Portal: <https://open.canada.ca/data/en/dataset/6ed50cd9-0d8c-471b-a5f6-26088298870e>.

The following tables provide the annual load of key radionuclides directly released to atmosphere or to surface waters from licensed facilities along with the relevant DRL for the reporting period of 2011 to 2020.

The CNSC published a report in 2012², which reported the radionuclide release data from Canadian nuclear generating stations from the years 2001 – 2010. Over this current reporting period (2011 – 2020), there have been no exceedances of licence derived release limits.

As facilities differ with respect to their on-site nuclear activities (e.g., presence of a tritium processing facility) or life-stage activities (e.g., safe shut-down), or operations (e.g., maintenance, rates of power productions), the relevant radionuclides specifically monitored and reported on as well as the actual quantities released will vary. Nuclear facilities monitor and report on a wide range of radionuclides with the standardized reporting provided here being based on the key radionuclides associated with public dose and the facilities derived releases limits. Therefore, direct comparisons between facilities are not possible, since 1 facility may have different release quantities of radioactive materials than another.

For the facilities associated with this Regulatory Oversight Report (ROR), the most common radionuclides or radionuclide groupings of interest are tritium (HTO), iodine-131, noble gases, particulates (beta/gamma) and carbon-14 for atmospheric releases and tritium (HTO), gross beta-gamma and carbon-14 for liquid releases to surface waters. Since particulate and gross beta-gamma consists of mixtures of radionuclides, the most dose-restrictive (based on potential dose to the public) radionuclide is often chosen to represent the mixture as the basis for comparison with the DRL.

Releases are reported in the following table as total becquerels (Bq) per year or in the case of noble gasses, becquerels-million electron volts (Bq-MeV). A becquerel is an SI (International System of Units) unit of radioactivity defined as the activity of a quantity of radioactive material in which 1 nucleus decays per second. Since the Bq is a very small unit, releases are reported here in scientific notation. In most cases, numbers are rounded to 2 or 3 significant figures. For example:

$$\begin{array}{rcl}
 100 & = & 1.0 \times 10^2 \\
 & & 1,260,000 = 1.2 \times 10^6 \\
 & & 4,445,758,748 = 4.4 \times 10^9
 \end{array}$$

² <http://publications.gc.ca/site/eng/9.506803/publication.html>

Bruce Nuclear Power Plant

The Bruce Power nuclear power plant reports releases from Bruce-A and Bruce-B.

Releases to atmosphere:

Table D.1: Bruce-A annual radionuclide releases to atmosphere for 2011 – 2020.
The applicable DRLs for 2020 are also presented.

Year	Tritium: (HTO: Bq)	Carbon- 14 (Bq)	Noble Gas (Bq- MeV)	Iodine- 131 (Bq)	Particulate (beta/gamma) (Bq)	Gross alpha (Bq)
2020 DRL	1.98 X 10¹⁷	6.34 X 10¹⁴	1.12 X 10¹⁷	1.14 X 10¹²	1.73 X 10¹²	2.96 X 10¹¹
2020	3.4 X 10 ¹⁴	1.6 X 10 ¹²	7.8 X 10 ¹³	2.2 X 10 ⁷	2.9 X 10 ⁶	3.0 X 10 ⁴
2019	4.62 X 10 ¹⁴	1.34 X 10 ¹²	7.06 X 10 ¹³	4.18 X 10 ⁷	1.97 X 10 ⁶	2.42 X 10 ⁴
2018	6.08 X 10 ¹⁴	1.14 X 10 ¹²	8.46 X 10 ¹³	6.57 X 10 ⁶	1.28 X 10 ⁶	1.10 X 10 ⁴
2017	7.32 X 10 ¹⁴	1.89 X 10 ¹²	9.48 X 10 ¹³	2.06 X 10 ⁷	4.39 X 10 ⁵	4.08 X 10 ³
2016	5.66 X 10 ¹⁴	1.69 X 10 ¹²	5.63 X 10 ¹³	4.40 X 10 ⁶	3.14 X 10 ⁵	2.46 X 10 ³
2015	7.05 X 10 ¹⁴	3.15 X 10 ¹²	5.62 X 10 ¹³	5.15 X 10 ⁷	1.06 X 10 ⁷	1.23 X 10 ⁶
2014	7.51 X 10 ¹⁴	1.64 X 10 ¹²	5.30 X 10 ¹³	3.94 X 10 ⁸	3.13 X 10 ⁶	8.02 X 10 ⁵
2013	5.09 X 10 ¹⁴	2.53 X 10 ¹²	6.66 X 10 ¹³	<4.94 X 10 ⁷	<4.84 X 10 ⁶	<6.67 X 10 ⁵
2012	4.50 X 10 ¹⁴	2.30 X 10 ¹²	6.82 X 10 ¹³	2.18 X 10 ⁸	<7.45 X 10 ⁶	<6.40 X 10 ⁵
2011	6.00 X 10 ¹⁴	1.36 X 10 ¹²	6.68 X 10 ¹³	3.58 X 10 ⁷	<7.06 X 10 ⁶	<5.99 X 10 ⁵

Table D.2: Bruce - B annual radionuclide releases to atmosphere for 2011 – 2020 with weekly releases provided for 2019. The applicable DRLs for 2020 are also presented.

Year	Tritium: (HTO: Bq)	Carbon - 14 (Bq)	Noble Gas (Bq-MeV)	Iodine- 131 (Bq)	Particulate (Gross beta/gamma) (Bq)	Gross alpha (Bq)
2020 DRL	3.16 X 10¹⁷	7.56 X 10¹⁴	2.17 X 10¹⁷	1.35 X 10¹²	3.61 X 10¹²	5.77 X 10¹¹
2020	3.1 X 10 ¹⁴	9.9 X 10 ¹¹	2.6 X 10 ¹³	2.9 X 10 ⁶	6.4 X 10 ⁶	4.3 X 10 ⁴
2019	3.29 X 10 ¹⁴	1.08 X 10 ¹²	3.39 X 10 ¹³	4.40 X 10 ⁵	4.77 X 10 ⁶	2.62 X 10 ⁴

Year	Tritium: (HTO: Bq)	Carbon - 14 (Bq)	Noble Gas (Bq-MeV)	Iodine- 131 (Bq)	Particulate (Gross beta/gamma) (Bq)	Gross alpha (Bq)
2018	3.86 X 10 ¹⁴	1.13 X 10 ¹²	4.24 X 10 ¹³	3.43 X 10 ⁶	2.21 X 10 ⁶	2.37 X 10 ⁴
2017	7.14 X 10 ¹⁴	1.23 X 10 ¹²	4.82 X 10 ¹³	1.41 X 10 ⁶	2.34 X 10 ⁶	3.70 X 10 ³
2016	5.70 X 10 ¹⁴	1.13 X 10 ¹²	5.25 X 10 ¹³	<LD ^a	1.13 X 10 ⁶	1.85 X 10 ³
2015	3.74 X 10 ¹⁴	1.16 X 10 ¹²	5.25 X 10 ¹³	4.01 X 10 ⁷	1.63 X 10 ⁷	2.34 X 10 ⁶
2014	4.13 X 10 ¹⁴	1.26 X 10 ¹²	5.25 X 10 ¹³	4.02 X 10 ⁷	1.53 X 10 ⁷	2.26 X 10 ⁶
2013	2.63 X 10 ¹⁴	1.10 X 10 ¹²	3.71 X 10 ¹²	<4.04 X 10 ⁷	<1.86 X 10 ⁷	<2.51 X 10 ⁶
2012	3.26 X 10 ¹⁴	1.16 X 10 ¹²	3.64 X 10 ¹²	4.13 X 10 ⁷	1.80 X 10 ⁷	<4.38 X 10 ⁵
2011	7.17 X 10 ¹⁴	1.44 X 10 ¹²	3.64 X 10 ¹²	4.19 X 10 ⁷	5.07 X 10 ⁷	1.78 X 10 ⁷

a = less than analytical detection limit

Releases to surface waters:

Table D.3: Bruce-A annual radionuclide releases to surface waters for 2011 – 2020. The applicable DRLs for 2020 are also presented.

Year	Tritium: (HTO: Bq)	Gross beta/gamma (Bq)	Carbon-14 (Bq)	Gross Alpha (Bq)
2020 DRL	2.30 X 10¹⁸	4.58 X 10¹³	1.03 X 10¹⁵	1.12 X 10¹⁴
2020	2.5 X 10 ¹⁴	7.7 X 10 ⁸	1.1 X 10 ⁹	<LD ^a
2019	2.12 X 10 ¹⁴	2.13 X 10 ⁹	8.17 X 10 ⁸	<LD ^a
2018	1.96 X 10 ¹⁴	1.20 X 10 ⁹	9.73 X 10 ⁸	<LD ^a
2017	2.26 X 10 ¹⁴	1.08 X 10 ⁹	9.13 X 10 ⁸	<LD ^a
2016	2.36 X 10 ¹⁴	9.96 X 10 ⁸	1.66 X 10 ⁹	6.96 X 10 ⁴
2015	2.20 X 10 ¹⁴	9.17 X 10 ⁸	2.45 X 10 ⁹	1.31 X 10 ⁶
2014	1.94 X 10 ¹⁴	9.57 X 10 ⁸	1.13 X 10 ⁹	1.77 X 10 ⁶
2013	1.96 X 10 ¹⁴	9.08 X 10 ⁸	9.95 X 10 ⁸	2.12 X 10 ⁶
2012	1.40 X 10 ¹⁴	5.79 X 10 ⁸	5.37 X 10 ⁸	1.60 X 10 ⁶
2011	2.95 X 10 ¹⁴	6.29 X 10 ⁸	1.70 X 10 ⁹	1.01 X 10 ⁶

a = less than analytical detection limit

Table D.4: Bruce-B annual radionuclide releases to surface waters for 2011 – 2020. The applicable DRLs for 2020 are also presented.

Year	Tritium: (HTO: Bq)	Gross beta/gamma (Bq)	Carbon-14 (Bq)	Gross Alpha (Bq)
2020 DRL	1.84 X 10¹⁸	5.17 X 10¹³	1.16 X 10¹⁵	1.21 X 10¹⁴
2020	5.7 X 10 ¹⁴	2.26 X 10 ⁹	1.79 X 10 ⁹	<LD ^a
2019	8.82 X 10 ¹⁴	2.26 X 10 ⁹	4.68 X 10 ⁹	<LD ^a
2018	5.60 X 10 ¹⁴	2.55 X 10 ⁹	1.38 X 10 ⁹	<LD ^a
2017	7.15 X 10 ¹⁴	2.04 X 10 ⁹	2.39 X 10 ⁹	<LD ^a
2016	5.07 X 10 ¹⁴	1.42 X 10 ⁹	1.76 X 10 ⁹	<LD ^a
2015	6.72 X 10 ¹⁴	1.53 X 10 ⁹	9.07 X 10 ⁹	1.40 X 10 ⁶
2014	6.42 X 10 ¹⁴	1.99 X 10 ⁹	8.06 X 10 ⁹	1.49 X 10 ⁶
2013	4.19 X 10 ¹⁴	3.95 X 10 ⁹	4.90 X 10 ⁹	8.91 X 10 ⁶
2012	1.14 X 10 ¹⁵	3.35 X 10 ⁹	4.63 X 10 ⁹	1.11 X 10 ⁶
2011	5.10 X 10 ¹⁴	2.38 X 10 ⁹	2.82 X 10 ⁹	1.48 X 10 ⁶

a = less than analytical detection limit

Western Waste Management Facility at the Bruce Operation

Releases to atmosphere:

Table D.5: Western waste management facility annual radionuclide releases to atmosphere for 2011 – 2020. The applicable DRLs for 2020 are also presented.

Year	Tritium: (HTO: Bq)	Carbon - 14 (Bq)	Iodine-131 (Bq)	Particulate (Gross gamma) (Bq)
2020 DRL	3.45 X 10¹⁷	2.41 X 10¹⁵	1.99 X 10¹²	6.65 X 10¹¹
2020	1.73 X 10 ¹³	2.63 X 10 ¹⁰	0	1.37 X 10 ⁴
2019	1.03 X 10 ¹³	2.62 X 10 ⁹	0	6.52 X 10 ²
2018	3.25 X 10 ¹²	1.57 X 10 ⁹	7.23 X 10 ⁴	2.41 X 10 ⁴
2017	1.72 X 10 ¹³	4.08 X 10 ⁹	1.38 X 10 ⁵	5.42 X 10 ³
2016	2.06 X 10 ¹³	3.94 X 10 ⁹	1.71 X 10 ⁵	5.41 X 10 ³
2015	4.14 X 10 ¹²	1.41 X 10 ⁹	1.21 X 10 ⁵	4.89 X 10 ⁵
2014	7.17 X 10 ¹²	1.57 X 10 ⁹	1.22 X 10 ⁵	5.12 X 10 ⁴
2013	1.43 X 10 ¹³	1.96 X 10 ⁹	6.38 X 10 ⁴	3.79 X 10 ⁵
2012	1.04 X 10 ¹³	1.88 X 10 ⁹	6.06 X 10 ⁴	1.27 X 10 ⁵
2011	1.99 X 10 ¹³	3.99 X 10 ⁹	8.66 X 10 ⁴	4.36 X 10 ⁵

Releases to surface waters:**Table D.6: Western waste management facility annual radionuclide releases to surface waters for 2011 – 2020. The applicable DRLs for 2020 are also presented.**

Year	Tritium: (HTO: Bq)	Gross Beta (Bq)
2020 DRL	3.59×10^{15}	4.01×10^{10}
2020	2.36×10^{11}	9.54×10^7
2019	1.60×10^{11}	7.08×10^7
2018	3.64×10^{11}	1.69×10^8
2017	2.59×10^{11}	2.84×10^8
2016	6.13×10^{11}	4.62×10^8
2015	4.29×10^{11}	1.56×10^8
2014	2.50×10^{11}	1.39×10^8
2013	1.42×10^{11}	1.26×10^8
2012	1.00×10^{11}	6.79×10^7
2011	1.45×10^{11}	9.55×10^7

Darlington Nuclear Power Plant

In addition to the standard suite of radionuclides reported for nuclear power plant releases, the Darlington facility also reports on atmospheric elemental tritium releases associated with the tritium removal facility that is on-site.

Releases to atmosphere:**Table D.7: Darlington annual radionuclide releases to atmosphere for 2011 – 2020. The applicable DRLs for 2020 are also presented (Note elemental tritium DRL is applicable to tritium removal facility).**

Year	Elemental Tritium (HT: Bq)	Tritium: (HTO: Bq)	Carbon- 14 (Bq)	Noble Gas (Bq-MeV)	Iodine- 131 (Bq)	Particulate (Gross beta/gamma) (Bq)	Gross alpha (Bq)
2020 DRL	8.2×10^{17}	4.9×10^{16}	1.2×10^{15}	3.8×10^{16}	1.7×10^{12}	6.1×10^{11}	1.1×10^{11}
2020	1.5×10^{13}	1.9×10^{14}	8.3×10^{11}	2.4×10^{13}	1.5×10^8	3.1×10^7	1.3×10^6
2019	2.3×10^{13}	2.0×10^{14}	9.7×10^{11}	5.0×10^{13}	1.4×10^8	2.6×10^7	1.3×10^6
2018	4.7×10^{13}	2.1×10^{14}	8.4×10^{11}	4.7×10^{13}	1.4×10^8	2.5×10^7	1.0×10^6
2017	1.4×10^{14}	2.4×10^{14}	1.4×10^{12}	1.5×10^{13}	$<1.5 \times 10^8$	2.6×10^7	1.8×10^6
2016	1.7×10^{13}	1.8×10^{14}	1.6×10^{12}	1.6×10^{13}	1.4×10^8	3.2×10^7	$<5.0 \times 10^6$
2015	1.7×10^{13}	2.5×10^{14}	1.3×10^{12}	2.2×10^{13}	1.4×10^8	3.5×10^7	$<6.4 \times 10^6$

Year	Elemental Tritium (HT: Bq)	Tritium: (HTO: Bq)	Carbon-14 (Bq)	Noble Gas (Bq-MeV)	Iodine-131 (Bq)	Particulate (Gross beta/gamma) (Bq)	Gross alpha (Bq)
2014	5.2×10^{13}	2.7×10^{14}	1.3×10^{12}	4.6×10^{13}	1.6×10^8	3.1×10^7	$<6.4 \times 10^6$
2013	1.8×10^{13}	2.1×10^{14}	1.0×10^{12}	3.2×10^{13}	1.4×10^8	2.9×10^7	$<6.2 \times 10^6$
2012	2.6×10^{13}	1.3×10^{14}	1.0×10^{12}	1.9×10^{13}	1.4×10^8	3.4×10^7	---
2011	8.8×10^{13}	1.4×10^{14}	1.0×10^{12}	2.2×10^{13}	1.5×10^8	4.0×10^7	---

Releases to surface waters:

Table D.8: Darlington annual radionuclide releases to surface waters for 2011 – 2020. The applicable DRLs for 2020 are also presented.

Year	Tritium: (HTO: Bq)	Gross beta/gamma (Bq)	Carbon-14 (Bq)	Gross Alpha (Bq)
2020 DRL	6.4×10^{18}	3.5×10^{13}	7.0×10^{14}	4.4×10^{14}
2020	1.2×10^{14}	2.5×10^{10}	3.8×10^8	6.5×10^5
2019	1.0×10^{14}	2.3×10^{10}	3.8×10^8	5.4×10^5
2018	2.2×10^{14}	2.6×10^{10}	1.2×10^9	$<3.5 \times 10^5$
2017	5.6×10^{14}	2.6×10^{10}	1.7×10^9	$<1 \times 10^6$
2016	3.5×10^{14}	4.9×10^{10}	2.2×10^9	1.2×10^6
2015	2.4×10^{14}	4.9×10^{10}	7.3×10^9	2.3×10^6
2014	1.7×10^{14}	3.0×10^{10}	5.5×10^9	1.8×10^6
2013	1.1×10^{14}	2.8×10^{10}	3.2×10^9	8.5×10^5
2012	1.3×10^{14}	3.0×10^{10}	6.3×10^9	9.0×10^5
2011	1.1×10^{14}	3.1×10^{10}	1.9×10^9	1.1×10^6

Pickering Nuclear Power Plant

Releases at the Pickering Nuclear Power Plant are monitored and reported on separately for Pickering A (units 1 – 4) and Pickering B (units 5 – 8).

Releases to atmosphere:

Table D.9: Pickering - A (units 1 - 4) and Pickering B (units 5 - 8) combined total annual radionuclide releases to atmosphere for 2020. The applicable DRLs for 2020 are also presented.

Year	Tritium: (HTO: Bq)	Carbon- 14 (Bq)	Noble Gas (Bq-MeV)	Iodine- 131 (Bq)	Particulate (Gross beta/gamma) (Bq)	Gross alpha (Bq)
2020 DRL	1.0 X 10¹⁷	2.7 X 10¹⁵	2.7 X 10¹⁶	2.8 X 10¹²	4.3 X 10¹¹	7.5 X 10¹⁰
2020	6.5 X 10 ¹⁴	2.3 X 10 ¹²	4.5 X 10 ¹³	1.0 X 10 ⁷	5.8 X 10 ⁶	1.0 X 10 ⁶
2019	5.6 X 10 ¹⁴	2.6 X 10 ¹²	1.3 X 10 ¹⁴	1.4 X 10 ⁷	5.7 X 10 ⁶	1.1 X 10 ⁶

Table D.10: Pickering - A (units 1 - 4) annual radionuclide releases to atmosphere for 2011 – 2018. The applicable DRLs for 2018 are also presented.

Year	Tritium: (HTO: Bq)	Carbon- 14 (Bq)	Noble Gas (Bq-MeV)	Iodine- 131 (Bq)	Particulate (Gross beta/gamma) (Bq)	Gross alpha (Bq)
2018 DRL	1.2 X 10¹⁷	2.2 X 10¹⁵	3.2 X 10¹⁶	9.8 X 10¹²	4.9 X 10¹¹	8.7 X 10¹⁰
2018	3.0 X 10 ¹⁴	2.3 X 10 ¹²	1.2 X 10 ¹⁴	7.0 X 10 ⁶	4.2 X 10 ⁶	4.3 X 10 ⁵
2017	3.1 X 10 ¹⁴	1.3 X 10 ¹²	1.5 X 10 ¹⁴	9.6 X 10 ⁶	6.9 X 10 ⁶	4.7 X 10 ⁵
2016	2.2 X 10 ¹⁴	1.2 X 10 ¹²	1.1 X 10 ¹⁴	9.9 X 10 ⁶	5.5 X 10 ⁶	3.7 X 10 ⁵
2015	2.4 X 10 ¹⁴	1.0 X 10 ¹²	9.3 X 10 ¹³	1.4 X 10 ⁷	5.3 X 10 ⁶	4.5 X 10 ⁵
2014	2.5 X 10 ¹⁴	9.1 X 10 ¹¹	1.1 X 10 ¹⁴	1.0 X 10 ⁷	4.1 X 10 ⁶	3.4 X 10 ⁵
2013	1.7 X 10 ¹⁴	7.8 X 10 ¹¹	1.1 X 10 ¹⁴	8.4 X 10 ⁶	3.7 X 10 ⁶	4.4 X 10 ⁵
2012	2.6 X 10 ¹⁴	8.8 X 10 ¹¹	1.1 X 10 ¹⁴	1.1 X 10 ⁷	4.5 X 10 ⁶	---
2011	2.1 X 10 ¹⁴	1.0 X 10 ¹²	9.9 X 10 ¹³	1.5 X 10 ⁷	8.2 X 10 ⁶	---

Table D.11: Pickering B (units 5 - 8) annual radionuclide releases to atmosphere for 2011 – 2018. The applicable DRLs for 2018 are also presented.

Year	Tritium: (HTO: Bq)	Carbon- 14 (Bq)	Noble Gas (Bq- MeV)	Iodine- 131 (Bq)	Particulate (Gross beta/gamma) (Bq)	Gross alpha (Bq)
2018 DRL	1.9 X 10¹⁷	2.0 X 10¹⁵	4.7 X 10¹⁶	8.9 X 10¹²	7.2 X 10¹¹	1.2 X 10¹¹
2018	3.2 X 10 ¹⁴	1.4 X 10 ¹²	5.0 X 10 ¹²	4.7 X 10 ⁶	3.5 X 10 ⁶	7.5 X 10 ⁵
2017	3.8 X 10 ¹⁴	1.3 X 10 ¹²	3.5 X 10 ¹²	4.3 X 10 ⁶	2.0 X 10 ⁸	3.7 X 10 ⁵
2016	4.6 X 10 ¹⁴	1.2 X 10 ¹²	5.8 X 10 ¹²	4.1 X 10 ⁶	2.4 X 10 ⁷	6.2 X 10 ⁵
2015	3.0 X 10 ¹⁴	1.0 X 10 ¹²	1.6 X 10 ¹³	4.6 X 10 ⁶	1.5 X 10 ⁷	6.1 X 10 ⁵
2014	2.8 X 10 ¹⁴	9.1 X 10 ¹¹	1.1 X 10 ¹³	5.2 X 10 ⁶	3.8 X 10 ⁶	5.2 X 10 ⁵
2013	2.4 X 10 ¹⁴	9.1 X 10 ¹¹	6.5 X 10 ¹²	4.4 X 10 ⁶	5.0 X 10 ⁶	5.8 X 10 ⁵
2012	2.8 X 10 ¹⁴	9.4 X 10 ¹¹	1.9 X 10 ¹³	6.6 X 10 ⁶	3.6 X 10 ⁶	---
2011	3.4 X 10 ¹⁴	7.7 X 10 ¹¹	8.4 X 10 ¹³	8.8 X 10 ⁶	3.6 X 10 ⁶	---

Releases to surface waters:

Note that carbon-14 and gross alpha releases associated with units 1 – 4 are included in the unit 5 – 8 reporting as the radioactive liquid waste management system is discharged through the outfall for units associated with units 5 – 8.

Table D.12: Pickering - A (units 1 - 4) and Pickering B (units 5 - 8) combined total annual radionuclide releases to surface water for 2020. The applicable DRLs for 2020 are also presented.

Year	Tritium: (HTO: Bq)	Gross beta/gamma (Bq)	C-14 (Bq)	Gross Alpha (Bq)
2020 DRL	7.9 X 10¹⁷	1.8 X 10¹²	3.8 X 10¹³	2.4 X 10¹⁰
2020	4.3 X 10 ¹⁴	3.2 X 10 ¹¹	1.8 X 10 ⁹	2.4 X 10 ⁶
2019	4.3 X 10 ¹⁴	7.8 X 10 ¹⁰	3.4 X 10 ⁹	2.3 X 10 ⁶

Table D.13: Pickering annual radionuclide releases to surface waters for 2011 – 2018. The applicable DRLs for 2018 are also presented.

Year	Units 1 - 4		Units 5 - 8			
	Tritium: (HTO: Bq)	Gross beta/gamma (Bq)	Tritium: (HTO: Bq)	Gross beta/gamma (Bq)	C-14 (Bq)	Gross Alpha (Bq)
2018 DRL	3.7 X 10¹⁷	1.7 X 10¹²	7.0 X 10¹⁷	3.2 X 10¹²	6.0 X 10¹³	2.6 X 10¹³
2018	1.4 X 10 ¹⁴	9.3 X 10 ⁹	2.8 X 10 ¹⁴	3.4 X 10 ¹⁰	1.1 X 10 ⁹	1.8 X 10 ⁶
2017	1.1 X 10 ¹⁴	6.6 X 10 ⁹	2.7 X 10 ¹⁴	2.0 X 10 ¹⁰	1.9 X 10 ⁹	<2.5 X 10 ⁶
2016	1.1 X 10 ¹⁴	6.8 X 10 ⁹	2.1 X 10 ¹⁴	5.1 X 10 ¹⁰	4.7 X 10 ⁹	<3.7 X 10 ⁶
2015	9.9 X 10 ¹³	4.9 X 10 ⁹	2.7 X 10 ¹⁴	1.7 X 10 ¹⁰	2.8 X 10 ⁹	5.4 X 10 ⁶
2014	1.0 X 10 ¹⁴	9.0 X 10 ⁹	2.4 X 10 ¹⁴	2.3 X 10 ¹⁰	1.5 X 10 ⁹	3.2 X 10 ⁶
2013	1.2 X 10 ¹⁴	6.7 X 10 ⁹	1.9 X 10 ¹⁴	2.6 X 10 ¹⁰	1.7 X 10 ⁹	1.3 X 10 ⁷
2012	1.1 X 10 ¹⁴	1.1 X 10 ¹⁰	1.8 X 10 ¹⁴	1.9 X 10 ¹⁰	1.1 X 10 ¹⁰	7.7 X 10 ⁶
2011	1.2 X 10 ¹⁴	5.1 X 10 ⁹	2.0 X 10 ¹⁴	1.4 X 10 ¹⁰	2.2 X 10 ⁹	4.8 X 10 ⁷

Point Lepreau Nuclear Power Plant

The Point Lepreau nuclear power plant consisting of a single reactor unit has DRLs for each individual noble gas and particulate categories and therefore monitors and reports on wide range of specific radionuclides. For consistency in reporting within this appendix, these have been combined as total noble gases and total particulate in the tables below.

Releases to atmosphere:

Table D.14: Point Lepreau annual radionuclide releases to atmosphere for 2011 – 2020. The applicable DRLs for 2020 are also presented.

Year	Tritium: (HTO: Bq)	Carbon- 14 (Bq)	Noble Gas (Bq- MeV)	Iodine- 131 (Bq)	Particulate (Gross beta/gamma) (Bq)
2020 DRL	2.4 X 10¹⁷	1.2 X 10¹⁶	a	6.3 X 10¹³	a
2020	2.9 X 10 ¹⁴	1.6 X 10 ¹¹	3.2 X 10 ¹³	7.1 X 10 ⁶	2.0 X 10 ⁶
2019	2.5 X 10 ¹⁴	2.8 X 10 ¹¹	2.9 X 10 ¹³	2.7 X 10 ⁷	<2.2 X 10 ⁸

Year	Tritium: (HTO: Bq)	Carbon- 14 (Bq)	Noble Gas (Bq- MeV)	Iodine- 131 (Bq)	Particulate (Gross beta/gamma) (Bq)
2018	1.4×10^{14}	3.3×10^{11}	2.5×10^{13}	1.3×10^6	$<2.2 \times 10^6$
2017	1.5×10^{14}	3.1×10^{11}	4.6×10^{13}	$<5.2 \times 10^5$	$<2.2 \times 10^6$
2016	1.5×10^{14}	1.1×10^{11}	9.5×10^{13}	5.2×10^5	$<2.2 \times 10^6$
2015	1.4×10^{14}	7.1×10^{10}	5.9×10^{12}	$<5.0 \times 10^5$	$<8.1 \times 10^5$
2014	6.6×10^{13}	8.4×10^{10}	3.8×10^{12}	---	---
2013	9.1×10^{13}	8.0×10^{10}	4.6×10^{12}	---	---
2012	1.4×10^{14}	3.7×10^{10}	8.0×10^{11}	---	---
2011	4.5×10^{13}	2.8×10^{10}	---	---	---

a: Specific DRLs are calculated for a range of noble gas and particulate categories.
None of these individuals DRLS were exceeded.

Releases to surface waters:

Table D.15: Point Lepreau annual radionuclide releases to surface waters for 2011 – 2020. The applicable DRLs for 2020 are also presented.

Year	Tritium: (HTO: Bq)	Gross beta (Bq)	Carbon-14 (Bq)	Gross Alpha (Bq)
2020 DRL	4.5×10^{19}	a	3.7×10^{14}	a
2020	4.6×10^{14}	3.8×10^7	1.0×10^9	7.1×10^6
2019	3.4×10^{14}	8.4×10^7	7.6×10^9	1.3×10^7
2018	2.4×10^{14}	9.7×10^7	4.9×10^9	1.7×10^7
2017	1.2×10^{14}	7.8×10^7	1.8×10^9	7.9×10^6
2016	1.8×10^{14}	7.8×10^7	2.9×10^9	7.9×10^6
2015	1.4×10^{14}	5.5×10^7	1.0×10^{10}	6.7×10^6
2014	3.2×10^{14}	1.0×10^7	6.6×10^9	8.3×10^7
2013	2.9×10^{14}	1.5×10^8	4.3×10^9	8.6×10^6
2012	7.8×10^{14}	7.2×10^7	1.4×10^{10}	6.5×10^6
2011	3.4×10^{13}	8.2×10^7	3.8×10^7	5.8×10^6

a: Specific DRLs are calculated for a range of noble gas and particulate categories

Gentilly-2

The G-2 facility was permanently shut down in December 2012. Since then, activities conducted by Hydro-Québec have been to stabilize and transition the G-2 facility to safe storage.

Releases to atmosphere:

Table D.16: Gentilly-2 annual radionuclide releases to atmosphere for 2011 – 2020. The applicable DRLs for 2020 are also presented.

Year	Tritium: (HTO: Bq)	Carbon- 14 (Bq)	Noble Gas (Bq-MeV)	Iodine-131 (Bq)	Particulate (Gross beta/gamma) (Bq)
2020 DRL	1.7×10^{17}	1.2×10^{15}	NA ¹	NA ¹	8.0×10^{11}
2020	8.11×10^{13}	8.19×10^9	NA ¹	NA ¹	4.47×10^5
2019	7.21×10^{13}	2.70×10^{10}	NA ¹	NA ¹	9.49×10^5
2018	9.17×10^{13}	4.63×10^{10}	NA ¹	NA ¹	2.15×10^6
2017	7.32×10^{13}	4.47×10^{11}	NA ¹	NA ¹	8.32×10^6
2016	7.32×10^{13}	3.79×10^{11}	NA ¹	NA ¹	5.17×10^5
2015	1.12×10^{14}	4.10×10^{11}	NA ¹	NA ¹	1.35×10^6
2014	1.19×10^{14}	4.83×10^{11}	3.15×10^9	<LD ^a	2.92×10^5
2013	1.14×10^{14}	7.49×10^{11}	6.96×10^8	<LD ^a	8.64×10^5
2012	2.09×10^{14}	4.41×10^{11}	3.87×10^{11}	8.32×10^6	1.79×10^6
2011	1.90×10^{14}	2.71×10^{11}	1.16×10^{11}	<LD ^a	9.13×10^5

¹ Not applicable as facility is in safe shut-down.

^a = less than analytical detection limit

Releases to surface waters:**Table D.17 Gentilly-2 annual radionuclide releases to surface waters for 2011 – 2020. The applicable DRLs for 2020 are also presented.**

Year	Tritium: (HTO: Bq)	Gross beta (Bq)	Carbon-14 (Bq)
2020 DRL	1.2×10^{18}	1.9×10^{13}	2.7×10^{14}
2020	1.97×10^{13}	1.65×10^8	4.92×10^7
2019	8.22×10^{13}	3.47×10^7	1.90×10^8
2018	5.46×10^{13}	2.51×10^7	1.71×10^8
2017	2.17×10^{14}	3.27×10^8	2.79×10^{11}
2016	3.83×10^{13}	1.33×10^8	5.64×10^{10}
2015	1.51×10^{14}	5.28×10^8	3.00×10^{11}
2014	3.56×10^{14}	2.86×10^8	5.28×10^{10}
2013	2.15×10^{14}	1.84×10^9	1.15×10^{10}
2012	3.52×10^{14}	1.09×10^9	2.88×10^{10}
2011	2.44×10^{14}	5.34×10^9	1.88×10^{10}

E. LIST OF LICENCE CONDITIONS HANDBOOK CHANGES

The following table lists the LCHs for each facility covered by the regulatory oversight report and indicates the changes made to LCHs in 2020. For those that were revised in 2020, the details are provided below.

Facility	LCH #	Revision # as of December 31, 2020	Revised in 2020?
DNGS	LCH-PR-13.01/2025	R003	No
DWMF	LCH-W4-355.01/2023	R003	Yes (July 22, 2020)
PNGS	LCH-PR-48.00/2028	R003	Yes (April 23, 2020)
PWMF	LCH-W4-350.00/2028	R001	Yes (July 22, 2020)
Bruce A and B	LCH-PR-18.01/2028-R002	R002	Yes (May 25, 2020)
WWMF	LCH-W4-314.00/2027	R001	Yes (August 4, 2020)
RWOS-1	LCH-WNSL-W1-320.05/2029	R000*	No
Point Lepreau	LCH-PR-17.00/2022	R001	No
Gentilly-2	MCP-GENTILLY-2	R001	No

*The LCH for RWOS-1 was issued on August 17, 2020. There have been no changes to the LCH since issuance.

Revisions to LCH for Darlington Waste Management Facility

On July 22, 2020 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 R003:

LC(s)	Sub-section	Change
G.1	Preamble	REGDOC-3.5.3, Regulatory Fundamentals superseded CNSC INFO 0795
G.1		Deleted the following under Licence Documents that require prior notification of Changes: <ul style="list-style-type: none"> • 00044-SR-01320-10002, <i>Darlington Waste Management Facility Safety Report</i> • 00044-SR-01320-10003, <i>Darlington Waste Management Facility Safety Report Annex</i> • W-PROG-WM-0001, <i>Nuclear Waste Management Program</i> • 00044-OPP-01911.1-00001, <i>Operating Policies and Principles, Darlington Waste Management Facility</i>
G.3	CVC	Added the following as CVC: <ul style="list-style-type: none"> • CSA N294-09 <i>Decommissioning of facilities containing nuclear substances</i> • CSA N294-19 <i>Decommissioning of facilities containing nuclear substances (with a transition date)</i>
G4	CVC	Added REGDOC-3.2.1, Public Information and Disclosure as CVC (with a transition date of August 7, 2020), to replace RD/GD-99.3.
1.1	Guidance	Added REGDOC-2.2.1 Human Factors as guidance
2.1	CVC	Added the following as CVC: <ul style="list-style-type: none"> • REGDOC-2.2.4 Fitness for Duty: Managing Worker Fatigue • REGDOC-2.2.4 Fitness for Duty, Volume II: Managing Alcohol and Drug Use, version 2

LC(s)	Sub-section	Change
		<ul style="list-style-type: none"> • REGDOC-2.1.2, Safety Culture
2.1	Guidance	<p>Added the following as guidance:</p> <ul style="list-style-type: none"> • REGDOC-2.2.5 Minimum Staff Complement • REGDOC-2.2.1 <i>Human Factors</i>
2.2	CVC	<p>Added the following as CVC:</p> <ul style="list-style-type: none"> • REGDOC-2.2.2, Personnel Training <p>Added the following text as CVC: “<i>The licensee shall implement and maintain training programs for workers in accordance with CNSC regulatory document REGDOC-2.2.2, Personnel Training</i>”.</p>
2.2	Guidance	<p>Removed TPED-01 - <i>Objectives and Criteria for Regulatory Evaluation of Nuclear Facility Training Programs, 2013</i> from guidance.</p>
3.2	CVC	<p>Added the following as CVC:</p> <ul style="list-style-type: none"> • REGDOC-3.2.1 Public Information and Disclosure (with a transition date) • REGDOC-3.1.2 Reporting Requirements, Volume 1: Non-Power Reactor Class I Nuclear Facilities and Uranium Mines and Mills
4.1	CVC	<p>Added the following as CVC:</p> <ul style="list-style-type: none"> • CSA N292.0-14 <i>General principles for the management of radioactive waste and irradiated fuel</i> • CSA N292.2-13 <i>Interim dry storage of irradiated fuel</i> • CSA N292.3-14 <i>Management of low- and intermediate-level radioactive waste</i> • CSA N286.7-16 <i>Quality assurance of analytical, scientific, and design computer programs</i> (with a transition date of March 31,2021)
5.1	CVC	<p>Added the following as CVC:</p> <ul style="list-style-type: none"> • CSA N393, <i>Fire protection for facilities that process, handle, or store nuclear substances</i>

LC(s)	Sub-section	Change
		<p>Changed the following:</p> <ul style="list-style-type: none"> • National Building Code of Canada (2010) to National Building Code of Canada (2015) • National Fire Code of Canada (2010) to National Fire Code of Canada (2015). • N-PROG-MP-0007 to N-STD-MP-0028 • N-PROG-MP-0005 to N-STD-MP-0027 <p>Deleted the following:</p> <ul style="list-style-type: none"> • N286-12 <i>Management system requirements for nuclear facilities</i> because of repetition (already covered under different section of LCH). • NFPA-801 as it was replaced by CSA N393-13 <i>Fire protection for facilities that process, handle, or store nuclear substances</i>
5.1	Guidance	Added CSA N290.12 <i>Human factors in design for nuclear power plants</i> as guidance.
5.2	CVC	Changes in the “ <i>Classification and Registration of Fire Protection Systems</i> ” section in accordance with document N-CORR-00531-19224.
5.2	Guidance	Added N-REF-01913.11-10001 <i>Temporary Leak Maintenance by Leak Mitigation Process</i> as guidance.
6.1	CVC	<ul style="list-style-type: none"> • REGDOC-2.6.3 Aging Management superseded RD-334 <i>Aging Management for Nuclear Power Plants</i>. • Added N-PROG-MP-0009, <i>Design Management</i> as a CVC. • Changed from N-PROG-MP-0007 to N-STD-MP-0028.
6.1	Guidance	Added REGDOC-2.6.2, Maintenance Programs for Nuclear Power Plants as guidance.
7.1	CVC	Added N-REP-03420-10011 <i>Occupational Radiation Protection Action Levels for Nuclear Waste Management Facilities</i> as CVC.
9.1	CVC	<ul style="list-style-type: none"> • N-PROG-OP-0006 <i>Environmental Management</i> superseded by OPG-PROG-0005 <i>Environmental Management System</i>.

LC(s)	Sub-section	Change
		<ul style="list-style-type: none"> • Added CSA N288.7-15, <i>Groundwater protection programs at Class I nuclear facilities and uranium mines and mills</i> as CVC (with a transition date of December 31, 2022.) • Added CSA N288.6 <i>Environmental risk assessments at class I nuclear facilities and uranium mines and mills</i> as a CVC. • Added CSA N288.3.4 <i>Performance testing of nuclear air-cleaning systems at nuclear facilities</i> as a CVC. • Added NK38-REP-07701-00001, <i>Darlington Nuclear Environmental Risk Assessment</i> as a CVC.
10.1	CVC	<p>Added the following as CVC:</p> <ul style="list-style-type: none"> • REGDOC-2.10.1, Nuclear Emergency Preparedness and Response, Version 2, superseded RD-353, <i>Testing and Implementation of Emergency Measures</i>
10.2	CVC	<p>Changed the following:</p> <ul style="list-style-type: none"> • National Building Code of Canada (2010) to National Building Code of Canada (2015) • National Fire Code of Canada (2010) to National Fire Code of Canada (2015). <p>Added the following as CVC:</p> <ul style="list-style-type: none"> • CSA N393-13, <i>Fire protection for facilities that process, handle, or store nuclear substances</i> <p>Deleted the following:</p> <ul style="list-style-type: none"> • NFPA 801, as it has been replaced by CSA N393-13.
11.1	CVC	<ul style="list-style-type: none"> • Added OPG-STD-0156 as CVC since it superseded N-PROC-OP-0043 • Added OPG-PROC-0126 • Added transition date for CSA N292.0-19 <i>General principles for the management of radioactive waste and irradiated fuel</i> • Removed CSA N292.2-07 and N292.3-08 as they were superseded by the documents that were added below.

LC(s)	Sub-section	Change
		Added the following as CVC: <ul style="list-style-type: none"> • CSA N292.0 <i>General principles for the management of radioactive waste and irradiated fuel</i> • CSA N292.2 <i>Interim dry storage of irradiated fuel</i> • CSA N292.3 <i>Management of low- and intermediate-level radioactive waste</i>
11.1	Guidance	Added REGDOC-2.11 Framework for Radioactive Waste Management and Decommissioning in Canada as guidance
11.2	CVC	Added transition date for CSA N294-19 <i>Decommissioning of facilities containing nuclear substances</i>
12.1	CVC	Added the following as CVC: <ul style="list-style-type: none"> • REGDOC-2.2.4 Fitness for Duty, Volume III: Nuclear Security Officer Medical, Physical, and Psychological Fitness • REGDOC-2.12.1 <i>High-Security Facilities, Volume II: Criteria for Nuclear Security Systems and Devices</i>
12.1	Guidance	Added REGDOC-2.12.3 Security of Nuclear Substances: Sealed Sources and Category I, II, and III Nuclear Material, Version 2 as guidance, to replace G-274 and G-208.
12.2	CVC & Guidance	Deleted the following, as it is already included under LC 12.1: <ul style="list-style-type: none"> • RD-361 <i>Criteria for Explosive Substance Detection, X-Ray Imaging and Metal Detection Devices at High-Security Sites</i> • RD-321 <i>Criteria for Physical Protection Systems and Devices at High-Security Sites</i>
13.1	CVC	<ul style="list-style-type: none"> • Added REGDOC-2.13.1 Safeguards and Nuclear Material Accountancy as CVC (with a transition date of March 31, 2020). • Added N-STD-RA-0024 as CVC
15.1	CVC	<ul style="list-style-type: none"> • Removed NFPA 801 and replaced with CSA N393 as CVC.

LC(s)	Sub-section	Change
		<p>Changed the following:</p> <ul style="list-style-type: none"><li>• National Building Code of Canada (2010) to National Building Code of Canada (2015)<li>• National Fire Code of Canada (2010) to National Fire Code of Canada (2015).

Revisions to LCH for Pickering Nuclear Generating Station

On April 23, 2020, 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 R003:

LC(s)	Sub-section	Change
G.6	CVC	Added REGDOC-3.2.1 Public Information and Disclosure . OPG submitted an implementation plan, and once fully implemented, REGDOC-3.2.1 will supersede RD/GD-99.3.
2.1	CVC	Added REGDOC-2.2.4, Fitness for Duty: Managing Worker Fatigue . Added REGDOC-2.2.4, Fitness for Duty, Volume II: Managing Alcohol and Drug Use, version 2 . CNSC staff have accepted the revised implementation timeline where all requirements other than random alcohol and drug testing will be implemented 6 months from the publication of REGDOC-2.2.4 Volume II, version 3. OPG will implement random alcohol and drug testing 12 months from the publication of REGDOC-2.2.4 Volume II, version 3. REGDOC-2.2.4 Fitness for Duty, Volume III: Nuclear Security Officer Medical, Physical and Psychological Fitness , replaces RD-363.
2.4	CVC	REGDOC-2.2.3 Personnel Certification, Volume III: Certification of Persons Working at Nuclear Power Plants replaces RD-204 <i>Certification of Persons Working at Nuclear Power Plants</i> .
3.1	CVC	Added CNSC conditional approval for irradiating Pickering NGS Units 6, 7, and 8 Cobalt adjuster rods beyond current limit of 2.2 Full Power Years to 3 Full Power Years.
6.1	CVC	Updated CVC to reflect regulatory position in CVC subsection titled “Pressure Tube-Calandria Tube (PT-CT) contact assessment for Pickering NGS-B inspected channels”.
6.1	CVC	Updated CVC to reflect regulatory position in CVC subsection titled “Pressure Tube-Calandria Tube (PT-CT)

LC(s)	Sub-section	Change
		<p>contact assessment for Pickering NGS-B inspected channels”.</p> <p>This consent pertains to partial exemption from CSA N285.4-05 clause 12.2.4.6.2 (c).</p>
6.1	CVC	Updated CVC to reflect CNSC consent to OPG’s adoption of the 2019 edition of CSA N285.4 for clauses 6.1.4.2, 7.6.1, 8.2.2, 8.2.5, 8.3.1, 8.3.2, 8.3.3, 9.4 and Table 5.
9.1	CVC	<p>P-REP-03482-00006 <i>Derived Release Limits and Environmental Action Levels for Pickering Nuclear</i>, replaces NA44-REP-03482-00001 <i>Derived Release Limits and Environmental Action Levels for Pickering Nuclear Generating Station A</i>, and NK30-REP-03482-00001 <i>Derived Release Limits and Environmental Action Levels for Pickering Nuclear Generating Station B</i>.</p>
9.1	CVC	<p>REGDOC-2.9.1 Environmental Protection: Environmental Principles, Assessments and Protection Measures, version 1.1 (2017 edition), supersedes REGDOC-2.9.1 (2013 edition).</p>
10.1	CVC	<p>REGDOC-2.10.1 Nuclear Emergency Preparedness and Response, version 2 (2017 edition) supersedes REGDOC-2.10.1 (2014 edition).</p>
12.1	CVC	<p>REGDOC-2.12.1 <i>High Security Facilities, Volume I: Nuclear Response Force, version 2 (2018 edition)</i> supersedes REGDOC-2.12.1 (2013 edition).</p>
13.1	CVC	<p>Added REGDOC-2.13.1 Safeguards and Nuclear Material Accountancy, 2018 edition, with exception to enforcement of requirements related to non-fuel nuclear material inventory. OPG will implement the requirements for non-fuel nuclear material inventory by March 31, 2021.</p> <p>Added: When Nuclear Material Accountancy Reporting (NMAR) e-business system is not available, OPG is to contact the CNSC International Safeguards Division (cnsccs@csn.gc.ca) to inform them of the issue and to seek guidance on how to fulfill reporting requirements</p>

Revisions to LCH for Pickering Waste Management Facility

On July 22, 2020 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 R001:

LC(s)	Sub-section	Change
G.1	Preamble	REGDOC-3.5.3, <i>Regulatory Fundamentals</i> superseded <i>CNSC INFO 0795</i>
G.3	CVC	Added the following as CVC: <ul style="list-style-type: none"> • <i>CSA N294-09 Decommissioning of facilities containing nuclear substances.</i> • <i>CSA N294-19 Decommissioning of facilities containing nuclear substances (with a transition date).</i>
G4	CVC	Added REGDOC-3.2.1, <i>Public Information and Disclosure</i> as CVC (with a transition date of August 7, 2020), to replace RD/GD-99.3.
1.1	Guidance	Added REGDOC-2.2.1 <i>Human Factors</i> as guidance
2.1	CVC	Added the following as CVC: <ul style="list-style-type: none"> • REGDOC-2.2.4 <i>Fitness for Duty: Managing Worker Fatigue</i> • REGDOC-2.2.4 <i>Fitness for Duty, Volume II: Managing Alcohol and Drug Use, version 2</i> • REGDOC-2.1.2, <i>Safety Culture</i>
2.1	Guidance	Added the following as guidance: <ul style="list-style-type: none"> • REGDOC-2.2.5 <i>Minimum Staff Complement</i> • REGDOC-2.2.1 <i>Human Factors</i>
3.2	CVC	Added the following as CVC: <ul style="list-style-type: none"> • REGDOC-3.2.1 <i>Public Information and Disclosure</i> (with a transition date)

LC(s)	Sub-section	Change
		<ul style="list-style-type: none"> • REGDOC-3.1.2 Reporting Requirements, Volume 1: Non-Power Reactor Class I Nuclear Facilities and Uranium Mines and Mills
4.1	CVC	Added CSA N286.7, <i>Quality assurance of analytical, scientific, and design computer programs</i> as a CVC (with a transition date of March 31, 2021).
5.1	CVC	<p>Changed the following:</p> <ul style="list-style-type: none"> • National Building Code of Canada (2010) to National Building Code of Canada (2015) • National Fire Code of Canada (2010) to National Fire Code of Canada (2015). <p>Deleted CSA N286-12, <i>Management system requirements for nuclear facilities</i> due to repetition (already covered under different section of LCH).</p>
5.2	CVC	Changes in the “ <i>Classification and Registration of Fire Protection Systems</i> ” section in accordance with document N-CORR-00531-19224.
5.2	Guidance	Added N-REF-01913.11-10001 <i>Temporary Leak Maintenance by Leak Mitigation Process</i> as guidance.
6.1	CVC	<ul style="list-style-type: none"> • REGDOC-2.6.3 Aging Management superseded RD-334 <i>Aging Management for Nuclear Power Plants</i>. • Added N-PROG-MP-0009, <i>Design Management</i> as a CVC. • Changed from N-PROG-MP-0007 to N-STD-MP-0028.
9.1	CVC	<ul style="list-style-type: none"> • N-PROG-OP-0006 <i>Environmental Management</i> superseded by OPG-PROG-0005 <i>Environmental Management System</i>. • Added CSA N288.7-15, <i>Groundwater protection programs at Class I nuclear facilities and uranium mines and mills</i> as CVC (with a transition date of December 31, 2022.)

LC(s)	Sub-section	Change
		<ul style="list-style-type: none"> • Added P-REP-07701-00001, <i>Environmental Risk Assessment Report for Pickering Nuclear</i> as Licensee Documents that Require Notification of Change, with prior notification status. • Changed notification status of N-PROC-OP-0025 and N-STD-OP-0031 as prior notification documents. • Added CSA N288.3.4 <i>Performance testing of nuclear air-cleaning systems at nuclear facilities</i> as a CVC. • Added CSA N288.6 <i>Environmental risk assessments at class I nuclear facilities and uranium mines and mills</i> as a CVC.
10.1	CVC	<p>Added the following as CVC:</p> <ul style="list-style-type: none"> • REGDOC-2.10.1, Nuclear Emergency Preparedness and Response, Version 2, superseded RD-353, <i>Testing and Implementation of Emergency Measures</i> • Removed W-PROG-WM-0001 as it is listed under LC 11.1 of the LCH.
10.2	CVC	<p>Changed the following:</p> <ul style="list-style-type: none"> • National Building Code of Canada (2010) to National Building Code of Canada (2015) • National Fire Code of Canada (2010) to National Fire Code of Canada (2015).
11.1	CVC	<ul style="list-style-type: none"> • Added OPG-STD-0156 as CVC since it superseded N-PROC-OP-0043 • Added OPG-PROC-0126 • Added transition date for CSA N292.0-19 <i>General principles for the management of radioactive waste and irradiated fuel</i>
11.1	Guidance	<p>Added REGDOC-2.11 Framework for Radioactive Waste Management and Decommissioning in Canada as guidance</p>
11.2	CVC	<p>Added transition date for CSA N294-19 <i>Decommissioning of facilities containing nuclear substances</i></p>
12.1	CVC	<p>Added the following as CVC:</p> <ul style="list-style-type: none"> • REGDOC-2.2.4 Fitness for Duty, Volume III:

LC(s)	Sub-section	Change
		<p><u><i>Nuclear Security Officer Medical, Physical, and Psychological Fitness</i></u></p> <ul style="list-style-type: none"> • REGDOC-2.12.1 <i>High-Security Facilities, Volume II: Criteria for Nuclear Security Systems and Devices</i>
12.1	Guidance	Added <u>REGDOC-2.12.3 <i>Security of Nuclear Substances: Sealed Sources and Category I, II, and III Nuclear Material, Version 2</i></u> as guidance, to replace G-274 and G-208
12.2	CVC & Guidance	<p>Deleted the following, as it is already included under LC 12.1:</p> <ul style="list-style-type: none"> • RD-361 <i>Criteria for Explosive Substance Detection, X-Ray Imaging and Metal Detection Devices at High-Security Sites</i> • RD-321 <i>Criteria for Physical Protection Systems and Devices at High-Security Sites</i> • RD-363 <i>Nuclear Security Officer Medical, Physical, and Psychological Fitness</i> • <u>REGDOC-2.12.3 <i>Security of Nuclear Substances – Sealed Sources</i></u> • <u>REGDOC-2.12.2 <i>Site Access Security Clearance</i></u>
13.1	CVC	Added <u>REGDOC-2.13.1 <i>Safeguards and Nuclear Material Accountancy</i></u> as CVC (with a transition date of October 29, 2021).
15.1	CVC	<p>Changed the following:</p> <ul style="list-style-type: none"> • National Building Code of Canada (2010) to National Building Code of Canada (2015) • National Fire Code of Canada (2010) to National Fire Code of Canada (2015).

Revisions to LCH for Bruce A and B Nuclear Generating Stations

On December 31, 2020, 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 R002:

LC(s)	Sub-section	Change
G.5	Guidance	Update title and version number from REGDOC-3.2.2, <i>Aboriginal Engagement</i> (2015) to REGDOC-3.2.2, <i>Indigenous Engagement</i> , Version 1.1 (2019).
1.1	Guidance, CVC	<ul style="list-style-type: none"> • REGDOC-2.1.1, <i>Management System</i> as a Guidance Document, added to Section 1.1 • REGDOC-2.1.2, <i>Safety Culture</i> changed from Guidance to CVC effective April 1, 2020.
2.1	CVC	<ul style="list-style-type: none"> • REGDOC-2.2.1, <i>Human Factors</i> superseded CNSC regulatory policy P-119 Policy on human factors. • Changes to implementation dates for REGDOC-2.2.4 Vol. II, <i>Managing Alcohol and Drug Use</i>. Bruce Power will implement random alcohol and drug testing 12 months from the publication of REGDOC-2.2.4 Vol II, version 3. • REGDOC-2.2.5, <i>Minimum Staff Complement</i> superseded G-323, <i>Minimum Staff Complement</i>. • REGDOC-2.2.3, <i>Personnel Certification, Vol. III: Certification of Persons Working at Nuclear Power Plants</i> replaced RD-204, <i>Certification of Persons Working at Nuclear Power Plants</i>.
3.2	CVC	Revision of the CVC text for Section 3.2 Approval to Restart after a Serious Process Failure to emphasize that it is due to a serious process failure and not just a trip resulting in a SPF that a request for a restart is to be made.
4.1	CVC	Revision of text for Deterministic Safety Analysis according to requirement of REGDOC-2.4.1, <i>Deterministic Safety Analysis</i> , Sections 4.2.1 and 4.2.2.
5.1	CVC	<ul style="list-style-type: none"> • REGDOC-2.5.1, <i>General Design Considerations: Human Factors</i> supersedes G-276, <i>Human Factors Engineering Program</i>

LC(s)	Sub-section	Change
		<p><i>Plans and G-278, Human Factors Verification and Validation Plans.</i></p> <ul style="list-style-type: none"> Update to the date for the Submission of the implementation update for CSA N290.12-14
5.2	CVC	Added a note to licensing basis publication in in Section 5.2 for CSA N285.0 revision 2012.
6.1	CVC	<ul style="list-style-type: none"> Added implementation plan for CSA N285.5-18 with effective date January 1, 2023. Added updated implementation of CSA N285.7-15 with the effective date is Oct. 1, 2028. Updated the status of CSA N285.8-15 implementation based on Bruce Power's request on the CNSC revision. Added the Systems Important to Safety List, B-REP-09034-00002, that was revised based on S-294, <i>Probabilistic Safety Assessment</i> compliant models on June 1, 2018. CSA N290.9 (2019) added as a guidance standard in Section 6.1 and Appendix C.
7.1	CVC	Action Levels for CSF in Section 7.1 were updated according to Bruce Power request to add Central Storage Facility (CSF) that constructed to support Major Component Replacement (MCR) work.
8.1	Guidance	REGDOC-2.8.1, Conventional Health and Safety included as a guidance publication in Section 8.1 of the LCH.
9.1	CVC	<ul style="list-style-type: none"> Text for section <i>Assessment of feasible mitigation measures for thermal effluent and impingement/ entrainment</i> was updated after Bruce Power's submission on assessment of feasible mitigation measures for thermal effluent and impingement/entrainment of March 31, 2020. Table 9.1 <i>Derived Release Limits</i> and Table 9.2a <i>New Environmental Action Levels</i> were updated according to Bruce Power's request to

LC(s)	Sub-section	Change
		add Central Storage Facility (CSF) that constructed to support Major Component Replacement (MCR) work.
10.1	CVC	Updated text on automatic data transfer in Section 10.1. Bruce Power phased out DLAN at the end of 2019 and implemented a web-based solution for data transfer. CNSC staff accepted this solution in December 2019.
11.1	Guidance, CVC	<ul style="list-style-type: none"> • Added CSA N292.1-16, <i>Wet storage of irradiated fuel and other radioactive materials</i> as a guidance publication. • Added the rationale why CSA N292.2 being a guidance document in the LCH. • Added BP-PROG-12.03, <i>Nuclear Fuel Management</i> as a document, which requires notification when implemented and cited in the LCH as a CVC document.
12.1	CVC	Added REGDOC-2.12.1, <i>High-Security Facilities, Vol. I: Nuclear Response Force</i> and REGDOC-2.2.4, <i>Fitness for Duty, Volume III: Nuclear Security Officer Medical, Physical, and Psychological Fitness</i> as Licensing Basis Documents in Section 12.1.
13.1	CVC	Added Nuclear Material Accountancy Reporting (NMAR) e-business system to CVC to avoid a potential non-compliance with REGDOC-2.13.1, Safeguards and Nuclear Material Accountancy .
15.5	Guidance	Text regarding REGDOC-2.3.1, Conduct of Licensed Activities: Construction and Commissioning Programs at MCR included in the Guidance section.
Appendix B		The list of All Version-Controlled Documents was updated as per above-mentioned changes.
Appendix C		The list of Other CNSC documents referenced in the LCH was updated as per above-mentioned changes.
Appendix D		The list of Licensee Documents Requiring Written Notification was updated as per above-mentioned changes.

Revisions to LCH for Western Waste Management Facility

On August 4, 2020 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 R001:

LC(s)	Sub-section	Change
G.1	Preamble	REGDOC-3.5.3, Regulatory Fundamentals superseded <i>CNSC INFO 0795</i>
G.1	CVC	Added the following licensee documents as CVC: <ul style="list-style-type: none"> W-CORR-00531-01118, <i>Application for Renewal of Western Waste Management Facility Operating Licence</i> W-CORR-00531-01282, <i>Additional Information to Support the Application for Renewal of Western Waste Management Facility Operating Licence</i>
G.3	CVC	Added the following as CVC: <ul style="list-style-type: none"> CSA N294-09 <i>Decommissioning of facilities containing nuclear substances.</i> CSA N294-19 <i>Decommissioning of facilities containing nuclear substances (with a transition date).</i>
G.4	CVC	Added REGDOC-3.2.1, Public Information and Disclosure as CVC (with a transition date of August 7, 2020), to replace RD/GD-99.3.
1.1	Guidance	Added REGDOC-2.2.1 Human Factors as guidance
1.2	CVC	Deleted the following, as the documents are included under LC 1.1: <ul style="list-style-type: none"> OPG, Nuclear Management Systems Organizations, N-STD-AS-0020 OPG, Health and Safety Management System Program, OPG-PROG-0010 OPG, Nuclear Safety Oversight, N-STD-AS-0023 OPG, Nuclear Management System, N-CHAR-AS-0002

LC(s)	Sub-section	Change
2.1	CVC	Added the following as CVC: <ul style="list-style-type: none"> • REGDOC-2.2.4 Fitness for Duty: Managing Worker Fatigue • REGDOC-2.2.4 Fitness for Duty, Volume II: Managing Alcohol and Drug Use, version 2 • REGDOC-2.1.2, Safety Culture
2.1	Guidance	Added the following as guidance: <ul style="list-style-type: none"> • REGDOC-2.2.5 Minimum Staff Complement • REGDOC-2.2.1 Human Factors
2.2	CVC	Added the following as CVC: <ul style="list-style-type: none"> • REGDOC-2.2.2, Personnel Training • Added the following text as CVC: “The licensee shall implement and maintain training programs for workers in accordance with CNSC regulatory document REGDOC-2.2.2, Personnel Training”.
2.2	Guidance	Removed TPED-01 - <i>Objectives and Criteria for Regulatory Evaluation of Nuclear Facility Training Programs, 2013</i> from guidance.
3.2	CVC	Added the following as CVC: <ul style="list-style-type: none"> • REGDOC-3.2.1 Public Information and Disclosure (with a transition date.) • REGDOC-3.1.2 Reporting Requirements, Volume 1: Non-Power Reactor Class I Nuclear Facilities and Uranium Mines and Mills
4.1	CVC	Added the following as CVC: <ul style="list-style-type: none"> • CSA N292.0-14 <i>General principles for the management of radioactive waste and irradiated fuel</i> • CSA N292.2-13 <i>Interim dry storage of irradiated fuel</i> • CSA N292.3-14 <i>Management of low- and intermediate-level radioactive waste</i> • CSA N286.7-16 <i>Quality assurance of analytical, scientific, and design computer programs</i> (with a transition date)

LC(s)	Sub-section	Change
5.1	CVC	<p>Added the following as CVC:</p> <ul style="list-style-type: none"> • CSA N393-13, <i>Fire protection for facilities that process, handle, or store nuclear substances</i> <p>Changed the following:</p> <ul style="list-style-type: none"> • National Building Code of Canada (2010) to National Building Code of Canada (2015) • National Fire Code of Canada (2010) to National Fire Code of Canada (2015). • N-PROG-MP-0007 to N-STD-MP-0028 <p>Deleted the following:</p> <ul style="list-style-type: none"> • CSA N286-12 <i>Management system requirements for nuclear facilities</i> because of repetition. • NFPA-801 as it was replaced by CSA N393-13.
5.2	Guidance	Added N-REF-01913.11-10001 <i>Temporary Leak Maintenance by Leak Mitigation Process</i> as guidance.
6.1	CVC	<ul style="list-style-type: none"> • REGDOC-2.6.3 Aging Management superseded <i>RD-334 Aging Management for Nuclear Power Plants</i>. • Added N-PROG-MP-0009, Design Management as a CVC. • Changed from N-PROG-MP-0007 to N-STD-MP-0028.
6.1	Guidance	REGDOC-2.6.2: Maintenance Programs for Nuclear Power Plants added as guidance.
7.1	CVC	Added N-REP-03420-10011 <i>Occupational Radiation Protection Action Levels for Nuclear Waste Management Facilities</i> as CVC.
9.1	CVC	<ul style="list-style-type: none"> • N-PROG-OP-0006 <i>Environmental Management</i> superseded by OPG-PROG-0005 <i>Environmental Management System</i>. • Added CSA N288.7-15, <i>Groundwater protection programs at Class I nuclear facilities and uranium mines and mills</i> as CVC (with as transition for December 31, 2022.)
10.1	CVC	The following was added as CVC:

LC(s)	Sub-section	Change
		<ul style="list-style-type: none"> • N-PROG-RA-0001 <i>Consolidated Nuclear Emergency Plan</i> • REGDOC-2.10.1 Nuclear Emergency Preparedness and Response, Version 2 superseded RD-353 <i>Testing and Implementation of Emergency Measures</i>
10.2	CVC	<p>Changed the following:</p> <ul style="list-style-type: none"> • National Building Code of Canada (2010) to National Building Code of Canada (2015) • National Fire Code of Canada (2010) to National Fire Code of Canada (2015).
11.1	Preamble	<p>Added in preamble: “<i>CNSC Regulatory Document REGDOC-2.11 Framework for Radioactive Waste Management and Decommissioning in Canada, defines radioactive waste as any material (liquid, gaseous or solid) that contains a radioactive “nuclear substance,” as defined in section 2 of the NSCA, and which the owner has declared to be waste. In addition to containing nuclear substances, radioactive waste may also contain non-radioactive “hazardous substances,” as defined in section 1 of the General Nuclear Safety and Control Regulations</i>”.</p>
11.1	CVC	<p>Added the following as CVC:</p> <ul style="list-style-type: none"> • OPG-STD-0156, Management of Waste and Other Environmentally Regulated Materials • Added transition date for CSA N292.0-19, <i>General principles for the management of radioactive waste and irradiated fuel</i> (by December 10, 2021).
11.1	Guidance	<p>Added REGDOC-2.11 Framework for Radioactive Waste Management and Decommissioning in Canada as guidance.</p>
11.2	CVC	<p>Added transition date for CSA N294-19 <i>Decommissioning of facilities containing nuclear substances</i></p>
12.1	CVC	<p>Added REGDOC-2.2.4 Fitness for Duty, Volume III: Nuclear Security Officer Medical, Physical, and Psychological Fitness as a CVC.</p>
12.1	Guidance	<p>G-274 <i>Security Programs for Category I or II Nuclear Material or Certain Nuclear Facilities</i> and G-208 <i>Transportation Security Plans for Category I, II, or III Nuclear Material</i> superseded by</p>

LC(s)	Sub-section	Change
		REGDOC-2.12.3 <i>Security of Nuclear Substances – Sealed Sources</i> .
12.2	CVC & Guidance	<p>Deleted the following, as it is already included under LC 12.1:</p> <ul style="list-style-type: none"> • RD-361 <i>Criteria for Explosive Substance Detection, X-Ray Imaging and Metal Detection Devices at High-Security Sites</i> • RD-321 <i>Criteria for Physical Protection Systems and Devices at High-Security Sites</i> • RD-363 <i>Nuclear Security Officer Medical, Physical, and Psychological Fitness</i> • REGDOC-2.12.3 <i>Security of Nuclear Substances – Sealed Sources</i> • REGDOC-2.12.2 <i>Site Access Security Clearance</i>
13.1	CVC	Added REGDOC-2.13.1 <i>Safeguards and Nuclear Material Accountancy</i> (2018) as a CVC (with a transition date of October 29, 2021)
15.1	CVC	<p>Changed the following:</p> <ul style="list-style-type: none"> • National Building Code of Canada (2010) to National Building Code of Canada (2015) • National Fire Code of Canada (2010) to National Fire Code of Canada (2015).