



Canadian Nuclear  
Safety Commission

Commission canadienne  
de sûreté nucléaire

## Record of Decision

In the Matter of

Applicant Ontario Power Generation Inc.

Subject Application to Renew the Nuclear Power  
Reactor Operating Licence for the Pickering  
Nuclear Generating Station

Public Hearing April 4, 2018  
Dates June 25 – 29, 2018



## RECORD OF DECISION

Applicant: Ontario Power Generation Inc.

Address/Location: 700 University Avenue, Toronto ON, M5G 1X6

Purpose: Application to Renew the Nuclear Power Reactor Operating Licence for the Pickering Nuclear Generating Station

Application received: August 28, 2017  
December 11, 2017 (supplementary information to the August 28, 2017 application)

Dates of public hearing: April 4, 2018 (Part 1)  
June 25 – 29, 2018 (Part 2)

Location: Part 1: Canadian Nuclear Safety Commission (CNSC) Public Hearing Room, 280 Slater St., 14th Floor, Ottawa, Ontario  
  
Part 2: Pickering Recreation Complex, 1867 Valley Farm Road, Pickering, Ontario

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R. Velshi K. Penney  
T. Berube

Secretary: M.A. Leblanc  
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**Licence: Renewed**

**Operation of Pickering Nuclear Generating Station Units 5 – 8 up to a maximum of 295,000  
Equivalent Full Power Hours: Authorized**



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## 1.0 INTRODUCTION

1. Ontario Power Generation Inc. (OPG) has applied to the Canadian Nuclear Safety Commission<sup>1</sup> for the renewal of the Nuclear Power Reactor Operating Licence (PROL) for its Pickering Nuclear Generating Station (PNGS) located on the north shore of Lake Ontario in Pickering, Ontario. The previous operating licence, PROL 48.04/2018, expired on August 31, 2018. OPG requested a renewal of the licence for a period of 10 years. On August 8, 2018, the Commission renewed the operating licence for the PNGS.<sup>2</sup> This *Record of Decision* provides the detailed reasons for that decision.
2. The PNGS is comprised of two reactor facilities – PNGS-A and PNGS-B – and consists of eight CANDU pressurized heavy water reactors and their associated equipment. Units 1 and 4 (PNGS-A) each have a nominal electrical output of 515 (MWe), Units 5 – 8 (PNGS-B) each have a nominal output of 516 MWe, and Units 2 and 3 are in a safe storage with surveillance (safe storage) state until the decommissioning of the nuclear generating station (NGS). The in-service dates for Units 1 – 4 were between 1971 and 1973 and the in-service dates for Units 5 – 8 were between 1983 and 1986.
3. The PNGS implements a cobalt-60 (Co-60) program whereby Co-60, a radioisotope that has a range of industrial, medical and food processing applications, is harvested during planned outages from the irradiated reactor components. With this application, OPG is requesting regulatory approval to continue implementing its Co-60 program. The Pickering nuclear site also includes the Pickering Waste Management Facility (PWMF) which is licensed separately under a Class IB Waste Facility Operating Licence. The PWMF operating licence was renewed in February 2018 until August 31, 2028.<sup>3</sup>
4. During the previous PNGS licence renewal hearing in 2013,<sup>4</sup> OPG had indicated the intention to cease commercial operation of the PNGS in 2020. In June 2016, the Province of Ontario requested OPG to plan for the safe operation of the PNGS beyond 2020, with OPG informing the CNSC in June 2017 that it would seek regulatory authorization to operate the PNGS until December 31, 2024.

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<sup>1</sup> The *Canadian Nuclear Safety Commission* is referred to as the “CNSC” when referring to the organization and its staff in general, and as the “Commission” when referring to the tribunal component.

<sup>2</sup> CNSC Summary Record of Decision – Ontario Power Generation Inc., *Application to Renew the Nuclear Power Reactor Operating Licence for the Pickering Nuclear Generating Station*, issued August 2018.

<sup>3</sup> CNSC Record of Decision – Ontario Power Generation Inc., *Application to Renew the Waste Facility Operating licence for the Pickering Waste Management Facility*, issued February 2018.

<sup>4</sup> CNSC Record of Proceedings, Including Reasons for Decision – Ontario Power Generation Inc., *Application to Renew the Power Reactor Operating Licence for the Pickering Nuclear Generating Station*, issued August 2013.

5. In May 2014, and in consideration of the 2020 end of commercial operations (ECO) plan, the Commission approved OPG's request to operate the PNGS up to 247,000 equivalent full power hours (EFPH).<sup>5</sup> With OPG's current request to continue commercial operation until the end of 2024, OPG is requesting the authorization to operate PNGS Units 5 – 8 up to 295,000 EFPH.
6. In September 2017, up to \$100,000 in funding to participate in this licensing process was made available to Indigenous peoples, members of the public and stakeholders through the CNSC's Participant Funding Program (PFP). A Funding Review Committee (FRC) – independent of the CNSC – recommended that up to \$112,962 in participant funding be provided to 10 applicants. These applicants were required, by virtue of being awarded funding, to submit a written intervention and make an oral presentation at Part 2 of the public hearing commenting on OPG's application. One PFP recipient withdrew its request prior to Part 2 of the public hearing on this matter.

#### Issues

7. In considering the application, the Commission was required to decide:
  - a) what environmental assessment review process to apply in relation to this application;
  - b) whether OPG is qualified to carry on the activity that the licence would authorize; and
  - c) whether, in carrying on that activity, OPG will make adequate provision for the protection of the environment, the health and safety of persons and the maintenance of national security and measures required to implement international obligations to which Canada has agreed.
8. The Commission was also required to decide:
  - a) whether to authorize OPG to operate PNGS Units 5-8 beyond 247,000 EFPH, up to 295,000 EFPH.

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<sup>5</sup> CNSC Record of Proceedings, Including Reasons for Decision – Ontario Power Generation Inc., *Application to Request Removal of a Hold Point for the Pickering Nuclear Generating Station*, issued July 2014.

### Public Hearing

9. The Commission, in making its decision, considered information presented for a two-part public hearing held on April 4, 2018 in Ottawa, Ontario and from June 25 to 29, 2018 in Pickering, Ontario.<sup>6</sup> The public hearing was conducted in accordance with the *Canadian Nuclear Safety Commission Rules of Procedure* (the Rules).<sup>7</sup> During the public hearing, the Commission considered written submissions and heard oral presentations from OPG (CMD 18-H6.1, CMD 18-H6.1A, CMD 18-H6.1B and 18-H6.1C) and CNSC staff (CMD 18-H6, 18-H6.A, CMD 18-H6.B and 18-H6.C). The Commission also considered oral and written submissions from 155 intervenors (see Appendix A for a list of interventions). The hearing was webcast live via the CNSC website, with video archives available following the hearing. A *Summary Record of Decision* was issued on August 8, 2018.

### Requests for Ruling

10. The Commission has made its Rules and interprets them in light of the direction Parliament gave to the Commission in subsection 20(3) of the *Nuclear Safety and Control Act*<sup>8</sup> (NSCA), that it deal with all proceedings “as informally and expeditiously as the circumstances and considerations of fairness permit.” In this context, Rule 20 contemplates that a participant in a public hearing may request that the Commission rule on a particular issue. Such a request may be made at any time before the start of a public hearing or during a public hearing. The rule contemplates that the “relevant persons” – those whose interests might be affected by the ruling that is requested – have notice of a request and have an opportunity to present their views on it, before a ruling may be made.
11. Requests for rulings can contribute to the Commission ensuring that it conducts an expeditious and fair hearing. Such requests are always in the context of a particular hearing, and some requests for a ruling on a matter of substance or procedure can contribute to a fair hearing and should be dealt with specifically – a ruling on substance might narrow the scope of a hearing, for example, or might fully address a matter arising in a hearing, or might speak to the limiting of participation in a hearing, as contemplated in paragraph 2(b) of Rule 20. In such circumstances, the potential for specific rulings before or within a hearing is positive, and reliance on the rule, salutary. Requests for rulings are appropriate in respect of matters that either would not otherwise arise in a hearing and a participant feels a ruling would clarify or simplify a matter in some way, or would advance the Commission’s consideration of the subject-matter of the hearing in some way that merits separate treatment outside

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<sup>6</sup> President Binder presided over the public hearing for this matter. His term on the Commission came to an end on 8 August 2018. Commission member Velshi became President of the Commission on 22 August 2018. Pursuant to subsection 23(2) of the NSCA, Dr. Binder was authorized by President Velshi to take part in the disposition of this matter. This decision and its reasons reflect the consensus reached by the Commission.

<sup>7</sup> Statutory Orders and Regulations (SOR)/2000-211

<sup>8</sup> Statutes of Canada (S.C.) 1997, chapter (c.) 9

of or in addition to the flow of the hearing.

12. On the other hand, Rule 20 is not meant as a substitute for, or supplement to, the normal unfolding of a hearing. Rule 20 is not a vehicle to make additional submissions to those made within the hearing process. That is, a request for the Commission to rule should deal with something other than that which the hearing itself is about. Those matters on which the Commission is gathering evidence and submissions in the hearing are not generally appropriate subject matter for a Rule 20 request. Use of Rule 20 in that context could impair the hearing process in one of several ways: by pre-empting the completion of the hearing record; rendering the time limits on the making of hearing submissions ineffectual; or lengthening the hearing with additional procedural considerations. Given the implications for the efficiency and the fairness of a hearing, Rule 20 should be mindfully used by hearing participants and judiciously managed by the Commission within its hearing process.
13. The Commission received five requests for ruling pursuant to subrule 20(3) of the Rules, with three filed just before the beginning of Part 2 of the hearing, one which accompanied interventions (CMD 18-H6.160) and one which was filed following an intervention (CMD 18-H6.161). These requests for ruling were filed by:
  - The Canadian Environmental Law Association (CELA) and Greenpeace on June 25, 2018 (CMD 18-H6.157)
  - CELA, Greenpeace and Northwatch on June 25, 2018 hearing (CMD 18-H6.158)
  - CELA, Greenpeace and Durham Nuclear Awareness (DNA) on June 25, 2018 (CMD 18-H6.159)
  - CELA on June 26, 2018 (CMD 18-H6.160)
  - Greenpeace on June 28, 2018 (CMD 18-H6.161)

The Commission notes that the requests for ruling were supported by several other intervenors, including the Canadian Association of Physicians for the Environment, L. Bertrand, and S. Smith. The Commission also notes that the Commission Secretary provided OPG the opportunity to respond to the requests for ruling and OPG did so.

14. The ruling requests were made by intervenors. While one request had a deadline proposed for compliance with the ruling that was requested, in general the requests dealt with what the hearing was about and merited no specific 'hearing within a hearing' to get to a particular ruling, under Rule 20. What licence conditions should be imposed respecting the ECO at the PNGS was a live issue for the hearing, as were the adequacy of emergency planning, the definitions of planning zones under the *Provincial Nuclear Emergency Response Plan*<sup>9</sup> (PNERP), the issue of KI pill distribution, and what public education programs about nuclear emergency

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<sup>9</sup> *Ontario Provincial Nuclear Emergency Response Plan (PNERP) Master Plan 2017*, Office of the Fire Marshal and Emergency Management, Ministry of Community Safety and Correctional Services, 2017.

preparedness should be undertaken and by whom. All of these matters were the subject of evidence and submissions by hearing participants and invited officials, and were going to be treated in the Commission's decision-making with respect to the renewal application. In this context, having specific requests under Rule 20 in relation to these issues was not helpful to the hearing process.

15. The requests for rulings all provided a certain rationale for use of Rule 20 in respect of these matters, by submitting that the requests were not time-barred, were within the scope of the hearing, were not duplicative of interventions and that the rule itself was not limited to procedural matters. The Commission is of the view that, notwithstanding any of these rationales, the basis for the rulings that were requested should more properly have been made in the interventions themselves; to some extent, they were. Reliance on Rule 20 for these matters was not an apt use of the rule, and the Commission hopes that in future, Rule 20 is used for matters that merit being dealt with specifically. For these Rule 20 requests, then, the Commission need not issue rulings in order to deal with the requests. Rather, as the matters raised are aspects of the issues that were before the Commission during the course of the hearing, this decision does address what licence conditions the Commission is imposing, this *Record of Decision* does contain those statements the Commission finds important to make in respect of the renewal and the licence, and these reasons address the Commission's appreciation of the issue of emergency preparedness and the adequacy of the measures that are in place.

#### Mandate of the Commission

16. Many intervenors provided the Commission with information about the socioeconomic impacts of the PNGS. The Commission notes that, as the regulatory authority over nuclear matters in Canada, it has no socioeconomic mandate and will not base its decisions on the social or economic impacts of a facility. It is the health, safety and security of the public, the protection of the environment, national security, and the implementation of the international obligations to which Canada has agreed that guide the Commission's decisions, in accordance with the NSCA.
17. The Commission further notes that it is the responsibility of the Ontario provincial government to address fundamental energy policy questions, such as the degree of reliance on nuclear energy. The CNSC does not have this statutory authority, nor will it consider questions that are of a political nature. Where, as here, OPG has applied to renew the operation of the PNGS, the role of the Commission is to determine whether and how such operation can be done in accordance with the NSCA, and to regulate it accordingly.

Scope of this Licence Renewal Application and Public Hearing

18. The Commission notes that the scope of OPG's licence renewal application and of this public hearing was the renewal of the PNGS operating licence. It did not consider the licensed activities at the PWSMF, which is located on the same site as the PNGS. As noted earlier in this *Record of Decision*, in February 2018, following a public hearing with public participation, the Commission renewed OPG's operating licence for the PWSMF for a period of ten years. The licensing of the PWSMF is not within the scope of this PNGS licence renewal hearing.
19. The Commission understands that the end state of the PNGS site is an important concern for intervenors. However, the Commission notes that as this hearing was for the renewal of the PNGS operating licence and not for the issuance of a decommissioning licence, those issues are outside the scope of these proceedings and will be considered at future proceedings with public participation, as appropriate.

**2.0 DECISION**

20. Based on its consideration of the matter, as described in detail in the following sections of this *Record of Decision*, the Commission concludes that OPG is qualified to carry on the activity that the licence will authorize. The Commission is of the opinion that OPG, in carrying on that activity, will make adequate provision for the protection of the environment, the health and safety of persons and the maintenance of national security and measures required to implement international obligations to which Canada has agreed. Therefore,
21. 

the Commission, pursuant to section 24 of the *Nuclear Safety and Control Act*, renews the Nuclear Power Reactor Operating Licence issued to Ontario Power Generation Inc. for its Pickering Nuclear Generating Station located in Pickering, Ontario. The renewed licence, PROL 48.00/2028, is valid from September 1, 2018 until August 31, 2028; and

the Commission authorizes Ontario Power Generation Inc. to operate the Pickering Nuclear Generating Station Units 5 – 8 up to a maximum of 295,000 equivalent full power hours.
22. The Commission includes in the licence the conditions as recommended by CNSC staff in CMD 18-H6 and CMD 18-H6.B. The Commission also delegates authority for the purpose of licence condition 3.2,<sup>10</sup> as recommended by CNSC staff.

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<sup>10</sup> Licence condition 3.2: "The licensee shall not restart a reactor after a serious process failure without the prior written approval of the Commission, or prior written consent of a person authorized by the Commission."

23. The Commission is satisfied that an environmental assessment under the *Canadian Environmental Assessment Act, 2012*<sup>11</sup> (CEAA 2012) was not required in this matter and considers the environmental review that was conducted by CNSC staff to be acceptable and thorough.
24. With this decision, the Commission directs CNSC staff to report annually on the performance of OPG and PNGS, as part of an annual *Regulatory Oversight Report* (ROR). CNSC staff shall present this report at a public proceeding of the Commission, where members of the public will be able to participate. The Commission encourages Indigenous groups and members of the public to participate in the proceedings considering the annual ROR.
25. The Commission notes that CNSC staff can bring any matter to the Commission which merits its attention. The Commission directs CNSC staff to inform the Commission on an annual basis of changes that are made to the Licence Conditions Handbook (LCH).
26. The Commission directs that, around the mid-point of the 10-year licence period and no later than 2023, OPG shall present to the Commission a comprehensive mid-term update on its licensed activities at the PNGS. This mid-term update will take place during a public Commission proceeding in the vicinity of the community that hosts the PNGS. The Commission intends, for this proceeding, that Indigenous groups, members of the public and stakeholders will be able to intervene.
27. The Commission recognizes the concerns expressed by many intervenors during this hearing in respect of the potential for the continuation of commercial operations at the PNGS beyond 2024. In this regard, the Commission's decision in this matter is based on OPG's application which indicated the intent to cease commercial operations at the PNGS on December 31, 2024. In accordance with the PNGS-specific licence condition 15.4 and the compliance verification criteria outlined for this licence condition in the draft LCH, OPG's strategy for the ECO of all PNGS reactor units will be developed and implemented well in advance of ECO, and updated regularly. OPG will inform the CNSC prior to December 31, 2022 of its intent to operate any reactor unit beyond 2024. This is part of the licensing basis for the Commission's decision herein. The commercial operation of any reactor unit of the PNGS beyond December 31, 2024 would constitute a change in OPG's licensing basis. Operation of any reactor unit beyond this date would require authorization from the Commission in the context of a separate public hearing during which Indigenous groups, members of the public and stakeholders would be able to intervene. An application from OPG for the continued operation of any PNGS reactor unit would be submitted to the Commission well before December 31, 2024 to ensure that sufficient time is available for such a proceeding to take place.

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<sup>11</sup> Statutes of Canada (S.C.) 2012, chapter (c.) 19, section (s.) 52

### 3.0 ENVIRONMENTAL ASSESSEMENT

#### 3.1 Application of the *Canadian Environmental Assessment Act, 2012*

28. In coming to its decision, the Commission was first required to determine whether an Environmental Assessment (EA) under the CEAA 2012, was required.
29. The application submitted by OPG is for a licence renewal and OPG is not requesting authorization for new projects or physical activities.<sup>12</sup> The Commission notes that a licence renewal is not a designated project under CEAA 2012.
30. Based on its consideration of the EA requirements for this licence renewal, the Commission is satisfied that an EA under CEAA 2012 is not required in regard to this licence renewal.
31. The Commission notes that four previous EAs for projects at the PNGS site have been carried out under the *Canadian Environmental Assessment Act*<sup>13</sup> (CEAA 1992). These included EAs in regard to the PNGS-A return to service (2001); the PWMF Phase II expansion project located at the PNGS site (2004); PNGS-A Units 2 and 3 guaranteed defuelled state (2008); and the refurbishment and continued operation of PNGS-B (2009). The Commission further notes that its decisions concerning all four EAs indicated that, with appropriate mitigation measures, the projects that were assessed at the PNGS site were not likely to cause significant adverse environmental effects.
32. CNSC staff submitted information to the Commission about EA follow-up programs that OPG had implemented for the PNGS-A return to service and the PWMF Phase II projects. CNSC staff reported that OPG had completed the PNGS-A return to service EA follow-up program to CNSC staff's satisfaction. With regard to the EA follow-up for the PWMF Phase II project, CNSC staff reported that OPG had submitted the first of two follow-up reports and that CNSC staff would continue to review the detailed monitoring plans for the EA follow-up program to ensure that OPG was meeting the program's objectives.
33. The Commission notes concerns submitted by intervenors including the CELA, Greenpeace, Northwatch, Swim Drink Fish / Lake Ontario Waterkeeper (the Waterkeeper), the Regional Municipality of Durham and individuals regarding the lack of a requirement for an EA under CEAA 2012 for any future decommissioning licence application that may be submitted by OPG. The Commission states that EAs as they relate to any future licensing applications will be carried out under the appropriate legislation in force at the time that such an application is submitted.

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<sup>12</sup> "Projects" as defined in section 66 of CEAA 2012.

<sup>13</sup> S.C. 1992, c. 7



### 3.2 CNSC Environmental Review

34. The Commission considered the completeness and adequacy of the environmental review carried out by CNSC staff for this licence renewal, as presented in CNSC staff's environmental review report. OPG submitted that it provided CNSC staff with the 2017 PNGS site-wide Environmental Risk Assessment (ERA) and Predictive Effects Assessment (PEA) reports in support of the PNGS licence renewal application and the CNSC environmental review.
35. CNSC staff submitted that findings from the environmental review for the PNGS licence renewal application showed that:
  - OPG's environmental protection programs met CNSC regulatory requirements and results from OPG's and from other regional monitoring programs carried out by other levels of government confirmed that the environment and health of persons around the PNGS were protected.
  - OPG carried out an ERA in relation to the licensed activities at the PNGS and a PEA in respect of future stabilization and safe storage with surveillance activities in accordance with CSA N288.6-12, *Environmental risk assessment at Class I nuclear facilities and uranium mines and mills*.<sup>14</sup>
  - The 2014, 2015 and 2017 sampling results from the CNSC's Independent Environmental Monitoring Program (IEMP) showed that the public and the environment near the PNGS site were protected from releases from the facility.
36. CNSC staff submitted that a detailed technical review of the results from the 2017 PNGS site-wide ERA showed that, overall, adverse ecological and human health effects due to releases to air and water were unlikely and were in line with the conclusions of previous EAs that had been carried out for the PNGS site under the CEAA 1992.
37. Further, CNSC staff reported that its technical review of OPG's 2017 PEA showed that baseline conditions resulting from transitioning the PNGS from continued operation to the stabilization and safe storage phases were not expected to change, and that adverse effects associated with these transitions were considered low. CNSC staff further confirmed that the predictions made in the PEA would be verified against any variances addressed in future ERAs during the renewed licence period.
38. The Commission noted that CELA, Greenpeace, Northwatch, Waterkeeper and individuals submitted concerns about the scope and validity of the CNSC environmental review. CNSC staff provided the Commission with information about the factors that were considered during its environmental review and further explained that, when a project was not within the scope of CEAA 2012, as was the

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<sup>14</sup> N288.6-12, *Environmental risk assessment at Class I nuclear facilities and uranium mines and mills*, CSA Group, 2012.

case for this licence renewal, CNSC staff carried out a rigorous environmental review. CNSC staff stated that, as part of its mandate to protect the environment, the CNSC regulates all environmental stressors arising from CNSC-licensed facilities including radionuclides, non-radiological contaminants and physical stressors, and that the review took into consideration environmental licensing limits and data from other provincial and federal departments. CNSC staff also explained that, as a lifecycle regulator, the CNSC was able to regulate a facility's on-site and off-site environmental effects across its entire project life, allowing for the incorporation of updated knowledge and adaptive management.

39. In response to interventions from CELA, Northwatch and individuals, the Commission invited CNSC staff to address the consideration of sustainability and cumulative effects of PNGS operations within the CNSC environmental review. CNSC staff explained that the information provided in the interventions related to how the assessment of sustainability and cumulative effects would fit into the proposed *Impact Assessment Act*,<sup>15</sup> the proposed replacement for CEAA 2012.
40. Further on this topic, the OPG representative informed the Commission that OPG had a comprehensive sustainability policy which focussed on the concepts of safe, clean and reliable energy. OPG informed the Commission that, while some of these concepts were not part of the CNSC's mandate and were the responsibility of other government departments, sustainability of operations was a large component of OPG's overall accountability as a good corporate citizen. The Commission notes the information provided by OPG and CNSC staff in regard to sustainability of operations and cumulative effects as they pertain to the PNGS.
41. The Commission acknowledges the concerns submitted by intervenors in regard to the scope of the CNSC environmental review. The Commission, however, is of the view that in the absence of a requirement for a CEAA 2012 EA, the CNSC environmental review is adequate to demonstrate that OPG continues to protect the environment from adverse impacts resulting from the operation of the PNGS.
42. Therefore, based on the information provided on the record for this hearing, the Commission is satisfied that the environmental review that was conducted by CNSC staff for the PNGS licence renewal was acceptable and thorough. The Commission notes that the NSCA provides a strong regulatory framework for environmental protection, and the health and safety of persons.

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<sup>15</sup> On February 8, 2018, a first reading of Bill C-69, *An Act to enact the Impact Assessment Act and the Canadian Energy Regulator Act, to amend the Navigation Protection Act and to make consequential amendments to other Acts*, was carried out in the House of Commons and proposed, among other things the enactment of an *Impact Assessment Act* to replace CEAA 2012. Bill C-69 passed its second reading in the Senate on December 12, 2018 and was referred to the Standing Senate Committee on Energy, the Environment and Natural Resources.

### 3.3 Conclusion on Environmental Assessment

43. The Commission concludes that a licence renewal is not a designated project under CEAA 2012 and that an EA under CEAA 2012 is not required. Further, the Commission is satisfied that OPG has made, and will continue to make throughout the renewed licence period, adequate provision for the protection of the environment.
44. Following its consideration of the information provided on the record for this hearing, the Commission concludes that the environmental review conducted by CNSC staff was appropriate for the PNGS licence renewal application. The Commission also finds that the review and consideration of alternatives to nuclear energy are not within the CNSC's mandate and therefore are not required in the CNSC's environmental review for this licence renewal application.
45. The Commission notes that several interventions, including those from CELA, Northwatch, Greenpeace and individuals, called for a strategic EA to be carried out prior to regulatory approval for the decommissioning of the PNGS. Since this hearing considered OPG's application for the PNGS operating licence renewal, the consideration of decommissioning-related EA matters is not within the scope of this matter. An EA or environmental review for the decommissioning of the PNGS will be considered in accordance with the legislation in force at the time when OPG applies for a decommissioning licence for the PNGS.

### 4.0 ISSUES AND COMMISSION FINDINGS

46. In making its licensing decision, the Commission considered a number of issues and submissions relating to OPG's qualification to carry out the licensed activities. The Commission also considered the adequacy of the proposed measures for protecting the environment, the health and safety of persons, national security and international obligations to which Canada has agreed.
47. OPG submitted its licence renewal application for the PNGS on August 28, 2017, with supplementary information to this application submitted to the CNSC on December 11, 2017. In its consideration of this matter, the Commission examined the completeness of the application and the adequacy of the information submitted by OPG, as required by the NSCA, the *General Nuclear Safety and Control Regulations*.<sup>16</sup> (GNSCR) and other applicable regulations made under the NSCA. The Commission also examined CNSC staff's assessment of OPG's performance in all 14 safety and control areas (SCAs) and several other matters of regulatory interest over the previous licence period.

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<sup>16</sup> SOR/2000-202

## 4.1 Management System

48. The Commission examined OPG's Management System which covers the framework that establishes the processes and programs required to ensure that the PNGS achieves its safety objectives, continuously monitors its performance against these objectives, and fosters a healthy safety culture. Throughout the previous licence period, CNSC staff rated OPG's performance in this SCA as "satisfactory."
49. The Commission assessed the information submitted by OPG and CNSC staff regarding OPG's nuclear management system. OPG reported to the Commission that its management system met the specifications of CSA N286-12, *Management system requirements for nuclear facilities*.<sup>17</sup> and that management system effectiveness was reviewed by the OPG's Nuclear Executive Committee as part of ongoing oversight. OPG provided the Commission with information about its nuclear management system framework, noting that performance monitoring at the PNGS was carried out at several organizational levels, including at the industry level in collaboration with international expertise.
50. Further on the PNGS management system, OPG submitted in its written materials that a well-established corrective action program was in place at the PNGS and that OPG carried out self-assessments, benchmarking and independent audits in this regard through its Nuclear Oversight Division. OPG also reported that its *Nuclear Safety Policy* established the guiding principles for OPG nuclear employees, namely stating that safety was the overriding priority in all activities carried out in support of OPG nuclear facilities.
51. CNSC staff submitted that OPG had successfully transitioned its management system to meet the specifications of CSA N286-12 during the previous licence period and that OPG's compliance in this regard was regularly assessed through compliance verification activities.

### 4.1.1 Quality Assurance

52. The Commission assessed the adequacy of OPG's quality assurance (QA) program at the PNGS. OPG submitted information regarding nuclear oversight audits and assessments at the PNGS, including regular self-assessments, benchmarking programs and performance indicators that were used to influence improvement at the PNGS to ensure that industry standard were being met or exceeded. OPG also explained that PNGS QA records were controlled and maintained in both paper and electronic form to ensure their consistent management.
53. OPG submitted information about the management of contractors at the PNGS and explained that, through its Supply Chain Quality Services process, OPG ensured that all of its contractors had developed and implemented a management system that met

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<sup>17</sup> N286-12, *Management system requirements for nuclear facilities*, CSA Group, 2012.

the applicable specifications of CSA N286-12. OPG also submitted detailed information about the program that OPG used for the QA and oversight of contractor management and performance.

54. CNSC staff submitted that OPG's nuclear oversight audit and self-assessment programs at the PNGS met the specifications of CSA N286-12, CNSC regulatory requirements and promoted early detection of issues. CNSC staff noted that OPG implemented satisfactory corrective action plans (CAPs) to address several areas of improvement that had been identified in respect of documentation control and records.
55. Based on the information provided on the record for this hearing, the Commission is satisfied that OPG has an appropriate QA program in place at the PNGS.
56. The Commission expects that OPG will continue the implementation of the CAPs in respect of documentation control and records during the renewed licence period, as detailed in the materials submitted on the record for this hearing.

#### *4.1.2 Organization*

57. The Commission reviewed the information submitted by OPG regarding its organizational structure, knowledge management and change management at the PNGS. OPG submitted that, during the previous licence period, OPG had revised its organizational and program structure, with several programs transitioned to being the responsibility of corporate business units rather than being considered only within the scope of the nuclear management system. OPG provided information about how it had ensured that the PNGS nuclear management system continued to meet the specifications of CSA N286-12 and remained effective, and noted that the Nuclear President and Chief Nuclear Officer was accountable for the establishment, the implementation and the effectiveness of the nuclear management system.
58. CNSC staff submitted that a January 2017 inspection to assess OPG's implementation of its revised organizational structure and programs showed that, although minor non-compliances had been identified in respect of records management and procedural adequacy, OPG's organizational structure met CNSC licensing requirements and OPG was appropriately addressing the non-compliances through CAPs.
59. Regarding the centralization of various OPG services across its nuclear, hydro and thermal branches, the Commission enquired about how OPG could ensure the continued safety and integrity of its services within the nuclear branch. The OPG representative detailed how OPG ensured that all nuclear-specific services remained embedded in the nuclear organization, emphasizing that all of the centralized management functions and programs that supported the nuclear organization reported to OPG's Nuclear Executive Committee and OPG's Chief Nuclear Officer. The

Commission is satisfied with the information provided on this point.

60. In its written materials, OPG provided information to the Commission regarding its corporate-wide approach to knowledge management and retention program which identified and mitigated knowledge risk within the organization. OPG also submitted that its knowledge management and retention program ensured that OPG retained sufficient employees with requisite qualifications, knowledge and skills to safely and competently perform their work until the ECO at the PNGS and throughout the station stabilization phase.
61. Asked to provide information on morale and staff engagement at the PNGS with the upcoming ECO, the OPG representative provided the Commission with information on various initiatives, such as collective work goals, that had been implemented at the PNGS to ensure a continued engaged workforce that was committed to safe operation. The OPG representative further noted that OPG had received positive assessments in regard to staff morale at the PNGS, including a 2017 World Association of Nuclear Operators (WANO) review.
62. Further on this topic, the OPG representative provided the Commission with an estimate of the workforce demographic at the PNGS after 2024 and explained that OPG had a company-wide 10-year plan that assessed OPG and its workforce as a whole, as well as by discipline. The OPG representative also stated that this plan, when finalized, would give the PNGS workforce more certainty as to future employment. The OPG representative emphasized OPG's commitment to communicate staffing plans and strategies to its employees, noting that employees were provided with opportunities to ask questions on a regular basis.
63. CNSC staff explained to the Commission that the PNGS Sustainable Operations Plan (SOP) would provide details in this regard, with CNSC staff therefore expecting OPG to have a detailed staffing plan in place by December 2019. CNSC staff also explained that, following OPG's submission of the Stabilization Activity Plan (SAP), CNSC staff would verify that the SAP included adequate information about PNGS staffing throughout the transition from commercial operations to ECO.
64. The Commission noted that interventions from unions and associations representing OPG workers including the Society of United Professionals, the Power Workers' Union (PWU), the Canadian Nuclear Workers Council, the Organization of Canadian Nuclear Industries (OCNI), as well as the Pickering Nuclear Generating Station Community Advisory Council (PNGSCAC), Greenpeace, the Regional Municipality of Durham, and individuals addressed PNGS staffing with the upcoming ECO. The Commission requested comments from the intervenors in this regard. The PWU representative informed the Commission that the PWU had engaged in continuous and productive dialogue in this regard with OPG. The OCNI representative responded that the OCNI had several options for the redeployment of its members, noting that some of its members would be redeployed to the Darlington NGS (DNNGS) refurbishment project. The PNGSCAC representative confirmed that the

PNGSCAC was satisfied with the plans that OPG had communicated to its stakeholders and expressed confidence in OPG's planning for ECO at the PNGS. In response, the OPG representative reaffirmed OPG's commitment to working with unions, worker associations and other stakeholders to ensure that their interests were met during the renewed licence period. The Commission expresses appreciation for the comments provided by intervenors on this matter and is satisfied with the sufficiency of the information provided by OPG, CNSC staff and intervenors on this point.

65. The Commission enquired about OPG's plans to retain competent and qualified staff in light of the upcoming ECO. The OPG representative responded that OPG had been planning for the shutdown of the PNGS for several years and provided details on how OPG had considered its knowledge management and staff retention strategies from the perspective of the needs of all of OPG. The OPG representative also stated to the Commission's satisfaction that OPG was continuing recruitment activities to ensure continued knowledge, skills base and leadership development at all of OPG's nuclear facilities, to facilitate worker mobility and to drive innovation at the PNGS.
66. The Commission requested additional information about OPG's programs for the facilitation of knowledge transfer at the PNGS. The OPG representative explained that OPG used a systematic and multi-disciplinary approach to transfer knowledge through programs such as the mentorship program referenced in the intervention from North American Young Generation in Nuclear – Durham Chapter (NYAGN-Durham). The OPG representative also provided information about OPG's qualification process for every position, which tracked where knowledge was being transferred and where gaps did or could exist.
67. Further on knowledge transfer, the OPG representative emphasized to the Commission that ensuring that knowledge was retained throughout the organization was incorporated in OPG's business and succession planning. The OPG representative also provided information about OPG's diploma program partnership with the University of Ontario Institute of Technology (UOIT), which aimed to ensure that OPG engineers acquired and retained the information required to work at an NGS, and about OPG's multi-faceted leadership development program. The Commission is satisfied that OPG is implementing comprehensive programs at the PNGS to ensure adequate knowledge retention and transfer amongst its workers.
68. Based on the information provided, the Commission is satisfied that OPG has an appropriate organizational structure and acceptable knowledge management program in place at the PNGS to ensure continued safety of persons and the environment throughout the renewed licence period.
69. Following its consideration of interventions in regard to staffing at the PNGS, the Commission is satisfied that OPG has considered and will continue to adequately consider future staffing and employee retention strategies at the PNGS. The Commission requests that updated organizational and staffing information in OPG's

SOP and SAP for the PNGS be as detailed as possible and that this information be communicated to PNGS workers as soon as practicable.

#### 4.1.3 Facility Management

70. The Commission assessed the adequacy of OPG's business continuity program at the PNGS, which aimed to minimize disruptions in the event of natural, human or technical threats. OPG reported that its business continuity program established a management system for business continuity, to provide direction related to business and operational continuity, and for recovery planning. OPG also submitted that the PNGS business continuity plans had been revised in 2015 to reflect an approach which considered various natural and technological hazards, as well as the pandemic influenza scenario, and that the business continuity plans would be updated every other year during the renewed licence period.
71. CNSC staff submitted to the Commission that OPG had adequate plans in place to maintain or restore critical safety and business functions in the event of disabling circumstances.
72. Based on the information provided, the Commission is satisfied that OPG has adequate programs in place for business continuity management at the PNGS during the renewed licence period.

#### 4.1.4 Safety Culture

73. The Commission considered submissions respecting the adequacy of OPG's safety culture at the PNGS. OPG confirmed its commitment to a healthy safety culture at the PNGS and reported that the OPG standard N-STD-AS-0023, *Nuclear Safety Oversight* applied to all aspects of nuclear operations at or in support of OPG's NGSs. OPG further explained that this standard summarized the framework of OPG's safety culture program, as well as the external and internal processes used for the oversight and assessment of nuclear safety. OPG also confirmed that safety requirements and expectations were the same for both OPG and contracted employees.
74. OPG reported that a station-wide nuclear safety culture assessment at the PNGS, which consisted of a staff survey, as well as an on-site evaluation by an assessment team, was carried out in 2015. OPG further reported that this assessment found that the PNGS had a healthy nuclear safety culture which was not compromised by business priorities, and that PNGS staff felt that they could challenge decisions made by other personnel, including management, without fear of retaliation. OPG also submitted that station-wide safety culture assessments would be carried out in accordance with OPG procedures during the renewed licence period, with the next assessment scheduled for 2018 and results expected in the fourth quarter of 2018.



75. OPG reported that nuclear safety oversight at the PNGS was carried out in accordance with the Institute of Nuclear Power Operators (INPO) 12-012, *Traits of a Healthy Nuclear Safety Culture*.<sup>18</sup> OPG provided information about its Nuclear Safety Culture Monitoring Panel (NSCMP), which met quarterly to discuss and ensure the implementation of the ten nuclear safety culture traits identified in INPO 12-012 at the PNGS.
76. CNSC staff submitted that OPG's processes for nuclear safety culture self-assessments at the PNGS met CNSC staff's expectations, with OPG taking adequate actions to further improve safety culture at the PNGS. CNSC staff also submitted that the NSCMP meetings provided an adequate opportunity to monitor changes in the nuclear safety culture traits at the PNGS in between assessments.
77. In respect of several interventions that addressed safety culture at the PNGS, the Commission enquired about international benchmarking for safety culture assessments. CNSC staff responded that the International Atomic Energy Agency (IAEA) 2016 Operational Safety Review Team (OSART) mission at the PNGS, which included reviews by international experts, showed that OPG had a strong safety culture at the facility. CNSC staff also explained that the INPO approach followed by OPG for its self-assessments was considered a best practice, with results allowing licensees to work towards international best practices. Noting that safety culture assessments were subjective in nature, the OPG representative provided the Commission with information about how OPG worked with national and international stakeholders in the nuclear industry to ensure the continuous improvement of safety culture performance at OPG facilities. Based on the information provided, the Commission is satisfied that OPG is adequately considering international best practices in respect to safety culture at the PNGS.
78. The Commission noted the information on safety culture provided in the interventions from the PWU and the Society of United Professionals, and asked about feedback that these organizations had received from their members in respect of OPG's safety culture at the PNGS in consideration of the planned ECO in 2024. The Society of United Professionals representative responded that the members of the Society of United Professionals had not raised any concerns regarding changes in safety culture at the PNGS. The PWU representative informed the Commission that the PWU had found OPG maintained a strong safety culture and provided details on how the PWU worked with OPG to ensure a continued strong safety culture at the PNGS. The Commission is satisfied on this point.
79. Asked to provide information about the Society of United Professionals' formal "Resolution of Differing Professional Opinions" process, the Society of United Professionals representative informed the Commission that the process provided a mechanism by which safety matters could be raised with upper management, thereby helping to ensure the maintenance of a strong safety culture in an organization. The Society of United Professional representative also informed the Commission that the

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<sup>18</sup> INPO 12-012, *Traits of a Healthy Nuclear Safety Culture*, Institute of Nuclear Power Operators, 2012.

Society of United Professionals was not aware of any outstanding safety issues at the PNGS that required resolution. The OPG representative agreed with the information presented and provided the Commission with examples on when this process could be used. The Commission expressed satisfaction with the existence of the formal dispute resolution process in place between the intervenor and OPG.

80. Asked by the Commission about how OPG instilled strong safety culture principles in new graduates, the NYAGN-Canada representative explained that OPG provided all new employees with immediate safety training, emphasizing safety as a priority for OPG. The NYAGN-Canada representative also provided details about OPG's employee supports and training programs, as well as the new employee mentorship and rotations programs, which ensured that each new employee had an experienced mentor in the workplace.
81. Based on the information examined for this hearing, the Commission is satisfied that OPG has maintained and will continue to maintain a strong safety culture at the PNGS.
82. The Commission anticipates an update on the results of OPG's 2018 safety culture assessment during the presentation of the 2018 Nuclear Power Plant (NPP) ROR, scheduled for 2019.

#### *4.1.5 Conclusion on Management System*

83. On the basis of the information provided on the record for this hearing, the Commission concludes that OPG has appropriate organization and management structures in place at the PNGS and that the operating performance at the PNGS in the previous licence period provides a positive indication of OPG's ability to adequately carry out the licensed activities during the renewed licence period.

## **4.2 Human Performance Management**

84. The Commission assessed OPG's human performance management programs which encompass activities that enable effective human performance through the development and implementation of processes that ensure that PNGS staff is sufficient in number in all relevant job areas and have the necessary knowledge, skills, procedures and tools in place to safely carry out their duties. During the previous licence period, CNSC staff rated OPG's performance in this SCA as "satisfactory."
85. The Commission examined the information submitted by OPG regarding the human performance program at the PNGS. OPG submitted that its Human Performance Management Program aimed to ensure the safe and reliable operation of the PNGS, and to minimize the frequency and severity of events of consequence. OPG reported

that its human performance program involved the use of systematic approaches to reducing human error and methods to achieve zero events of consequence.

86. CNSC staff submitted that a CNSC Type II inspection during the previous licence period confirmed that OPG had in place a human performance program that met the specifications of the applicable parts of CSA N286-05.<sup>19</sup> CNSC staff further submitted to the Commission that OPG used an INPO human performance program process that relied on event-free tools and that OPG continuously improved its human performance program throughout the previous licence period.

#### 4.2.1 Personnel Training

87. The Commission considered the information submitted by OPG about its personnel training programs, noting that OPG's programs met the specifications of REGDOC-2.2.2, *Personnel Training*.<sup>20</sup> OPG submitted that its training program applied to all PNGS workers, including contractors, and ensured that all staff had the appropriate knowledge, skills and attitudes for safe and efficient operations at the PNGS.
88. OPG reported that the health of its Systematic Approach to Training-based (SAT-based) training programs was monitored to ensure continuous improvements. OPG also reported that the PNGS operations, maintenance and engineering departments had robust continuing training programs that were revised and reissued every five years. OPG provided the Commission with information about the improvements that had been made to PNGS training programs and noted that the consistent application of SAT-based training had been successfully implemented to OPG's Emergency Response Organization training activities during the previous licence period.
89. OPG submitted that all OPG employees were required to undergo various levels of continuing training throughout the year. OPG also submitted that all of its certified operations staff underwent more than 200 hours of continuing training every year and that the PNGS exceeded the minimum number of certified staff for each position. Further, OPG reported that its training programs adequately prepared trainees for initial certification testing and for appointment into certified positions.
90. CNSC staff submitted that four inspections and five desktop reviews that were performed during the previous licence period showed that SAT-based training programs were well defined, designed, developed, evaluated and managed, as well as adequately implemented at the PNGS, and that OPG met regulatory requirements in this regard.
91. The Commission enquired about the training that OPG was providing its staff to ensure a smooth transition from an operating NGS to ECO, and beyond. The OPG representative provided the Commission with information about the training that

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<sup>19</sup> N286-05, *Management system requirements for nuclear power plants*, CSA Group, 2005.

<sup>20</sup> CNSC Regulatory Document REGDOC-2.2.2, *Personnel Training*, 2016.

OPG staff would be required to undergo prior to the execution of these activities, including full walk downs, classroom training, review of operating experience (OPEX) and a detailed assessment of each critical step in the activity procedures, noting that no work would be carried out if OPG management did not see evidence of adequate training and understanding of the work and procedures. CNSC staff detailed the regulatory oversight activities that would be carried out in regard to transition-related activities at the PNGS. The Commission is satisfied on this point, but directs that CNSC staff implement increased regulatory oversight in this regard during the renewed licence period.

92. Having examined all of the information provided on the record for this hearing, the Commission is satisfied that OPG has appropriate training programs in place at the PNGS at and that these programs meet the objectives of REGDOC-2.2.2. The Commission is also satisfied that OPG has adequately considered training requirements for its employees to ensure that the transition of the PNGS to the ECO is carried out safely.

#### 4.2.2 *Certification and Examinations*

93. The Commission assessed OPG's programs for the certification of employees in certain positions at the PNGS. OPG submitted that, under its operating licence, the positions that required a valid CNSC certification included: responsible health physicists, authorized nuclear operators, control room shift supervisors and shift managers. OPG also submitted that the initial training programs for these positions were SAT-based and that OPG's programs met the specifications of RD-204, *Certification of Persons Working at Nuclear Power Plants*.<sup>21</sup>
94. In its written materials, OPG provided the Commission with information about its initial certification and requalification testing programs, and about the improvements that had been made to these programs during the previous licence period. OPG reported that, as per RD-204, initial certification and requalification testing of responsible health physicists continued to be administered by the CNSC. OPG also confirmed that it would continue to demonstrate its capability to administer initial examinations and requalification testing for authorized nuclear operators, control room shift supervisors and shift managers, the three other positions that required valid CNSC certification during the renewed licence period.
95. CNSC staff submitted that three compliance inspections during the previous licence period showed that OPG's initial certification examination and requalification testing programs for all certified positions at the PNGS met regulatory requirements.
96. The Commission appreciated the information about training partnerships provided in the interventions from Durham College and the UOIT, and requested additional information in this regard. The OPG representative presented details about the

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<sup>21</sup> CNSC Regulatory Document RD-204, *Certification of Persons Working at Nuclear Power Plants*, February 2008.

courses and other training activities that OPG carried out in partnership with these two academic institutions. Asked about these partnerships following the ECO, OPG stated to the Commission's satisfaction that these partnerships would not be discontinued since the training activities were used for both PNGS and DNGS employees.

97. Based on the information presented during this hearing, the Commission is satisfied that OPG has appropriate initial certification and requalification testing programs at the PNGS that meet regulatory requirements and the specifications of RD-204.

#### 4.2.3 Human Factors

98. The Commission assessed the information provided by OPG regarding its adherence to minimum shift complement (MSC) requirements at the PNGS. The MSC ensures that there is sufficient qualified staff, including certified staff, at the PNGS in the event of a resource-intensive event. OPG submitted information regarding the MSC program at the PNGS, noting that it met the specifications of G-323, *Ensuring the Presence of Sufficient Qualified Staff at Class I Nuclear Facilities – Minimum Staff Complement*<sup>22</sup> and G-278, *Human Factors Verification and Validation Plans*.<sup>23</sup>
99. OPG also submitted information regarding the assessment of the Emergency Response Team (ERT) complement and capabilities to respond to beyond design basis accidents (BDBA) that was undertaken in response to the lessons learned from the Fukushima Daiichi accident. OPG reported that the assessment showed that PNGS MSC requirements in the event of a BDBA were adequate.
100. CNSC staff submitted that, throughout the previous licence period, OPG met regulatory requirements in respect of the MSC at the PNGS. CNSC staff noted that a Type II inspection of the PNGS MSC program in May 2017 identified some opportunities for improvement related to record keeping, training qualifications and consistent use of the MSC. CNSC staff further reported that OPG had implemented a satisfactory CAP to address these opportunities for improvement and that CNSC staff would continue to follow up on the completion of this CAP during the renewed licence period.
101. The Commission also assessed OPG's fitness for duty programs at the PNGS. OPG submitted that a set of staffing policies implemented at the PNGS, including limits on hours of work and the observation of employee behaviours, ensured that PNGS staff remained fit for duty. OPG reported that the PNGS fitness for duty programs for certified and security staff met the specifications of RD-204 and of RD-363, *Nuclear*

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<sup>22</sup> CNSC Guide G-323, *Ensuring the Presence of Sufficient Qualified Staff at Class I Nuclear Facilities – Minimum Staff Complement*, 2007.

<sup>23</sup> CNSC Guide G-278, *Human Factors Verification and Validation Plans*, 2003.

*Security Officer Medical, Physical and Psychological Fitness.*<sup>24</sup>

102. OPG provided the Commission with information regarding its Continuous Behaviour Observation Program which provided supervisors with training to recognize and respond to employee behaviours that could be a risk to the security, safety or health of employees, facilities or the public. Asked by the Commission, the OPG representative confirmed that if any employee was found to be unfit for duty, they would be denied access to the PNGS or any other OPG facility.
103. CNSC staff informed the Commission in its written materials that OPG would complete its implementation of REGDOC-2.2.4, *Human Performance Management – Fitness for Duty: Managing Working Fatigue*,<sup>25</sup> (REGDOC-2.2.4) by January 2019.
104. CNSC staff provided the Commission with details on the various hours of work limits in place for PNGS workers and how the CNSC oversaw compliance in that regard. CNSC staff submitted that, in July 2017, a desktop review was carried out in respect of OPG's reporting of non-compliances at the PNGS with the limits of hours of work by certified staff performing safety-related tasks or working on safety-related systems. CNSC staff submitted that some inaccuracies in OPG's reporting system had been identified, that OPG had put in place a satisfactory CAP to address these inaccuracies and that OPG's resolution of this issue would be monitored by CNSC staff during the renewed licence period.
105. CNSC staff reported that, in accordance with the implementation plan that OPG submitted to the CNSC in April 2018, REGDOC-2.2.4, *Fitness for Duty, Volume II: Managing Alcohol and Drug Use*,<sup>26</sup> (REGDOC-2.2.4, Volume II) would be implemented at the PNGS by July 1, 2019, with the exception of random testing. CNSC staff further reported that full implementation of REGDOC-2.2.4, Volume II at the PNGS was expected by December 1, 2019.
106. The Commission noted the concerns expressed by several intervenors, including unions and industry groups, about the drug and alcohol testing of workers as set out in REGDOC-2.2.4, Volume II and requested comments about the implementation of this REGDOC at the PNGS. OPG confirmed to the Commission's satisfaction that OPG had been working with industry peers, union and industry groups, and experts to ensure that a program based on best practices, while in accordance with REGDOC-2.2.4, Volume II, was implemented at OPG facilities. The OPG representative also informed the Commission that OPG already had a clear, zero-tolerance fitness for duty policy relating to alcohol and drug impairment, and that expectations in regard to the policy were regularly communicated to OPG staff. The

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<sup>24</sup> CNSC Regulatory Document RD-363, *Nuclear Security Officer Medical, Physical and Psychological Fitness*, 2008.

<sup>25</sup> CNSC Regulatory Document REGDOC-2.2.4, *Fitness for Duty: Managing Worker Fatigue*, 2017.

<sup>26</sup> CNSC Regulatory Document REGDOC-2.2.4, *Fitness for Duty, Volume II: Managing Alcohol and Drug Use*, Version 2, 2018.

OPG representative further explained that, with the legalization of cannabis in October 2018,<sup>27</sup> OPG's policies in this regard would not change and that procedures to assess workers' fitness for duty were already in place. Asked about OPG's use of dogs to search the PNGS for cannabis and other illicit drugs, the OPG representative responded that illicit drugs were not often found by the drug detection dogs at the PNGS and that the implementation of the drug detection dog program had been an effective deterrent from such practices. The Commission is satisfied with the information provided on these points.

107. The Commission examined the information provided by OPG regarding human performance errors that resulted in events at the PNGS during the previous licence period. OPG submitted information regarding the "back to basics" campaign implemented at the PNGS in 2017 due to increased Site Event Free Day Resets<sup>28</sup> (SEFDR). OPG reported that the number of SEFDRs at the PNGS decreased and were below target in 2015 and 2016, and that, overall, SEFDRs were reduced during the previous licence period. However, OPG further reported that 5 SEFDRs occurred at the PNGS from August to October 2017 and, in response, OPG initiated a PNGS-wide stand down to highlight the significance of these events to its staff. OPG also submitted that an initiative implemented at the PNGS to improve event communication and analysis would facilitate the development and dissemination of lessons learned from events, prevent their re-occurrence and foster an open reporting culture at the PNGS.
108. In considering the concerns about the 2017 PNGS-wide stand down expressed in the intervention from K. Dahl, the Commission requested additional information about this matter. The OPG representative provided information to the Commission regarding the lower-level events that had occurred at OPG NGS sites and indicated the potential for a deterioration in safety culture, noting that OPG had also reported to the Commission on this stand down in December 2017.<sup>29</sup> The OPG representative emphasized that safety stand downs were an industry standard proactive measure and that full stand downs at both the PNGS and DNGS sites were carried out to highlight the obligation of all staff to implement the highest safety standards. CNSC staff noted that safety stand downs were considered an industry best practice.
109. Following its examination of the information provided on the record for this hearing, the Commission is satisfied that OPG's MSC at the PNGS meets the specifications of G-323 and G-278. The Commission is also satisfied that OPG maintains an acceptable fitness for duty program at the PNGS.

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<sup>27</sup> At the time of the hearing, the *Cannabis Act* (S.C. 2018, c. 16) had received Royal Assent but was not yet in force. The *Cannabis Act* entered into force on October 17, 2018.

<sup>28</sup> OPG defines a Site Event Free Day Reset as "The number of human performance errors that result in events with significant consequences within a given period; it is an industry-wide measure of the effectiveness of organizational safety and other human performance programs."

<sup>29</sup> *Minutes of the Canadian Nuclear Safety Commission (CNSC) held on December 13-14, 2017*, paragraphs 13 – 15.

110. The Commission expects OPG to continue the implementation of the CAPs to address the identified opportunities for improvement for the MSC and reporting inaccuracies related to hours of work non-compliances at the PNGS.
111. In regard to the safety stand downs at OPG NGS in 2017, the Commission agrees that these are an industry best practice and is satisfied with the actions taken by OPG in respect of the increased SEFDRs at the PNGS. The Commission expects OPG to continue its improvement initiatives in regard to the increased SEFDRs at the PNGS site.
112. The Commission anticipates that REGDOC-2.2.4 and REGDOC-2.2.4, Volume II will be implemented in accordance with the schedule proposed during this hearing. The Commission expects annual updates in this regard via the NPP ROR or other means, as appropriate.

#### *4.2.4 Conclusion on Human Performance Management*

113. Based on its consideration of the information presented on the record for this hearing, the Commission concludes that OPG has appropriate programs in place and that current efforts related to human performance management provide a positive indication of OPG's ability to adequately carry out the activities under the renewed licence.

### **4.3 Operating Performance**

114. The Commission examined operating performance at the PNGS, which includes an overall review of the conduct of the licensed activities and the activities that enable effective performance, as well as improvement plans and significant future activities, at the PNGS. CNSC staff rated OPG's performance in the operating performance SCA as "satisfactory" from 2013 – 2014 and as "fully satisfactory" for the balance of the previous licence period.

#### *4.3.1 Conduct of Licensed Activity*

115. The Commission evaluated OPG's Operations Program at the PNGS which is meant to ensure that PNGS operations are safe and secure, and carried out with adequate regard for health, safety, security, radiation and environmental protection and international obligations. OPG submitted that, during the previous licence period, it had improved its operating performance through a commitment to continuous improvement, management reinforcement of high standards and reliable operations resulting in a low forced loss rate (FLR).



116. In its written materials, OPG provided the Commission with information about its Nuclear Operations Program, which had as its goal that the PNGS is operated in a manner such that the PROL, Operating Policies and Principles (OP&P), regulations and other standards were followed. OPG submitted information about Plant Status Control at the PNGS, which formed part of the managed process to operate the NGS safely and within the approved design basis. OPG noted that the frequency and significance of misposition events<sup>30</sup> had decreased throughout the previous licence period and that this indicated a positive trend in plant status control at the PNGS. OPG also provided information about PNGS reactivity management practices, reporting that the Reactivity Management Index for the facility was consistent with industry standards.
117. CNSC staff submitted that CNSC compliance verification activities focussing on OPG's conduct of licensed activities showed that the PNGS operated safely and that OPG had implemented CNSC-approved programs in accordance with the PNGS licence requirements throughout the previous licence period. CNSC staff reported that OPG had improved its resolution of preliminary findings during field inspections over the previous licence period, but noted that Plant Status Control continued to be an area of focus for CNSC site inspectors, with frequent findings in this area. CNSC staff confirmed that it would continue to follow up on these findings through routine compliance verification activities during the renewed licence period.
118. The Commission assessed the OPEX program at the PNGS. OPG submitted that the PNGS OPEX program included both internal and external OPEX, which ensured that lessons learned were reviewed and appropriate actions were taken. OPG also provided information about the improvements made to the PNGS OPEX process and tools during the previous licence period, including the sharing of internal information with other OPG stations. CNSC staff confirmed the information provided by OPG and reported that OPG's OPEX program met the specifications of CSA N286-12.
119. The Commission asked for comments in regard to the intervention from RESD Inc. which suggested that the sharing of information and OPEX between operators was decreasing due to intellectual property considerations. The OPG representative provided details about the various working groups that existed via the CANDU Owners' Group (COG), through which the nuclear industry embarked on joint research and development projects and shared safety-related operating experience. The OPG representative further explained that certain projects involved valuable intellectual property and that, if the project was not directly related to a safety issue, OPG did not share that information with other COG members. However, the OPG representative confirmed to the Commission's satisfaction that any safety related OPEX and research and development were shared throughout the nuclear industry.

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<sup>30</sup> From CMD 18-H6.1: "As a performance metric of plant status control, a misposition is declared when a component is found in a position off its baseline position without documented approval, or a component is incorrectly operated, or the incorrect component is operated."

120. CNSC staff reported that, during 2014 and 2017, CNSC inspections were conducted to assess OPG's problem identification and resolution programs at the PNGS, and that both inspections showed that OPG met licensing requirements in this regard. CNSC staff also submitted that the inspections in 2017 identified some areas for improvement with respect to documentation and that OPG's implementation of CAPs would be monitored during the renewed licence period.
121. The Commission notes that one of the significant indicators pertinent to the conduct of licensed activities is the number of unplanned reactor transients, their causes and their consequences. In its written materials, OPG provided the Commission with information about its strategies to minimize unplanned transients at the PNGS and about its response protocols should unplanned transients occur. OPG noted that the unplanned transient protocols required a post-transient review to confirm the direct cause of the transient, verify system response, and to identify corrective actions and lessons learned. CNSC staff submitted that OPG investigated all unplanned reactor transients at the PNGS – including stepbacks, setbacks and unplanned reactor trips – appropriately during the previous licence period and in accordance with approved procedures.
122. Asked to provide information about the 2016 OSART mission that was carried out at the PNGS in 2016, the OPG representative stated that the mission included a review by 19 international nuclear experts in respect to PNGS operational safety and how PNGS operations compared against IAEA guidance. The OPG representative also provided information about the results from the mission, which noted eight good practices and the finding that OPG was focussed on improving operational safety at the PNGS. The Commission is satisfied with the information provided on this point.
123. CNSC staff submitted that OPG could carry out activities related to the transition to safe storage under an operating licence and that OPG did not need a decommissioning licence to carry out such licensed activities during the renewed licence period. The Commission notes that it is the authorized activities in Part IV) of OPG's PROL for the PNGS that defines the licensed activities that OPG is authorized to carry out, within the limitation of the PNGS licensing basis.
124. The Commission considered OPG's Co-60 program at the PNGS, through which OPG harvested Co-60 from the Units 6 – 8 irradiated reactor components during planned outages. OPG provided the Commission with information on its Co-60 program, noting that the shipment of Co-60 from the PNGS site was carried out in accordance with the *Packaging and Transport of Nuclear Substances Regulations, 2015*<sup>31</sup> (PTNSR, 2015) and Transport Canada's *Transportation of Dangerous Goods Regulations*<sup>32</sup> (TDG Regulations). CNSC staff confirmed this information and noted that OPG's implementation of a Co-60 program was proposed to be included in the renewed PROL under facility-specific licence condition 15.5.

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<sup>31</sup> SOR/2015-145

<sup>32</sup> SOR/2001-286

125. During its examination of the intervention from BWXT, the Commission enquired about the quantity of Co-60 that was produced at the PNGS. The OPG representative responded that the three PNGS reactor units produced approximately 20% of the world's Co-60 supply. The Commission further enquired about how this supply would be affected with the ECO at the PNGS. The OPG representative provided an overview of how the Co-60 was produced and harvested, and explained that, following the end of ECO, Co-60 would no longer be produced at the PNGS. The OPG representative noted, however, that OPG was investigating other options for the continued production of Co-60 following the ECO at the PNGS.
126. Having examined the information submitted for this hearing, the Commission is satisfied that the PNGS will continue to be operated safely during the renewed licence period. The Commission includes the proposed licence condition 15.5 in the renewed licence, allowing OPG to continue the implementation of the PNGS Co-60 program. The Commission notes that OPG is authorized to produce Co-60 as a commercial by-product at Units 5 – 8 at the PNGS.
127. The Commission expresses satisfaction with OPG's continuous improvement plans for operations at the PNGS. The Commission directs OPG to continue the implementation of improvements to Plant Status Control and the CAPs for the PNGS problem identification and resolution program during the renewed licence period.

#### 4.3.2 *Periodic Safety Review*

128. The Commission assessed the Periodic Safety Review (PSR) that OPG carried out in support of its application to extend commercial operation of the PNGS to the end of 2024. The Commission notes that the PSR covers a 10-year period to align with the proposed 10-year licence renewal.
129. OPG submitted that the PSR carried out in support of the PNGS licence renewal application was a forward-looking assessment that focussed on changes to requirements since the last applicable assessment, noting that the PSR compared the operations at the PNGS against modern codes and standards. OPG further submitted that the PSR built on the results from previous PSRs at the PNGS and was used to confirm that its design, operation, systems, structures and components supported its continued operation to the end of 2024. OPG noted that, in accordance with REGDOC-2.3.3, *Periodic Safety Reviews*,<sup>33</sup> PSRs were conducted every 10 years.
130. In its written materials, OPG informed the Commission that the PSR resulted in recommendations for reasonable and practicable safety enhancements to further reduce risks at the PNGS and that these were documented in the Global Assessment Report (GAR) that was submitted to CNSC staff in February 2018. Further, OPG explained that the safety enhancements captured in the GAR, along with target completion dates, were documented in the associated Integrated Implementation Plan

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<sup>33</sup> CNSC Regulatory Document REGDOC-2.3.3, *Periodic Safety Reviews*, 2015.

(IIP). OPG provided details about the IIP actions, noting that CNSC staff had reviewed and commented on a November 2017 version, and that a revised version of the IIP which captured CNSC staff's comments was accepted by CNSC staff in March 2018 and posted on OPG's corporate website. During the hearing, the OPG representative informed the Commission that OPG had begun implementing the IIP at the PNGS, with 13 of the 63 IIP actions completed and 27 actions in progress. The OPG representative confirmed that OPG was on track with the IIP schedule, with a planned completion date of December 31, 2020.

131. CNSC staff reported that CNSC staff had accepted OPG's PSR Basis Document for the PNGS in July 2016, noting that the PSR covered a 10-year period including the operational, stabilization, and the beginning of the safe storage phases, and appropriately identified all the safety significant systems and processes for each phase. CNSC staff further reported that OPG carried out the PSR in conformance with REGDOC-2.3.3, CSA N290.18, *Periodic safety review for nuclear reactor facilities*,<sup>34</sup> and IAEA SSG-25, *Periodic Safety Review for Nuclear Power Plants*,<sup>35</sup> and that the PSR demonstrated that all safety significant systems at the PNGS would remain fit for service throughout the renewed licence period. CNSC staff also submitted that the IIP was accepted by CNSC staff in March 2018 and that it met the specifications of REGDOC-2.3.3.
132. The Commission requested details about the additional 23 gaps that were identified during CNSC staff's review of the PSR. CNSC staff explained that the gaps primarily represented activities from the 2010 PSR that should have been included in the updated PSR and IIP. The Commission is satisfied on this point.
133. CNSC staff recommended that the Commission accept PNGS-specific licence condition 15.1 which would require OPG to implement the IIP and also ensure that the IIP formed part of the PNGS licensing basis, with any changes to the IIP actions requiring Commission acceptance. CNSC staff also submitted that OPG would be required to report on the status of the IIP actions quarterly, starting in the fourth quarter of 2018, as well as in OPG's annual report.
134. The Commission considered the CNSC's regulatory oversight of OPG's implementation of the IIP actions. CNSC staff reported that inspections and assessment of key IIP actions would be carried out to confirm that the corresponding completion and closure criteria detailed in the IIP were satisfied. CNSC staff also submitted that it would formalize its approach to the regulatory oversight of the effective implementation of the IIP, including the roles and responsibilities of CNSC staff, by August 2018.
135. Upon review of the intervention from L. Bertrand, the Commission enquired about how software used at the PNGS was considered in the PSR. The OPG representative

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<sup>34</sup> CSA N290.18, *Periodic safety review for nuclear reactor facilities*, CSA Group,

<sup>35</sup> Specific Safety Guide SSG-25, *Periodic Safety Review for Nuclear Power Plants*, International Atomic Energy Agency, 2013.

stated that the PSR assessed modern codes and standards for all electronic equipment and software used at the PNGS. The OPG representative also confirmed that no significant software-related gaps were identified during the PSR. The Commission is satisfied that software and related equipment were adequately considered in the PNGS PSR.

136. Noting that the PSR did not include on-site waste facilities, the Commission requested information in this regard. CNSC staff confirmed that on-site waste facilities were typically not included in NGS PSRs due to their low risk profile. CNSC staff also noted that the IAEA considered waste facility PSRs a good practice for countries that carried out higher-risk spent fuel activities, such as the management of enriched uranium spent fuel or spent fuel reprocessing activities; however, since Canadian operators did not carry out these activities, a waste facility PSR would not add any tangible safety value for Canadian on-site fuel waste facilities. Following its consideration of the information provided, the Commission is satisfied on this topic.
137. The Commission noted that intervenors including CELA, A. Tilman, Greenpeace, DNA and individuals expressed concerns about PSR requirements and their adequacy should OPG apply to operate the PNGS beyond 2024, and requested comments on this issue. CNSC staff informed the Commission that, since the PSR was based on the ECO at the PNGS in December 2024, OPG would be required to update the PSR in accordance with REGDOC-2.3.3 should it apply to operate the PNGS beyond 2024, and noted that the PNGS LCH provided detailed compliance verification criteria in that regard. The Commission is satisfied with the information provided on this point, but acknowledges the intervenors' concerns about PNGS PSR requirements in the event of an application for extended commercial operation of the PNGS. In that vein, the Commission notes that the PSR carried out in support of this licence renewal application only considers the commercial operation of the PNGS until the end of 2024.
138. In relation to concerns submitted in the interventions from Greenpeace, Northwatch, CELA and individuals, the Commission enquired about the transparency of the PSR process and public availability of related documentation. The OPG representative stated that the GAR and the associated IIP were both publicly available on OPG's corporate website. CNSC staff informed the Commission that references to the PSR Basis Document and the associated PSR process were included in the CMD 18-H6 and that these documents were made available to intervenors upon request. CNSC staff also stated that the PSR-related safety factors reports were available to the public upon request. Following its consideration of the information provided, the Commission is satisfied that intervenors had timely access to publicly-available PSR information in preparation for this licence renewal hearing.
139. The Commission is satisfied that the PSR to support the commercial operation of the PNGS until the end of 2024 was carried out in accordance with REGDOC-2.3.3, CSA N290.18 and IAEA SSG-25. The Commission does find, however, that should OPG apply to operate the PNGS beyond 2024, OPG shall be required to carry out an

updated PSR that would adequately consider the extended operation of the PNGS.

140. The Commission is also satisfied that the IIP adequately identifies all necessary enhancements to the PNGS to ensure its safe operation and to further reduce risks throughout the renewed licence period. The Commission directs OPG to implement the IIP actions by December 2020 as presented during this hearing. The Commission requests to be informed as soon as practicable of any significant concerns or delays related to the implementation of IIP actions.
141. The Commission includes proposed licence condition 15.1 in the renewed licence for the PNGS and makes it clear that, should OPG want to make any changes to the IIP, this would constitute a change in the PNGS licensing basis and would require authorization from the Commission. The Commission directs CNSC staff to implement increased regulatory oversight in respect of OPG's IIP activities and to provide annual updates in this regard during the presentation of the NPP ROR or through other means, as appropriate.
142. Based on the information provided on the record for this hearing, the Commission is satisfied that PSR-related information was made publicly available by both OPG and CNSC staff. The Commission notes the concerns raised by Greenpeace about the information requests that the intervenor made under the *Access to Information Act*.<sup>36</sup> and states that such information requests are not within the scope of the Commission's mandate or of these proceedings. Notwithstanding, and in the context of public information, disclosure and transparency, the Commission expects OPG and CNSC staff to provide non-confidential information to intervenors as soon as they are made aware of any requests.

#### 4.3.3 *End of PNGS Commercial Operation*

143. The Commission assessed OPG's plans for the December 31, 2024 ECO at the PNGS. OPG submitted detailed information about the activities that would have to be carried out at the PNGS to support the transition phase during the years prior to ECO, as well to support the post-shutdown phase. OPG informed the Commission that, through its SOP, OPG would document the actions and define stand-alone supplemental measures to existing programs to ensure the continued safe operation of and the maintenance of a healthy safety culture at the PNGS. OPG noted that the SOP would be submitted to the CNSC at least 5 years before the permanent shutdown of the first PNGS unit and that nuclear safety would be assured through to the ECO at the PNGS.
144. OPG also provided the Commission with information about its SAP which detailed OPG's planning and the activities that would safely transition the PNGS from the electricity generating state to the safe storage state. OPG explained the activities to be undertaken during the stabilization phase, including the defuelling of the reactors;

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<sup>36</sup> R.S.C., 1985, c. A-1

dewatering systems containing heavy water; and removing systems that were required for commercial operation from service. OPG submitted that, during the stabilization phase, an operational footprint would be maintained by PNGS to support used fuel removal and storage in the irradiated fuel bays (IFB), heavy water storage, monitoring activities and security. OPG indicated that it would provide the CNSC with annual updates to the SOP and SAP by December 15 of each year and that these updates would include a progress report and information on the effectiveness of measures that OPG committed to in the plans.

145. CNSC staff reported that OPG had submitted its ECO strategy for the PNGS site in the *Pickering Site Strategic Plan*.<sup>37</sup> CNSC staff also reported that, as per proposed PNGS-specific licence condition 15.4, OPG would be required to develop the SAP at least 3 years prior to the ECO at the PNGS. CNSC staff noted that OPG was required to inform the CNSC, in writing and no later than December 31, 2022, should OPG intend to operate any reactor beyond December 31, 2024.
146. The Commission reviewed the interventions from several groups and individuals that expressed a concern that OPG would apply to operate the PNGS beyond 2024, and initiated an explanation of the regulatory process that OPG would have to undertake should OPG submit such an application to the CNSC. CNSC staff reiterated the requirement for OPG to inform the CNSC by December 31, 2022 of its intent to apply for authorization to operate the PNGS beyond December 31, 2024, explaining that such an application would represent a change in the PNGS licensing basis and would require Commission approval through a public hearing. CNSC staff also noted that there was no requirement for a phased approach to the ECO, as suggested in the intervention from Greenpeace, that OPG would be required to update the SOP annually and that, if OPG did decide to shut down any units before 2024, this change in business strategy would be reflected in the updated SOP.
147. Further on this topic, the OPG representative stated that OPG understood that operation beyond 2024 would be a change in the PNGS licensing basis and would require approval from the Commission. The OPG representative noted, however, that OPG had submitted this licence renewal application with the intention to ECO at the PNGS in 2024. The Commission is satisfied with the information provided on this point and, following its review, is satisfied that the proposed PROL and LCH adequately address and consider the requirements on OPG should it apply for continued operations at the PNGS beyond 2024.
148. The Commission noted that there were no REGDOCs or formal guidance in respect of the development of the SOP or the SAP, and requested additional information on how these plans would be developed. CNSC staff explained that previous OPEX with the shutdown and stabilization of the PNGS Units 2 and 3, as well as of the Gentilly-2 NGS, had provided the basis and informed the plans for the shutdown and stabilization of the six remaining PNGS reactor units, noting that the shutdown of reactors would decrease safety risks. CNSC staff confirmed that the 2016 SOP that

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<sup>37</sup> Ontario Power Generation Inc., *Pickering Site Strategic Plan*, P-PLAN-09314-00003-R000, July 2017.

was developed for the OPG's original intended ECO in 2020 met CNSC expectations.

149. Further on this topic, the OPG representative explained that, in addition to the shutdown-related activities described by CNSC staff, OPG had national and international OPEX to draw from through refurbishment activities at the DNGS and other NGSs, as well as from international conferences and benchmarking. The OPG representative also stated that OPG began planning for the ECO at the PNGS in 2011, and provided additional information about the ECO plans that had been submitted to the CNSC and the ongoing communication that OPG had had with CNSC staff in that regard. The Commission is satisfied with the information submitted on this topic.
150. The Commission noted the 4-year timeline for the PNGS transition into the safe storage state, and enquired about how OPG developed this timeline and about the resources that would be required for the work. The OPG representative detailed the projects included in the SAP and stated that these projects informed OPG's development of the associated timelines. CNSC staff submitted that its review of OPG's plans showed that the timelines were appropriate for the work that OPG planned to carry out from 2025 to 2028, adding that OPG was required to consider both the work to be undertaken at the PNGS as well as the human performance element in the SAP. Following its consideration of the information provided, the Commission is satisfied that OPG has adequately considered all relevant factors in the development of the timeline to transition the PNGS to a safe storage state.
151. The Commission considered the interventions from community groups, non-government organizations and individuals, which expressed concerns about the potential for decreased safety standards at the PNGS with the ECO in 2024. Asked to provide comments in this regard, the OPG representative emphasized that safe operations at the PNGS and nuclear safety were OPG's first priority, and reasserted OPG's commitment to the continuous improvement of PNGS operations until the last day of commercial operation. The OPG representative also stated that, from a technical standpoint, the PSR and associated IIP demonstrated that OPG could safely operate the PNGS until December 31, 2024. Based on the information provided, the Commission is satisfied that a reduction in safety standards or safety margins at the PNGS as a result of the planned ECO in 2024 is not expected and notes that the PNGS PSR and IIP are considered by the Commission in greater detail in section 4.3.2 of the *Record of Decision*. The Commission directs that, should any reduction in safety margins or standards at the PNGS occur, this be reported to the Commission via the NPP Status Report presented at every public Commission meeting.
152. The Commission enquired about the management of the heavy water following the defuelling and dewatering of the reactor units at the PNGS. The OPG representative explained that, between the heavy water storage tanks available at the PNGS and the DNGS, OPG could safely store all of the heavy water following the de-watering of the reactor units.



153. Based on the information provided, the Commission is satisfied that OPG will have appropriate plans in place for the transition of the PNGS from commercial operation to a safe storage state. The Commission is satisfied with the proposed PNGS-specific licence condition 15.4 as it pertains to the ECO at the PNGS and includes it in the renewed licence. The Commission is also satisfied that OPG has the requisite knowledge and planning tools in place to safely complete the PNGS transition to a safe storage state.
154. The Commission directs OPG to submit the SOP to the CNSC no later than December 31, 2019 and to submit the SAP no later than December 31, 2022 (5 years and 2 years before the ECO at the PNGS, respectively). The Commission also directs OPG to submit updates to the SOP and SAP before December 15 of every calendar year, as proposed during this hearing.

#### *4.3.4 Operating Procedures*

155. The Commission assessed OPG's operating procedures at the PNGS, noting that these were essential for the safe execution of authorized activities. OPG submitted that a dedicated group at the PNGS ensured that procedures remained current and that the Technical Procedural Action Request was used to request any changes to technical procedures. OPG further submitted that, during the previous licence period, the number of temporary operating instructions and the backlog of operationally significant procedure change requests had been reduced at the PNGS.
156. CNSC staff confirmed that OPG had mature and efficient governance in place to ensure that the operating procedures for the PNGS were written in a consistent and useable manner, and that a process to effectively manage procedural change had been implemented.
157. Based on the information provided on the record for this hearing, the Commission is satisfied that OPG has adequate procedures in place to operate and manage procedural changes at the PNGS.

#### *4.3.5 Reporting and Trending*

158. The Commission assessed OPG's adherence to the specifications of S-99, *Reporting Requirements for Operating Nuclear Power Plants*.<sup>38</sup> and REGDOC-3.1.1, *Reporting Requirements for Nuclear Power Plants*.<sup>39</sup> which superseded S-99 on January 1, 2015. OPG submitted that reporting procedures were in place to establish notification requirements for events at the PNGS and to ensure that routine scheduled reports

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<sup>38</sup> CNSC Regulatory Standard S-99, *Reporting Requirements for Operating Nuclear Power Plants*, March 2003.

<sup>39</sup> CNSC Regulatory Document REGDOC-3.1.1, *Reporting Requirements for Nuclear Power Plants*, Version 2, April 2016.

were submitted in a timely fashion to the CNSC. CNSC staff confirmed that OPG submitted reports in accordance with S-99 and REGDOC-3.1.1 throughout the previous licence period.

159. OPG submitted that, through its PNGS Corrective Action Program, OPG identified and dispositioned any conditions that had an adverse impact on PNGS operations. OPG also submitted that trending was carried out for lower-level performance trends before they became a significant issue, and that root cause and apparent cause investigations were carried out for significant events to improve plant reliability and human performance at the PNGS. Although CNSC staff noted some delays in OPG's submitting of detailed event reports during the previous licence period, CNSC staff submitted that, overall, OPG was meeting licence requirements and that CNSC staff was satisfied with the improvements to the Corrective Action Review Board process that OPG had initiated in this regard.
160. Based on the information provided, the Commission is satisfied that OPG met reporting parameters as specified in S-99 and currently meets the parameters of REGDOC-3.1.1. The Commission expects OPG to continue the implementation of improvements to the Corrective Action Review Board process during the renewed licence period.
161. In reference to the concerns regarding reporting requirements raised by the Mohawks of the Bay of Quinte (MBQ) and several other intervenors, the Commission reminds OPG that public information disclosure relates to the information about PNGS operations that could be of interest to Indigenous groups, members of the public and stakeholders, whereas reporting requirements relate to information that OPG is required to report to the CNSC in accordance with CNSC regulatory requirements. In this vein, the Commission directs OPG and CNSC staff to identify areas of improvement to their procedures for public reporting on environmental events and implement changes, as required. The Commission anticipates an update in the next year on the improvements to public reporting procedures during the next NPP ROR or via other means, as appropriate.

#### *4.3.6 Outage Management Performance*

162. The Commission considered the adequacy of OPG's outage management processes which were used to manage planned outages at the PNGS. During planned outages, OPG carried out inspections, maintenance and modifications that could not be carried out when a reactor was at power. OPG submitted information about the PNGS outage management procedures, noting that all outages at the PNGS were carried out in a safe and effective manner during the previous licence period. OPG also submitted information on its procedures for the management of heat sinks at the PNGS during planned outages, forced outages and heat sink failures.

163. OPG provided the Commission with information regarding its PNGS outage performance improvement plan which included a focus on risk mitigation and contingency planning. OPG submitted that a study considering a 30-month outage scheduling cycle at the PNGS was being conducted, with expected benefits including dose reduction, improved training windows and fewer outage days.
164. CNSC staff submitted information regarding its compliance verification activities of OPG's outage management at the PNGS, and reported that OPG carried out planned and forced unplanned outages safely and in a manner that met regulatory requirements.
165. Based on the information provided by OPG and CNSC staff, the Commission is satisfied that planned outages were performed appropriately throughout the previous licence period and that OPG has adequate procedures in place to carry out planned outages during the renewed licence period. The Commission is also satisfied that forced outages were communicated to the Commission as required and that their follow-up was, and will continue to be, carried out appropriately.

#### *4.3.7 Safe Operating Envelope*

166. The Commission examined the information provided by OPG and CNSC staff regarding the PNGS Safe Operating Envelope (SOE), which is defined by CSA N290.15, *Requirements for the safe operating envelope for nuclear power plants*.<sup>40</sup> OPG submitted information about its processes, organizational responsibilities and key program elements that confirmed that the SOE was properly defined, documented and ensured that the operation of the PNGS remained within its licensing basis.
167. CNSC staff submitted that OPG's SOE program at the PNGS met the specifications of CSA N290.15 and licensing requirements throughout the previous licence period.
168. Based on the information provided for this hearing, the Commission is satisfied that OPG has an appropriate SOE program in place at the PNGS that meets the specifications of N290.15.

#### *4.3.8 Accident Management and Recovery*

169. The Commission assessed the severe accident management and recovery programs at the PNGS. OPG submitted that the PNGS severe accident management program ensured that the safety of the public, environment, plant personnel and the station remained protected during in the event of a BDBA. OPG provided details about the PNGS severe accident management guidelines (SAMG), which focussed on containment integrity and fuel cooling, as well as about the PNGS emergency mitigating equipment guidelines (EMEG), which would be used to mitigate accident

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<sup>40</sup> N290.15, *Requirements for the safe operating envelope for nuclear power plants*, CSA Group, 2010.

progression and ensure adequate fuel cooling.

170. CNSC staff submitted that compliance verification activities during the previous licence period showed that OPG had appropriate procedures in place for dealing with abnormal incidents and design basis accidents (DBA). CNSC staff further noted that OPG's PNGS abnormal incident manuals and emergency operating procedures met licensing requirements and were available to operators who were trained in their use.
171. CNSC staff reported that an extensive desktop review of the PNGS severe accident management program was carried out in 2015, that this review showed that OPG had adequately implemented the program, and that SAMGs and EMEGs were validated through large exercises, table top exercises, and drills. CNSC staff submitted that OPG was adequately addressing areas of improvement identified through this review.
172. OPG submitted that, as part of the IIP, safety-enhancement modifications and design changes were being implemented at the PNGS to prevent a BDBA from progressing to the point of challenging containment. CNSC staff confirmed that the IIP-committed modifications would enhance PNGS safety in the event of a BDBA and provided additional information about these enhancements, noting that they would be monitored through the IIP compliance verification process. CNSC staff also reported that OPG had committed to implement the emergency filtered air discharge system (EFADS) for the filtered venting of containment in two phases at the PNGS, with physical changes related to EFADS implementation completed in June 2018 and programmatic changes expected to be completed by December 2018.
173. In considering the concerns about containment structures and the single PNGS vacuum building as presented in the intervention from D. Rudka, the Commission requested additional information in this regard. The OPG representative explained that each reactor building had its own concrete containment structure and that these containment structures were connected to the shared vacuum building through a pressure-relief duct. The OPG representative also explained that the containment structures and the vacuum building were all kept at a sub-atmospheric pressure and that they were shown to be fully effective under both DBA and BDBA conditions.
174. Further on the issue of containment, the Commission enquired about controlled venting at the PNGS in the event of a nuclear emergency. CNSC staff explained that the EFADS that had been installed at the PNGS would ensure that any release which required controlled venting to reduce containment pressure would be filtered prior to release. CNSC staff emphasized that venting would likely only be required during a multi-unit accident since the PNGS vacuum building had a design capacity of approximately one and a half reactors. The Commission is satisfied that OPG has adequately considered the issue of containment and controlled venting at the PNGS.
175. Based on the information provided by OPG and CNSC staff, the Commission is satisfied that OPG has adequate programs in place to manage and respond to DBA and BDBA events at the PNGS. The Commission expects that OPG continue the

implementation of severe accident management program-related corrective actions identified during the CNSC's compliance verification activities during the renewed licence period.

176. The Commission directs CNSC staff to maintain close oversight of the IIP-identified enhancements to OPG's BDBA management programs during the renewed licence period and expects annual updates in this regard through the NPP ROR or other means, as appropriate.
177. The Commission acknowledges that numerous intervenors, including municipalities and community organizations in the vicinity of the PNGS, the MBQ, CELA, the Oxford Coalition for Social Justice, the David Suzuki Foundation, Greenpeace, DNA, the Canadian Coalition for Nuclear Responsibility (CCNR), the Waterkeeper, the Ontario Clean Air Alliance (OCAA), the Provincial Council of Women of Ontario, the Registered Nurses' Association of Ontario, the Toronto District School Board (TDSB) and the Toronto District Catholic School Board (TDSCB), and individuals expressed concerns about emergency management and recovery in the event of a severe accident at the PNGS. The issues submitted in these interventions are considered by the Commission in Section 4.10, *Emergency Management and Fire Protection* of this *Record of Decision*.

#### 4.3.9 Conclusion on Operating Performance

178. Based on the above information, the Commission concludes that the operating performance at the PNGS during the previous licence period provides a positive indication of OPG's ability to carry out the activities under the renewed licence.
179. On the basis of its review of the information, the Commission is satisfied that OPG will continue to ensure that appropriate operating performance-related programs are in place at the PNGS throughout the renewed licence period to ensure the health and safety of persons and the environment.
180. The Commission directs OPG to report to the CNSC quarterly on the status of the IIP actions, as submitted during this hearing. The Commission also directs CNSC staff to maintain close oversight of OPG performance in carrying out the IIP actions and to report to the Commission annually on the status of the IIP actions during the presentation of the annual NPP ROR or via other means, as appropriate.
181. The Commission acknowledges intervenors' concerns about the continued operation of the PNGS beyond 2024. With this decision, the Commission makes it clear that any application for the continued operation of the PNGS beyond 2024 would constitute a change in the PNGS licensing basis and would require approval from the Commission through a public hearing. Should OPG submit an application for PNGS operation beyond 2024, OPG shall submit this application to the CNSC as early as practicable, and no later than December 31, 2022.

#### 4.4 Safety Analysis

182. The Commission assessed safety analysis at the PNGS, which includes a systematic evaluation of the potential hazards associated with the conduct of the licensed activity or the operation of a facility, and considers the effectiveness of preventive measures and strategies in reducing the effects of such hazards. Safety analysis supports the overall safety case for the PNGS. CNSC staff reported that, throughout the previous licence period, the PNGS was operated safely and within licence limits, with OPG's performance in this SCA rated by CNSC staff as "satisfactory" from 2013 to 2014 and as "fully satisfactory" from 2015 to 2017.
183. OPG submitted that the OPG Reactor Safety Program defined the organizational responsibilities and key program elements for the management of nuclear safety analysis issues and operational safety requirements at the PNGS. OPG also submitted that, through the COG Industry Standard Toolset Program, OPG ensured the adequate maintenance, support, development and qualification of the computer codes used for CANDU reactors.
184. CNSC staff submitted that, during the previous licence period, OPG's safety analysis software met the specifications of CSA N286.7-99, *Quality assurance of analytical, scientific and design computer programs for nuclear power plants*<sup>41</sup> (reaffirmed in 2012) and that OPG would implement CSA N286.7-16<sup>42</sup> by September 1, 2018.
185. CNSC staff informed the Commission that, in 2015 and in collaboration with Bruce Power, OPG successfully completed a severe accident software simulator solution (SASS) project to verify the multi-unit severe accident modelling capability of the MAAP-CANDU computer code used in the current severe accident analyses. CNSC staff reported that it had reviewed the project reports and had provided recommendations in this regard to industry.
186. The Commission asked for comments in regard to the intervention from S. Nijhawan which suggested that the MAAP-CANDU software was not adequate for the modelling and analysis of severe accidents. CNSC staff explained that, while MAAP-CANDU had been developed in the late 1980s, the software had evolved and improved significantly since that time to incorporate extensive research and OPEX. CNSC staff provided information about benchmarking that had been carried out against other modeling programs and explained that the latest version of the software, MAAP5-CANDU, had been recently validated against CSA N286.7-16.
187. Further on the MAAP-CANDU software, the OPG representative informed the Commission that, following the Commission's directions to investigate the concerns raised by this intervenor in several Commission meetings and hearings about the use

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<sup>41</sup> CSA N286.7-99, *Quality assurance of analytical, scientific and design computer programs for nuclear power plants*, CSA Group, 1999 (reaffirmed in 2012).

<sup>42</sup> CSA N286.7-16, *Quality assurance of analytical, scientific and design computer programs*, CSA Group, 2016.

of this software and other issues, an extensive review in this regard was carried out by the Canadian nuclear industry through COG. The OPG representative further explained that an independently-reviewed paper about this matter which indicated that, amongst other findings, the MAAP-CANDU software was an appropriate tool for the modelling of severe accidents at CANDU NGSs, was presented to the Commission in March 2017.<sup>43</sup> The OPG representative also informed the Commission that the MAAP-CANDU software was included in OPG's lifecycle management plan (LCMP) to ensure that OPG's severe accident modelling reflected the most up-to-date knowledge and research. The Commission has carefully examined the concerns brought forth by S. Nijhawan regarding the use of MAAP-CANDU for the modelling of severe accidents. The Commission remains satisfied that the MAAP-CANDU software remains adequate and fit for purpose.

188. The Commission requested comments about the issues raised in the intervention from S. Nijhawan about the adequacy of passive auto-catalytic recombiners (PARs). CNSC staff responded that it had reviewed the information provided by the intervenor and that CNSC staff had not identified any novel information in addition to that considered by the Commission at the March 2017 Commission meeting item.<sup>44</sup> CNSC staff stated that CNSC assessments showed that OPG had adequately estimated hydrogen production and the resulting concentration at the PNGS, and that the PARs at the PNGS remained fit for purpose. The OPG representative informed the Commission that, although OPG continued to work with CNL in respect of hydrogen production and mitigation in NGS, OPG remained of the view that the PARs installed at the PNGS were adequate. The Commission wishes to thank the intervenor for the information submitted for this hearing and states that the reported concerns about the safety of the PNGS were examined in detail by the Commission. However, based on the information provided during this hearing by the intervenor, OPG and CNSC staff, the Commission remains satisfied that the PARs installed in Canadian NGS, including the PNGS, are adequate and fit for purpose.
189. Noting the concern expressed in several interventions about the positive void reactivity coefficient of CANDU reactors, the Commission initiated an explanation about this matter. CNSC staff explained that the power of a reactor with a positive void reactivity increased in the event of voiding in the area of the fuel, and stated that this was a design characteristic of the CANDU reactor rather than a design flaw. CNSC staff also explained that CANDU safety system design considered the positive void reactivity coefficient and provided information about how emergency shutdown systems (ESDS) mitigated this risk. The Commission is satisfied with the information provided by CNSC staff on this topic.

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<sup>43</sup> *Minutes of the Canadian Nuclear Safety Commission (CNSC) held on March 8, 2017.*

<sup>44</sup> *Ibid.*

#### 4.4.1 *Deterministic Safety Analysis*

190. The Commission considered the information provided by OPG and CNSC staff about the deterministic safety analyses (DSA) that were performed for PNGS-A and PNGS-B. OPG submitted detailed information about how DSAs were used to support safety provisions at the PNGS, noting that DSAs had been used since the inception of the PNGS design and were key in supporting the defence-in-depth approach. OPG also informed the Commission that the PNGS DSAs were documented in the *Pickering Safety Reports*, were periodically updated and showed that adequate safety margins were in place in the event of a DBA at the PNGS.
191. Recognizing that the aging of the PNGS heat transport systems (HTS) could have an impact on safety margins, OPG submitted that DSAs considering future aging scenarios had been completed for all PNGS reactor units. OPG confirmed to the Commission that the aging of PNGS reactor units was managed effectively and that adequate safety margins would be maintained through to the ECO at the PNGS, with progress reports regarding HTS safety analysis submitted to CNSC staff annually.
192. CNSC staff confirmed the information provided by OPG and reported to the Commission details about several other factors that could affect the PNGS safety margins that OPG addressed during the previous licence period, including large loss of coolant accidents (LOCA) and the implementation of the enhanced neutron overpower protection (NOP) methodology. CNSC staff reported that its reviews showed that OPG was adequately managing safety margins at the PNGS, including those associated with the aging HTS.
193. Regarding the implementation of REGDOC-2.4.1, *Deterministic Safety Analysis*<sup>45</sup> at the PNGS, OPG informed the Commission that an implementation plan had been submitted to CNSC staff in October 2014 and that the assessment of common mode events (CME) represented the largest gap in the *Pickering Safety Reports*. OPG reported that the plans to address this gap were submitted to CNSC staff in August 2016, with OPG completing the CME analysis and submitting the results in the context of its *Pickering Safety Reports* to the CNSC in December 2017.
194. CNSC staff reported that it would complete its CME analysis review in 2018, with OPG then addressing CNSC staff's comments through the *Pickering Safety Reports* update process. With OPG having addressed the largest gap in respect of the implementation of REGDOC-2.4.1, CNSC staff submitted that it was satisfied with OPG's revised risk-informed implementation plan and that OPG would carry out the remaining work between 2018 and 2021.
195. The Commission noted that the draft PNGS LCH included a reference to the 1972-published AECB 1059, *Reactor Licensing and Safety Requirements*<sup>46</sup> and enquired about whether more modern references existed. CNSC staff explained that the dose

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<sup>45</sup> CNSC Regulatory Document REGDOC-2.4.1, *Deterministic Safety Analysis*, May 2014.

<sup>46</sup> Hurst and Boyd, AECB 1059, *Reactor Licensing and Safety Requirements*, Atomic Energy Control Board, 1072.



limits, as referenced in AECB 1059, maintained from the original PNGS licensing basis, were still considered safe and were therefore maintained in the CNSC's regulatory framework. CNSC staff further explained that REGDOC-2.4.1 was published in 2014 and represented modern requirements for DSA.

196. Based on the information provided on the record for this hearing, the Commission is satisfied that OPG's current DSA for the PNGS is adequate and the safety margins for the licensed activities to be carried out at the PNGS during the renewed licence period are adequate.
197. The Commission is of the view that the licensing basis for a facility should refer to updated codes and standards and directs CNSC staff to review the information in AECB 1059 and incorporate it in the CNSC's modern regulatory framework.
198. The Commission is satisfied with OPG's implementation plans for REGDOC-2.4.1 and expects annual updates in this regard during the presentation of the NPP ROR or via other means, as appropriate.

#### 4.4.2 Probabilistic Safety Assessment

199. The Commission assessed the information provided by OPG about its Probabilistic Safety Assessment (PSA) Program at the PNGS and its compliance with S-294, *Probabilistic Safety Assessment (PSA) for Nuclear Power Plants*,<sup>47</sup> as well as the implementation of REGDOC-2.4.2, *Probabilistic Safety Assessment (PSA) for Nuclear Power Plants*.<sup>48</sup> OPG informed the Commission that, even though PSA results were typically expressed on a per-unit basis, PNGS PSAs had always represented multi-unit PSAs that accounted for multi-unit interactions since PNGS units extensively shared safety-related systems, including containment.
200. CNSC staff submitted information about the increased PSA specifications in REGDOC-2.4.2 and noted that OPG had committed to implementing this REGDOC by the end of 2020, with OPG's transition plan meeting CNSC staff's expectations. CNSC staff confirmed that OPG's progress in this regard would be monitored throughout the renewed licence period.
201. The Commission considered the detailed information about the PNGS-A PSAs (PNGS-A risk assessment or "PARA") for Units 1 and 4 that OPG had carried out during the previous licence period. OPG submitted that the PARA was first completed in 2012 and that, following the 2013 PNGS licence renewal hearing and a Commission request, a 2014 PARA update that was compliant with S-294 and included the Fukushima Action Items (FAI) was carried out. OPG further reported that the 2014 PARA update showed that EME reduced risk at the PNGS and that both the Level 1 PSA (severe core damage frequency – SCDF) and Level 2 PSA (large release frequency – LRF) for internal and external events met the safety limits

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<sup>47</sup> CNSC Regulatory Standard S-294, *Probabilistic Safety Assessment (PSA) for Nuclear Power Plants*, 2005.

<sup>48</sup> CNSC Regulatory Document REGDOC-2.4.2, *Probabilistic Safety Assessment (PSA) for Nuclear Power Plants*, 2014.

- of 1.00E-04 events / reactor-year and 1.00E-05 events / reactor-year, respectively. OPG also reported that a 2018 PARA update was in progress, that it met the specifications of S-294 and that preliminary results showed that safety limits for all internal and external hazards would be met. CNSC staff concurred with the information provided by OPG, noting that it had accepted the PARA methodology and that CNSC staff expected OPG to submit to the CNSC a full-scope updated PARA that met the specifications of S-294 by the end of 2018.
202. The Commission also considered the detailed information about the PNGS-B PSAs (PNGS-B risk assessment or “PBRA”) for Units 5 – 8 that had been carried out during the previous licence period. OPG submitted that the S-294 compliant PBRA was first completed in 2012, followed by an update that included EME in 2014. OPG also reported that the 2017 PBRA update included the impacts of Phase 1 and Phase 2 EME, and that the PBRA showed that the Level 1 and Level 2 PSAs for internal and external events continued to meet safety limits. CNSC staff noted that it had accepted OPG’s methodology for the 2017 PBRA update, which met the specifications of S-294.
203. OPG informed the Commission that, in addition to the SCDF and LRF safety limits, OPG had also implemented continuous improvements at the PNGS to meet the SCDF and LRF safety targets of 1.00E-05 events / reactor-year and 1.00E-06 events / reactor-year, respectively. OPG provided information regarding the PSA Risk Improvement Plan which included EME modifications, installation of PARs, tie-down of EME in the event of high winds, and the installation of flood barriers. OPG submitted that the improvements had resulted in a significant risk reduction to internal fires, SCDF and LRF results, and that OPG completed implementation of the plan in 2017. CNSC staff confirmed to the Commission that the PSA Risk Improvement Plan met CNSC staff’s expectations and that OPG had provided annual updates to the CNSC on the plan’s progress and status, noting that a final update on the status of the plan would be provided to the Commission in the 2017 NPP ROR.
204. OPG reported that PNGS-B met the safety targets on a per-unit basis for all hazards. OPG also explained that the PNGS-A SCDF met the safety target of 1.00E-05 events / reactor-year, but the PNGS-A LRF did not meet the safety target of 1.00E-06 events / reactor-year for internal events and fires. OPG further explained that several station improvement projects were being carried out through the IIP to further reduce the PNGS-A LRF to below the safety target of 1.00E-06 events / reactor-year. CNSC staff confirmed that the improvements that OPG had implemented at the PNGS to further reduce risks met CNSC expectations.
205. The Commission reviewed the major safety analysis activities to which OPG had committed through the IIP, including the safety analysis of small-break LOCA, loss of flow and NOP; as well as connecting the PNGS firewater system to the PNGS-A Units 1 and 4 steam generators, HTS and calandria to achieve further risk reduction. CNSC staff submitted that these improvements would reduce the estimated LRF for PNGS-A to 1.00E-06 events / reactor-year, the safety target for existing plants and

the safety limit for new build NGS.<sup>49</sup>

206. The Commission expressed satisfaction with the improvements implemented at the PNGS as a result of the FAIs and enquired about how effectively OPG could deploy EME. The OPG representative responded that all EME could be deployed within 6 hours, that this was a shared function between the PNGS fire response unit, operators and maintenance staff, and provided the Commission with information on training exercises that OPG carried out to practice the EME deployment and use. The Commission is satisfied that OPG has adequate plans to deploy EME at the PNGS quickly, if required.
207. In reference to the intervention from M. Duguay, the Commission enquired about the validity of and uncertainty in PSA calculations. CNSC staff acknowledged that uncertainties existed in PSAs, but noted that this was considered and accounted for through uncertainty analysis in the PSA. CNSC staff also explained that, although several intervenors had referred to a PSA as an absolute measure of risk and frequency of events at an NGS, this was not the purpose of the PSA. CNSC staff stated that a PSA was internationally considered to be an appropriate predictive tool which provided information about the risk of operating an NGS over a wide range of conditions and could inform facility enhancements to increase safety margins. Asked to comment about the accident scenario presented in the intervention from CCNR which contemplated a nuclear weapon hitting the PNGS, CNSC staff informed the Commission that was not a valid scenario. The Commission understands that the purpose of PSA and related uncertainties remains a complex topic of interest to intervenors. The Commission has considered the information provided on this topic by intervenors, OPG and CNSC staff, and is satisfied that uncertainties are adequately considered in the PNGS PSAs and that the PSAs demonstrate that the risk from the PNGS remains low.
208. In considering the intervention from L. Bertrand, the Commission enquired about whether the PNGS PSA had considered a software failure. CNSC staff responded that this was a scenario that was considered in the PSA and informed the Commission that the reactors' primary safety systems were fail safe and, should there be a software failure, the reactors would shut down rather than continue operating. The Commission is satisfied on this point.

#### Whole-site PSA

209. The Commission notes that, during the 2013 PNGS licence renewal hearing, the Commission placed an action on OPG to “*develop a whole-site PSA or methodology*”

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<sup>49</sup> The LRF safety limit for a new build is 1.00E-06 / year, as stipulated in CNSC Regulatory Document REGDOC-2.5.2, *Design of Reactor Facilities: Nuclear Power Plants*, 2014.

for a whole site PSA, specific to the Pickering NGS site”<sup>50</sup> for the assessment of the overall risk of the entire PNGS site. This overall risk would include the multi-unit risk, other sources of radioactivity at the site including IFBs, internal and external hazards, and operating modes other than the full power and outage operating conditions.

210. The Commission considered the information provided by OPG regarding the development of the whole-site PSA methodology that was submitted to the CNSC in 2014, and the related whole-site PSA work that it had carried out through COG, noting that the work represented a comprehensive and first-of-a-kind pilot study. OPG also submitted detailed information about the calculation of the PNGS LRF aggregation and the consideration of each hazard type, each side (A and B) of the PNGS and how these were added together to determine the whole-site LRF, noting that the whole-site PSA considered internal events, internal flood, internal fire, seismic risks and high winds. OPG stated that there was no international consensus yet on whole-site risk assessment methodology and provided details about the challenges that had been encountered during the assessment. The Commission notes that OPG presented the Pickering whole-site PSA results to CNSC staff in December 2017 and also presented a summary to the Commission at the December 2017 Commission meeting.<sup>51</sup>
211. In regard to the whole-site PSA results, OPG informed the Commission that risk aggregation across all hazards at the PNGS site, which was considered a conservative approach, showed a whole-site LRF to be 0.82E-05 events / year. OPG further explained that this was lower than the per-unit LRF safety goal of 1.00E-05 events / reactor-year and was generally applied on a per-hazard basis. On this basis, OPG reported that the PNGS whole-site risk was acceptably low. OPG also provided the Commission with several lessons learned and insights that had been gleaned from the PNGS whole-site PSA.
212. CNSC staff informed the Commission that it had agreed with OPG’s PNGS whole-site PSA methodology, with the overall results and with the finding that the overall risk of the PNGS site was low. CNSC staff confirmed that CNSC staff’s reviews of the OPG’s methodology showed that OPG adequately eliminated the double-counting issue that had been raised by the nuclear power industry. CNSC staff also submitted information regarding international efforts in respect of the development of whole-site PSA methodology, noting that the Nuclear Energy Agency’s (NEA) work was targeted for completion in December 2018 and the IAEA’s project was targeted for completion by October 2019.

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<sup>50</sup> CNSC Record of Proceedings, Including Reasons for Decision – Ontario Power Generation Inc., *Application to Renew the Power Reactor Operating Licence for the Pickering Nuclear Generating Station*, paragraphs 24, 106 and 361, issued August 2013.

<sup>51</sup> *Pickering Whole-Site Risk*, Ontario Power Generation, presented to the Commission on December 14, 2017, CMD 17-M64.1.

213. In considering the intervention from Greenpeace about PSA and whole-site PSA, the Commission expressed satisfaction with OPG's contribution to the whole-site PSA work that had been carried out and requested additional information in this regard. The OPG representative provided the Commission with an explanation of the development of the whole-site PSA methodology, noting that the single-unit PSA methodology that was used in the development of the whole-site PSA methodology was based on industry-best practices, was accepted by CNSC staff, and met IAEA and American Society of Mechanical Engineers (ASME) standards. The OPG representative also noted that, as with single-unit PSA, the whole-site PSA was an indicator of risk rather than a predictor of an accident, and that OPG was of the view that the whole-site PSA for the PNGS achieved this goal.

Assessment of Probabilistic Safety Assessment

214. Based on the information provided, the Commission finds that CNSC staff's analysis of the PSAs for the PNGS adequate and that the PSAs demonstrate that OPG meets the SCDF limit of 1.00E-04 events / reactor-year and LRF limit of 1.00E-05 events / reactor-year for the PNGS from all contributors: internal events, internal floods, internal fire, high winds and seismic PSAs.
215. Further, the Commission is satisfied with the adequacy of OPG's whole-site PSA methodology and the whole-site LRF of 0.82E-05 events / year demonstrates that the risk of the PNGS to persons and the environment remains acceptably low. The Commission notes OPG's commitments to share its learnings in regard to whole-site PSA with the international community and requests OPG and CNSC staff to continue their work with other CANDU operators and international organizations on whole-site PSA methodologies and best practices in this field.

*4.4.3 Criticality Safety*

216. The Commission considered OPG's procedures and guidance at the PNGS for in- and ex-core criticality control of nuclear fuel. In its written materials, OPG informed the Commission that, since only natural and depleted uranium were used at the PNGS, there were no criticality concerns when the nuclear fuel was not in a heavy water moderator and that nuclear fuel was segregated from heavy water at all times. OPG further explained that, since there were no criticality concerns with used fuel in any configuration, it could be stored in light water and that the IFBs posed no criticality concerns. CNSC staff confirmed the information submitted by OPG.
217. Based on the information provided, the Commission is satisfied that OPG is maintaining appropriate programs to ensure criticality safety at the PNGS.

#### 4.4.4 Severe Accident and Hazard Analysis

218. The Commission assessed the information provided by OPG regarding severe accident analyses that were undertaken to evaluate residual risk at the PNGS. OPG submitted information about its BDBA Management program and the severe accident analysis to support the Level 2 PSA that had been carried out at the PNGS in response to the FAIs and to meet the specifications of S-294. OPG reported that the PNGS EMEGs and SAMGs reflected the results of the severe accident analysis to ensure that the public, environment and OPG employees remained safe in the event of a BDBA. More information regarding the EMEGs and SAMGs is found in section 4.3.8 of this *Record of Decision*.
219. CNSC staff reported that OPG's severe accident analysis met regulatory requirements and that all SAMG-related FAIs for the PNGS were closed to CNSC staff's expectations during the previous licence period. CNSC staff also submitted that REGDOC-2.4.1 required the performance of deterministic BDBA/severe accident analysis and that REGDOC-2.4.2 required that assessments of severe accidents be included as part of the Level 2 PSA. The Commission notes that OPG committed to implement these REGDOCs during the renewed licence period.
220. The Commission considered OPG's hazard analysis for the PNGS. OPG submitted that a hazard analysis was carried out as an initial step in PSAs and included the screening of internal and external hazards; naturally occurring hazards; and human-induced hazards. OPG further submitted that, based on the hazard analysis and screening process, PSAs were developed for internal floods, internal fires, seismic events and high winds, with all other hazards screened out because they were assessed to be of very low risk.
221. CNSC staff confirmed that OPG's hazard analysis for the PNGS met regulatory and licensing requirements, and that OPG adequately addressed and closed FAIs related to the re-assessment of site-specific extreme external hazards. CNSC staff also submitted that OPG updated its Internal Screening Analysis methodology in 2016, which was accepted by CNSC staff.
222. Noting the concerns raised in the interventions from the MBQ, the Provincial Council of Women of Ontario and individuals about seismic risks at the PNGS site, the Commission invited submissions on this matter. CNSC staff informed the Commission that the CNSC relied on analyses from Natural Resources Canada (NRCan) and the Geological Survey of Canada which showed that only a minor fault line, rather than an active fault line, ran along the bottom of Lake Ontario and that seismic activity in that area was considered to be low to medium. CNSC staff also stated that the PNGS was designed in accordance with CSA N289 series of standards<sup>52</sup> to withstand such seismic activity.

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<sup>52</sup> The CSA N289 series of Standards covers general requirements for the seismic hazard evaluation, seismic design, qualification, evaluation, and testing and monitoring. (Source: CSA Group website, <http://shop.csagroup.org>)

223. Further on this topic, the NRCan representative stated that the occurrence of a magnitude 9 earthquake, such as the one that occurred at the Fukushima-Daiichi NGS in 2011, was not a credible hazard scenario for the PNGS. The NRCan representative also stated that NRCan's review of OPG's seismic hazard modelling for the PNGS, which considered magnitude 7 earthquakes, was adequate and appropriate for the geology of the area. Based on the information provided during this hearing, the Commission is satisfied that OPG has adequately considered a comprehensive range of scenarios in its assessment of seismic risks for the PNGS.
224. The Commission requested additional information on OPG's severe weather hazards analysis for the PNGS. The OPG representative provided the Commission with information on the design of the PNGS that ensured that all equipment on the site was secure and remained intact in the event of severe weather conditions. In respect of high wind hazards, the OPG representative provided information about modelling that had been carried out for the PNGS, noting that it had considered tornadoes and projectiles that would be generated in the event of a tornado. The Commission is satisfied that OPG considered severe weather hazards in the PNGS hazards analysis.
225. CNSC staff informed the Commission that OPG's revised PNGS fire safety assessment met the specifications of CSA N293-12, *Fire protection for nuclear power plants*.<sup>53</sup> CNSC staff further reported that the PNGS fire safety assessment showed that OPG had effective measures in place to mitigate fire hazards and maintain fire and nuclear safety objectives at the PNGS.
226. On the basis of the information provided, the Commission is satisfied that the severe accident and hazard analyses performed by the OPG were adequate to evaluate and further mitigate residual risks at the PNGS. The Commission is also satisfied that OPG has adequately characterized seismic risks at the PNGS.

#### 4.4.5 *Management of Safety Issues (including Research and Development Programs)*

227. The Commission considered the information provided by the OPG and CNSC staff regarding the procedures and processes used at the PNGS for the identification and management of safety-related issues. OPG provided the Commission with information about its Safety and Licensing Research and Development Program through which OPG collaborated with COG members, as well as other international NGS operators. OPG also submitted that PNGS-specific safety analysis issues were addressed through OPG's Reactor Safety Program and the Risk and Reliability Program. OPG noted that information regarding its research and development activities was submitted in accordance with the specifications of REGDOC-3.1.1.

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<sup>53</sup> CSA N293-12, *Fire Protection for Nuclear Power Plants*, CSA Group, 2012.

228. OPG provided the Commission with details on the status of CANDU Safety Issues<sup>54</sup> (CSI) at the PNGS, noting that the CNSC had confirmed the overall safety case for CANDU reactors, but that CSIs addressed residual nuclear safety concerns. OPG submitted that there were four Category 3 CSIs (issues that were a concern in Canada) still open at the PNGS, with three issues regarding large break LOCA and one issue regarding non-large break LOCA. OPG further submitted details about the work that was being carried out to address these CSIs.
229. CNSC staff confirmed that OPG was adequately managing the four remaining Category 3 CSIs at the PNGS and that CNSC staff would continue to monitor OPG's progress in this regard during the renewed licence period. CNSC staff also submitted that an update on CSIs was provided to the Commission at a public Commission meeting in August 2016 which included public participation.<sup>55</sup> CNSC staff noted that, in March 2017, during a follow-up Commission meeting item which addressed the Commission's and intervenors' concerns regarding the basis for re-categorization of Category 3 CSIs, the Commission confirmed CNSC staff's recategorization of the Category 3 CSIs.<sup>56</sup>
230. Referencing the information about innovations at the PNGS provided by the OCNI in its intervention, the Commission enquired about technology-based innovation being carried out by OPG. The OPG representative provided detailed information about OPG's X-Lab innovation incubation centre which was focussed on using advanced technologies to drive quality, safety and efficiency, noting that WANO had recognized innovation at OPG as a strength during a December 2017 WANO review. The OPG representative also provided information about specific recent innovations at the PNGS, including remote battery monitoring, and the use of robotics to reduce dose and increase safety to workers. The Commission expressed satisfaction with OPG's commitment to innovation in the nuclear field.
231. Noting that several interventions referenced research and development activities being carried out by Canadian NGS licensees through COG fuel channel working groups, the Commission asked the COG representative for more information in this regard. The COG representative provided information about international fuel channel seminars, the COG Fuel Channel Life Management Project, peer groups focussed on specific research areas, and the sharing of safety-related issues. The COG representative also provided information about the COG database which included over 40,000 entries, including OPEX and research, which were fully searchable by COG members.

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<sup>54</sup> CANDU Safety Issues as developed and categorized by the CNSC using IAEA TECDOC-1554, *Generic Safety Issues for Nuclear Power Plants with Pressurized Heavy Water Reactors and Measures for their Resolution* (June 2007), [https://www-pub.iaea.org/MTCD/Publications/PDF/te\\_1554\\_web.pdf](https://www-pub.iaea.org/MTCD/Publications/PDF/te_1554_web.pdf).

<sup>55</sup> *Minutes of the Canadian Nuclear Safety Commission (CNSC) Meeting held on August 17-18, 2016.*

<sup>56</sup> *Minutes of the Canadian Nuclear Safety Commission (CNSC) Meeting held on March 8, 2018.*



232. Based on the information provided, the Commission is satisfied that OPG has an adequate program in place for the management of emergent safety issues.
233. The Commission is satisfied with the progress made by OPG during the previous licence period in regard to the management of the PNGS-specific Category 3 CSIs and directs OPG to continue its work in this regard during the renewed licence period. The Commission directs CNSC staff to continue providing annual updates regarding OPG's progress in addressing the Category 3 CSIs in the NPP ROR or through other means, as appropriate.

#### *4.4.6 Conclusion on Safety Analysis*

234. On the basis of the information presented, the Commission concludes that the systematic evaluation of the potential hazards and the preparedness for reducing the effects of such hazards is adequate for the operation of the facility and the activities under the renewed licence. The Commission finds that OPG's safety analysis program at the PNGS meets regulatory requirements and that OPG has adequate preventive measures and strategies in place at the PNGS to ensure the protection of workers, members of the public and the environment, and that the facilities at PNGS meet safety requirements.
235. The Commission expects the implementation of CSA N286.7-16, REGDOC-2.4.1 and REGDOC-2.4.2 at the PNGS during the renewed licence period, in accordance with the implementation plans presented during this hearing. The Commission expects that any deviation from these implementation plans will be reported to the Commission.
236. The Commission also expects that OPG will continue work on whole-site PSA methodology improvements, as discussed during this hearing. The Commission directs CNSC staff to provide annual updates on whole-site PSA methodology in the NPP ROR or via other means, as appropriate.

#### **4.5 Physical Design**

237. The Commission considered the physical design of facilities at the PNGS, including the activities to design the systems, structures and components (SSCs) to meet and maintain the design basis of the facility. The design basis is the range of conditions, according to established criteria, that the facility must withstand without exceeding authorized limits for the planned operation of safety systems. CNSC staff rated OPG's performance in this SCA as "satisfactory" throughout the previous licence period.

#### 4.5.1 Design Governance

238. The Commission assessed the adequacy of the PNGS design governance programs. OPG submitted information about the Conduct of Engineering program, the Design Management Program and the Procurement Engineering process which were implemented at the PNGS. CNSC staff reported that regular compliance verification activities and desktop reviews confirmed that OPG had implemented adequate design management programs at the PNGS and that these programs and procedures met regulatory requirements.
239. OPG provided information to the Commission about its Engineering Change Control (ECC) program which ensured that changes at the PNGS were planned, designed, installed, commissioned and placed into, or removed from service, in such a way that the PNGS remained with its licensing and design bases. OPG also explained that the timeliness of engineering change close-out activities improved during the previous licence period and that the number of temporary modifications installed at the PNGS was brought in line with industry best practices. CNSC staff confirmed the information provided by OPG, noting that the ECC program at the PNGS was well-established, ensured that human factors were considered in design and was compliant with CSA N290.12-14, *Human factors in design for nuclear power plants*.<sup>57</sup>
240. OPG submitted that a formal and systematic process for ensuring the safe use of nuclear fuel had been established through the PNGS Fuel Program and that OPG demonstrated compliance with the fuel design basis through the program. OPG reported that, during the previous licence period, post-discharge fuel inspections and post-irradiation hot cell examinations of used fuel samples showed that used fuel remained within the design basis compliance envelope for wear and deformation.
241. CNSC staff confirmed to the Commission that the fuel defect rate at the PNGS was lower than the target of one fuel bundle per unit per year and that, although PNGS Unit 1 experienced a higher than normal rate of oxide formation on fuel during the previous licence period, OPG's corrective actions through the well-developed PNGS fuel inspections and monitoring program were adequately mitigating this issue.
242. OPG provided the Commission with details about the Environmental Qualification (EQ) program at the PNGS, noting that it had been implemented and maintained in accordance with CSA N290.13-05, *Environmental qualification for CANDU nuclear power plants*.<sup>58</sup> OPG submitted that the objective of the program was to ensure that all SSCs at the PNGS were qualified to perform their safety functions under the environmental conditions defined by the PNGS DBAs. CNSC staff confirmed that the PNGS EQ program met regulatory requirements and reported that OPG was addressing one action under the IIP related to EQ, with information on the closure of this action scheduled to be submitted to CNSC staff no later than in December 2019.

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<sup>57</sup> N290.12-14, *Human factors in design for nuclear power plants*, CSA Group, 2014.

<sup>58</sup> N290.13-05, *Environmental Qualification for CANDU Nuclear Power Plants*, CSA Group, Update 1, 2009.

243. OPG informed the Commission that, through the Software Program at the PNGS, OPG had identified the processes and overall requirements for software that supported safe and efficient plant operation. The Commission notes that, as detailed in section 4.4 of this *Record of Decision*, OPG submitted that its Scientific, Engineering and Safety Analysis software met the specifications of CSA N286.7.
244. The Commission considered the issues raised in the intervention from L. Bertrand and requested information about OPG's software-related design governance program at the PNGS. The OPG representative informed the Commission that OPG had an extensive software change control process that had been audited by independent third parties including WANO and INPO, assessed by the CNSC and benchmarked against international best practices. The OPG representative provided the Commission with information about the industry-leading monitoring and diagnostic centre at the PNGS, which allowed OPG to perform advanced pattern recognition and the proactive replacement of software and electronics, and reported that its software change control process met the specifications of CSA N286.7. Further on this topic, CNSC staff informed the Commission that CNSC software maintenance and hardware inspections showed that OPG had a robust program in the place at the PNGS that met the specifications of CSA N290.14-15, *Qualification of digital hardware and software for use in instrumentation and control applications for nuclear power plants*.<sup>59</sup>

#### Pressure Boundary Program

245. The Commission considered the information provided by OPG and CNSC staff about the Pressure Boundary Program at the PNGS. OPG submitted that its Pressure Boundary Program was a mature program which managed the processes that controlled the quality of pressure boundary activities at the PNGS. OPG reported that, during the previous licence period, CSA N285.0-08 (Update No. 2), *General requirements for pressure-retaining systems and components in CANDU nuclear power plants*.<sup>60</sup> was implemented at the PNGS. OPG also reported that, in 2017, the Technical Standards and Safety Authority renewed the PNGS Certificates of Authorization for pressure boundary activities until April 15, 2020.
246. CNSC staff explained that a 2014 Type II inspection to verify OPG's compliance in regard to the implementation of a pressure boundary program showed positive findings and that CNSC regulatory oversight activities showed that OPG's program met regulatory requirements.
247. Based on the information provided for this hearing, the Commission concludes that the programs that OPG has in place for design governance at the PNGS are adequate

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<sup>59</sup> N290.14-15, *Qualification of digital hardware and software for use in instrumentation and control applications for nuclear power plants*, CSA Group, 2015.

<sup>60</sup> N285.0-08 (Update No. 2), *General requirements for pressure-retaining systems and components in CANDU nuclear power plants*, CSA Group, 2010.

and satisfy the parameters of the applicable codes and standards.

#### 4.5.2 *Systems and Components Design*

248. The Commission considered the adequacy of the design of PNGS systems and components. OPG submitted that, through its design programs at the PNGS, OPG had ensured that SSCs at the PNGS were fit for continued commercial operation during the renewed licence period.
249. OPG submitted that the PNGS PSR confirmed that PNGS equipment important to safety had been environmentally and seismically qualified, and that these qualifications were being met through maintenance, inspection and testing programs. CNSC staff confirmed the information provided by OPG and noted that an IIP activity to confirm that the seismic capacity of the fuel basket stacking arrangement in the IFBs would be maintained throughout the continued operations of the PNGS.
250. In response to the intervention from Northwatch, the Commission requested additional information about how the design and safety of IFBs was considered in the PSR. The OPG representative explained that IFBs were considered in the PSR through the assessment of the condition of their SSCs, and that the programs related to IFBs and supporting equipment were found to be in good condition. The Commission is satisfied on this point.
251. CNSC staff submitted that inspections at PNGS-A, Units 1 and 4, and PNGS-B, Units 5 – 8, showed that OPG maintained electrical power systems and a cable management program at the PNGS that met regulatory requirements. CNSC staff also submitted that OPG had carried out a PNGS Instrumentation and Control Obsolescence Project and provided the Commission with information on projects in this regard that had been undertaken to support the extended PNGS operations. CNSC staff informed the Commission that, during the renewed licence period, follow-up would be continued with OPG in regard to these projects as part of regular compliance verification activities.
252. Asked to provide information about the safety shutdown systems (SSDS) at the PNGS, OPG explained that Units 1 and 4 employed two independent shutdown systems consisting of neutron-absorbing shutoff rods and a moderator dump system. The OPG representative also informed the Commission that, following reviews of modern codes and standards in the mid-1990s, shutdown system enhancement (SDSE) had been implemented for the PNGS-A reactor units. The OPG representative further stated that PNGS Units 5 – 8 also used two independent shutdown system, consisting of neutron-absorbing shut-off rods and gadolinium nitrate poison injection. The OPG representative confirmed to the Commission's satisfaction that the PNGS SSDS met the specifications of CSA N290.1, *Requirements for the shutdown systems of nuclear power plants.*<sup>61</sup>

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<sup>61</sup> N290.1, *Requirements for the shutdown systems of nuclear power plants*, CSA Group, 2013.

253. The Commission requested clarification in response to the assertion from the BPEG and the CCNR that the PNGS-A Units 1 and 4 had inadequate SSDS. The OPG representative informed the Commission that, while the SSDS for Units 1 and 4 differed from the SSDS for Units 5 – 8, both approaches for the emergency shutdown of a reactor unit had been found to meet modern regulatory requirements, codes and standards. The OPG representative also provided the Commission with information about the Units 1 and 4 SDSE approach, including the installation of additional shutdown rods and neutron flux monitoring, noting that there was no credible scenario that would preclude a reactor from shutting down by way of an SSDS.
254. Further on this topic, CNSC staff informed the Commission that OPG's SSDS for all reactors met licensing requirements, noting that the PNGS-A SSDS had been found to be qualified for the credible events that were analyzed through the PSR. CNSC also reported that, although the moderator dump system for Units 1 and 4 was generally more suitable for slow events, the SDSE had improved the response of the PNGS-A SSDS. Based on the information provided, the Commission is satisfied that no credible evidence exists that the SSDS for PNGS Units 1 and 4 are not adequate to shut down reactors in the event of an emergency.
255. The Commission noted the presence of enriched uranium at the PNGS and enquired about its use. The OPG representative responded that enriched uranium was used in fission chambers in PNGS Units 1 and 4 to measure neutron flux as part of the SDSE and provided details in this regard. CNSC staff confirmed that OPG's PROL provided for the use of enriched uranium in these components, noting that it was a very small quantity, and that it was properly reported on and accounted for under Canada's safeguards agreements with the IAEA.

#### Fire Protection Design

256. The Commission considered the adequacy of the fire protection design at the PNGS. OPG submitted that the PNGS Fire Protection program was designed to meet the specifications of CSA N293-07, *Fire protection for CANDU nuclear power plants*,<sup>62</sup> as well as industry best practices.
257. In its written materials, OPG explained that, during the PSR, PNGS-A Units 1 and 4 were found to meet the specifications of CSA N293-12; however, a gap was found in regard to firewater supply for PNGS-B Units 5 – 8. OPG provided details about how this gap would be addressed through IIP actions, indicating that interconnection of the existing firewater supply for Units 1 and 4 to the firewater supply for Units 5 – 8 would ensure that the PNGS site fire protection system would meet the specifications of CSA N293-12 during the renewed licence period.

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<sup>62</sup> N293-07, *Fire protection for nuclear power plants*, CSA Group, 2007.

258. CNSC staff reported that third-party reviews of the PNGS fire protection design showed that OPG met the specifications of CSA N293-07 as well as IRC-10NBC, *National Building Code of Canada 2010*.<sup>63</sup> and IRC-10NFC, *National Fire Code of Canada 2010*.<sup>64</sup> CNSC staff also reported that a CNSC Type II inspection during the previous licence period showed that OPG met regulatory requirements for the PNGS fire water and fire alarm systems monitoring program.
259. On the basis of the information provided for this hearing, the Commission is satisfied that the systems and components design programs at PNGS are adequate and meet the specifications of the appropriate codes and standards.
260. The Commission expects that OPG will implement CSA N293-12 at the PNGS during the renewed licence period as proposed during this hearing.

#### 4.5.3 Conclusion on Physical Design

261. On the basis of the information presented, the Commission concludes that OPG continues to implement and maintain an effective design program at the PNGS and that the design of the PNGS meets regulatory requirements and is adequate for the licensed activities during the renewed licence period as detailed during this hearing. The Commission is satisfied with CNSC staff's assessment of the adequacy of the physical design of the PNGS.
262. The Commission directs CNSC staff to continue regular compliance verification activities throughout the renewed licence period to monitor OPG's implementation of IIP actions, updated codes and standards, design modifications to address PNGS design-related aging effects, and risk improvement measures. The Commission anticipates being updated on progress on such implementation as a matter of course.

#### 4.6 Fitness for Service

263. Fitness for Service covers activities that are performed to ensure that the SSCs at the PNGS continue to effectively fulfill their intended purpose. CNSC staff rated OPG's performance in this SCA as "satisfactory" throughout the previous licence period.
264. OPG noted that many interventions expressed concern about the fitness for service and overall safety of the PNGS due to its age. OPG confirmed its commitment to ensuring that all PNGS SSCs were fit for service until the ECO in 2024 and that inspection programs to ensure continued fitness for service would be continued throughout the renewed licence period. In addition, OPG reported that over 500,000 PNGS SSCs were assessed during the PSR and that the PSR determined that OPG had effective maintenance plans in place to support the safe and reliable operation of the PNGS to the end of 2024, and through the transition to safe storage by 2028.

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<sup>63</sup> IRC-10NBC, *National Building Code of Canada 2010*, National Research Council, 2010.

<sup>64</sup> IRC-10NBF, *National Fire Code of Canada 2010*, National Research Council, 2010.

#### 4.6.1 *Equipment Fitness for Service*

265. The Commission considered the information provided by the OPG and CNSC staff regarding the fitness for service of equipment at the PNGS. OPG reported that its Major Components Program established processes and activities to demonstrate fitness for service of fuel channels, feeders, steam generators, and reactor components and structures. OPG further explained that this program ensured that major NGS components would perform safely and reliably until the end of 2024, while maintaining the design and licensing bases of the PNGS.
266. OPG also provided information about the feeder degradation assessments and the feeder replacement program at the PNGS, noting that guidelines on feeder thickness had been developed by the COG Feeder Joint Integrity Project. OPG further reported that feeder stress analyses for reduced feeder wall thickness were performed as per the specification of the ASME Pressure and Vessel Codes, noting that pressure burst tests had demonstrated that feeder pipes maintained structural integrity at reduced wall thicknesses. OPG also explained that, pursuant to licence condition 7.1 of the PNGS PROL and CSA N285.4-05, OPG submitted a feeder piping and components inspection report to the CNSC following every outage. OPG stated that any feeder that was assessed to have reached its end of life was replaced and that the need for feeder replacement would continue to be assessed through to the PNGS ECO.
267. OPG informed the Commission that, through its planned research and development activities, inspections and industry OPEX, OPG continued to further its understanding about the key degradation mechanisms, material properties and component fitness for service of PNGS fuel channels. OPG noted that these activities had contributed to the maintenance and improvement of adequate fitness for service margins in respect of PNGS fuel channels.
268. CNSC staff submitted that OPG had programs in place to manage aging of equipment and monitoring of systems at the PNGS. CNSC staff also reported that the PNGS equipment fitness for service met regulatory requirements.
269. In relation to the concerns about feeder fitness for service expressed by M. Duguay, the Commission enquired about operator response to, and off-site consequences of, feeder failure events. The OPG representative explained that OPG operators were fully trained in responding to feeder failures, noting that no failures had occurred at the PNGS. The OPG representative also stated that feeder design implemented the leak-before-break (LBB) methodology and that feeders were continuously monitored for leakage. CNSC staff added that a feeder failure was a DBA with no expected off-site consequences. The Commission is satisfied on this point.
270. CNSC staff provided the Commission with information regarding system and component health reports submitted quarterly by OPG during the previous licence period. CNSC staff also informed the Commission that, during the previous licence

period, OPG had successfully implemented corrective actions to address an issue related to emergency low and high pressure service pumps for Units 1 and 4, which were part of Systems Important to Safety (SIS) at the PNGS.

271. Based on the information presented on the record for this hearing, the Commission is satisfied that OPG has adequate processes in place to ensure that the equipment at the PNGS will remain fit for service throughout the renewed licence period.

#### 4.6.2 Reliability

272. The Commission assessed OPG's reliability program for the PNGS. OPG reported that the PNGS used the industry benchmarking metric called the Equipment Reliability Index (ERI) to assess PNGS equipment reliability and the programs that supported them. OPG reported that the PNGS ERI had continued to improve throughout the previous licence period by surpassing targets, and that the improved ERI represented a reduction in forced loss rate (FLR). OPG further explained that the FLR was a measure of the amount of gross unplanned production losses in a period of time, and that PNGS achieved its two best FLRs in 2015 and 2016 respectively. OPG asserted its commitment to the continuous improvement of the reliability program during the renewed licence period.
273. CNSC staff reported that the PNGS reliability program continued to meet the specifications of RD/GD-98, *Reliability Programs for Nuclear Power Plants*,<sup>65</sup> with OPG having appropriately established reliability targets for identified SIS at the PNGS.
274. CNSC staff also submitted that a 2017 review of OPG's maintenance strategy to improve system availability and reliability showed that OPG's strategy met licensing requirements. CNSC staff added that the effectiveness of OPG's existing system for health and reliability improvement actions would continue to be monitored during the renewed licence period.
275. OPG provided the Commission with information about fuel handling reliability at the PNGS, noting that a fuel handling reliability plan was developed in 2012/13 and was adapted every year to meet the station's needs. OPG explained that the FLR due to fuel handling was acceptable at 1.54% in 2016 and 2.32% in 2017.
276. CNSC staff reported that OPG submitted the *Pickering Annual Reliability Report* in accordance with REGDOC-3.1.1 and that SIS had generally met unavailability targets during the previous licence period. CNSC staff noted that, although the Unit 5 – 8 Emergency Power Generator had been above the unavailability target since 2012, CNSC staff was satisfied with the OPG's corrective actions in this regard.

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<sup>65</sup> CNSC Regulatory Document/Guidance Document RD/GD-98, *Reliability Programs for Nuclear Power Plants*, 2012.



277. OPG submitted that improving fuelling machine reliability at the PNGS would be a major focus during the renewed licence period and provided details about a project between OPG, COG and New Brunswick Power to address this issue. Asked to provide additional details about this project, the OPG representative informed the Commission that, although this project was not part of the IIP because the issues identified were primarily operational issues rather than safety issues, this project was well underway and that OPG had already identified benefits to PNGS operations from the improved fuelling machine reliability. The Commission is satisfied with the information provided on this point.
278. Based on the information presented, the Commission is satisfied that OPG has implemented an adequate reliability program at the PNGS. The Commission notes the areas for improvement in regard to system availability and reliability targets as submitted by OPG and CNSC staff during this hearing and expects OPG to continue actively addressing these areas for improvement during the renewed licence period.
279. The Commission also requests annual updates about the joint fuel machine reliability project in the context of the NPP ROR or through other means, as appropriate.

#### 4.6.3 Maintenance

280. The Commission considered the adequacy of the PNGS maintenance program, with OPG reporting that the programs were closely aligned with the Engineering, Work Management, Operations and Supply Chain organizations to support equipment fitness for service requirements. OPG provided information about how the PNGS maintenance program and associated corrective and preventive maintenance activities ensured safety system availability and that equipment failures were minimized.
281. CNSC staff reported that the maintenance program at the PNGS met the specifications of S-210, *Maintenance Programs at Nuclear Power Plants*.<sup>66</sup> CNSC staff also reported that OPG had implemented RD/GD-210, *Maintenance Programs for Nuclear Power Plants*.<sup>67</sup> at the PNGS and that RD/GD-210 would be included as compliance verification criteria in the LCH.
282. OPG provided detailed information regarding the maintenance backlogs at the PNGS during the previous licence period, noting that components important to safety and reliability that were identified as no longer being able to perform their function reliably were repaired on a risk-ranked priority basis, with repairs ranked as corrective critical or corrective non-critical. OPG reported that the number of corrective maintenance backlog work orders steadily decreased during the previous licence period, with 24.5 outstanding corrective critical and corrective non-critical work orders per unit at the end of 2017, against a target of 28.

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<sup>66</sup> CNSC Regulatory Standard S-210, *Maintenance Programs at Nuclear Power Plants*, 2007.

<sup>67</sup> CNSC Regulatory Document/Regulatory Guide RD/GD-210, *Maintenance Programs for Nuclear Power Plants*, 2012.

283. CNSC staff concurred that the PNGS maintenance backlogs were decreasing, but noted that corrective critical and preventive maintenance backlogs remained above industry average. CNSC noted that a 2017 desktop review showed that, overall, system safety functions at the PNGS remained effective and that the corrective actions related to maintenance backlogs implemented by OPG satisfied CNSC staff's expectations.
284. The Commission considered the concerns about maintenance backlogs expressed in the intervention from Northwatch, and asked OPG to address its backlogs and the sufficiency of maintenance resources at the PNGS. The OPG representative provided information about OPG's value-based maintenance program, which focussed on safety through the prioritization of critical maintenance activities and improving equipment reliability. The OPG representative also stated that, at the end of 2017, OPG had performed better than its targets for corrective maintenance backlogs and was at zero backlogs for 2018. The OPG representative informed the Commission that OPG would likely meet industry best targets for deficient maintenance backlogs by 2019, that preventive maintenance backlogs were also trending towards industry best and that OPG was committed to ensuring the availability of sufficient resources for all maintenance activities at the PNGS through to the ECO in 2024.
285. Further on this issue, CNSC staff provided the Commission with information about the compliance actions that were taken by CNSC staff to ensure that the PNGS maintenance backlogs continued to decrease, including the 2017 desktop review which showed a lack of adequate maintenance resources. The Commission is satisfied with OPG's efforts in reducing maintenance backlogs and deferrals at the PNGS and directs OPG to continue reducing them to bring them below industry average. The Commission wishes to make it clear that OPG is required to ensure the continuous provision of sufficient resources for all maintenance activities at the PNGS through to the last day of commercial operation at the PNGS.
286. After considering the information provided on the record for this hearing, the Commission is satisfied that OPG has adequate maintenance programs in place at PNGS for the renewed licence period.
287. The Commission notes that the corrective critical and preventive maintenance backlogs at the PNGS are above industry average and directs OPG to continue its implementation of corrective actions to reduce these backlogs during the renewed licence period. The Commission expects that CNSC staff will continue to carry out targeted compliance verification activities on this issue and anticipates annual updates in this regard through the NPP ROR or other means, as appropriate.

#### *4.6.4 Aging Management*

288. The Commission examined the information submitted by OPG and CNSC staff regarding the PNGS aging management program. OPG submitted that REGDOC-

2.6.3, *Aging Management*.<sup>68</sup> had been implemented at the PNGS in December 2017. CNSC staff submitted that OPG's effective implementation of REGDOC-2.6.3 would be evaluated through compliance activities during the renewed licence period.

289. OPG submitted that, through the Integrated Aging Management Program (IAMP) at the PNGS, OPG ensured that aging and related degradation mechanisms of SSCs necessary for the safe and reliable operation of the PNGS were well understood. OPG further provided the Commission with detailed information regarding the lifecycle management plans (LCMP) for PNGS major components including fuel channels, steam generators, feeders, and reactor components and structures. OPG noted that, through the LCMPs, degradation mechanisms for major components had been identified and provided information about how the LCMPs identified corrective or mitigating actions to ensure that all major components at the PNGS remained fit for service until the ECO in 2024.
290. CNSC staff informed the Commission that a Type II inspection of OPG's IAMP in 2015 showed some deficiencies in OPG's implementation of the program and the IAMP's interfaces with other programs. CNSC staff further reported that OPG's CAP in response to the findings was acceptable and that CNSC staff would continue verification of OPG's implementation of the corrective actions throughout the renewed licence period.
291. CNSC staff informed the Commission that, as part of a major IIP action, OPG was required to complete a risk-based management approach to aging management, as well as an action tracking and reporting process which included a database for condition assessment of all SSCs important to safety at the PNGS. CNSC staff further reported that OPG's progress in this regard would be monitored by CNSC staff in conjunction with the verification of other IIP actions.
292. The Commission considered the concerns expressed by several intervenors, including the MBQ, Oxford Coalition for Social Justice, Greenpeace, CELA, DNA, the Waterkeeper, the CCNR, the Toronto Environmental Alliance and individuals about the aging of safety-critical SSCs at the PNGS. In this vein, the Commission sought details on the CNSC's compliance and oversight activities to ensure the continued fitness for service of SSCs during the renewed licence period. CNSC staff responded that, as in the previous licence period, CNSC staff oversight activities in respect of safety-critical SSCs would continue to increase and provided information about how oversight in respect of the IIP-related activities would be integrated with CNSC staff's inspection plans. The Commission is satisfied that CNSC staff's planned regulatory oversight for aging SSCs at the PNGS is adequate.
293. Asked about general aging risks to PNGS operations, the OPG representative responded that, although PNGS was an older NGS, a lot of components at the facility were refurbished, significantly decreasing the risk of the facility. The OPG representative stated that OPG had identified that the aging management program

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<sup>68</sup> CNSC Regulatory Document REGDOC-2.6.3, *Aging Management*, 2014.

was a significant factor in ensuring the safe operations of the PNGS until the ECO and explained how this program would ensure that aging-related risks were mitigated. The OPG representative also stated that obsolescence of NGS parts and components had been identified as a risk to continued operations, but explained that this risk was mitigated through an effective obsolescence program and provided details in this regard.

294. In regard to the concerns expressed in the intervention from M. Duguay about the risk of feeder piping micro cracks, the OPG representative explained to the Commission that micro cracking was not a feasible aging mechanism for PNGS feeders due to the low residual stress from fabrication and because feeder material was fully ductile at PNGS operating temperatures and pressures.
295. Further on this issue, the Commission asked about feeder pipe aging mechanisms. The OPG representative explained that extensive inspections and testing had confirmed flow accelerated corrosion as the degradation mechanism of concern for feeder pipes, confirmed to the Commission's satisfaction that flow accelerated corrosion was well understood within the nuclear industry and submitted information about OPG's management of this aging mechanism. CNSC staff provided additional information about the extensive research that had been done by the CNSC and the nuclear industry on this issue and stated that the CNSC's assessments of PNGS feeders showed that they would remain fit for service until the ECO. The Commission is satisfied with the information provided on this point.
296. Asked to comment on the concerns raised in A. Neacsu's intervention about steam generator tube thinning, the OPG representative clarified that steam generator tubes were associated with steam generators in the NGS and not fuel channels, and explained that the PNGS LCMP included steam generator fitness for service. The OPG representative noted that steam generators were part of the IIP and provided information about inspection and operational criteria that had to be met in this regard, and further explained that if a tube was found to not be fit for service, it was plugged and not allowed to operate. The Commission is satisfied that OPG has an effective program in place to monitor the fitness for service of steam generator tubes.
297. The Commission requested details about the types of inspections that OPG carried out to ensure continued fitness for service of major reactor components. The OPG representative explained that, through OPG's LCMP, OPG established set inspections for pressure tubes, feeders, steam generators and other major reactor components, and provided details on the methods that were used to inspect the components. The OPG representative further explained that outages were carried out approximately every two years and that inspections of major components informed OPG of their fitness for service for the next operating period. The Commission is satisfied on this point.

## Fuel Channels

298. Noting that, in its licence renewal application, OPG requested authorization to operate the PNGS Units 5 – 8 up to a maximum of 295,000 EFPH, the Commission assessed OPG's approach to aging management and ensuring the fitness for service of the PNGS fuel channels. OPG reported to the Commission that, through many years of operation and inspections, OPG had gathered significant data about fuel channel degradation mechanisms and mitigation measures. OPG also provided information regarding the PNGS Fuel Channel Life Cycle Management Plan (FCLCMP) through which OPG carried out inspections and monitoring to confirm that fuel channels remained in an acceptable condition for continued operation. OPG noted that the FCLCMP met the specifications of REGDOC-2.6.3 as well as IAEA Safety Guide NS-G-2.12, *Ageing Management for Nuclear Power Plants*.<sup>69</sup>
299. OPG provided a detailed overview of its fuel channel fitness for service programs, which included periodic inspections of multiple fuel channels, non-destructive testing such as scrape tests, and destructive testing such as burst tests, and noted that OPG met the specifications of CSA N285.4 and CSA N285.8 in this regard. OPG further submitted that, based on technical reviews, collaboration with industry peers, established fuel channel aging management controls and the availability of mitigation measures, OPG had ascertained that degradation in fuel channels was occurring at the predicted rates. OPG reported that analyses had shown that safety margins were adequate to support the continued operation of PNGS Units 5 – 8 fuel channels beyond 247,000 EFPH and until December 31, 2024. OPG also stated that, through existing PNGS programs, the fitness for service of the PNGS Units 5 – 8 fuel channels could be demonstrated up to 295,000 EFPH, and that only Unit 6 was expected to reach 295,000 EFPH before the ECO at the PNGS.
300. CNSC staff reported that OPG had continued to submit fuel channel fitness for service assessments to the CNSC throughout the previous licence period and that OPG had met the specifications of applicable CSA Group standards. CNSC staff submitted that compliance verification activities had shown that OPG was adequately managing aging of fuel channels at the PNGS and that adequate safety margins were in place to ensure the safe operation of the PNGS Units 5 – 8 fuel channels up to 295,000 EFPH.
301. CNSC staff also reported that the most current model for fracture toughness of pressure tubes had been incorporated into CSA N285.8, that this model assessed the risk of pressure tube failure from postulated flaws in the reactor core, and that the model provided for a maximum pressure tube hydrogen equivalent concentration ([Heq]) of 120 parts per million (ppm). CNSC staff stated that the lead PNGS fuel channels were not expected to reach the 120 ppm [Heq] target before the ECO in 2024 and recommended that the Commission include in the renewed PROL PNGS-specific licence condition 15.3 which would require OPG to demonstrate, before

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<sup>69</sup> IAEA Safety Standards Safety Guide No. NS-G-2.12, *Ageing Management for Nuclear Power Plants*, IAEA, Vienna, 2009.

pressure tube [Heq] exceeded 120 ppm, that pressure tube fracture toughness would be sufficient for safe operation beyond 120 ppm.

302. CNSC staff provided the Commission with details on major fuel-channel related IIP actions that OPG would undertake during the renewed licence period, including an updated FCLCMP which will be submitted to CNSC staff annually, and the Fuel Channel Readiness Plan which will identify current fuel channel knowledge gaps.
303. Considering the intervention from RESD Inc. regarding the aging management of fuel channels, the Commission requested additional information about pressure tube integrity and aging modelling. The OPG representative provided the Commission with information about the joint OPG, CNL and Bruce Power Fuel Channel Life Management Project which was initiated in 2009 to further study fuel channel degradation mechanisms, pressure tube fracture toughness and annulus spacer integrity. The OPG representative confirmed that research showed that aging models and assumptions were conservative and provided the Commission with information about the PNGS FCLCMP “Plan-Do-Check-Act” model, which uses thorough and frequent inspection activities to ensure continued fuel channel fitness for service. CNSC staff informed the Commission that it was satisfied with the fuel channel research that was being carried out and confirmed that OPG was implementing adequate testing methodologies to assess PNGS fuel channel aging predictions. The Commission is satisfied with the information provided on this topic.
304. The Commission enquired about the frequency of pressure tube inspections. The OPG representative responded that OPG carried out approximately 12 to 15 full-length volumetric and dimensional inspections of fuel channels every two to two and a half years, in accordance with the FCLCMP and which surpassed the specifications of CSA Group standards. The OPG representative also stated that OPG regularly visually inspected PNGS pressure tubes and carried out body-of-tube scrapes to sample for deuterium ingress during every outage.
305. Further on this issue, OPG informed the Commission that, every four years, a pressure tube was removed from each reactor and sent for destructive testing at CNL’s Chalk River Laboratories (CRL) facility. Asked to provide details about this testing during CNL’s intervention, the CNL representative provided details about the destructive testing that was carried out at CRL for Canadian CANDU reactor pressure tubes. The CNL representative also provided details about the research and development that had been carried out at CRL for the last 10 years in respect of pressure tube fitness for service and the database that had been established in this regard. The Commission is satisfied with the information submitted on this point.
306. The Commission noted that the interventions from RESD Inc. and S. Nijhawan referred to pressure tube elongation and requested information on this degradation mechanism. CNSC staff responded that pressure tube elongation occurred due to the irradiation of the pressure tube material and had been recognized as a degradation mechanism since the development of CANDU reactors. CNSC staff further explained

how design changes had mitigated this issue, noting that elongation was considered in CSA Group standards and only affected a few of the fuel channels in the core. CNSC staff informed the Commission that pressure tube elongation had not required taking a fuel channel out of service in the operational history of CANDU reactors.

307. Further on pressure tube elongation, the OPG representative provided the Commission with information on how elongation effects were mitigated at the PNGS and about the visual inspection of pressure tubes for elongation effects carried out during outages. The OPG representative further explained that OPG reviewed the elongation data submitted in the intervention from RESD Inc., determined that the data did not reflect the maintenance and other lifecycle management activities undertaken by OPG, and stated that PNGS fuel channels would not be operated in the states suggested by the intervenor, such as off bearing. The Commission is satisfied with the information provided on this point.
308. The Commission noted that the intervention from A. Tilman made reference to hot hours versus EFPH and requested clarification on this issue. CNSC staff explained that hot hours were used to gauge aging mechanisms that were induced by high temperatures, such as corrosion and corresponding hydrogen ingress, whereas EFPH were a better metric for other types of pressure tube degradation related to neutron irradiation damage. CNSC staff noted that, for these reasons, both hot hours and EFPH metrics were considered in fitness for service assessments. The Commission is satisfied with the information provided on this point.
309. The Commission considered the concerns expressed in the interventions from the BPEG, the MBQ and individuals about the risks associated with OPG's application to operate the PNGS units up to 295,000 EFPH. The Commission enquired about which unit was first expected to reach 247,000 EFPH and 295,000 EFPH. The OPG representative responded that the Unit 6 reactor was expected to reach 247,000 EFPH around mid-2019 and that, based on OPG's conservative estimates, OPG did not expect that any PNGS unit would need to be operated beyond 295,000 EFPH. CNSC staff confirmed the information provided by OPG and stated that, should OPG decide to operate beyond the 295,000 EFPH, OPG would have to apply for Commission approval. The Commission is satisfied with the information provided in this regard.
310. The Commission further enquired about the pressure tube [Heq] of the first reactor expected to reach the proposed 295,000 EFPH limit. The OPG representative explained that if the lead reactor Unit 6 reached 295,000 EFPH, a bounding assessment predicted a pressure tube [Heq] of 95 ppm, approximately 25 ppm below the 120 ppm [Heq] limit set by CSA N285.8. The OPG representative also stated that assessments had shown that pressure tubes would reach an [Heq] of 120 ppm beyond 350,000 EFPH. The Commission is satisfied with the information showing that the pressure tube fracture toughness of the lead reactor would remain below the CSA Group standard limits even at the proposed operating limit of 295,000 EFPH. The Commission also notes that, before [Heq] exceeds 120 ppm, licence condition 15.3 requires OPG to demonstrate that pressure tube fracture toughness would remain

sufficient for safe operation beyond an [Heq] of 120 ppm.

311. The Commission enquired about how the various aging mechanisms interacted. The OPG representative explained that the rate of hydrogen ingress in PNGS pressure tubes was steady and well understood by OPG, and stated that research was forward looking to ensure that future conditions and fuel channel degradation mechanisms were well understood. CNSC staff explained how degradation mechanisms were affected by temperature, pressure, neutron flux and other varying conditions, noting that degradation mechanisms such as pressure tube deformations including expansion, elongation and thinning were not linear with time and, for this reason, considerable research and development was carried out in this regard. CNSC also noted that frequent verifications of OPG's predictive data against actual results and conditions were carried out. The Commission expressed satisfaction with the information provided by OPG and CNSC staff in respect of fuel channel aging mechanisms, research and development, and modelling.
312. The Commission considered the concerns about the possibility of a pressure tube rupture expressed in the interventions from RESD Inc. and F. Greening, and requested additional information about the adequacy of current leak-before-break (LBB) assessments. The OPG representative provided the Commission with a detailed explanation about how LBB assessments were carried out at the PNGS and stated that a pressure tube leak could be detected within one to two hours, with OPG having clear operational procedures should such a leak occur. The OPG representative also stated that OPG's LBB assessment met the specifications of CSA N285.4 and N285.8, that these standards were conservative and that OPG had not identified any reasons to reduce this conservatism. The OPG representative added that LBB research was ongoing to ensure that the most up to date information is available for future assessments.
313. Further on this topic and noting the importance of accurate moisture detection in the AGS, as raised in the interventions from RESD Inc. and F. Greening, the Commission requested comments on this topic. The OPG representative provided details on moisture detection monitoring within the AGS at the PNGS and explained that the AGS accurately detected leakage from the HTS, the moderator system, or the end shield cooling system. The OPG representative emphasized that, through OPEX and research, AGS design had significantly evolved in the past 30 years and continued to evolve, and that OPG was confident in the accuracy and reliability of moisture detection monitoring within the AGS at the PNGS. CNSC staff explained that the CNSC did not prescribe the design of fuel channel components. Rather a licensee was required to show that the methodology chosen to measure moisture in the AGS met CSA Group standards and REGDOC specifications, with CNSC staff assessing whether the LBB assessment conformed to applicable standards. CNSC staff further noted that LBB assessments were station-specific and could not be considered on a generic basis, and confirmed to the Commission's satisfaction why OPG's LBB assessments had been found to be satisfactory and met licensing requirements.



314. In regard to the potential consequences if a leak was not detected and a pressure tube ruptured, CNSC staff explained that this type of event was considered to be a DBA. CNSC staff also explained that a pressure tube rupture was addressed in the *Pickering Safety Report* and that OPG had adequately demonstrated that it would be able to shut down the reactor safely and contain any releases should such an event occur. The Commission is satisfied on this point.
315. The Commission requested comments regarding the concerns expressed in the intervention from A. Neacsu that “the safety of fuel channels is 70% assured.” The OPG representative responded that the information in this intervention stemmed from a 2013 OPG report that considered an OPG business case study, not a safety case for PNGS fuel channel fitness for service. The OPG representative and CNSC staff confirmed to the Commission satisfaction that 70% was not and would not be an acceptable confidence level for safety assessment purposes.
316. The Commission, in considering the intervention from J. Cuttler, requested additional information about the pressure tube rupture at PNGS-A, Unit 2 in 1983. CNSC staff informed the Commission that that rupture was one of the only instances of break before leak in Canadian reactor operation history, that the event was related to a fuel channel and pressure tube design that was no longer being used and that there had not been any similar events since that one. CNSC staff provided details about the corrective actions that were taken following the event and the many lessons learned, including a change to pressure tube material to zirconium-niobium (Zr-2.5Nb) and the use of four annulus spacers, instead of two, in CANDU fuel channels. The Commission is satisfied with the information provided on this point.

#### Assessment of Aging Management

317. Based on the information provided on the record for this hearing, the Commission is satisfied that OPG has an appropriate aging management plan in place at the PNGS.
318. The Commission is also satisfied that OPG has an adequate program in place to ensure and demonstrate the fitness for service of PNGS fuel channels for safe operation of the PNGS until December 31, 2024. On this basis, the Commission authorizes OPG to operate the PNGS Units 5 – 8 up to a maximum of 295,000 EFPH. The Commission includes PNGS-specific licence condition 15.3 in the renewed operating licence, as recommended by CNSC staff and submitted in CMD 18-H6.B. The Commission directs OPG to report annually on any developments in the deterioration of the fuel channels at the PNGS. The Commission also directs OPG to provide the Commission with annual updates on fuel channel research and development results.
319. The Commission notes that, through IIP actions, OPG shall submit an upgraded and updated fuel channel LCMP to the CNSC annually, as described during this hearing.

Further, the Commission directs that CNSC staff carry out additional oversight in regard to PNGS aging management-related IIP activities and expects annual reports in this regard in the NPP ROR or via other means, as appropriate.

#### 4.6.5 Chemistry Control

320. OPG informed the Commission about the PNGS chemistry program, noting that the program applied to all PNGS processes, systems and OPG staff that supported chemistry control. OPG reported that the concentration of selected impurities and corrosion products was measured through the Chemistry Performance Index (CPI). OPG further reported that, throughout the previous licence period, the CPI for the PNGS improved steadily and met industry targets at the beginning of 2017.
321. CNSC staff reported to the Commission that OPG maintained acceptable performance for chemistry control during the previous licence period. CNSC staff further submitted that a 2017 Type II inspection showed that the PNGS chemistry program met regulatory requirements and industry best practices.
322. Based on the information provided by OPG and CNSC staff, the Commission is satisfied that OPG has maintained and will continue to maintain an adequate chemistry control program in place at the PNGS throughout the renewed licence period.

#### 4.6.6 Periodic Inspection and Testing

323. OPG and CNSC staff provided the Commission with detailed information about the PNGS periodic inspection programs (PIPs) for pressure retaining systems and components, and their supports. OPG reported that the PIPs at the PNGS met the specifications of CSA N285.4-05, *Periodic inspection of CANDU nuclear power plant components*<sup>70</sup> and CSA N285.5-08, *Periodic inspection of CANDU nuclear power plant containment components*.<sup>71</sup>
324. OPG reported that the inspection and testing of the vacuum building and pressure relief duct containment structures were carried out in accordance with the specifications of CSA N287.7-08, *In-service examination and testing requirements for concrete containment structures for CANDU nuclear power plants*.<sup>72</sup> OPG provided information about the inspections and testing that were carried out at the PNGS in 2010 and asserted its commitment to continue meeting regulatory requirements in this regard.

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<sup>70</sup> N285.4-05, *Periodic inspection of CANDU nuclear power plant components*, CSA Group, 2005.

<sup>71</sup> N285.5-08, *Periodic inspection of CANDU nuclear power plant containment components*, CSA Group, 2008.

<sup>72</sup> N287.7-08, *In-service examination and testing requirements for concrete containment structures for CANDU nuclear power plants*, CSA Group, 2008.

325. CNSC staff submitted that its compliance verification activities had shown that OPG had adequate and well-maintained PIPs at the PNGS that met the specifications of the applicable CSA Group standards. CNSC staff also submitted that compliance inspections in regard to OPG's PIPs for the PNGS steam generators and fuel channels showed that OPG was meeting regulatory requirements. CNSC staff noted that compliance verification activities have shown that OPG has effectively implemented and was meeting regulatory requirements for inspection programs to monitor potential aging effects that could contribute to degradation of PNGS pressure boundary components and civil structures.
326. Further on CNSC inspections of OPG's programs, CNSC staff provided details about results from the multi-phase Type II compliance inspection of PNGS pressure tubes that was carried out during the previous licence period, as directed by the Commission during the 2014 PNGS hold point removal hearing. CNSC staff submitted that Phases 1 – 3 of the inspections were carried out from 2015 to 2017 and focussed on tube-to-calandria tube contact; scrape sampling for deuterium ingress and hydrogen measurement; the calculation of the AGS response times; and OPG's adherence to CSA N285.4-05, CSA N286-12 and CSA N285.8, *Technical requirements for in-service inspection evaluation of zirconium alloy in pressure tubes in CANDU Reactors*.<sup>73</sup> CNSC staff reported that inspections found that OPG met the regulatory requirements for the periodic inspection of fuel channels.
327. CNSC staff informed the Commission that OPG would submit additional information to CNSC staff regarding its implementation of the updated CSA N285.4-14.<sup>74</sup> and CSA N285.5-13.<sup>75</sup> and that the LCH would be revised to reflect the implementation of the updated standards when this information was submitted to the CNSC.
328. Referencing the intervention from S. Nijhawan, the Commission requested information regarding the integrity of the 12,000 concrete piles that supported the foundation of the PNGS. CNSC staff informed the Commission that the continued integrity of the concrete piles had been assessed during the PSR and that, although physical inspection was not a viable assessment method, studies and inspections had shown that the environment surrounding the concrete piles was not corrosive and that the foundation showed no signs of deterioration. CNSC staff further stated that the concrete piles were, and would continue, functioning as designed throughout the renewed licence period. The OPG representative concurred with these findings, noted that ensuring the continued integrity of the concrete piles was part of the IIP and provided information regarding the integrated aging management plan associated with the concrete piles. The Commission is satisfied with the information provided in respect of the integrity and aging management of the PNGS concrete piles.

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<sup>73</sup> N285.8-15, *Technical requirements for in-service inspection evaluation of zirconium alloy in pressure tubes in CANDU reactors*, CSA Group, 2015.

<sup>74</sup> N285.4-14, *Periodic inspection of CANDU nuclear power plant components*, CSA Group, 2014.

<sup>75</sup> N285.5-13, *Periodic inspection of CANDU nuclear power plant containment components*, CSA Group, 2013.

329. The Commission enquired about the blister formation associated with pressure tube-to-calandria contact. CNSC staff provided the Commission with information regarding the possible formation of hydride blisters when hot pressure tubes came into contact with cool calandria tubes, and about how maintenance and inspections prevented their formation. CNSC staff also stated that, through periodic inspections of pressure tubes, licensees implemented measures to avoid hydride blister formation, noting that licensees were not authorized to operate with hydride blister or a predicted hydride blister. The Commission is satisfied on this point.
330. Based on the information provided, the Commission is satisfied that OPG has adequate inspection and testing programs in place to support safe operations at the PNGS. The Commission is also satisfied that CNSC staff's inspection of OPG's fuel channel PIP was adequate and showed that OPG met requirements in this regard.
331. The Commission directs OPG to submit implementation plans to CNSC staff and implement the updated CSA N285.4-14 and N284.4-13 as soon as practicable at the PNGS, and directs CNSC staff to provide annual updates in this regard through the NPP ROR or other means, as appropriate.

#### *4.6.7 Structural Integrity*

332. The Commission considered the testing of structural integrity of structures and components at the PNGS site. OPG submitted that the PNGS met the specifications of N285.5-08 and CSA N287.7-08 for reactor building integrity. OPG further submitted that the reactor building underwent an inspection for integrity, covered under the PNGS PIP, during every planned outage and that a reactor building pressure test was performed every 6 years.
333. Noting the concern expressed by several intervenors about the structural integrity of major components, OPG submitted detailed information to the Commission about the structural integrity of feeders, steam generators, fuel channels and other PNGS major components. OPG summarized that the PNGS remained within its licensing basis at all times and that the structural integrity of major components was confirmed through to the ECO. CNSC staff reported that, through compliance verification activities, CNSC staff was satisfied that the structural integrity of pressure boundary components, containment components and structures, and SSCs at the PNGS continued to meet regulatory requirements and relevant standards, and that PNGS structural integrity remained within acceptable safety margins. The Commission is satisfied on this point.
334. Referring to the concerns about the integrity of PNGS containment systems raised in the intervention from CCNR, the Commission requested additional information in this regard. The OPG representative informed the Commission that OPG carried out pressure relief duct and vacuum building testing every 10 years, in accordance with licensing requirements and CSA N287.7-08. The OPG representative also provided

the Commission with information about other tests that were done on the containment structure and the reactor buildings at low and also full design pressures, noting that reactor buildings were tested up to 43 kilopascals and on a 6-year frequency, with the most recent tests carried out from 2016 to 2018. The OPG representative also confirmed to the Commission's satisfaction that the impact on containment from hydrogen gas explosions had been assessed by OPG. The Commission is satisfied that OPG has adequately demonstrated the structural integrity of PNGS containment systems.

335. Based on the information provided on the record for this hearing, the Commission is satisfied that OPG has appropriate programs in place to assess and maintain the structural integrity of pressure boundary components and other safety-related SSCs at the PNGS.
336. Additionally, the Commission is satisfied that, with the improvements made through IIP actions, assessments and analysis, the fuel channels at the PNGS will continue to meet structural integrity requirements until the ECO in 2024.

#### *4.6.8 Conclusion on Fitness for Service*

337. Based on the information provided on the record for this hearing, the Commission concludes that the equipment as installed at the PNGS is fit for service and that appropriate programs are in place to ensure that the equipment remains fit for service through to the planned ECO in 2024. Further, the Commission is satisfied with OPG's programs for the inspection and lifecycle management of key safety systems at the PNGS.
338. Recognizing the importance of fitness for service of the PNGS until the ECO, the Commission directs OPG to continue rigorous fitness for service assessments at the PNGS throughout its continued operation. The Commission also directs OPG to increase assessments for safety-sensitive SSCs, such as fuel channels, through inspections, research and analysis throughout the renewed licence period to ensure the continuous improvement of safety margins. The Commission requests that CNSC staff increase compliance verification activities in this regard.

### **4.7 Radiation Protection**

339. As part of its evaluation of the adequacy of the measures for protecting the health and safety of persons, the Commission considered the past performance of OPG in the area of radiation protection (RP). The Commission also considered how the PNGS radiation protection program ensured that both radiation doses to persons and contamination were monitored, controlled and kept as low as reasonably achievable (ALARA), with social and economic factors taken into consideration. CNSC staff rated OPG's performance in this SCA as "fully satisfactory" from 2013 to 2015, and

as “satisfactory” from 2016 to 2017.

340. The Commission considered the information provided by OPG and CNSC staff to assess whether the PNGS RP program satisfied the requirements of the *Radiation Protection Regulations*.<sup>76</sup> (RPR). OPG submitted information about how the PNGS RP program was monitored to ensure compliance with the RPR.
341. CNSC staff submitted that, throughout the previous licence period, OPG implemented an effective RP at the PNGS that satisfied regulatory requirements. CNSC staff also provided information about major changes that OPG made to its RP program during the previous licence period, noting that OPG continually measured the performance of its program against industry objectives, goals and targets.

#### 4.7.1 Application of ALARA

342. The Commission assessed the information submitted by OPG and CNSC staff regarding the application of ALARA at the PNGS. OPG submitted that its RP program at the PNGS implemented a series of standards and procedures for the conduct of activities within the PNGS and with nuclear substances that intended to keep radiation exposure to workers ALARA.
343. OPG further submitted that the ALARA strategy applied to all PNGS units, whether operating, in outage or in safe storage, and that the strategy applied to OPG staff, contractors and visitors at the PNGS. OPG also reported that the ALARA strategy was updated annually to ensure that results from benchmarking, corrective actions and industry best practices were incorporated.
344. OPG provided the Commission with information on PNGS collective dose performance targets, noting that these were established annually by OPG and that, as work was planned in more detail, collective dose projections were reviewed and actions were taken to ensure that doses were ALARA. OPG reported that, during the previous licence period, the collective radiation exposure at the PNGS was better than the established targets, even during major outage activities such as feeder inspections and single fuel channel replacement.
345. CNSC staff reported that OPG’s RP program was developed in accordance with G-129, *Keeping Radiation Exposures and Doses “As Low as Reasonably Achievable (ALARA)”*.<sup>77</sup> and that a 2017 CNSC Type II compliance inspection showed that OPG had a mature ALARA program in place at the PNGS. CNSC staff also reported that OPG’s ALARA program at the PNGS met regulatory requirements and that OPG achieved planned goals during the previous licence period, with a noted improved trend in dose reduction.

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<sup>76</sup> SOR/2000-203

<sup>77</sup> CNSC Regulatory Guide G-129, *Keeping Radiation Doses “As Low as Reasonably Achievable (ALARA)”*, Revision 1, 2004.

346. Based on the information considered for this hearing, the Commission is satisfied that the ALARA concept is adequately applied to all PNGS activities.

#### 4.7.2 Worker Dose Control

347. OPG provided the Commission with detailed information regarding the average and maximum effective doses to PNGS workers and reported that, during the previous licence period, no worker doses at the PNGS exceeded regulatory or OPG administrative dose limits. OPG reported on its novel technology solutions for worker dose control and the continued strong performance at the PNGS in the precursor indicators related to worker dose control<sup>78</sup> such as the number of Electronic Person Dosimeter dose alarms and precursor-level tritium updates. OPG also submitted that the PNGS action levels<sup>79</sup> and the timeline for notification when an action level was reached met the requirements of section 6 of the RPR and were documented as required by the GNSCR.
348. CNSC staff confirmed that OPG's RP program was designed to ensure that doses to workers were controlled and that doses did not exceed regulatory limits during the previous licence period, with approximately 81% of workers monitored receiving an annual dose below 1 mSv. CNSC staff also reported that OPG used a CNSC-licensed dosimetry service and that OPG used a combination of action levels, staff training, dose management tools and personal protective equipment to ensure that doses to workers were kept ALARA.
349. CNSC staff submitted that two inspections at the PNGS during the previous licence period showed several non-compliances of low safety significance in relation to OPG internal governance and the worker dose control program. CNSC staff elaborated that, in respect to the worker dose control program non-compliances, these were related to OPG not complying with paragraph 7(1)(d) of the RPR under which OPG was required to inform all contractor nuclear energy workers (NEWs) in writing of the doses they received at the PNGS. CNSC staff reported that OPG developed acceptable corrective action plans to address the non-compliances.
350. The Commission asked for comments on the intervention from D. Rudka which suggested inadequate protection for NEWs in Canada. CNSC staff provided the Commission with information about Canadian and international studies that showed that the current dose limit for NEWs of 50 mSv in a 1-year dosimetry period and 100 mSv over a rolling 5-year dosimetry period, and the public dose limit of 1 mSv per year for non-NEWs (as well as members of the public) was adequate to protect their health and safety. In reference to this intervention, CNSC staff also provided the

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<sup>78</sup> "Precursor indicators related to worker dose control" track low-level events which are used to identify and correct behaviours, or to improve radiation work plans, with the objective of preventing more serious events from occurring.

<sup>79</sup> The *Radiation Protection Regulations* define an action level as a specific dose of radiation or other parameter that, if reached, may indicate a loss of control of part of a licensee's radiation protection program and triggers a requirement for specific action to be taken.

Commission with details about the analysis of nuclear workers in Port Hope, Ontario, noting that no specific increases in mortality or cancers were identified. CNSC staff reiterated to the Commission that, based on the research and international guidelines, CNSC staff remained satisfied that the protective measures and procedures implemented at Canadian nuclear facilities to keep doses ALARA and well below dose limits had been found to be protective of human health. Based on the information provided on this topic, and the Commission's understanding of the current consensus scientific view, the Commission is satisfied that workers at Canadian nuclear facilities are adequately protected against radiation hazards.

351. Based on the information provided for this hearing, the Commission is satisfied that doses to workers at the PNGS are adequately controlled.
352. The Commission expects OPG to continue its implementation of the CAPs in regard to the internal governance of the PNGS workers dose control program non-compliances during the renewed licence period.

#### 4.7.3 *Radiological Hazard Control*

353. The Commission assessed OPG's identification and control of existing and potential radiological hazards during work activities at the PNGS. OPG provided the Commission with information about radiological hazard surveys that were performed, and remote instrumentation and robotic equipment that were used, to control exposure to radiological hazards. OPG also provided detailed information about contamination and high radiation field control measures at the PNGS, including whole body contamination monitoring alarms and locked access points.
354. CNSC staff submitted that OPG had adequate measures in place to monitor and control surface and airborne contamination, as well as of radiation dose rates, at the PNGS. CNSC reported, however, that the rating in the RP SCA had decreased from "fully satisfactory" to "satisfactory." CNSC staff explained that the rating decreased because, during inspections, CNSC staff had identified fixed and semi-portable area gamma monitors that had not been calibrated in the preceding twelve months, as required by section 20 of the *Nuclear Substances and Radiation Devices Regulations*.<sup>80</sup> NSRDR. Additionally, CNSC staff reported that OPG was found to not be meeting its own procedural requirements for placing approved back up gamma monitoring equipment in the field. CNSC staff submitted that OPG took immediate action to correct the non-compliances following the issuance of CNSC enforcement actions and was back in compliance with regulatory requirements. CNSC staff further reported that OPG had implemented a CAP to prevent reoccurrence of the non-compliances.

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<sup>80</sup> SOR/2000-207.



355. On the basis of the information provided for this hearing, the Commission is satisfied that OPG has done, and will continue to adequately identify and control radiological hazards at the PNGS. The Commission, however, expects that OPG continue its implementation of corrective actions to prevent the occurrence of gamma monitoring non-compliances at the PNGS during the renewed licence period.

#### 4.7.4 Control of Dose to the Public

356. The Commission considered the effectiveness of OPG's programs to prevent uncontrolled releases of contaminants or radioactive materials to the public from the PNGS site. OPG submitted that the dose to the public was maintained at well below the regulatory limit of 1 mSv (1,000  $\mu$ Sv) per year<sup>81</sup> throughout the previous licence period. OPG further submitted that the highest estimated potential critical group dose was used to establish the official public dose for the PNGS site, noting that the public dose was less than 2  $\mu$ Sv/year from 2013 to 2017.
357. OPG informed the Commission that the Derived Release Limits (DRL) for emissions to air or water were established in accordance with CSA N288.1-14, *Guidelines for calculating derived release limits for radioactive material in airborne and liquid effluents for normal operation of nuclear facilities*<sup>82</sup> and that there were no exceedances in DRLs or action limits during the previous licence period.
358. CNSC staff confirmed the information provided by OPG and submitted that, throughout the previous licence period, OPG continued to ensure the protection of members of the public in accordance with the RPR.
359. The Commission requested comments in response to the assertion made in the intervention from F. Greening that CSA N288.2, *Guidelines for calculating the radiological consequences to the public of a release of airborne radioactive material for nuclear reactor accidents*,<sup>83</sup> rather than N288.1, was the appropriate standard to use for the calculation of dose to the public. CNSC staff explained that CSA N288.1-14 applied to routine emissions from a facility, whereas N288.2-14 applied to the modelling of dose during an emergency. CNSC staff also noted that data peaks had been considered in public dose assessments and that the maximum yearly dose to the public was calculated to be 40  $\mu$ Sv/year. CNSC staff expressed the professional view that the current model for the measurement of emissions was reasonable and that OPG's results had been validated by various means, including the CNSC's IEMP. The Commission is satisfied that the correct standard, CSA N288.1-14, is being used for public dose assessments at the PNGS.

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<sup>81</sup> The regulatory dose limit for a member of the public is 1 mSv (1,000  $\mu$ Sv) per year and the natural background dose is estimated between 2 mSv – 5 mSv (2,000  $\mu$ Sv – 5,000  $\mu$ Sv) per year.

<sup>82</sup> N288.1-14, *Guidelines for calculating derived release limits for radioactive material in airborne and liquid effluents for normal operation of nuclear facilities*, CSA Group, 2014.

<sup>83</sup> N288.2-14, *Guidelines for calculating the radiological consequences to the public of a release of airborne radioactive material for nuclear reactor accidents*, CSA Group, 2014.

360. Based on the Commission's assessment of the information provided for this hearing, the Commission is satisfied that OPG is adequately controlling radiological doses to the public.

#### 4.7.5 *Conclusion on Radiation Protection*

361. Based on the information provided on the record for this hearing, the Commission concludes that, given the mitigation measures and safety programs that are in place and will be in place to control radiation hazards, OPG provides for, and will continue to provide for, adequate protection of health and safety of persons and the environment throughout the renewed licence period.
362. The Commission is satisfied that OPG's radiation protection program at the PNGS meets the requirements of the *Radiation Protection Regulations*.
363. The Commission notes the actions taken by OPG to improve its rating in the Radiation Protection SCA and directs OPG to continue these corrective actions in its effort to regain the "fully satisfactory" rating during the renewed licence period.

#### **4.8 Conventional Health and Safety**

364. The Commission examined the implementation of a conventional health and safety program at the PNGS, which covers the management of workplace safety hazards. The conventional health and safety program is mandated by law for all employers and employees to minimize risk to the health and safety of workers posed by conventional (non-radiological) hazards in the workplace. This program includes compliance with applicable labour codes and conventional safety training. CNSC staff rated the OPG's performance in this SCA as "satisfactory" in 2013 and 2014, and as "fully satisfactory" from 2015 to 2017.
365. OPG provided the Commission with detailed information about its conventional health and safety program, reporting that the program at the PNGS complied with all applicable regulatory requirements. OPG reported that the Health and Safety Management System program and supporting governing documents established process requirements that protected employees by ensuring that they were working safely in a healthy and injury-free workplace.
366. CNSC staff submitted that OPG's conventional health and safety program was governed by the Ontario *Occupational Health and Safety Act*.<sup>84</sup> (OSHA) and the Ontario *Labour Relations Act*.<sup>85</sup> CNSC staff also submitted that the CNSC had an MOU with the Ontario Ministry of Labour (MOL) in regard to occupational health and safety practices at nuclear facilities. CNSC staff informed the Commission that

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<sup>84</sup> Revised Statutes of Ontario (R.S.O.) 1990, chapter (c.) O.1.

<sup>85</sup> S.O. 1995, c. 1, Sched. A.

OPG had a highly effective occupational health and safety program that met licensing requirements and explained that OPG's performance rating in this SCA had improved during the previous licence period as a result of improvements in OPG's scaffolding inspections and record keeping practices.

367. OPG reported that, in 2014, the PNGS reached 11 million hours without a lost time accident (LTA) and provided information about the all injury rate<sup>86</sup> and accident severity rate at the PNGS throughout the previous licence period. OPG further reported that its accident frequency rate was below target from 2013 to 2015; however, following an increase in 2016, OPG reduced the target to challenge OPG workers and to focus on low-level safety events and injury prevention. OPG submitted that in 2017, a best-ever safety performance in terms of the all injury rate of 0.06 (per 200,000 hours) was achieved at the PNGS, well below the target of 0.22. CNSC staff informed the Commission that these indicators were comparable to those of the Canadian nuclear industry and low compared to other Canadian industries.
368. OPG provided the Commission with information about the health and safety enhancements that had been made at the PNGS during the previous licence period including the "iCare" safety culture initiative; the implementation of a Total Health initiative aimed at fostering a stronger employee health, including mental health, culture; and focussed situational awareness campaigns.
369. The Commission noted the information provided in the PWU's intervention about its participation in the PNGS Joint Health and Safety Committee and requested information in this regard. The PWU representative informed the Commission that the PWU enjoyed a good working relationship with OPG through this committee and that appropriate mechanisms were in place to ensure that any issues were dealt with properly. The PWU representative also informed the Commission that the PWU actively participated in the investigation and in the severity rating of incidents at the PNGS. The OPG representative added that the PWU's participation in the investigation of incidents at the PNGS allowed for an independent assessment of the incident, corrective actions and follow-up actions. The Commission appreciates the information provided by the PWU on this topic.
370. Based on the information presented, the Commission concludes that OPG's conventional health and safety program at the PNGS satisfies CNSC requirements. The Commission also concludes that the health and safety of workers and the public were adequately protected during the operation of the PNGS in the previous licence period and that the health and safety of persons will continue to be adequately protected throughout the renewed licence period.
371. The Commission expresses its satisfaction with OPG's commitment to the health and safety of its workers at the PNGS and the initiatives that were implemented in this regard during the previous licence period. The Commission expects OPG to continue the implementation of planned health and safety initiatives throughout the renewed

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<sup>86</sup> The "all injury rate" represents a summary of all injuries per each 200,000 actual hours worked.

licence period, as presented on the record during this hearing.

#### **4.9 Environmental Protection**

372. The Commission examined OPG's environmental protection programs at the PNGS, under which OPG identifies, controls and monitors all releases of radioactive and hazardous substances, and aims to minimize the effects on the environment which may result from the licensed activities. These programs include effluent and emissions control, environmental monitoring and estimated doses to the public. CNSC staff rated OPG's performance in this SCA as "satisfactory" throughout the previous licence period.
373. The Commission also considered whether the PNGS environmental protection programs adequately met the specifications of REGDOC-2.9.1, *Environmental Protection Policies, Programs and Procedures*.<sup>87</sup>

##### *4.9.1 Effluent and Emissions Control (Releases)*

374. The Commission reviewed OPG's programs to control the release of effluent and emissions from the PNGS to the environment. OPG informed the Commission that, during the previous licence period, there were no DRL or action level exceedances for tritium, beta, gamma, carbon-14 or alpha emissions to water on an annual basis from the PNGS. OPG also reported that the DRLs or action levels for annual radiological emissions to air were not exceeded during the previous licence period.
375. In regard to conventional (non-radiological) emissions, OPG submitted information about chemicals used at the PNGS that were regulated by the Ontario Ministry of the Environment and Climate Change<sup>88</sup> (MOECC) and noted that the OPG controlled and monitored certain waterborne discharge streams under the *Municipal Industrial Strategy for Abatement* (MISA) regulations.<sup>89</sup> OPG provided confirmation that all effluent streams that were monitored under the MISA regulations were discharged to the environment via approved pathways during the previous licence period.
376. OPG informed the Commission that it met all applicable regulatory requirements that pertained to emissions and releases to the environment from the PNGS in the previous licence period. OPG submitted that it had no major infractions of environmental regulations at the PNGS during the previous licence period and that other non-major environmental infractions steadily decreased, with a total of 23 infractions during the previous licence period, only 1 infraction in 2016 and no

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<sup>87</sup> CNSC Regulatory Document REGDOC-2.9.1, *Environmental Protection Policies, Programs and Procedures*, 2013.

<sup>88</sup> Following the June 2018 Ontario provincial election, the name of the Ontario Ministry of the Environment and Climate Change (MOECC) was changed to the Ministry of the Environment, Conservation and Parks (MOECP) on June 29, 2018.

<sup>89</sup> O. Reg. 215/95

infractions in 2017.

377. Upon Commission enquiry, the OPG representative confirmed that every effluent stream from the PNGS was monitored and stated that OPG had data for all of the emissions to air from the PNGS, allowing OPG to accurately model all releases from the facility. CNSC staff and the MOECC representative confirmed that OPG met all requirements in respect of effluent control and emission releases.
378. CNSC staff reported that OPG's effluent monitoring program met the specifications of CSA N288.5-11, *Effluent monitoring programs at Class I nuclear facilities and uranium mines and mills*.<sup>90</sup> CNSC staff also confirmed that radiological and non-radiological releases at the PNGS remained below regulatory limits during the previous licence period.
379. In regard to radiological releases, CNSC staff reported that OPG submitted revised DRLs to the CNSC in 2017, that these were calculated in accordance with CSA N288.1-14, and that OPG was addressing CNSC staff's comments on the revised DRLs. CNSC staff informed the Commission that the revised DRLs would be included in the PNGS LCH following their formal acceptance by CNSC staff.
380. The Commission noted that several interventions from individuals expressed concerns about organically-bound tritium (OBT) in water and foodstuffs near the PNGS and requested additional information in this regard. CNSC staff responded that results from the CNSC IEMP confirmed that the concentration of OBT in foodstuffs and water near the PNGS remained well below regulatory limits. The Commission further enquired about whether tritium limits in water had recently been increased in Canada. CNSC staff responded that no provincial or federal limits had recently been changed. The Commission is satisfied that the concentration of OBT in foodstuffs and water near the PNGS remains below regulatory limits and does not present a risk to humans or the environment.
381. The Commission enquired about the assertion in several interventions that the PNGS was the largest tritium emitter in Canada. The OPG representative stated that reports from COG about tritium emissions from Canadian facilities showed that the PNGS was not the largest tritium emitter in Canada. The OPG representative acknowledged, however, that the PNGS was a tritium emitter and that, as such, OPG had put measures in place, including ventilation and effluent controls, to reduce these emissions. The Commission is satisfied with the information provided on this point.
382. On the basis of the information provided for this hearing, the Commission is satisfied that OPG has and will continue to have adequate programs in place for the control of effluent and emissions at the PNGS to protect the environment and meet regulatory requirements.

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<sup>90</sup> N288.5-11, *Effluent monitoring programs at Class I nuclear facilities and uranium mines and mills*, CSA Group, 2011.

#### 4.9.2 *Environmental Management System*

383. The Commission assessed the information provided by OPG and CNSC staff about the PNGS Environmental Management System (EMS). OPG submitted that the PNGS EMS was certified under the International Organization for Standardization (ISO) 14001, *Environmental Management System* and that the EMS provided the structure and processes for the assessment of environmental risks associated with PNGS activities, and to ensure that the impacts of these activities on the environment are prevented or mitigated. CNSC staff confirmed that OPG had implemented an EMS at the PNGS that met the CNSC's expectations.
384. OPG submitted that, as part of the EMS, environmental performance targets and environmental compliance were reviewed annually to identify and implement opportunities for continuous improvement. OPG also submitted that annual internal OPG environmental compliance audits which included reviews of the EMS were conducted during the previous licence period.
385. Based on the information provided, the Commission is satisfied that OPG has maintained, and will continue to maintain, an adequate EMS at the PNGS.

#### 4.9.3 *Environmental Monitoring*

386. The Commission considered information submitted by OPG about the PNGS environmental monitoring program (EMP) that is designed to demonstrate that emissions from the PNGS site are properly controlled. OPG provided the Commission with information about the EMP at the PNGS, noting that the EMP encompasses the protection of both the public and the environment from nuclear substances; hazardous substances and physical stressors; and the waste management facilities located on the PNGS site. OPG also submitted that the EMP ensured that all releases from the PNGS were ALARA and within regulatory limits, and that the PNGS EMP met the specifications of CSA N288.4-10, *Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills*.<sup>91</sup>
387. OPG reported that results from its effluent monitoring program were provided to the CNSC annually, with the results available to the public on the OPG website. OPG also reported that all radiological emissions to air and water, waste management facility monitoring results, and spills to the environment that were reportable to a regulatory authority were published quarterly and publicly available on the OPG website. OPG submitted that the environmental sampling and analyses from the EMP supported the calculation of the annual public dose resulting from PNGS operations. The Commission notes that several intervenors expressed difficulties with obtaining PNGS environmental data and the Commission considers this issue more broadly in section 4.15.3.

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<sup>91</sup> N288.4-10, *Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills*, CSA Group, 2010.

388. The Commission also examined CNSC staff's environmental review report for this licence renewal. CNSC staff confirmed that OPG's EMP results as well as the CNSC's environmental review showed that the concentrations of radionuclides and hazardous substances released to the environment from the PNGS were very low and resulted in a very low dose to the public, between 1.1 and 1.7  $\mu\text{Sv}$  per year from 2013 to 2017. CNSC staff also reported that an inspection in 2015 showed that the PNGS EMP was meeting regulatory requirements and that CNSC staff was satisfied that OPG had made and would continue to make adequate provision for the protection for the environment and persons.
389. OPG provided detailed information regarding spills that had occurred at the PNGS site during the previous licence period, noting that all spills had been reported to the CNSC and MOECC in accordance with licensing requirements. CNSC staff confirmed the information provided by OPG and reported that OPG had a satisfactory spill management program in place at the PNGS.
390. The Commission considered the concerns expressed by the MBQ about OPG's reporting of spills at the PNGS and requested additional information on this topic. CNSC staff provided the Commission with information about spill categorization and licensee reporting requirements, noting that information about spills was posted online by both OPG and the CNSC, and that the CNSC also informed stakeholders through its email list. The OPG representative confirmed OPG's commitment to informing the public about reportable events that occurred at the PNGS. Following its consideration of the concerns raised by the MBQ, the Commission directs OPG to review its procedures for informing the public about reportable events at the PNGS.
391. Referencing the intervention from the Waterkeeper, the Commission enquired about the requirements for storm water monitoring at the PNGS site. The OPG representative informed the Commission that storm water runoff from the PNGS was well understood and provided information about studies and modelling that had been carried out in that regard. The OPG representative also provided information about how OPG met requirements for storm water monitoring and run off imposed by other regulatory bodies, including the MOECC. Asked for comments, the MOECC representative confirmed that OPG was meeting all provincial storm water monitoring requirements at the PNGS site.
392. Further on this topic, CNSC staff stated that OPG's ERA in 2014 and follow up monitoring in 2015-2016 showed that there was no unreasonable risk from storm water on Lake Ontario near shore from PNGS operations. CNSC staff also informed the Commission that OPG monitored Lake Ontario surface water to ensure that no radiological or non-radiological contaminants that could pose a risk to the environment were present, noting that the level of contaminants in surface water provided a good indication of the contaminants that may be entering Lake Ontario, and that the CNSC's IEMP had confirmed OPG's EMP results. The ECCC representative confirmed that ECCC's review of OPG's monitoring data and ERA showed that the environment was protected from storm water run-off from the PNGS

site. Based on the information provided on this topic during this hearing by CNSC staff, OPG and ECCC, the Commission is satisfied that storm water runoff from the PNGS site is being appropriately characterized, managed and monitored.

### Groundwater Monitoring

393. OPG submitted information to the Commission about its groundwater monitoring program at the PNGS. In its written materials, OPG explained that groundwater sampling was done at sampling points on the PNGS site, including monitoring wells, foundation drains, sumps, catch basins and ground tubes. OPG also reported that the overall objective of the program was to ensure that there were no adverse off-site impacts from contaminants in groundwater.
394. Upon request by the Commission, the OPG representative provided an overview of OPG's extensive groundwater monitoring program, which included over 300 on-site wells and had been in place for over 20 years, noting that the groundwater pathway was north, away from Lake Ontario, and that tritium concentrations beyond the fence line of the PNGS were well below regulatory limits. The OPG representative stated that, based on over 20 years of monitoring results, there was no evidence that contaminated groundwater was being discharged from the PNGS site, and that tritium concentrations at site-perimeter locations of the PNGS remained low and indicated no adverse off-site trends.
395. CNSC staff reported that OPG would implement CSA N288.7, *Groundwater protection programs at Class I nuclear facilities and uranium mines and mills* at the PNGS by December 31, 2020. CNSC staff also explained to the Commission that tritium in groundwater at the PNGS site was limited to the site's protected area, that the foundation drains acted as hydraulic sinks that captured most of the tritium plumes in the groundwater and that OPG was adequately mitigating tritium releases.
396. OPG informed the Commission that tritium concentrations in groundwater at the PNGS Unit 1 Reactor Building had declined substantially since 2012 as a result of corrective actions that were carried out to mitigate tritium migration from the foundation drainage sump. OPG also reported that elevated tritium concentrations in groundwater were observed at the PNGS Units 5 – 8 IFB area during the previous licence period and that a project to repair the IFB epoxy liner was initiated in 2013 to mitigate leakage of water from the IFB to the sump and to reduce the tritium concentrations. OPG submitted that Phase I of the repair was carried out in 2017, Phase II would be completed by December 2018, and that tritium concentrations had been decreasing since 2016. OPG also submitted that the releases of groundwater from the PNGS site were monitored through release paths, that this monitoring confirmed that the tritium in discharges to the environment were well below regulatory limits and that the monitoring of tritium in groundwater in this area would be continued throughout the renewed licence period. CNSC staff submitted that it was satisfied with OPG's corrective actions for the Units 5 – 8 IFB liner repair.



397. The Commission noted the concerns about IFB leakage expressed by Northwatch and requested further details on this matter. The OPG representative clarified that no water from PNGS IFBs was leaking directly into groundwater and that this water was captured in the IFB sumps where it was processed and pumped back into the IFB. The OPG representative informed the Commission that, following the ECO at the PNGS in 2024, the IFBs and related sump pumps would remain in service, with continued environmental monitoring for the identified groundwater pathways throughout the renewed licence period.
398. Further on this topic, CNSC staff stated that leaks from the IFBs did not present risks to groundwater. CNSC staff explained that elevated tritium concentrations were found only on the PNGS site and that groundwater tritium concentrations outside the PNGS site perimeter were well below the Health Canada (HC) drinking water guidelines of 7,000 Bq/L.<sup>92</sup> CNSC staff also stated that inspections had confirmed the concrete structural integrity of the IFBs and that OPG was adequately mitigating the IFB leaks with the leak rate decreasing from 2,000 litres per hour to 200 litres per hour in past years. CNSC staff also confirmed to the Commission's satisfaction that OPG would be required to continue monitoring and controlling the tritium plume throughout PNGS decommissioning activities. Based on the information provided, the Commission is satisfied that the IFB leakage at the PNGS site is not presenting risks to groundwater or drinking water.
399. The Commission considered the concerns expressed by the Toronto Environmental Alliance, Northwatch, the Waterkeeper and individuals about the levels of tritium in waterways and Lake Ontario and requested information on this issue. In response, CNSC staff informed the Commission that the IEMP, OPG compliance reports and provincial environmental surveillance reports showed that the level of tritium in water supply plants near the PNGS was between 4 and 8 Bq/L, only reached 15 to 20 Bq/L in abnormal conditions, and that tritium exposure was not a risk to persons living in the vicinity of the PNGS. CNSC staff also noted that, since a peak in tritium concentrations in the Great Lakes as a result of above-ground nuclear weapons testing in the 1960s, tritium concentrations had been and continued to be steadily decreasing. The Commission is satisfied with the information provided on this point.
400. The Commission examined the intervention from I. Fairlie and requested clarification in regard to the asserted Ontario limit for tritium of 20 Bq/L. CNSC staff informed the Commission that the intervention referenced 20 Bq/L as a health limit and that it was, in fact, only a suggestion made by the Ontario Drinking Water Advisory Council in 2009 which had not been accepted by the Province of Ontario. OPG concurred with the information provided by CNSC staff and provided additional information about how tritium intake rates were calculated by OPG in respect of its

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<sup>92</sup> Health Canada, *Guidelines for Canadian Drinking Water Quality: Guideline Technical Document — Radiological Parameters*, Radiation Protection Bureau, Healthy Environments and Consumer Safety Branch, Health Canada, Ottawa, Ontario, 2009.

operations at the PNGS. The Commission notes that both the HC and the Province of Ontario's<sup>93</sup> drinking water guideline for tritium is 7,000 Bq/L.

401. The Commission enquired about the 2016 gross beta exceedance in PNGS effluent as raised in the intervention from the MBQ. CNSC staff explained that the source of beta radiation was found to be cesium-137 (Cs-137) and that, upon a thorough investigation by OPG, the source of the Cs-137 was determined to be Lake Ontario rather than the PNGS. CNSC staff further explained that the Cs-137 had entered Lake Ontario in the 1960s as a result of non-Canadian above-ground nuclear weapons testing and that, as with the tritium in lake water, contaminant levels were steadily declining. The Commission requests that OPG provide the report with findings from the investigation into this event to the MBQ, as asked for by the intervenor.
402. The Commission requested clarification in regard to the assertion in the Waterkeeper's intervention that a 3.0E+6 Bq/L site-specific limit for tritium concentration in groundwater was in place at the PNGS. CNSC staff informed the Commission that this generic screening criterion was developed from a risk assessment perspective by OPG when OPG was mitigating legacy tritium contamination issues. CNSC staff confirmed to the Commission's satisfaction that this criterion was never a regulatory limit and that it was no longer in place.

#### Independent Environmental Monitoring Program (IEMP)

403. The Commission examined the information provided by CNSC staff in regard to the CNSC's IEMP. CNSC staff provided detailed results from monitoring that was carried out in 2014, 2015 and 2017 in publicly accessible areas outside the perimeter of the PNGS. CNSC staff reported that samples included air particulate, vegetation, lake water, soil and sediment and foodstuff from a local farm outside the perimeter of the PNGS fence.
404. CNSC staff reported that all of the IEMP results from the previous licence period showed that the measured radioactivity in all samples was below available guidelines and CNSC reference levels.<sup>94</sup> On this basis, CNSC staff submitted that the IEMP results confirmed that the public and the environment around the PNGS were protected and that there should be no health impacts as a result of PNGS operations. Furthermore, CNSC staff confirmed that the IEMP results were consistent with PNGS environmental monitoring results.

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<sup>93</sup> Schedule 3, Table 2, item 59. of the *Ontario Drinking Water Quality Standards* (O. Reg. 169/03 under the *Safe Drinking Water Act, 2002*, S.O. 2002, c. 32.) provides for the drinking water limit for tritium in Ontario.

<sup>94</sup> CNSC reference levels are established based on conservative assumptions about the exposure scenario and using N288.1-14. On this basis, the reference level for a particular radionuclide in a particular medium represents the activity concentration that would result in a dose of 0.1 mSv/year.

Assessment of Environmental Monitoring

405. Based on the information provided on the record in regard to environmental monitoring at the PNGS, the Commission is satisfied that OPG's EMP and the CNSC's IEMP show that the public and the environment around the PNGS site remain protected. The Commission is also satisfied that OPG is adequately controlling the release of tritium from the PNGS.
406. The Commission notes that CNSC staff was required to issue OPG enforcement action notices to compel OPG to repair the PNGS Units 5 – 8 IFB epoxy liner in a timely manner. The Commission understands the complexity of this repair, as discussed and presented on the record for this hearing. However, the Commission is of the view that such maintenance and repairs should be undertaken as quickly as feasible and directs OPG to take a more proactive approach in response to such issues in the future.
407. Further, although the Commission concludes that OPG is controlling the release of tritium from the PNGS, the Commission directs OPG to continue its efforts in regard to the mitigation and remediation of tritium releases on the PNGS site, particularly in the vicinity of the Units 5 – 8 IFB. The Commission is satisfied that there is no need for an additional PNGS-specific licence condition on this issue and expects OPG to continue its efforts in this regard within its existing programs. The Commission also directs OPG to carry out focussed monitoring in this regard during the renewed licence period.
408. The Commission notes that on-site groundwater and other environmental monitoring raw data and reports had been requested by Northwatch and the Waterkeeper as part of their interventions. Based on the information provided to the Commission during this hearing, and noting no identified confidentiality or proprietary issues with respect to the on-site raw data and monitoring reports, the Commission directs OPG to make this information publicly available as soon as practicable.

*4.9.4 Environmental Risk Assessment*

409. The Commission assessed the adequacy of the environmental risk assessment (ERA) carried out by OPG for the PNGS and which was focussed on the years 2011 to 2015. OPG submitted that the ERA was completed in accordance with CSA N288.6-12, *Environmental risk assessment at Class I nuclear facilities and uranium mines and mills*.<sup>95</sup> and that the ERA included a human health risk assessment (HHRA) and an ecological risk assessment (EcoRA).
410. OPG submitted detailed information about the radiological and non-radiological HHRA that were carried out and which showed that there were no increased risks to

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<sup>95</sup> N288.6-12, *Environmental risk assessment at Class I nuclear facilities and uranium mines and mills*, CSA Group, 2012.

human receptors in the vicinity of the PNGS from radiological dose, chemicals of potential concern (COPCs) or physical stressors.

411. OPG informed the Commission that the EcoRA was focussed on the near shore of Lake Ontario, the PNGS site and Frenchman's Bay. OPG provided detailed information about the selection of valued ecosystem components for the EcoRA, as well as about the threatened and endangered species that were identified within the PNGS Terrestrial Site Study Area from 2011 to 2015. OPG reported on the results from the radiological and non-radiological EcoRAs which showed that the PNGS was continuing to operate in a manner that was protective of human and ecological receptors residing in the surrounding area.
412. CNSC staff reported that the 2017 ERA updated the baseline ERA submitted by OPG in 2014. CNSC staff reported that its technical review showed that the 2017 ERA was carried out in accordance with CSA N288.6-12 and that the 2017 ERA showed that meaningful adverse ecological and human health effects due to releases to air and water from the PNGS were found to be unlikely.
413. Addressing the presence of COPCs in the sediment samples from Frenchman's Bay, the OPG representative clarified that the ERA considered the risk presented and the COPCs contributed by the PNGS site to Frenchman's Bay, and that the ERA found that this risk was very low. The OPG representative explained that the PNGS site contributed to approximately 0.3% to 22% of the COPCs in Frenchman's Bay, depending on the contaminant, with a high proportion of COPCs entering Frenchman's Bay via urban runoff, and provided the Commission with information on how these levels were ascertained through monitoring and measurements. The Commission is satisfied with the information provided on this point.
414. The Commission requested comments in response to the concern expressed by D. Rudka that radionuclides would not be considered a chemical of mutual concern<sup>96</sup> (COMC) in the Great Lakes. CNSC staff explained that several non-governmental organizations had made a nomination to include radionuclides as COMC under Annex 3 of the *Great Lakes Water Quality Agreement (GLWQA)*.<sup>97</sup> CNSC staff stated that, under a MOU with ECCC, the CNSC carried out an assessment in regard to that nomination and explained that the US Nuclear Regulatory Commission (USNRC) undertook a similar assessment at the request of the US Environmental Protection Agency. CNSC staff reported that the assessments from both Canada and the US recommended that radionuclides not be included as a COMC given that they were being extensively monitored and assessed through other national and international bodies, and noted that the assessment reports were available online.

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<sup>96</sup> Chemicals of mutual concern can be defined as chemicals that originate from anthropogenic (human) sources and that are agreed to by both countries as being potentially harmful to human health or the environment. (Source: *Great Lakes Water Quality Agreement*, Annex 3).

<sup>97</sup> *Protocol Amending the Agreement Between Canada and the United States of America on Great Lakes Water Quality, 1978, as Amended on October 6, 1983 and on November 18, 1987*; Signed September 7, 2012; Entered into force February 12, 2013.

Asked to comment on radionuclides as a COMC in the Great Lakes, the ECCC representative concurred with the information provided by CNSC staff and stated that the nomination was still being evaluated by the ECCC, with a decision on this matter expected in December 2018. The Commission requests an update on the decision made by ECCC on the issue of COMCs via memo.

415. The Commission examined the concerns expressed in the interventions from the Canadian Association of Physicians for the Environment, DNA, and individuals about increased cancer rates in populations near NGS and requested information on this topic. CNSC staff responded that, based on research, the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) had found that living in the vicinity of an NGS did not increase a person's cancer risk. CNSC staff also provided the Commission with information about the 2013 RADICON Study,<sup>98</sup> noting that the study showed that there was no increase in childhood leukemia near Canadian NGS between 1990 and 2008. CNSC staff further informed the Commission that, although the RADICON study showed that thyroid cancer rates were statistically significantly higher at the PNGS and DNGS, thyroid cancer rates near the Bruce NGS were found to be similar to those of the Ontario population, with additional research showing that the higher rates were likely attributable to lifestyle rather than the consistently low radioactive iodine emissions from Canadian NGS. CNSC staff noted that increases in thyroid cancer had been confirmed to be a worldwide trend, most likely due to improved detection of thyroid cancers and not due to nuclear power generation. The Commission is satisfied with the information provided on this point.
416. The Commission requested comments on the assertion in the intervention from I. Fairlie that suggested that the risk of leukemia from tritium exposure had been underestimated. CNSC staff explained that a 2016 UNSCEAR study investigated links between cancer rates, tritium exposure and biokinetic models, and stated that the resulting UNSCEAR report specifically addressed the issue of increased leukemia rates related to tritium exposure that was raised in this intervention. CNSC staff provided information about how the results from the UNSCEAR study did not substantiate the intervenor's claim. Following the Commission's consideration of the information provided on this topic, and the Commission's understanding of the current consensus scientific view, the Commission is satisfied that the risk of leukemia from tritium exposure is adequately characterized.
417. Asked to comment about the health status reports and indicators in the vicinity of the PNGS, the epidemiologist for the Durham Region Health Department responded that a lot of work had been carried out in regard to the health status in the Durham Region municipalities, including Pickering, and that there were no indications of increased cancers or concerns with fetal-maternal health in those areas. The epidemiologist for the Durham Region Health Department also stated that detailed public health reports for the Durham Region's 50 neighbourhoods were available online.

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<sup>98</sup> CNSC, *Radiation and Incidence of Cancer Around Ontario Nuclear Power Plants From 1990 to 2008 (The RADICON Study)*, 2013.

### Thermal Plume

418. OPG submitted information to the Commission about the assessments that had been carried out in regard to the thermal plume resulting from PNGS operations, explaining that, in 2017, a revised impact assessment model was used to predict the hatch date and survival of Round Whitefish embryos at plume stations versus reference stations from 2009 – 2010, 2010 – 2011 and 2011 – 2012. OPG reported that the estimated survival loss at the plume stations was below the 10% threshold for the no-effect level for Round Whitefish embryo survival. OPG also reported that the average water temperature during the spawning and egg incubation period for all plume stations for the same time periods was below the threshold effect level of 6°C in each year. As such, OPG reported that the thermal plume from the Pickering NGS was not having an adverse effect on Round Whitefish embryo survival.
419. OPG reported that, during the previous licence period, the PNGS had ten Environmental Compliance Approval delta temperature limit infractions but noted that, starting in 2015, the number of these events declined significantly due to the implementation of corrective actions. The OPG representative informed the Commission that, in accordance with OPG's MOECC Environmental Compliance Approval, OPG was required to maintain a maximum of an 11°C difference between the inlet and outlet water. OPG also stated that the Environmental Compliance Approval included an effluent temperature limit which varied throughout the year and provided information about the mechanisms that OPG employed to ensure that these limits were maintained.
420. CNSC staff submitted in its environmental review report that CNSC staff assessments of the thermal plume from the PNGS showed a reported discharge from the PNGS of, on average, 2°C above ambient lake temperatures with a spatial extent from 1.5 to 8 km<sup>2</sup>. CNSC staff also explained that thermal discharges were regulated by multiple bodies, including the CNSC, Fisheries and Oceans Canada (DFO), MOECC and ECCC. CNSC staff provided detailed information about the thermal risk assessment undertaken by OPG and stated that both the assessments showed that there was no unreasonable risk to fish species or communities in the area.
421. The Commission enquired about the consequences of not meeting water discharge conditions. The OPG representative stated that if either of the two conditions imposed on OPG were exceeded, OPG had to notify the MOECC, at which point regulatory action could be taken. The MOECC representative confirmed the information provided by OPG, and reported that the MOECC had issued an order to OPG in 2014 in regard to cooling water temperature exceedances, with OPG having met the order's requirements.
422. The Commission considered the interventions from MBQ, the Waterkeeper, Northwatch and individuals which expressed concerns about the PNGS thermal plume and asked for additional submissions in this regard. CNSC staff provided details about the thermal risk assessment to fish that was carried out in collaboration

with ECCC that confirmed that the thermal plume was not likely to have an adverse effect on the embryo development and survival of Round Whitefish and other fish species in Lake Ontario. CNSC staff reported to the Commission that OPG would carry out two additional years of monitoring in 2018 – 2019 and 2019 – 2020 to reassess and confirm the thermal risk assessment. The ECCC representative responded that, following ECCC's review of OPG's ERA, ECCC was satisfied that the risk from the PNGS thermal plume was low but provided information about some areas for which ECCC had requested additional information from OPG, including exceedances to the maximum weekly average temperature thresholds (MWATT). The Commission is satisfied with the information provided by CNSC staff and ECCC on this matter and that the assessed risk from the PNGS thermal plume is low.

423. The Commission asked for comment about the adequacy of OPG's consideration of climate change in its environmental programs as it related to the thermal impacts of the PNGS. The ECCC and DFO representative informed the Commission that, through ongoing regulatory oversight and updates to the PNGS ERA, climate change effects as they related to the thermal impact of the PNGS to Lake Ontario could be adequately mitigated. The Commission is satisfied on this point.

#### Fish Impingement and Entrainment

424. The Commission assessed the information submitted for this hearing regarding the impingement and entrainment of fish resulting from PNGS operations. OPG submitted that, although fish impingement and entrainment was historically a significant environmental issue related to PNGS operations, the installation of a seasonal fish diversion system (FDS) in 2010, which consisted of a barrier net installed around the water intake structure at the PNGS, significantly reduced the annual impingement mortality.
425. OPG submitted that, since 2011 and with the exception of 2015 and 2017, OPG had met the 80% fish impingement reduction target requirement. OPG provided the Commission with details on why the 80% impingement reduction target was not met in 2015 and 2017, including a breach in the net and unexpected environmental conditions. OPG reported that the CNSC and DFO were notified of the fish impingement events during those two years, that investigations were carried out and that corrective actions, such as net replacement in 2017 and offsets to compensate for the fish losses, were implemented.
426. Asked for more details on the 2015 fish impingement exceedance, the OPG representative explained that a breach in the net during installation resulted in the impingement of approximately 6,000 kg of fish. The OPG representative confirmed to the Commission's satisfaction that corrective actions had been implemented as a result of the event, provided details about the design of the FDS, and about lessons learned from the operation of the FDS since 2010.

427. CNSC submitted information on impingement monitoring results for the previous licence period, noting that a third party hydroacoustic evaluation of the FDS showed that its effectiveness was more than 80% for spring, summer and fall periods combined, and that CNSC staff was satisfied with the performance of the FDS. CNSC staff also reported that it was satisfied with the corrective actions that OPG had implemented following the 2015 and 2017 fish impingement events and that OPG was reporting on the estimated biomass of impinged fish to the CNSC in accordance with reporting requirements. CNSC staff further explained that OPG was required to report annually on the FDS performance and on the related *Fisheries Act*<sup>99</sup> (FA) authorization, and noted that these reports would be conveyed to the Commission via the annual NPP ROR or other means, as appropriate.
428. In its written materials, OPG explained that the FDS was not designed to prevent entrainment and provided the Commission with information about the entrainment of fish eggs and small young fish that passed through the travelling screens and were carried through the condenser cooling water system. OPG provided details about the three proposed offsetting measures for fish entrainment, including habitat creation projects and Lake Ontario fish restocking contributions.
429. The Commission noted that impingement monitoring was carried out annually whereas entrainment monitoring was carried out only approximately every 15 years, and requested information in this regard. CNSC staff provided the Commission with information about the activities that were carried out for both impingement and entrainment monitoring, noting that impingement monitoring focussed on collecting samples on a routine basis, whereas entrainment monitoring was a more complex research-based activity that was only carried out periodically.
430. Asked to comment about the assertion in the intervention from the David Suzuki Foundation that 25,000 kg of fish were impinged during the November 2017 event, the OPG representative responded that, after FDS removal in November 2017, an equivalent of approximately 1,500 kg of age one fish were impinged at the PNGS. The OPG representative further explained that the event was reported to CNSC staff, as well as to the DFO, that a comprehensive investigation found that a contributing factor to that event was unpredicted environmental changes, and stated that OPG was working on mitigating measures to prevent such an event from reoccurring. CNSC staff also noted that, in terms of a population, the mass impinged was a small amount. The Commission is satisfied with the information provided on this matter and that OPG had followed appropriate procedures to report and investigate this event. The Commission directs OPG to implement measures to prevent its reoccurrence as soon as practicable.
431. Noting the “Bring Back the Salmon” initiative referred to in the intervention from the Pickering Naturalists, the Commission requested additional information about the initiative. The OPG representative responded that the “Bring Back the Salmon” initiative was part of OPG’s commitment to restock salmon in Lake Ontario and that

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<sup>99</sup> R.S.C., 1985, c. F-14



OPG had been supporting this initiative for the past six years. The OPG representative also stated that this initiative was one of OPG's offset measures to counteract fish impingement and entrainment, that the Ontario Ministry of Natural Resources and Forestry monitored fish populations and the effectiveness of this initiative, and emphasized OPG's commitment to fish restocking initiatives.

432. Asked by the Commission, the Ontario Ministry of Natural Resources and Forestry representative stated that specific studies had been carried out in respect of the impact of the PNGS on fish populations and that, at a lake-wide scale, the PNGS was not having a detectable impact in this regard.

#### Assessment of *Environmental Risk Assessment*

433. The Commission considered all of the information presented on the record in this hearing in regard to the ERA carried out for the PNGS. Based on this information, the Commission is satisfied that the ERA for the PNGS was carried out satisfactorily and showed that OPG was adequately protecting the environment in the vicinity of the PNGS site.
434. The Commission directs OPG to carry out the thermal plume monitoring in 2018 – 2019 and 2019 – 2020, as presented during this hearing to confirm findings and reassess uncertainties of risk. The Commission also directs CNSC staff to verify the results of OPG's thermal plume monitoring and report on the results annually during the presentation of the NPP ROR or through other means, as appropriate.
435. The Commission also directs OPG to continue implementing mitigating and offsetting measures in regard to the impingement and entrainment of fish resulting from the operation of the PNGS. The Commission directs OPG to continue its efforts in continually decreasing the impingement rate and to meet the annual 80% impingement reduction target. The Commission also directs CNSC staff to report annually to the Commission about any exceedances of the impingement reduction target via the NPP ROR or other means, as appropriate.
436. The Commission notes that, in response to the intervention from the MBQ, OPG committed to publicly posting annual information about the effectiveness of the FDS on its website and directs OPG to fulfill this commitment as soon as practicable.

#### *4.9.5 Fisheries Act Authorization*

437. The Commission notes that, since operations at the PNGS result in harm to fish that support a commercial, recreational or Indigenous fishery, a *Fisheries Act* (FA) authorization from the DFO is required for the PNGS. The need for an FA authorization is based on the definition of "serious harm" in the FA, which deals directly with impacts to fish rather than the general environmental protection

requirements of the NSCA and CEAA 2012, which assess impacts at a population level. The Commission notes that it is DFO, not the Commission, which makes decisions under the FA.

438. OPG provided the Commission with detailed information about the FA authorization application that was submitted to the DFO, including the quantitative assessment of residual impact from fish loss, offsets for these residual impacts and the engagement activities that OPG had carried out with Indigenous groups in regard to the FA authorization applications. OPG reported that the FA authorization was granted to OPG in January 2018 and that this authorization had acknowledged OPG's FDS as an appropriate mitigation strategy for impacts to fish through impingement.
439. CNSC staff provided the Commission with additional information about the FA authorization process, noting that OPG's request for authorization included two applications, and that, as per a CNSC-DFO MOU, CNSC staff oversaw OPG's self-assessment and draft applications for the FA authorization. CNSC staff reported that, following the May 2015 fish impingement event at the PNGS, the DFO carried out an investigation and required OPG to submit an application for an authorization under paragraph 35(2)(b) of the FA. CNSC staff further reported that OPG's second application considered the offsets required by the FA for any residual harm caused to fish and fish habitats.
440. OPG submitted that, as part of the FA authorization, OPG was required to install the FDS by May 1 of every year, with the FDS remaining functional until November 1 of that year. OPG also submitted that the FA authorization allowed OPG to continue carrying out activities related to the operation of the PNGS that were likely to result in serious harm to fish, and provided a mechanism for OPG to report annually on residual effects, the effectiveness of the offsetting measures that OPG implemented and other conditions of the authorization. CNSC staff confirmed that OPG's actions in this regard met CNSC staff's expectations.
441. Referring to the 2015 and 2017 impingement events at the PNGS, the Commission requested details about compliance requirements associated with the FA authorization. The OPG representative responded that the annual impingement limit in the FA authorization was 3,619 kg of fish and that, should that limit be exceeded, OPG was required to inform and work with the DFO to investigate the cause of the exceedances and to assess potential additional offsets.
442. The Commission invited the DFO to provide information regarding follow-up monitoring that would be carried out in relation to the FA authorization. The DFO representative provided the Commission with information about how the FA applied to PNGS operations and the offsets included in the FA authorization. The DFO representative explained that the FA authorization included specific monitoring and reporting requirements that OPG had to carry out in respect of the authorization, and that OPG would work with both the DFO and the CNSC to fulfill these requirements. The DFO representative also confirmed that, in addition to OPG's monitoring

reports, the DFO or the CNSC, through the DFO-CNSC MOU, would conduct site visits to confirm that OPG was fulfilling the requirements of the FA authorization.

443. Further on this topic, CNSC staff informed the Commission that, as part of the CNSC-DFO MOU, CNSC staff would review OPG's FA-related monitoring reports. CNSC staff also noted that a summary of the results from OPG's monitoring reports would be provided in the annual NPP ROR. Asked to confirm that OPG had appropriate plans and mechanisms in place to implement the requirements of the FA authorization, the DFO representative and CNSC staff concurred that OPG was meeting expectations in this regard. Based on the information provided on this topic, the Commission is satisfied that effective and appropriate mechanisms are in place to confirm OPG's compliance with the FA authorization.
444. Noting the Waterkeeper's recommendation that the entrainment study required of OPG under the FA authorization be started in 2018 rather than 2021, the Commission requested comments in this regard. The DFO representative explained that, with the planned shutdown of the PNGS in 2024, the DFO had assessed that one more year of study in 2021 was acceptable and provided additional information in this regard. The Commission is satisfied with the information provided on this point.
445. The Commission enquired about Indigenous engagement activities that had been carried out in respect of the FA authorization, noting that concerns had been raised by the MBQ about residual effects on fish resulting from PNGS operations. The DFO representative responded that the DFO met with interested Indigenous communities in respect of the FA authorization and that many outstanding issues had been addressed by OPG and CNSC staff through engagement activities. The Commission is satisfied with the information provided on this topic.
446. The Commission concludes that the environmental protection requirements of the NSCA as they relate to the protection of the environment generally are satisfied. The Commission notes that the renewal of OPG's PROL for the PNGS is a separate statutory process from the FA, which is under DFO authority. NSCA licensing is about the general prevention of unreasonable risk to the environment from the nuclear industry, whereas the FA deals very specifically with that part of the environment including fish.
447. The Commission notes the concerns raised by Indigenous groups and members of the public in regard to the offset measures and residual effects as they relate to harm to fish from the operations of the PNGS. The Commission expects OPG and CNSC staff to continue Indigenous engagement activities, as well as engagement with stakeholders, in this regard and expects OPG to continue its efforts in implementing and improving offset measures.
448. The Commission will monitor the FA authorization related activities carried out by OPG during the renewed licence period and directs that regular updates on Indigenous groups' involvement in those FA authorization-related activities be

provided to the Commission annually via the NPP ROR or other means, as appropriate.

449. The Commission notes that, during this hearing, OPG agreed to make the FA authorization compliance reports publicly available. The Commission understands that, since the FA authorization was given to OPG in January 2018, this report is not yet available but directs OPG to fulfill this commitment as soon as practicable.

#### *4.9.6 Predictive Effects Assessment*

450. The Commission examined the information provided by OPG in regard to a predictive effects assessment (PEA) that was carried out to evaluate the potential for adverse effects to human and ecological receptors based on future conditions at the PNGS. OPG submitted that the PEA applied to post-shutdown activities which included the stabilization phase (from 2024 to 2028) and to the first 10 years of the safe storage with surveillance phase.
451. Within the context of the PEA, OPG reported that an HHRA and EcoRA considering the future activities at the PNGS were carried out. OPG informed the Commission that the results of the PEA showed that, overall, the transition from commercial operation to the stabilization and safe storage with surveillance phases would result in reductions in noise, atmospheric emissions, waterborne emissions and thermal discharges. OPG also reported that the maximum predicted dose to the public during the safe storage with surveillance phase was approximately 2  $\mu\text{Sv}/\text{year}$ , representing 0.002% of the 1 mSv/year regulatory limit.
452. In regard to entrainment and impingement effects that were evaluated as part of the PEA, OPG reported that these effects would cease to be a concern during the safe storage with surveillance phase since the condenser cooling water pumps would no longer be in operation.
453. OPG informed the Commission that, since the PEA showed that no interactions were predicted to pose an unacceptable risk to humans or the environment during the stabilization and storage with surveillance phases, no new mitigation measures were found to be required since there were no predicted potential adverse effects from those activities. OPG noted that, since the planning work for the ECO was ongoing, if assumptions and environmental interactions were found to be substantially different than those indicated in the PEA, the environmental risk would be reassessed and mitigation activities would be identified as required.
454. CNSC staff explained that, in the assessed scenarios where the stabilization phase and safe storage with surveillance phase activities resulted in environmental emissions that were less than current operational conditions, the current operational conditions were considered the bounding environmental emissions. As such, further evaluation was not warranted since the effects were evaluated in the 2017 ERA.

455. Based on the information presented on the record for this hearing, the Commission is satisfied that the PNGS PEA was carried out satisfactorily and shows that the environment in the vicinity of the PNGS will continue to be adequately protected during the stabilization phase of the renewed licence period. The Commission notes that any subsequent licence renewals will require OPG to submit an application to the CNSC, at which point the validity of the PNGS PEA will be reassessed through a future ERA.
456. The Commission is satisfied with the bounding conditions of the PEA. The Commission expects OPG to continually confirm the validity of the environmental assumptions and interactions in the PEA, and to carry out reassessments should these change. The Commission directs CNSC staff to report on any changes in regard to the validity of environmental assumptions and interactions in the PEA in the annual NPP ROR or through other means, as appropriate.

#### *4.9.7 Protection of the Public*

457. The Commission assessed OPG's programs to mitigate risk to members of the public from hazardous substances discharged from the PNGS. OPG provided the Commission with information regarding the measures that have been put in place at the PNGS to ensure the protection of the public from conventional and radiological hazards. OPG also provided the Commission with details about approvals that it had obtained under provincial legislation to operate the PNGS.
458. CNSC staff submitted that, through the assessment of OPG annual and quarterly reports, reported spills and regulatory performance indicators, CNSC staff was satisfied that OPG was adequately protecting the public from unreasonable risks due to hazardous or nuclear substances resulting from the operation of the PNGS.
459. Based on the information provided, the Commission is satisfied that OPG's programs to mitigate risk to members of the public from PNGS operations are adequate.

#### *4.9.8 Conclusion on Environmental Protection*

460. Based on the assessment of the application and the information provided on the record at the hearing, the Commission is satisfied that, given the mitigation measures and safety programs that are in place to control hazards, OPG will provide adequate protection to the health and safety of persons and the environment throughout the renewed licence period.
461. The Commission is satisfied that the PNGS environmental protection programs adequately meet the specifications of REGDOC-2.9.1.

462. The Commission is satisfied that CNSC staff's environmental review and the associated report included in CMD 18-H6 are adequate for the Commission's consideration of environmental protection for this licence renewal application.
463. The Commission is also satisfied that the measures implemented at the PNGS are adequate for the purposes of environmental protection of marine species under the NSCA.
464. The Commission notes that OPG committed to the implementation of several updated CSA Group standards during the renewed licence period. The Commission expects OPG to implement these standards in accordance with the schedule submitted during this hearing. The Commission anticipates being updated annually on progress on such implementation through the NPP ROR or by other means, as appropriate.
465. The Commission is satisfied that the monitoring and reporting requirements under the FA authorization for the PNGS, as reported during this hearing, will ensure adequate verification of OPG's compliance in this regard. The Commission notes that it will be DFO that will make any decisions under the FA; at the same time, in light of the CNSC role under the NSCA, the Commission directs CNSC staff to provide annual updates in regard to the effectiveness of offset measures and residual effects, and OPG's compliance with the FA authorization, in the NPP ROR or through other means, as appropriate.
466. The Commission notes the information submitted by CNSC staff during this hearing about the plans for the development of an environmental data and report registry that would improve public access to licensee monitoring data. The Commission recommends that the development of this registry be expedited, insofar as practicable, and requests CNSC staff to provide updates to the Commission on this registry as more information about it becomes available.

#### **4.10 Emergency Management and Fire Protection**

467. The Commission considered OPG's emergency management and fire protection programs, which cover the measures for preparedness and response capabilities implemented by OPG in the event of emergencies and non-routine conditions at the PNGS. This includes nuclear emergency management, conventional emergency response, and fire protection and response. Throughout the previous licence period, CNSC staff rated OPG's performance in this SCA as "satisfactory."
468. OPG submitted that the PNGS emergency preparedness measures and fire response capabilities were in place to prevent and mitigate the effects of nuclear and hazardous substance releases, both onsite and offsite, and fire hazards to protect workers, the public and the environment. OPG also submitted that the PNGS emergency preparedness and fire protection program met regulatory requirements.

469. CNSC staff reported that OPG had implemented and maintained an emergency preparedness program and conducted emergency exercises in accordance with RD-353, *Testing and Implementation of Emergency Measures*.<sup>100</sup> throughout the previous licence period, and that OPG implemented REGDOC-2.10.1, Version 1, *Nuclear Emergency Preparedness and Response*.<sup>101</sup> in September 2017 (REGDOC-2.10.1). CNSC staff submitted that compliance verification activities showed that OPG's nuclear emergency management program met the specifications of REGDOC-2.10.1.
470. CNSC staff reported that REGDOC-2.10.1 was consistent with modern national and international emergency management practices including the IAEA GS-R-2, *Preparedness and Response for a Nuclear or Radiological Emergency*,<sup>102</sup> GS-G-2.1, *Arrangements for Preparedness for a Nuclear or Radiological Emergency*,<sup>103</sup> and the IAEA EPR-Exercise, *Preparation, Conduct and Evaluation of Exercises to Test Preparedness for a Nuclear or Radiological Emergency*.<sup>104</sup>
471. CNSC staff informed the Commission that the Ontario Officer of the Fire Marshal and Emergency Management (OFMEM) updated the *Provincial Nuclear Emergency Response Plan*.<sup>105</sup> (PNERP) in December 2017 and that, for the first time, this process involved public consultation. CNSC staff also reported that the PNGS Implementing Plan for the 2017 PNERP was available on the OFMEM website since April 30, 2018 and that the updated PNGS Implementing Plan would be implemented at the PNGS within the first year of the renewed licence period. CNSC staff emphasized that a fully functioning implementing plan was currently in place for the PNGS and that CNSC staff was satisfied that all stakeholders were prepared in the unlikely event of a nuclear emergency at the facility. Additional information on the 2017 PNERP and its implementation at the PNGS is found in subsection 4.10.2.

#### 4.10.1 Conventional Emergency Management

472. The Commission considered the adequacy of OPG's conventional emergency (non-nuclear) management programs at the PNGS and the information submitted in this regard. OPG submitted that appropriate emergency measures and staff had been, and would continue to be, maintained and in place to prevent and mitigate the effects of hazardous substance releases and other conventional emergencies. OPG also submitted information about the drills and exercises that PNGS emergency response

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<sup>100</sup> CNSC Regulatory Document RD-353, *Testing and Implementation of Emergency Measures*, 2008.

<sup>101</sup> CNSC Regulatory Document REGDOC-2.10.1, *Nuclear Emergency Preparedness and Response*, 2014.

<sup>102</sup> IAEA Safety Standards Series GS-R-2, *Preparedness and Response for a Nuclear or Radiological Emergency*, International Atomic Energy Agency, Vienna, 2002.

<sup>103</sup> IAEA Safety Standards Series GS-G-2.1, *Arrangements for Preparedness for a Nuclear or Radiological Emergency*, International Atomic Energy Agency, Vienna, 2007.

<sup>104</sup> Emergency Preparedness and Response EPR-Exercise, *Preparation, Conduct and Evaluation of Exercises to Test Preparedness for a Nuclear or Radiological Emergency*, International Atomic Energy Agency, 2005.

<sup>105</sup> *Ontario Provincial Nuclear Emergency Response Plan (PNERP) Master Plan 2017*, Office of the Fire Marshal and Emergency Management, Ministry of Community Safety and Correctional Services, 2017.

personnel participated in throughout the previous licence period.

473. CNSC staff informed the Commission that compliance verification activities showed that OPG had the required emergency personnel available at the PNGS 24 hours a day to respond to any type of emergency and that OPG's conventional emergency program for the PNGS met regulatory requirements.
474. Based on the information provided on the record for this hearing, the Commission is satisfied with OPG's programs to manage conventional emergencies at PNGS.

#### *4.10.2 Nuclear Emergency Management*

475. The Commission considered the information submitted by OPG and CNSC staff about nuclear emergency management at the PNGS. OPG provided detailed information about its *Consolidated Nuclear Emergency Plan (CNEP)*, which describes the governance for the implementation and maintenance of an effective response in the case of a nuclear emergency at the PNGS. OPG submitted that the CNEP provided the framework for its interaction with external authorities as defined under the PNERP.
476. OPG also provided the Commission with a summary of its nuclear emergency preparedness performance under several performance indicators, including the Radiological Performance Emergencies index; the Emergency Response Organization Drill Performance index; and the Emergency Response Resources Completion index. OPG noted that it had achieved 100% under these indicators from 2013 – 2016, with the exception of the Radiological Emergencies Performance index, for which it received its lowest rating of 92.6%, but returned to 100% in 2016.
477. CNSC staff explained that OPG submitted an updated PNGS CNEP for CNSC staff review in October 2017, and that CNSC staff was satisfied with the updated plan. Noting the recent publication of REGDOC-2.10.1, Version 2,<sup>106</sup> the Commission enquired about when OPG would be required to implement the updated REGDOC-2.10.1. CNSC staff informed the Commission of the differences between Versions 1 and 2 of REGDOC-2.10.1, that Version 2 was already considered in the LCH as a guidance document, and stated to the Commission's satisfaction that Version 2 would be implemented by OPG during the renewed licence period.
478. The Commission considered the nuclear emergency preparedness and planning enhancements that had been made at the PNGS during the previous licence period. OPG provided detailed information about the implementation of several nuclear emergency preparedness initiatives at the PNGS, including substantial upgrades to PNGS EME to mitigate the risk of severe accidents and to improve response BDB events. OPG also submitted that the recent implementation of the "Unified RASCAL

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<sup>106</sup> CNSC Regulatory Document REGDOC-2.10.1, Version 2, *Nuclear Emergency Preparedness and Response*, 2017.



Interface” computer code at the PNGS to more effectively predict radiological dose effect and inform protective action decision-making in the event of an emergency.

479. CNSC staff submitted that regulatory compliance oversight during the previous licence period showed that OPG continued to support and maintain a comprehensive nuclear emergency preparedness program at the PNGS. CNSC staff also provided additional information about other emergency management-related initiatives that OPG had carried out during the previous licence period, noting that OPG had implemented a real-time automatic data transfer system to the CNSC Emergency Operations Centre (EOC) which will help CNSC staff to independently assess the likelihood and magnitude of a radiological release.
480. In regard to nuclear emergency-related public communications and awareness, OPG provided details about initiatives that were carried out throughout the previous licence period, including collaborative activities with municipal, regional and provincial governments, such as the November 2017 emergency preparedness campaign in the detailed planning zone<sup>107</sup> (DPZ). OPG asserted its commitment to continue its work and collaboration with various levels of government in this regard.
481. The Commission assessed the Equipment Important to Emergency Response (EITER) program in place at the PNGS to ensure the appropriate management of emergency response equipment. OPG submitted that the EITER program aligned with industry best practices, identifying emergency equipment, additional back-up equipment and contingency actions should back-up equipment be unavailable. OPG also provided information about how the EITER included information about the SSCs, and the tools and equipment necessary to implement the CNEP. CNSC staff confirmed the adequacy of the EITER at the PNGS.
482. Asked to provide additional information on how OPG assured the continued availability of EME at the PNGS and how its proper use was exercised, the OPG representative provided details about initial EME qualification, EME training provided to workers and exercises that were carried out which required deployment of the EME. The Commission is satisfied that OPG has well-developed processes in place to ensure the continued availability of EME at the PNGS.
483. The Commission asked for comments regarding the implementation of the Fukushima Action Plan (FAP) for the PNGS. CNSC staff confirmed that OPG had fully implemented the FAP at the PNGS and that, with the planned ECO in 2024, CNSC staff had reassessed the PNGS-related FAIs during its review of the PSR. CNSC staff further stated that any FAP-related items that had been identified in the IIP were improvements to the original FAP actions and provided details in this regard. The OPG representative provided additional information on the nature of the FAP-related improvements identified in the IIP and on the EME improvements that

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<sup>107</sup> The *PNERP Implementing Plan for the Pickering Nuclear Generating Station* provides for the full scope of the DPZ, which can be broadly defined as the area immediately surrounding the reactor facility extending out to an approximate radius of 10 kilometres.

had been implemented during the previous licence period. The Commission is satisfied that OPG has adequately implemented the FAP at the PNGS and that OPG would implement FAP-related IIP actions during the renewed licence period as presented during this hearing.

484. OPG provided the Commission with information about the three major exercises that were carried out at the PNGS during the previous licence period, including
- Exercise Unified Response (ExUR) in May 2014, which involved over 2,000 participants and 54 agencies over three days and demonstrated the integration of nuclear response plans;
  - a station emergency exercise in November 2015 involving a multi-unit severe accident, which required redeployment of EME and demonstrated OPG's response capability in such a situation; and
  - Exercise Unified Control (ExUC) in December 2017 which tested on-site and off-site emergency response capability and integration.

CNSC staff confirmed that OPG carried out exercises and drills during the previous licence period that met the expectations of CNSC staff and RD-353.

485. The Commission requested updated information about performance evaluations and results from ExUC. OPG informed the Commission that the three levels of exercise evaluations included internal, CNSC and third-party evaluations. The OPG representative reported that the CNSC evaluation of ExUC validated the effectiveness of OPG's emergency management program and also noted that intra-agency communications were a key learning point identified during the exercise. The OPG representative also highlighted ExUC successes including the real-time data transfer to the CNSC emergency operations centre during the exercise. CNSC staff confirmed that ExUC evaluation reports showed that OPG's existing capabilities to respond to an emergency at the PNGS were adequate. The Commission is satisfied with the information provided in this regard.
486. Noting the intervention from DNA which expressed that nuclear emergency exercises were not useful for the public, the Commission invited further details. The DNA representative informed the Commission that public awareness and engagement in respect of nuclear emergencies could be increased if the public was provided with greater opportunities to participate in such exercises. The OPG representative informed the Commission that OPG encouraged public involvement in emergency exercises, noting that OPG ran focus groups during its last two exercises to assess OPG's communications with the public during the exercise, and that valuable lessons learned had been generated during these focus groups. Asked to provide the OFMEM's input on this topic, the OFMEM representative explained that emergency exercises benefitted not only licensees, but all stakeholders including members of the public, and provided information about how the public could participate in future

exercises, including volunteering as a casualty or through focus groups. Following its consideration of the issues raised by DNA and the information provided in this regard, the Commission is satisfied that nuclear emergency exercises are achieving their intended purpose. However, recognizing the value-added aspect of public participation in nuclear emergency exercises, the Commission requests OPG to assess increased public participation during its emergency exercises and implement changes in this regard, as practicable.

487. The Commission considered the mechanisms in place for the alerting of the public in the event of an emergency at the PNGS. OPG submitted that various forms of communication such as sirens, media (including social media), and an automated telephone dialing system would be used to inform the public in the event of an emergency. OPG also provided information about its participation in the piloting of the Region of Durham's Wireless Public Alerting System, which was fully implemented by Canadian Radio-television and Telecommunications Commission directive on April 6, 2018.<sup>108</sup>
488. The Commission requested information about HC's *Generic Criteria and Operational Intervention Levels for Nuclear Emergency Planning and Response*<sup>109</sup> (Generic Criteria) document and about HC's coordination with the OFMEM in this regard. The HC representative responded that the Generic Criteria document had been finalized in 2017 and would be published on HC's website in 2018. The HC representative also provided the Commission with details about HC's extensive consultation with provincial and territorial partners in respect to the Generic Criteria document and about the feedback received through these consultation activities. The HC representative noted that, although the guidelines in the Generic Criteria document were voluntary, they were incorporated in the updated PNERP, establishing a strong correlation between federal and Ontario generic criteria and operational intervention levels.
489. The Commission considered interventions from the CCNR, the OCAA, DNA, CELA and individuals, and requested additional details about recovery plans that would be implemented following a nuclear accident. The HC representative stated that the recovery framework would be addressed in a separate document from the Generic Criteria document, noting that the Canadian federal recovery framework was being led by the CNSC and HC. CNSC staff confirmed that the CNSC was working with provincial and federal partners, including HC and the OFMEM, to address recovery planning and provided the Commission with information on the upcoming REGDOC-2.10.1, *Emergency Management and Fire Protection, Volume II: Framework for Recovery After a Nuclear Emergency*.<sup>110</sup> CNSC staff confirmed to

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<sup>108</sup> In 2017, the CRTC issued regulatory policy CRTC 2017-91 to direct wireless service providers to implement wireless public alerting capability on their networks by April 6, 2018.

<sup>109</sup> Health Canada, *Generic Criteria and Operational Intervention Levels for Nuclear Emergency Planning and Response*, finalized in 2017, to be published.

<sup>110</sup> CNSC Regulatory Document REGDOC-2.10.1, *Emergency Management and Fire Protection, Volume II: Framework for Recovery After a Nuclear Emergency*, under development.

the Commission's satisfaction that this REGDOC would consider a wide scope of issues, including psychosocial issues for further consideration by authorities.

490. The Commission requested additional information about the IAEA-led Emergency Preparedness Review (EPREV) mission to Canada that was planned for June 2019. The HC representative informed the Commission that, in preparation for the EPREV mission and through a planning committee across all national jurisdictions, Canadian authorities reviewed Canada's nuclear emergency arrangements against IAEA, International Commission on Radiation Protection (ICRP), UNSCEAR, NEA and Organisation for Economic Co-operation and Development emergency preparedness and response standards and guidelines. The HC representative opined that current self-assessments showed that Canada was well-prepared but that the EPREV mission would help identify any remaining gaps in Canada's nuclear emergency preparedness plans. OPG provided additional information about further planning and preparatory activities that were scheduled to prepare for the EPREV mission. The Commission requests an update on the 2019 EPREV mission when results are available.
491. Referencing the post-nuclear emergency dose estimates and related cancer risk submitted in the intervention from the OCAA, the Commission enquired about the appropriateness of using collective dose to estimate cancer risks after a nuclear accident. CNSC staff responded that, through studies carried out after the Chernobyl and Fukushima accidents, and as per UNSCEAR reports and ICRP guidelines in this regard, the use of collective dose that covered a wide range of exposures, conditions, geographical areas and time periods was not appropriate. CNSC staff provided information about international consensus regarding the appropriate use of collective dose to estimate public doses following an accident. The Commission is satisfied with the information provided on this point.
492. Further considering the intervention from the OCAA, the Commission asked for comments regarding radiation distribution patterns following a nuclear accident that were submitted in this intervention. CNSC staff opined that overlaying radiation distribution patterns from the Fukushima accident in Japan over the area in the vicinity of the PNGS, as was done in the intervention, was neither accurate nor appropriate. CNSC staff stated that radiation distribution patterns were dependent on many factors including reactor technology, EME availability and weather patterns. CNSC staff further stated that the radiation plume shown in the intervention was not a credible distribution pattern in the event of a nuclear accident at the PNGS and explained that a Fukushima-level emission was assessed in CNSC staff's study *Consequences of a Hypothetical Severe Nuclear Accident and Effectiveness of Mitigation Measures*' (SARP Study). Asked for comment on this topic, the HC representative agreed with the information provided by CNSC staff and stated that HC had evaluated the CNSC's SARP Study and found the methodology used and dose projections to be reasonable. Based on the information provided, the Commission is satisfied that the use of collective dose to estimate cancer risk, as well as the radiation plume detailed in this intervention, do not represent credible methods for the assessment of accident scenarios at the PNGS.

493. In response to the intervention from the Ajax Pickering Hospital and the Ajax Pickering Hospital Foundation, CELA and the Registered Nurses' Association of Ontario, the Commission enquired about the response capabilities of hospitals near the PNGS. The OPG representative provided the Commission with information about the nuclear emergency support agreements that OPG had with local hospitals and how local hospitals were included in regular drills and exercises to test contaminated casualty treatment protocols and response procedures. The OPG representative also stated that support municipalities could be called on by the Ministry of Health and Long-Term Care (MOHLTC) through the Ontario Provincial Emergency Operations Centre (PEOC) if additional resources were required.
494. Further on this topic, the HC representative provided the Commission with details about the *Medical Emergency Treatment for Exposure to Training* course that was offered to personnel who would be called on to attend to a potentially contaminated casualty. The HC representative also stated that HC delivered this course to municipalities as requested and that, under the provincial requirements, all medical facilities were required to have an updated radiation health response plan which was overseen by the MOHLTC. Following its consideration of the information provided on this topic, the Commission is satisfied that adequate support agreements are in place with hospitals near the PNGS and that health care facilities were involved in drills and exercises to test these agreements.
495. The Commission noted the concerns expressed by CELA, the OCAA, DNA, Greenpeace, the Registered Nurses' Association of Ontario, and individuals about the contamination of Lake Ontario in the event of a radiological release and requested additional information about such a scenario. CNSC staff explained that no credible scenario involving a radiological release from the PNGS that would contaminate all of Lake Ontario had been identified. CNSC staff further explained that the EA carried out under CEAA 1992 for the PNGS-B refurbishment project considered a release of moderator-grade heavy water to Lake Ontario that resulted in a maximum tritium concentration of 17,000 Bq/L, translating to a dose to a member of the public of less than 1 µSv/day and less than 1 mSv/year.
496. The Commission enquired about how the potential contamination of drinking water was considered in the 2017 PNERP. The OFMEM representative stated that all response plans that had been developed were publicly available and provided details on how the MOECC would support the OFMEM in this regard. The OFMEM representative confirmed CNSC staff's statement that the MOECC had oversight in this regard and would support municipal and non-municipal drinking water systems that were regulated under the *Safe Water Drinking Act*,<sup>111</sup> with this support having been verified during emergency exercises.
497. Further on this topic, the OFMEM representative also explained that the contamination of drinking water was considered in section 1.9.4 of the 2017 PNERP, which provided information about Ontario drinking water standards, and in Annex E,

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<sup>111</sup> Statutes of Ontario (S.O.) 2002, c. 32.

Appendix 2 of the 2017 PNERP, which provided specific intervention levels in terms of contamination levels and the procedures that would be put into place. The OFMEM representative also provided information about Ontario's *Provincial Liquid Emissions Response Plan*, which was referenced in section 7.15 of the 2017 PNERP, and outlined how all stakeholders would coordinate their responses in the event of a radiological release to a source of drinking water. The OFMEM submitted information about the Environmental Radiation and Assurance Monitoring Group Plan, referenced in section 7.6 of the 2017 PNERP, which would be responsible for the monitoring of foodstuffs and water during a nuclear emergency and which was conducting additional work in regard to liquid emissions response. The Commission is satisfied with the information provided on this topic.

498. The Commission has carefully considered the concerns submitted by intervenors regarding the potential for the contamination of drinking water in the event of a nuclear emergency at the PNGS and the emergency preparedness plans in place should this occur. Based on the information provided by the OFMEM, CNSC staff and OPG, the Commission is satisfied that the contamination of the whole of Lake Ontario in the event of a nuclear accident at the PNGS is not a credible scenario. Nevertheless, the Commission agrees about the importance of ensuring that an adequate plan to maintain public access to clean drinking water in the event of a nuclear emergency is in place. Following its consideration of the information presented for this hearing on this topic, the Commission is satisfied that the Commission's role in this regard is understood and satisfied, and that the readiness of other authorities whose responsibilities would be engaged, is in place.
499. The Commission considered the information provided by OPG about evacuation time estimates (ETE) and off-site support in the event of an emergency at the PNGS site. OPG reported that an updated PNGS ETE study carried out in 2016 used industry-accepted methodology and that the conservative evacuation time estimate of the DPZ was found to be 8 hours and 40 minutes. OPG reported on the extensive emergency support readiness that OPG provided to the Province of Ontario, the Region of Durham and the City of Pickering, as well as engagement activities that OPG carried out with these government partners to ensure that emergency plans continued to support a timely and safe evacuation in the event of a nuclear emergency. CNSC staff informed the Commission that its reviews agreed with the adequacy of the ETE study.
500. The Commission requested information in response to interventions from CELA, Greenpeace, DNA, the Toronto Environmental Alliance, the Registered Nurses' Association of Ontario and individuals that submitted concerns about evacuation planning in the event of a nuclear emergency at the PNGS. The OFMEM stated that, under the 2017 PNERP, it was the responsibility of the Ontario Ministry of Transportation (MTO) to lead the development of measures for all-hazards evacuations and provided information about the various stakeholders that would be involved in an evacuation in the event of an emergency at the PNGS. The OFMEM representative also provided information about the detailed evacuation plans that

were in place for the DPZ, noting that the evacuation plans were scalable and included a unified transportation coordination management methodology based on the one developed for the 2015 Pan Am and Parapan Am Games in Toronto, as well as on lessons learned from international events.

501. Further on this topic, the OFMEM representative submitted that a provincial all-hazards unified transportation management plan was under development and was expected to be finalized within two years. The MTO representative confirmed the information about the development and implementation of the unified transportation management plan, in which the MTO was participating with municipal and provincial stakeholders. The MTO representative also confirmed that a provincial all-hazards evacuation plan was created in 2016 and that, following modelling and the consideration of various scenarios, the plan could be implemented on Ontario highways.
502. The Commission assessed the concerns about the accuracy of the PNGS ETE study as raised in the intervention from CELA and DNA, and asked for additional information on these studies. The OPG representative explained that the contractor that was used for the study was highly-experienced and well-regarded in both Canada and the US and that, based on modelling and exercises, OPG was confident in the accuracy and adequacy of the evacuation estimates. The OPG representative also informed the Commission that evacuation plans were updated when new census data were received and that the plans considered the projected population in 2025. The OFMEM concurred with OPG about the adequacy of the ETE study and that it was forward-looking in terms of population density near the PNGS, but agreed with the view expressed by the Commission that ETE studies should be carried out frequently to ensure that planning was as up to date as possible.
503. Following its consideration of the information submitted by intervenors, OPG, CNSC staff, the OFMEM and the MTO regarding evacuation planning, the Commission is satisfied with the coordination between CNSC-regulated matters and other authorities, such that the Commission can be satisfied of adequate protection against the risks that it regulates. The Commission is of the view that the unified transportation management plan should be made implementable as soon as practicable.
504. The Commission noted OPG's "Neighbours" brochure which provides information, including emergency planning information, to residents in the PNGS and DNGS DPZs on a quarterly basis. The Commission also noted that several intervenors including CELA, DNA and individuals submitted that additional public awareness and education programs were needed beyond the DPZ and asked the OFMEM to provide comments about the requirements in this regard. The OFMEM representative stated that public awareness and education requirements were addressed in Section 3, Annex C of the 2017 PNERP. The OFMEM representative noted that, while these requirements were limited to the PNGS emergency planning zones under the

PNERP,<sup>112</sup> these could be expanded to a broader area if required. The OFMEM representative also stated that, under the *Emergency Management and Civil Protection Act*<sup>113</sup> (EMCPA), municipalities in Ontario were required to have a public education program that focussed on identified risks in their communities and that this would cover areas outside the DPZ, further noting that all stakeholder websites, including Government of Ontario and municipality websites, included information in respect of nuclear emergency preparedness.

505. The Commission noted that the City of Toronto had passed a motion asking the CNSC, OPG and the Province of Ontario to increase nuclear emergency awareness of the public within the entire Ingestion Planning Zone<sup>114</sup> (IPZ) and requested comments in this regard. The OPG representative informed the Commission that municipalities outside the DPZ, including the Durham Region and the City of Toronto, carried out bi-annual emergency preparedness and KI pill awareness campaigns through various campaigns. OPG expressed its commitment to working with all stakeholders outside the DPZ to ensure that appropriate emergency preparedness information was disseminated to the public. CNSC staff noted that OPG was meeting the specifications of REGDOC-2.10.1 in respect of nuclear emergency awareness activities but that CNSC staff strongly supported efforts to extend these communications beyond the DPZ.
506. Further on this topic, the OFMEM representative informed the Commission that, under the EMCPA, municipalities were required to have risk-specific public education programs and that the OFMEM considered these programs as a shared responsibility. The OFMEM representative provided information about the support provided to municipalities, noting that much of this support was provided by the nuclear industry. The OFMEM also reported that awareness campaign results showed that, although the public's emergency planning awareness had improved, this was an area that needed constant attention, municipal engagement and resources for continued education. Following its consideration of the information provided, the Commission is of the view that, although OPG meets the specifications of REGDOC-2.10.1 in regard to nuclear emergency preparedness awareness, the Commission requests that OPG works with stakeholders to assess and implement additional awareness strategies throughout the IPZ.
507. In response to information submitted by intervenors, including CELA, Greenpeace, DNA, Northwatch, the Registered Nurses' Association of Ontario, and individuals about population density in the vicinity of NGS, the Commission requested information about existing guidelines for the siting of NGS. CNSC staff explained that there were no national or international guidelines in respect of population density and the siting of NGS, with overall NGS safety and the availability of emergency response capabilities being the primary considerations. CNSC staff also emphasized

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<sup>112</sup> Under the PNERP, the emergency planning zones represent the area 50 km beyond the boundary of the facility.

<sup>113</sup> R.S.O. 1990, c. E.9

<sup>114</sup> The *PNERP Implementing Plan for the Pickering Nuclear Generating Station* provides for the full scope of the IPZ, which can be broadly defined as all areas within a 50-km radius of the PNGS.



that all Canadian NGS had exclusion zones, as well as other protective zones, to ensure the protection of the public in the event of a nuclear emergency, and that the PNGS met all of CNSC's requirements in this regard.

508. Further on the topic of population density, the Commission noted that, in 2011, the Joint Review Panel (JRP) for the EA for the proposed Darlington New Build project<sup>115</sup> had given CNSC staff direction in regard to population density near the proposed new-build NGS and requested information about that matter. CNSC staff responded that, as a result of the JRP's direction, the Province of Ontario modified its policy with respect to land planning in 2014 to ensure that the policy adequately considered future significant infrastructure projects, including NGS. However, CNSC staff noted that this policy did not consider existing infrastructure. The Commission acknowledges the concerns submitted by intervenors regarding the increasing population density in the vicinity of the PNGS. Based on the information examined for this hearing, the Commission is satisfied that the PNGS, as an existing facility, meets current guidelines and requirements in regard to the safety of the public living near the facility, noting emergency preparedness as a major consideration in respect of this public safety.

Updated 2017 Provincial Nuclear Emergency Response Plan (PNERP)

509. The Commission considered Ontario's updated 2017 PNERP and its integration with OPG's emergency management preparedness planning. The Commission states that, while the CNSC's mandate is to regulate the licensee's emergency management program within the PNGS site, the Commission's mandate also includes ensuring that the operation of the PNGS does not pose an unreasonable risk to the health and safety of workers, public and the environment. Therefore, in this vein, the Commission is considering how the OPG's emergency management program integrates with Ontario's PNERP to ensure that workers, the public and the environment would be protected in the event of a nuclear emergency.
510. OPG submitted that the OFMEM updated the PNERP in December 2017 and that, for the first time, this process involved a public consultation period. OPG also submitted that the PNGS Implementing Plan for the 2017 PNERP would be implemented in the first year of the renewed licence period. OPG asserted its commitment to provide support to off-site emergency and government authorities in the effective and timely implementation of the updated PNERP.

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<sup>115</sup> CNSC *Record of Proceedings, Including Reasons for Decision* – Ontario Power Generation Inc., *Application for the Issuance of a Licence to Prepare Site for a New Nuclear Power Plant at the Darlington Nuclear Site*, August 17, 2012.

511. CNSC staff submitted to the Commission that its review showed that the updated PNERP better aligned with national and international standards, including CSA N1600-16, *General requirements for nuclear emergency management programs*.<sup>116</sup> and IAEA GSR-7, *Preparedness and response for a nuclear or radiological emergency*.<sup>117</sup>
512. Upon request from the Commission, the OFMEM representative provided additional information regarding the updated PNERP and the implementation plans related to the PNERP, explaining that under the EMCPA and regulations, as well as under Order in Council, the OFMEM had the responsibility to lead offsite response and management for nuclear emergencies in Ontario. The OFMEM representative also stated that the PNERP was the overall policy framework and standard for nuclear emergency management in Ontario, and better aligned with emergency management best practices, including CSA Z1600-17, *Emergency and continuity management program*.<sup>118</sup> The OFMEM representative provided the Commission with information about the international advisory board that had been appointed and the public consultation that had been carried out for the development of the 2017 PNERP, confirming to the Commission's satisfaction that BDB and multi-reactor scenarios had been adequately considered in the 2017 PNERP.
513. Asked to comment on the PNERP, the HC representative stated that the 2017 PNERP was adequate and that HC was involved in the technical hazard assessment that was carried out in support of the PNERP update. The HC representative also stated that HC was satisfied that the source-term considered in the 2017 PNERP was adequate and that the revised planning zones adequately protected the public.
514. Upon enquiry from the Commission about the PNGS Implementing Plan under the 2017 PNERP, the OPG representative provided a detailed explanation of the steps that would be taken by OPG, municipal, provincial and federal partners in the event of a nuclear emergency, including the activation of the emergency operations centres, decision made in respect to evacuation and KI pill consumption, distribution of KI pills beyond the DPZ and other off-site responses. The OFMEM representative confirmed the information provided by OPG and noted that, as a result of consultation activities with the City of Toronto, the Region of Durham and other communities in the Contingency Planning Zone<sup>119</sup> (CPZ), Annex C in the PNGS Implementing Plan with directions specific to the CPZ had been developed. The Commission is satisfied with the information provided by OPG and the OFMEM on this point, noting its appreciation of the concrete consideration of stakeholder comments in the PNGS Implementing Plan.

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<sup>116</sup> N1600, *General requirements for nuclear emergency management programs*, CSA Group, 2016.

<sup>117</sup> IAEA Safety Standards Series GSR-7, *Preparedness and Response for a Nuclear or Radiological Emergency*, International Atomic Energy Agency, Vienna, 2015.

<sup>118</sup> Z1600-17, *Emergency and continuity management program*, CSA Group, 2017.

<sup>119</sup> The *PNERP Implementing Plan for the Pickering Nuclear Generating Station* provides for the full scope of the CPZ, which can be broadly defined as all areas within a 20-km radius of the PNGS.

515. The Commission requested additional information about the 2017 PNERP technical study being carried out by the OFMEM. The OFMEM representative informed the Commission that the study would assess three accident scenarios, DBA, BDBA and severe BDBA, and would assess technical matters such as protective zones, KI requirements, evacuations, the monitoring of water, and foodstuffs contamination. The OFMEM representative also stated that the study was building on work carried out for, and the public consultation that had been done during, the development of the 2017 PNERP, with a target completion date of the end of 2018. The Commission is satisfied with the information provided on this matter and anticipates updates on the PNERP technical study as a matter of course.
516. The Commission noted that several intervenors, including the Canadian Association of Physicians for the Environment, Greenpeace, the OCAA, CCNR, CELA, DNA and individuals, expressed concerns that the 2017 PNERP did not adequately address the response to a severe BDBA and requested clarification in this regard. In this same vein, the Commission also requested information about the role of the IAEA's International Nuclear and Radiological Event Scale (INES) and how it related to emergency planning. CNSC staff explained that it was of the view that the 2017 PNERP adequately considered DBA, BDBA and severe BDBA scenarios, and noted that all nuclear emergency management related decision making, including that under the PNERP, was conservative and assumed a worst case or INES Level 7, as referred to in several interventions, scenario. CNSC staff cautioned, however, that the INES was a communication tool, rather than a tool for the modeling of accident scenarios, and provided the Commission with information on the appropriate use of the INES.
517. Further on this topic, the OFMEM representative confirmed to the Commission that the 2017 PNERP planning basis and the updated emergency planning zones considered a worst case scenario and that the PNERP international advisory committee found the 2017 PNERP adequate in this regard. The Commission is satisfied with the information provided on this point during the hearing and in written materials, and that the updated PNERP adequately considers DBA, BDBA and severe BDBA scenarios. The Commission also wishes to note that the purpose of the INES is often misunderstood and recommends that references to the INES in the context of emergency planning and in relation to accident scenarios be avoided in the future.
518. Noting the concerns expressed by several intervenors including CELA, DNA and Greenpeace regarding the planning zones in the 2017 PNERP, the Commission enquired about the international benchmarking that had been carried out in this regard. CNSC staff informed the Commission about the elaborate benchmarking that had been carried out in respect of IAEA recommendations and the existing planning zones in Germany, Sweden, Switzerland and other contracting parties to the *Convention on Nuclear Safety*.<sup>120</sup> CNSC staff further explained that, in the consideration of IAEA recommendations, the design and technology of a reactor had

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<sup>120</sup> *Convention on Nuclear Safety* (1994), IAEA Doc. INFCIRC/449, 1963 UNTS 293, entered into force 24 October 1996 (CNS).

to be considered, emphasizing that light water reactors were used in many countries for which larger emergency planning zones were, in general, needed. Following its consideration of the information provided for this hearing, the Commission is satisfied that the development of emergency planning zones in the 2017 PNERP considered international guidance in conjunction with technical aspects of CANDU reactors to ensure the protection of the public.

519. The Commission noted that several interventions, including those from the Town of Ajax, the Municipality of Clarington, the Regional Municipality of Durham, the City of Toronto and others, expressed concerns regarding additional financial and human resources that would be required to implement the updated PNERP. In response, the OFMEM representative informed the Commission that the implementation of the PNERP involved the collaboration between many organizations at all levels of government and provided information about the Nuclear Emergency Management Coordinating Committee which was reviewing resource gaps under the updated PNERP, noting that this committee helped facilitate the provision of these resources.
520. Further on the implementation of the updated PNERP, the Commission enquired about the OPG's obligations in this regard. CNSC staff explained that, while emergency preparedness was a shared responsibility between various levels of government as well as the licensee, REGDOC-2.10.1 specified that the licensee was to provide the necessary resources and support to provincial and municipal authorities in the implementation of the provincial and municipal nuclear emergency preparedness plans. CNSC staff also stated that it had assessed OPG's compliance with REGDOC-2.10.1 in this regard, found that OPG met CNSC expectations and that CNSC staff would continue associated compliance verification activities throughout the renewed licence period.
521. The OPG representative emphasized to the Commission that the implementation of the updated PNERP was a priority for OPG and provided details about the MOUs that OPG had with the municipalities to provide support, including financial support, for the implementation of emergency preparedness programs and for KI distribution. The OPG representative stated to the Commission's satisfaction that discussions with the Regional Municipality of Durham and other municipalities in regard to updated MOUs had started and that OPG was committed to continuing its strong relationships with stakeholders. Based on the information provided, the Commission is satisfied that OPG has mechanisms in place to ensure that adequate resources are provided to key stakeholders in relation to the implementation of the 2017 PNERP. The Commission, however, requests that OPG maintain its discussions with these stakeholders to ensure that any gaps in this regard are resolved.

#### Potassium Iodide (KI)

522. The Commission considered OPG's program for the pre-distribution and stocking of KI pills, as specified in REGDOC-2.10.1. OPG provided the Commission with

details about the information campaign related to the distribution of KI in the DPZ that began in January 2015 and culminated with the pre-distribution of the KI pills in October 2015. OPG also submitted that multiple mechanisms, such as a dedicated website ([www.preparetobesafe.ca](http://www.preparetobesafe.ca)), are available to residents within the PNGS IPZ to obtain KI pills and emergency preparedness information. CNSC staff confirmed that OPG meets the expectations of REGDOC-2.10.1 in this regard.

523. OPG provided the Commission with details about how it supported public medical facilities, government stakeholders, businesses and other stakeholders with information about emergency preparedness and the use of KI pills. OPG submitted that a comprehensive fact sheet in this regard had been developed and that OPG remained available to support stakeholders should any questions or concerns arise.
524. The Commission noted the KI pill emergency preparedness package that was distributed by OPG to residents of the DPZ and entered the package into the record during Part 1 of this public hearing on April 4, 2018. The Commission enquired about whether OPG had received any feedback from the public in respect of the KI package. The OPG representative responded that polling had shown that 80% to 90% members of the public in the DPZ understood the purpose of the KI package and the associated information that was provided to them. The OPG representative explained that OPG maintained a program to ensure that newcomers to the DPZ received a KI package and that, throughout the year, OPG provided information to the public to remind them about the KI package and other emergency preparedness issues. The OFMEM representative informed the Commission that OPG's model for KI pre-distribution was considered to be an industry best practice.
525. The Commission noted the suggestion in the intervention from E. Munro that OPG use modern means of communication to inform and encourage the public beyond the DPZ to order KI pills. The Commission requests that OPG consider this suggestion in future KI distribution and emergency communications planning.
526. Asked to provide information on KI pre-distribution, the Commissioner and Medical Officer of Health, Durham Regional Health Department (Durham MOH) explained that the Durham Region Health Department was responsible for the pre-distribution of KI pills within the DPZ and explained that there were five pharmacies within the DPZ that had KI pill stockpiles which were restocked three times a year. The Durham MOH further explained that, should pre-distribution be carried out beyond the DPZ, additional resources would be required to enable this distribution and to educate the population.
527. CNSC staff informed the Commission about the international benchmarking that had been carried out in regard to the regulatory expectations and guidance for KI distribution and pre-stocking, and noted that benchmarking showed that the implementation plans for the distribution of pre-stocked KI was typically the responsibility of municipal authorities. CNSC staff also explained that REGDOC-2.10.1 provided guidance to the responsible authority in regard to the implementation

plans for the distribution of pre-stocked KI pills.

528. The Commission examined the intervention from the TDSB and the TDCSB which requested that KI pills be pre-distributed to and stockpiled in all Toronto-area schools within 50 km of the PNGS; which submitted that the TDSB had approved a motion for this pre-distribution in June 2018; and which submitted that the Elementary Teachers of Toronto (ETT) also supported the pre-distribution of KI in schools in the IPZ. The intervenor opined that the students in Toronto should be afforded the same level of protection in the event of a nuclear emergency as those near the Bruce NGS. The Commission notes that, although not a requirement under the PNERP or REGDOC-2.10.1, Bruce Power had voluntarily agreed to distribute KI pills to school boards for redistribution to the 52 schools within the Bruce NGS IPZ.
529. In considering the request a stockpile KI pills in Toronto schools, the Commission asked for more information about KI distribution and stockpiling in the IPZ. CNSC staff explained that, in accordance with REGDOC-2.10.1, OPG had pre-distributed KI within the DPZ and made 6 million doses of KI available for stockpiling within the IPZ. CNSC staff also confirmed that under the PNERP and REGDOC-2.10.1, OPG was expected to ensure that sensitive populations in the IPZ, such as children and pregnant women, were adequately considered in the MOHLTC's (the responsible authority) KI distributions plans. Asked to provide comments, the OPG representative explained that OPG's KI strategies were evidence-based and provided information about accident progression scenarios which supported the current KI strategy for the PNGS. The OPG representative also provided information on why the emergency management strategies for the Bruce NGS and the PNGS differed, and noted that, although provincial and federal stakeholders had found the current emergency planning basis satisfactory, if future technical assessments recommend changes to this planning basis, OPG would support those recommendations.
530. The Commission requested additional details about how KI pills would be distributed outside the DPZ, noting the specific needs of vulnerable populations, as raised in the interventions from CELA, the TDSB and the TDCSB, and individuals, and recognizing that KI was most effective prior to the exposure to a radioactive plume. The OFMEM representative explained that the 6 million doses of KI that were supplied by OPG for stockpiling in the IPZ was maintained by the MOHLTC in the provincial government pharmacy within the Greater Toronto Area, with the location of the stockpile having been selected by the provincial KI Working Group following the publication of REGDOC-2.10.1. The OFMEM representative further explained that the stockpile location had easy and ready access to distribution points via the Ontario 400-Series Highways and that, under the updated PNERP and taking into account the PNERP technical study, the MOHLTC and OFMEM were collaborating to develop a further refined strategy for KI distribution in the IPZ. The OFMEM representative also stated that worst case scenario modelling had shown that KI would not be required beyond 33 km of the PNGS site boundary and that, for this reason, pre-distribution to the entire IPZ was not recommended.

531. Further on this topic, the OFMEM representative stated that the distribution of the stockpiled KI pills would be coordinated by government stakeholders via the PEOC, with the decision to inform residents to consume KI pills and to distribute KI pills beyond the DPZ coming from the MOHLTC. The OFMEM representative further explained that the order to consume KI would be carried out in a phased manner as radioactive plume modelling evolved and that a direction for all residents in the IPZ to consume KI was not a credible scenario. The OFMEM representative also informed the Commission that the PEOC operated 24 hours per day, year-round, was staffed at all times, was required to respond to any level of emergency at the PNGS within 15 minutes of notification and noted that the OFMEM had procedures in place to carry out focussed KI pill distribution to persons in affected areas.
532. The Commission has considered the submissions from intervenors and information provided by OPG, CNSC staff, the OFMEM and other stakeholders in respect of KI distribution in the PNGS IPZ. Based on the information provided for this hearing, the Commission is satisfied that plans are in place for the distribution of KI to residents of the IPZ in the event of a nuclear emergency. The Commission, however, is disappointed in the lack of detailed KI distribution strategies and transparency in this regard.
533. In response to the concerns raised during this hearing from intervenors and the Commission about the KI distribution strategies beyond the PNGS DPZ, CNSC staff proposed the creation of a KI working group. The Commission notes that CNSC staff's KI working group proposal was supported by OPG and that, through this working group, CNSC staff and OPG proposed to work with the OFMEM, the MOHLTC, and other stakeholders, to provide clarity on the plans and responsible authorities to distribute KI pills in the IPZ in the event of an emergency at the PNGS.
534. The Commission examined the intervention from E. Guecha and enquired about potential side effects or contraindications associated with the consumption of KI. The OPG representative informed the Commission that the "Prepare to be Safe" website provided information about potential side effects or contraindications associated with KI consumption. CNSC staff added that, based on research following KI consumption after the Chernobyl and Fukushima nuclear accidents, reported side effects related to KI consumption were typically minor and occurred in less than 0.1% of persons who consumed KI. The Commission is satisfied on this topic.

#### Assessment of Nuclear Emergency Management

535. Based on the information submitted for this hearing, the Commission is satisfied that OPG has appropriate emergency plans in place to protect the health and safety of persons and the environment in the event of a nuclear emergency at the PNGS.
536. The Commission acknowledges the work that had been done by OPG, the OFMEM and other provincial and federal stakeholders, as well as members of the public, in

the development of the 2017 PNERP and the PNGS Implementing Plan. Based on the information provided for this hearing, the Commission is satisfied that the planning basis for the 2017 PNERP considered a worst case scenario accident at the PNGS and that the emergency planning zones would adequately protect the public in the event of a nuclear emergency at the PNGS.

537. The Commission expresses its disappointment at the timeline required for the PNERP's full implementation and expects OPG to implement the updated PNERP through the PNGS Implementing Plan as soon as practicable. The Commission directs CNSC staff to provide an update on the 2017 PNERP and the PNGS Implementation Plan in the 2018 NPP ROR or through other means, as appropriate. The Commission also directs CNSC staff to provide updates from CNSC staff about the PNERP technical study including information about evacuation plans, KI distribution, and hospital nuclear emergency preparedness and planning provisions for the DPZ, CPZ and IPZ.
538. The Commission recognizes the concerns expressed by intervenors regarding evacuations in the event of a nuclear emergency at the PNGS. Based on the information provided by OPG, CNSC staff, the OFMEM and intervenors, the Commission is satisfied that the latest ETE study carried out for the PNGS is adequate but requests that OPG consider carrying out evacuation studies more frequently, based on the change in population density in the DPZ. The Commission requests updates on the unified transportation management plan being developed for the Province of Ontario and is of the view that such a plan should be made implementable as soon as practicable.
539. The Commission notes the concerns submitted by CELA, DNA and individuals that nuclear emergency preparedness awareness beyond the DPZ was low. The Commission also notes that survey results submitted as part of interventions substantiated these concerns. The Commission expects OPG to review its means of communication with the public in regard to nuclear emergency preparedness awareness outside the DPZ during the renewed licence period.
540. The Commission directs that a KI working group between CNSC staff, OPG, the OFMEM, the MOHLTC, other stakeholders, and which would allow for the participation of intervenors in these proceedings, be established as soon as practicable. The Commission is of the view that this working group should establish clear and detailed plans for the distribution of KI pills throughout the IPZ in the event of an emergency at the PNGS. Further, the Commission directs that CNSC staff present updates on the progress of this working group during the Status Report on Power Reactors, which is presented at every Commission meeting.
541. The Commission appreciates the intervention from the TDSB and the TDCSB and has carefully considered the information provided on the record during this hearing about the pre-distribution of KI pills to all schools in the PNGS IPZ. Following its consideration of this information, the Commission directs that the KI working group



examine the feasibility of pre-distribution of KI pills to all schools within the IPZ and strongly encourages the participation of school boards in the IPZ in the KI working group.

542. The Commission is satisfied that, based on the information provided during this hearing, the readiness of authorities whose responsibilities in regard to ensuring that that sufficient drinking water would be available to the public in the unlikely event of the contamination of Lake Ontario would be engaged, is in place.
543. The Commission directs OPG to continue its work with municipalities to ensure that adequate financial and physical resources are in place for the implementation of the updated PNERP and to support emergency preparedness measures for response to an accident at the PNGS.
544. The Commission notes that establishing population density guidelines and limits is outside the scope of the CNSC's mandate. The Commission is, however, of the view that ensuring adequate emergency response measures is directly tied to population density. In the context of the CNSC's mandate of ensuring the health and safety of persons, the Commission encourages the Province of Ontario to examine the concerns submitted by intervenors for this hearing and to take into consideration zoning and population intensification in the vicinity of the PNGS. The Commission recommends that emergency preparedness be a major consideration during any population density intensification planning near existing NGSs.

#### 4.10.3 Fire Protection

545. The Commission examined the adequacy of the PNGS fire protection program. OPG submitted information regarding the compliance of the PNGS fire protection program with N293-07, *Fire protection in CANDU nuclear power plants*.<sup>121</sup> and reported that the program incorporated industry best practices. OPG also submitted that, during the previous licence period, substantial enhancements to its field training simulators at the Wesleyville Fire and Rescue Academy had been made.
546. OPG informed the Commission that many improvements were made to the PNGS Fire Protection Program in 2017, including the implementation of the industry standard *Blue Card Incident Command Certification*.<sup>122</sup> and that National Fire Protection Association (NFPA) 1407, *Standard for Training Fire Service Rapid Intervention Crews*.<sup>123</sup> program during the previous licence period.

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<sup>121</sup> N293-07, *Fire Protection in CANDU nuclear power plants*, CSA Group, 2007.

<sup>122</sup> "The Blue Card Incident Command Certification Program has been developed by Alan, John and Nick Brunacini to first instruct and then certify fire officers who serve in the role of Incident Commander or as a member of an Incident Management Team (IMT). This program teaches officers how to command everyday incidents so when a major event happens they know how to react effectively." (<http://www.firewiseconsulting.com/firewatch/blue-card-command>).

<sup>123</sup> NFPA 1407, *Standard for Training Fire Service Rapid Intervention Crews*, 2015.

547. OPG submitted information about the fire protection integrated response capability, including the MOU with the City of Pickering for fire protection at the PNGS, which was reviewed annually, and about integrated response training that the PNGS Pickering Fire Services and other PNGS emergency staff underwent to ensure an effective coordinated response capability.
548. CNSC staff informed the Commission that a March 2017 CNSC compliance inspection showed that the PNGS Fire Protection program met regulatory requirements. CNSC staff submitted that OPG had committed to implement N293-12<sup>124</sup> during the renewed licence period. CNSC staff also reported that, as specified in the IIP, OPG would implement the interconnection of the PNGS Units 1 and 4, and the PNGS Units 5 – 8 fire protection system water supplies, and that CNSC staff would monitor progress in this regard.
549. Based on the information provided, the Commission is satisfied that OPG has an adequate fire protection program in place at the PNGS that meets regulatory requirements.
550. The Commission expects OPG to implement updated standards and improvements to the PNGS Fire Protection program as detailed during this hearing. The Commission anticipates being updated on progress on such implementation as a matter of course.

#### *4.10.4 Conclusion on Emergency Management and Fire Protection*

551. Based on the above information provided on the record for this hearing, the Commission concludes that the PNGS nuclear and conventional emergency management preparedness programs and the fire protection measures in place, and that will be in place during the renewed licence period, are adequate to protect the health and safety of persons and the environment.
552. Based on the information submitted for this hearing, the Commission is satisfied that the PNGS CNEP is adequate. The Commission directs OPG to implement changes to the CNEP arising from the updated PNERP as presented during this hearing. The Commission anticipates being updated on progress on such implementation as a matter of course.
553. Based on the information and considering the interventions submitted for this hearing, the Commission is satisfied that the DPZ is protective of the public and the environment and that there would be minimal impact outside of the DPZ in the event of an emergency at the PNGS.
554. The Commission notes that REGDOC-2.10.1, Version 2 will be implemented at the PNGS during the renewed licence period and requests annual updates in this regard via the NPP ROR or other means, as appropriate.

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<sup>124</sup> N293-12, *Fire Protection in CANDU nuclear power plants*, CSA Group, 2012.

#### 4.11 Waste Management

555. The Commission assessed OPG's PNGS site-wide waste management program. During the previous licence period, CNSC staff assessed OPG's performance in this SCA, including waste minimization, segregation, characterization, and storage programs, as "satisfactory" from 2013 – 2014 and as "fully satisfactory" during the balance of the previous licence period.
556. OPG submitted that it had an effective waste management program at the PNGS and provided information about how the program covered the management of conventional solid waste, hazardous and chemical wastes, as well as low-level radioactive waste (LLRW), intermediate-level waste (ILW) and used fuel waste (HLW). OPG affirmed its commitment to reduce the amount of all wastes, both conventional and radiological, at the PNGS site and provided details in this regard.
557. OPG provided the Commission with information about the wet storage of used fuel bundles in on-site IFBs and their subsequent interim dry storage at the PWF in dry storage containers (DSC). OPG reported that, since 1996 and as of 2016, approximately 855 DSCs containing 330,000 bundles of used fuel had been safely stored at the PWF. OPG also confirmed that all of its waste management planning activities, including those for the used fuel, adequately considered operation of the PNGS until 2024 and the subsequent stabilization phase activities.
558. CNSC staff reported that OPG's waste management program met the specifications of CSA N292.3-08, *Management of low and intermediate-level radioactive waste*.<sup>125</sup> CNSC staff also reported that OPG had committed to implementing CSA N292.2-13, *Interim dry storage of irradiated fuel* by September 1, 2018. CNSC staff submitted that inspections during the previous licence period showed that the waste management program at the PNGS met regulatory requirements.
559. Several interventions, including those from the MBQ, the BPEG, the Regional Municipality of Durham, Greenpeace, CELA, Northwatch, and individuals, suggested that the long-term planning for the management of HLW in Canada was not adequate and the Commission requested clarification in this regard. CNSC staff provided the Commission with detailed information about the long-term management of HLW in Canada, including the siting and construction of a used fuel deep geological repository (DGR), which is being managed by the Nuclear Waste Management Organization (NWMO) under the *Nuclear Fuel Waste Act*.<sup>126</sup> (NFWA). The OPG representative informed the Commission that the NWMO's in-service date for the HLW DGR by the 2040s adequately met OPG's needs, and provided details on how OPG could safely manage its HLW, including aging management for the DSCs, until the DGR was available. Based on the information provided for this hearing, the Commission is satisfied that OPG has adequate plans in place for the

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<sup>125</sup> N292.3, *Management of low and intermediate-level radioactive waste*, CSA Group, 2008 and 2014.

<sup>126</sup> S.C. 2002, c. 23.

management of HLW until such time that a final disposal solution is available.

560. Further on this topic, CNSC staff explained that PNGS HLW was transferred to and safely stored at the PWMF, and that ILW was transferred to and safely stored at the CNSC-licensed Western Waste Management Facility, directly adjacent to the Bruce NGS site. CNSC staff also provided the Commission with details on the future management of the LLRW and ILW in Canada, explaining that OPG expected to manage this waste at an OPG-managed DGR near the Bruce NGS site, and stating that this DGR project was currently awaiting a decision from the Federal Minister of Environment and Climate Change on the environmental assessment that was carried out for the project under CEEA 2012.
561. In response to the intervention from Northwatch, the Commission enquired about the storage capacity of the PNGS IFBs. The OPG representative responded that the three IFBs at the PNGS had a capacity of over 496,000 fuel bundles, representing sufficient capacity for all used fuel bundles until ECO in 2024. The Commission is satisfied on this point.
562. The Commission examined the requests made by the Regional Municipality of Durham in respect to compensation for hosting the nuclear waste generated by the operations at the PNGS and requested comments on this issue. The OPG representative confirmed to the Commission's satisfaction that OPG was committed to working with the Regional Municipality of Durham on nuclear waste issues and provided information about outreach activities and other support that OPG had offered to the Regional Municipality of Durham in this regard. The Commission is satisfied that OPG is working with the Regional Municipality of Durham on these issues. The Commission notes that compensation agreements are made between the host community and the licensee, are outside the scope of the CNSC's authority and, therefore, the Commission cannot fulfill the intervenor's requests in this regard. The Commission, however, requests that OPG work with the Regional Municipality of Durham on waste management and other concerns during the renewed licence period.
563. Based on the above information and consideration of the hearing materials, the Commission is satisfied that OPG has appropriate programs in place to safely manage waste at the PNGS.
564. The Commission acknowledges the concerns brought forth by intervenors about the long-term management of HLW in Canada. The Commission notes that, under the NFWA, it is the mandate of the NWMO and not the CNSC to manage the long-term storage of used nuclear fuel waste in Canada. The Commission is, however, satisfied that OPG has appropriate plans in place to carry out CNSC-licensed activities in respect of the management of the HLW that will be generated through the commercial operation of the PNGS up to 2024, and until such time that a long-term solution is in place in Canada.

565. The Commission notes that OPG will implement updated standards for the PNGS waste management program during the renewed licence period as presented for this hearing and anticipates being updated on progress on such implementation as a matter of course.

#### 4.12 Security

566. The Commission examined OPG's security program at the PNGS, which is required to implement and support the security requirements stipulated in the relevant regulations and the licence. This includes compliance with the applicable provisions of the GNSCR and the *Nuclear Security Regulations*<sup>127</sup> (NSR). CNSC staff rated OPG's performance in this SCA as "fully satisfactory" in 2013 and 2014, and as "satisfactory" from 2015 – 2017. CNSC staff submitted that OPG's rating was reduced to "satisfactory" in 2015 due to OPG's failure to effectively correct security equipment issues in a timely manner and for taking unilateral decisions to cease corrective actions needed for compliance. CNSC staff submitted that OPG had since corrected these issues and was in compliance with the NSR.
567. OPG submitted to the Commission information about the PNGS security program, explaining that the program was intended to prevent the loss, theft or sabotage of nuclear materials and the sabotage of the nuclear facility. OPG also reported that the PNGS security program ensured the safe and secure operation of the station, maximizing protection against threats to security through the use of equipment, personnel and procedures.
568. OPG reported that the updated *Pickering Site Security Report* (protected document) was submitted to the CNSC in December 2017. CNSC staff confirmed that the *Pickering Nuclear Security Report* was submitted in accordance with G-274, *Security Programs for Category I or II Nuclear Material and Certain Nuclear Facilities*<sup>128</sup> and that OPG continued to submit annual Threat and Risk Assessments to the CNSC, as required by the NSR.
569. OPG informed the Commission that security personnel at the PNGS included Nuclear Security Officers and Armed Nuclear Security Officers and that, during the renewed licence period, the mandatory credit checks and digital fingerprinting requirements in the recently updated Treasury Board Secretariat *Standard on Security Screening*<sup>129</sup> would be implemented as part of the PNGS Site Access Security Clearance (SASC) programs. CNSC staff submitted that OPG's nuclear response force (NRF) met the specifications of REGDOC-2.12-1, *High Security Sites: Nuclear Response Force*<sup>130</sup> and the requirements of the NSR. CNSC staff also reported that

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<sup>127</sup> SOR/2000-209

<sup>128</sup> CNSC Regulatory Guide G-274, *Security Programs for Category I or II Nuclear Material and Certain Nuclear Facilities*, 2003.

<sup>129</sup> Treasury Board Secretariat, *Standard on Security Screening*, took effect on 20 October 2014.

<sup>130</sup> CNSC Regulatory Document REGDOC 2.12.1, *High Security Sites: Nuclear Response Force*, 2013.

OPG's detailed implementations plans for the updated SASC program requirements were acceptable.

570. OPG provided the Commission with information about the facilities and equipment used to support the PNGS security program, including personnel and vehicle search equipment; facility alarms and security measures; and the physical measures taken to prevent external breaches of the PNGS site and facility. OPG also reported that, during the previous licence period, it had partnered in the Durham Regional NextGen public safety radio system which allowed for an improved communication link to offsite services in the Durham Region. OPG submitted that overall response capability at the PNGS would be improved through enhancements to the Security Monitoring Room during the renewed licence period.
571. OPG submitted information about the drills and exercises carried out by the NRF at the PNGS, as well as the response arrangements that OPG had in place. OPG reported that it had an MOU with the Durham Regional Police Service to provide off-site armed response to the PNGS, in accordance with the NSR. OPG also submitted that PNGS security drills were conducted regularly and that CNSC-audited security exercises were carried out every two years. CNSC staff confirmed that OPG carried out drills and exercises in accordance with regulatory requirements.
572. The Commission noted the concerns expressed in the intervention from the BPEG in regard to PNGS lakefront security measures and requested additional information in this regard. In response, the OPG representative provided the Commission with information about OPG's comprehensive physical protection system on the lakefront side of the PNGS, which included fence and associated detection systems, and stated that benchmarking exercises showed that the physical protection of Canadian NGSs was equal to that of US NGS. CNSC staff stated that the CNSC hosted an IAEA IRRS mission in respect of physical protection measures at Canadian NGSs in 2015 and that the results of this mission were very positive. In regard to no-fly zones around NGS, CNSC staff informed the Commission that flights over NGS were regulated by Transport Canada through the *Canadian Aviation Regulations*,<sup>131</sup> not the CNSC. The Commission is satisfied with the information provided on these issues by OPG and CNSC staff, and that OPG has adequate physical security measures, lakefront and otherwise, at the PNGS.
573. The Commission asked for comments in regard to the concern expressed by Northwatch about the security of on-site DSC transfers. The OPG representative informed the Commission that all DSC transfers took place on the PNGS site, did not involve travel on public roads, were accompanied by a nuclear security escort and confirmed that OPG's transportation security plans complied with the NSR. The Commission is satisfied that OPG has adequate security measures in place to mitigate security-related risks, including sabotage vulnerabilities, to carry out DSC transfers on the PNGS site as detailed on the record for this hearing.

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<sup>131</sup> SOR/96-43

### Cybersecurity

574. The Commission examined OPG's cybersecurity program at the PNGS. OPG reported that the objective of the PNGS cybersecurity program was to provide for the secure operations of computer systems governed by the nuclear safety program. OPG submitted information regarding updates and improvements that had been made to the PNGS cybersecurity program during the previous licence period, including carrying out a gap analysis between the existing program and CSA N290.7-14, *Cyber security for nuclear power plants and small reactor facilities*,<sup>132</sup> and noted that an implementation plan in this regard had been submitted to the CNSC in 2016.
575. CNSC staff confirmed that OPG's current cybersecurity program met CNSC staff's expectations, with OPG having committed to the full implementation of CSA N290.7-14 by the end of 2019, and that verification of OPG's implementation of the updated standard would be done through regular compliance verification activities.
576. Noting that several intervenors submitted information about the high importance of adequate cybersecurity at NGS, the Commission requested additional information about the PNGS cybersecurity program. The OPG representative provided a detailed explanation of how OPG applied defence-in-depth principles to cybersecurity, noting that its industrial control systems were isolated from the business systems, and also informed the Commission on how OPG ensured that its staff remained trained in respect of and aware of potential and changing cyber threats. The OPG representative also provided information on exercises that it carried out with other industry partners, such as the North American GridEx exercise in 2017, and how OPG incorporated operational experience into its cybersecurity program. The Commission concurs with intervenors in regard to the importance of cybersecurity at NGSs and is satisfied with the information provided during the hearing on this point.
577. The Commission asked about how the software-related concerns raised in the intervention from L. Bertrand were considered by OPG in the context of the PNGS cybersecurity program. The OPG representative informed the Commission that, through OPG's design governance and related change control programs, and through OPG's adherence to CSA N290.14-15 for its software development processes, OPG has a robust program in place to manage the security, safety and reliability of its cyber assets. The Commission is satisfied that OPG has adequately considered software-related security issues within the context of the PNGS security program and notes that design governance as it relates to software is also considered in subsection 4.5.1 of this *Record of Decision*.

### Assessment of Security

578. On the basis of the information provided on the record for this hearing, the Commission is satisfied that OPG's performance with respect to maintaining security

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<sup>132</sup> N290.7-14, *Cyber security for nuclear power plants and small reactor facilities*, CSA Group, 2014.

at the PNGS has been acceptable. The Commission concludes that OPG has made adequate provision for the physical security of the PNGS, and is of the opinion that OPG will continue to make adequate provision for security during the renewed licence period. However, the Commission notes the decrease in OPG's rating in this SCA during the previous licence period and encourages that OPG implement measures to again achieve fully satisfactory rating in this SCA.

579. Based on the information provided by OPG and CNSC staff, and considering the interventions submitted for this hearing, the Commission is satisfied that the cybersecurity program at the PNGS is adequate to protect the PNGS from cyberattacks and other cybersecurity-related concerns.
580. The Commission directs OPG to implement CSA N290.7-14 at the PNGS in accordance with the schedule presented during this hearing.

#### **4.13 Safeguards and Non-Proliferation**

581. The Commission examined the adequacy of OPG's safeguards program at the PNGS. The CNSC's regulatory mandate includes ensuring conformity with measures required to implement Canada's international obligations, including those under the *Treaty on the Non-Proliferation of Nuclear Weapons*<sup>133</sup> (NPT). Pursuant to the NPT, Canada has entered into a Comprehensive Safeguards Agreement and an Additional Protocol (safeguards agreements) with the IAEA. The objective of these agreements is for the IAEA to provide credible assurance on an annual basis to Canada and to the international community that all declared nuclear material is in peaceful, non-explosive uses and that there are no undeclared nuclear material or activities in this country. CNSC staff rated OPG's performance in this SCA as "satisfactory" throughout the previous licence period.
582. OPG provided the Commission with information on the PNGS safeguards program and how IAEA safeguards were implemented at the PNGS, noting that the safeguards program satisfied the requirements of the GNSCR. OPG submitted that, throughout the previous licence period, OPG fully cooperated with the IAEA and facilitated the achievement of IAEA safeguards goals. CNSC staff confirmed the information provided by OPG, noting that OPG provided the IAEA with the required assistance and access during four Physical Inventory Inspections and four short-notice random inspections during the previous licence period.
583. OPG submitted detailed information about its compliance with the IAEA's Fuel Verification Program and explained that it prepared and submitted nuclear material accountancy reports in accordance with RD-336, *Accounting and Reporting of Nuclear Material*<sup>134</sup> and as specified by REGDOC-3.1.1. OPG also submitted that

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<sup>133</sup>*Treaty on the Non-Proliferation of Nuclear Weapons* (1968), IAEA Doc. INFCIRC/140, 729 UNTS 169, entered into force 5 March 1970 (NPT).

<sup>134</sup> CNSC Regulatory Document RD-336, *Accounting and Reporting of Nuclear Material*, 2010.



surveillance systems were installed at the PNGS as required in order to provide the IAEA with continuous detailed data of safeguards-related functions. OPG reported that the IAEA raised an accessibility issue for a portion of the IFBs due to the stacking of fuel frames and that OPG was working with the IAEA and CNSC to address this issue.

584. CNSC staff confirmed that OPG's reporting met the specifications of RD-336 and reported to the Commission that OPG's corrective actions in regard to the IFB accessibility issue were satisfactory, with OPG working collaboratively with the CNSC and the IAEA in this regard. CNSC staff also reported that OPG supported IAEA and CNSC field surveys in 2017 to identify options for an equipment-based approach for safeguards on used fuel transfers.
585. OPG submitted that the scope of the non-proliferation program at the PNGS was limited to the tracking and reporting of foreign obligations and the origins of nuclear material. OPG further submitted that the import and export of controlled nuclear substances, equipment and information, as identified in the *Nuclear Non-proliferation Import and Export Control Regulations*,<sup>135</sup> was not permitted under the previous PROL and that any application in this regard was made in accordance with applicable regulations.
586. The Commission asked for comments in response to the assertion in the interventions from the OCAA, CCNR, T. Seitz and M. Duguay that activities related to the operation of CANDU reactors could result in the proliferation of nuclear material and the development of nuclear weapons. CNSC staff provided the view that there was no validity to this assertion, providing detailed information about Canada's nuclear material accounting and reporting obligations under the IAEA safeguards agreements, which ensured that all nuclear material in Canada was continuously accounted for and prevented the unauthorized diversion of nuclear material in Canada. Following its consideration of the information provided on the record on this matter, the Commission is satisfied that the diversion of nuclear materials resulting from the operation of CANDU reactors in Canada, as described in these interventions, is not a credible scenario.
587. Based on the above information, the Commission is satisfied that OPG has provided and will continue to provide adequate measures in the areas of safeguards and non-proliferation at the PNGS that are necessary for maintaining the measures necessary for implementing international agreements to which Canada has agreed in these areas.
588. The Commission directs OPG to continue its collaborative resolution with the IAEA and CNSC in regard to the accessibility issues identified with the PNGS IFBs.

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<sup>135</sup> SOR/2000-210

#### **4.14 Packaging and Transport**

589. The Commission examined OPG's packaging and transport program at the PNGS. Packaging and transport covers the safe packaging and transport of nuclear substances and radiation devices to and from the licensed facility. The licensee must adhere to the *Packaging and Transport of Nuclear Substances Regulations, 2015*<sup>136</sup> (PTNSR, 2015) and Transport Canada's *Transportation of Dangerous Goods Regulations*<sup>137</sup> (TDG Regulations) for all shipments. During the previous licence period, CNSC staff rated OPG's performance in this SCA as "satisfactory."
590. OPG provided the Commission with information about PNGS packaging and transport activities and about how the PNGS Radioactive Material Transportation Program met the requirements of the PTNSR, 2015 and the TDG Regulations. OPG reported that the implementation of its Radioactive Material Transportation Program ensured that radioactive shipments were characterized, classified, packed, shipped and received in accordance with approved procedures and applicable regulations.
591. OPG submitted that it was a registered user with the CNSC for 12 different package designs. OPG provided details about package design and maintenance and noted that, during the renewed licence period, OPG would replace some of its older transport packages with new packages that incorporated improvements gleaned from operational and industry experience. CNSC staff confirmed that OPG package designs were certified by the CNSC in accordance with the PTNSR, 2015.
592. The Commission considered OPG's transport security provisions for Category III nuclear material as required by OPG's licence conditions. OPG submitted that its Transport Security Plan provided a description of the threat assessment of actions to be taken during the planning and execution of a Category III shipment and that the plan was updated annually in accordance with PNGS licence conditions.
593. Based on the information presented on the record for this hearing, the Commission is satisfied that OPG is meeting, and will continue to meet, regulatory requirements regarding packaging and transport.

#### **4.15 Aboriginal Engagement and Public Information**

##### *4.15.1 Participant Funding Program*

594. The Commission assessed the information provided by CNSC staff regarding public engagement in the licensing process as enhanced by the CNSC's Participant Funding Program (PFP). CNSC staff submitted that, in September 2017, up to \$100,000 in funding to participate in this licensing process was made available to Indigenous groups, members of the public and stakeholders to review OPG's PNGS licence

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<sup>136</sup> SOR/2015-145

<sup>137</sup> SOR/2001-286

renewal application and associated documents, and to provide the Commission with value-added information through topic-specific interventions.

595. A Funding Review Committee (FRC), independent of the CNSC, recommended that nine applicants be provided with participant funding. These applicants were required, by virtue of being in receipt of participant funding, to submit a written intervention and make an oral presentation at Part 2 of the public hearing commenting on OPG's licence renewal application. One PFP applicant withdrew its request prior to Part 2 of the hearing. As such, \$97,632 in participant funding was awarded to the following recipients:

- the Mohawks of the Bay of Quinte First Nation (MBQ)
- Paul James Sedran (RESO Inc.)
- the Canadian Environmental Law Association (CELA)
- the Ontario Clean Air Alliance (OCAA)
- Women in Nuclear Canada (WiN-Canada)
- Durham Nuclear Awareness (DNA)
- Northwatch
- Lake Ontario Waterkeeper (the Waterkeeper)

596. Part 2 of this public hearing was originally scheduled to be held in Clarington, Ontario due to the lack of availability of large public venues in or near Pickering, Ontario. Following the submission of concerns from intervenors including DNA, CELA, OCAA and individuals that Part 2 of the hearing was not being held in the PNGS host community, the Pickering Recreation Complex informed the Commission that it would make available the required meeting spaces to accommodate these proceedings. Through this decision, the Commission reaffirms its commitment in ensuring that Indigenous groups, members of the public and stakeholders have the opportunity to participate in the Commission's public proceedings and states that efforts will continue to be made to hold public proceedings in licensee host communities when practicable. Further, the Commission wishes to express its appreciation to the Pickering Recreation Complex and the City of Pickering for accommodating these proceedings.

597. Based on the information submitted for this hearing, the Commission is satisfied that Indigenous groups, members of the public and stakeholders were encouraged to participate in this licence renewal process.

#### *4.15.2 Aboriginal Engagement*

598. The common law duty to consult with Aboriginal peoples applies when the Crown contemplates action that may adversely affect established or potential Aboriginal and/or treaty rights. The CNSC, as an agent of the Crown and as Canada's nuclear regulator, recognizes and understands the importance of building relationships and engaging with Canada's Aboriginal peoples. The CNSC ensures that its licensing

decisions under the NSCA uphold the honour of the Crown and consider Aboriginal peoples' potential or established Aboriginal and/or treaty rights pursuant to section 35 of the *Constitution Act, 1982*.<sup>138</sup>

599. The Commission examined the information submitted by OPG regarding its ongoing engagement with Indigenous groups near the PNGS site. OPG asserted its commitment to engagement with Indigenous groups about the operations at the PNGS and submitted that its Indigenous Relations program met the specifications of REGDOC-3.2.2, *Aboriginal Engagement*.<sup>139</sup> OPG also reported that, under its Indigenous Relations Policy, OPG undertook engagement activities with Indigenous communities with asserted or established Aboriginal and Treaty rights or interests in the vicinity of the PNGS. OPG submitted that the communities with which it carried out engagement activities included the Members of the Williams Treaties First Nations (WTFN); the Mississaugas of the New Credit First Nation; the MBQ; and the Métis Nation of Ontario (MNO), Region 8.
600. OPG reported that, in 2015, OPG began a renewed series of conversations with the Indigenous groups in the vicinity of the PNGS, focussing on the ways in which they would like to be engaged to ensure that the scope of the engagement activities met the needs of the groups. OPG provided details in regard to this review of the scope of its Indigenous engagement program and how engagement activities had evolved throughout the previous licence period. OPG also provided the Commission with information about the primary concerns expressed by Indigenous groups in respect of activities at the PNGS site, which included but were not limited to: environmental protection; the protection of fish and fish habitat; nuclear waste; emergency preparedness; economic and employment opportunities; and participation in environmental monitoring activities.
601. CNSC staff confirmed that OPG was meeting the expectations of REGDOC-3.2.2 and submitted information about the Indigenous groups that had expressed an interest in being kept informed about the activities at the PNGS. CNSC staff submitted details about the engagement activities that CNSC staff had carried out with Indigenous groups prior to the submission of OPG's licence renewal application and throughout the regulatory review process. CNSC staff also informed the Commission that all of the Indigenous groups that had expressed an interest in the licensed activities being carried out at the PNGS had been invited to participate in the licensing hearing process, to apply for participant funding, and to intervene at the public hearing and communicate with the Commission directly regarding their concerns and interests.
602. CNSC submitted that, following the assessment of OPG's licence application and information from Indigenous groups, CNSC staff determined that, since the proposed licence renewal did not include any significant modifications to the PNGS, which is located in a secure fenced-in site that has been in operation for many decades, this

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<sup>138</sup> *Constitution Act, 1982*, Schedule B to the *Canada Act 1982*, 1982, c. 11 (U.K.)

<sup>139</sup> CNSC Regulatory Document REGDOC-3.2.2, *Aboriginal Engagement*, 2016.

renewal would not cause adverse impacts to any potential or established Aboriginal and/or treaty rights. CNSC staff also submitted that there are no new activities or changes proposed in the licence renewal application that could reasonably be anticipated to have any novel off-site impacts and that, based on its assessment of this licence renewal application, no formal duty to consult was triggered by the licence renewal. CNSC staff also submitted that it recognized the CNSC's responsibilities as a lifecycle regulator and that CNSC staff would continue, as a priority, communication with interested Indigenous groups throughout the renewed licence period to ensure that the groups received all information requested and to establish, maintain and enhance relationships with the groups.

603. CNSC staff further informed the Commission that the WTFN had raised concerns regarding localized fish kills and environmental impacts, but not regarding specific impacts to potential or established Aboriginal and/or treaty rights, and that CNSC would continue to communicate with the WTFN on its concerns in this regard. The Commission is satisfied with CNSC staff's proposed engagement activities in relation to the concerns submitted by the WTFN.
604. Noting that only one Indigenous group requested to intervene during these proceedings, the Commission asked for additional information about engagement activities that were carried out with Indigenous groups in the vicinity of the PNGS. The OPG representative provided details about the regular Indigenous engagement activities that OPG carried out with the WTFN and the MNO, noting that OPG had provided interested Indigenous groups with the opportunity to participate in environmental monitoring programs. The OPG representative also stated that OPG worked with Indigenous groups to ensure that sufficient resources were made available to them to enable a satisfactory level of engagement with OPG.
605. On this same topic, CNSC staff provided the Commission with information about engagement activities that CNSC staff had carried out with Indigenous groups including the MBQ, the MNO, New Credit First Nation, the WTFN and the Scugog First Nation with respect to providing them with information about the PFP and other resources available to enable their participation in the proceedings. CNSC staff confirmed that CNSC staff remained committed to engagement activities with these groups in respect of the licensed activities at the PNGS.
606. The Commission expressed appreciation for the intervention from the MBQ, noting the MBQ's interest in environmental monitoring activities and the MBQ's concerns about issues including environmental protection, aging management and emergency preparedness. The Commission enquired about the Indigenous engagement activities that OPG had carried out specifically with the MBQ. The OPG representative informed the Commission that OPG met with the MBQ approximately twice a year, either in the MBQ's traditional territory or in Pickering, and provided details about these meetings. The OPG representative also informed the Commission that OPG had engaged with the MBQ in regard to the FA Authorization and the offsets.

607. CNSC staff also provided information to the Commission about the CNSC's engagement activities with the MBQ, noting that CNSC staff was in the process of developing a more formalized and regular engagement mechanism with the MBQ. CNSC staff also informed the Commission about the issues and concerns frequently discussed during engagement activities, including environmental monitoring and the IEMP, and traditional knowledge. The Commission is satisfied with the information provided on this point but requests that OPG and CNSC staff work with the MBQ to ensure that the MBQ receives the information about PNGS operations as discussed during this hearing.
608. Based on the information provided for this hearing, the Commission is satisfied that Aboriginal engagement activities carried out for this licence renewal were adequate and finds that the hearing process provided a means for the Commission to consider Indigenous interest in the PNGS licence renewal. The Commission expresses its appreciation for the MBQ's participation.
609. The Commission is satisfied that OPG's engagement activities with Indigenous groups in the vicinity of the PNGS meet the expectations of REGDOC-3.2.2. The Commission requests that OPG continues to enhance its Indigenous engagement activities as proposed during this hearing, and continues to provide Indigenous groups with the resources to participate in these activities. The Commission also expects CNSC staff to continue its engagement activities with Indigenous groups in the vicinity of the PNGS to ensure that any questions and concerns are addressed as soon as possible.
610. The Commission requests that formalized engagement mechanisms are established with Indigenous groups, if so desired by the groups, as soon as practicable. The Commission expects that annual reports about CNSC and licensee Indigenous engagement activities be provided through the annual NPP ROR or other means, as appropriate.

#### *4.15.3 Public Information*

611. The Commission assessed OPG's public information and disclosure program (PIDP) for the PNGS. A public information program is a regulatory requirement for licence applicants and licensed operators of Class I nuclear facilities. Paragraph 3(j) of the *Class I Nuclear Facilities Regulations*.<sup>140</sup> requires that licence applications include

“the proposed program to inform persons living in the vicinity of the site of the general nature and characteristics of the anticipated effects on the environment and the health and safety of persons that may result from the activity to be licensed.”

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<sup>140</sup> SOR/2000-204

612. The Commission also assessed how OPG's PIDP met the specifications of RD/GD-99.3, *Public Information and Disclosure*.<sup>141</sup> OPG informed the Commission that its principles and processes for external communications were governed by the OPG standard *Nuclear Public Information and Disclosure*, which guided stakeholder activities, public response requirements and OPG's standards in regard to responding to concerns expressed by the public. OPG provided detailed information regarding the three primary activities within its public information program and the information that was regularly disseminated to OPG's stakeholders. OPG submitted that the PNGS maintained a public information centre and that OPG worked with local communities through outreach programs and committees such as the Pickering Nuclear Generating Station Community Advisory Council (PNGSCAC) and the Durham Nuclear Health Committee.
613. OPG informed the Commission that its corporate website provided the public with extensive up-to-date information regarding the PNGS, including environmental data and monthly emissions reports, quarterly performance reports and regulatory information, as well as the full application and CMDs for these proceedings. OPG also reported on its proactive reporting to the public regarding PNGS activities and about the protocol to provide prompt information to key community stakeholders.
614. CNSC staff submitted that compliance verification activities found that OPG's PIDP met the expectations of RD/GD-99.3 and regulatory requirements. CNSC staff submitted that OPG information delivery was consistent, timely and used a variety of means determined by audience preference, and promoted openness and transparency.
615. The Commission noted the public information survey results presented in DNA's intervention and requested additional details in that regard. The DNA representative informed the Commission that the survey polled persons within a 20-km radius of the PNGS, with additional specificity in respect of the population within 3 km of the PNGS. The DNA representative stated that the survey results were consistent with previous surveys and showed that, in general, there was a low level of preparedness for a nuclear emergency but that there was also a low level of concern in that regard. The DNA representative noted that a higher level of awareness of 36% was seen within 3 km of the PNGS, whereas the level of awareness was only 29% up to the 20-km radius.
616. Further on this topic and asked to comment on its communications with the public, the OPG representative acknowledged that there was a significant difference between OPG's surveys and those carried out by other organizations, noting that recent polling carried out by OPG showed an 80% retention rate of emergency preparedness information. The OPG representative also provided the Commission with details about how OPG had improved its public communication activities through collaboration with its stakeholders, including the City of Toronto, the Region of Durham and the MOHLTC, and in providing information to the public about emergency preparedness, protective actions and KI pills. The OPG representative

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<sup>141</sup> CNSC Regulatory/Guidance Document RD/GD-99.3, *Public Information and Disclosure*, 2012.

indicated OPG's commitment to continue its strong partnerships and collaboration with off-site stakeholders to promote transparency, and to raise awareness about OPG's operations and emergency preparedness planning during the renewed licence period.

617. The Commission asked intervenors for additional information about the level and quality of public information provided by OPG in regard to its operations at the PNGS. Following its consideration of the responses provided by intervenors, the Commission notes that, generally, intervenors were of the view that OPG, as well as OPG's municipal partners, did not provide sufficient information regarding the PNGS or emergency preparedness measures. These intervenors also noted that many of OPG's outreach activities, such as the posting of information on websites or mailing out information to targeted audiences, were passive and that the public could benefit from a more comprehensive public awareness campaign that would reach beyond the usual targeted audiences in the DPZ.
618. In regard to the concerns voiced about OPG's public information for emergency planning, the OPG representative informed the Commission that it had significantly increased its outreach within the IPZ in the past five years. The OPG representative further acknowledged that the interventions for this hearing showed that a gap in the information provided to the public beyond the DPZ still existed and indicated OPG's commitment to making additional efforts in this regard during the renewed licence period.
619. The Commission also notes that several intervenors were dissatisfied with the granularity of environmental data and information provided by OPG to enable them to prepare adequately for this hearing and asked for comments on the type of information OPG had provided to the public. The OPG representative informed the Commission that OPG remained committed to responding to information requests made directly to OPG in a timely manner and detailed the information that had been provided, as well as the information that is publicly available online, including the ERA, the PEA and quarterly emissions reports. The OPG representative also stated that OPG had extensively engaged its stakeholders to ensure that they were receiving the information they considered most pertinent and provided the Commission with details about information requests from intervenors that were not fulfilled, why they were not fulfilled, and the steps OPG took to assist those intervenors.
620. CNSC staff confirmed to the Commission that CNSC staff would work with licensees to facilitate the provision of detailed environmental data to the public, as practicable. Upon enquiry, CNSC staff provided the Commission with details about the processes CNSC staff used for the dissemination of its own and third-party information. CNSC staff emphasized that the CNSC did not have the authority to disseminate information deemed confidential or proprietary by the licensee but stated that, if an intervenor was not able to obtain the information requested from a licensee, that CNSC would help facilitate the provision of information, as practicable, that is not protected or proprietary.



621. The Commission noted that, in relation to his intervention, F. Greening had made several information requests and enquired about the status of these requests. CNSC staff explained to the Commission that the requests for a large volume of information were made very close to the intervention due date and that the intervenor was informed by the Commission Secretary that CNSC staff could not compile the information in that short time frame, but noted that much of the requested information was publicly available on the OPG website. Asked to comment in this regard the OPG representative informed the Commission that these information requests had not been submitted to OPG and were therefore not fulfilled by OPG. The Commission notes that CNSC staff stated that during the proceeding that the requested information could be provided to F. Greening and expects that this be done as soon as practicable.
622. Asked by the Commission, the PNGSCAC representative provided the Commission with information about the methods by which OPG engaged the PNGSCAC to provide information to the public, noting that it was of the view that OPG was committed to the continuous improvement of its stakeholder engagement activities and methods, including those related to emergency planning. The OPG representative confirmed OPG's continued commitment to collaboration with the PNGSCAC.
623. Based on the information presented for this hearing, the Commission is satisfied that OPG has communicated and will continue to communicate to the public information about the health, safety and security of persons and the environment and other issues related to the PNGS. The Commission is also satisfied that OPG PIDP meets the expectations of RD/GD-99.3 and the *Class I Nuclear Facilities Regulations*.
624. The Commission wishes to acknowledge the interventions submitted in regard to OPG's public information program. Following its consideration of these interventions, the Commission notes that, although CNSC staff had assessed that OPG was meeting the specifications of RD-99.3, additional information needs to be provided to the public beyond the DPZ. As such, the Commission directs OPG to review the PNGS PIDP as it relates to emergency preparedness and the provision of information to populations beyond the DPZ, and directs CNSC staff to provide annual updates in this regard via the NPP ROR or other means, as appropriate.

#### *4.15.4 Conclusion on Aboriginal Engagement and Public Information*

625. Based on the information presented, the Commission is satisfied that OPG's PIDP meets regulatory requirements and its use is effective in keeping Indigenous groups and the public informed of PNGS operations. The Commission acknowledges the many good practices already implemented by OPG and requests that OPG continue its efforts in creating, maintaining and improving its dialogue with the neighbouring communities.

626. Based on the information presented on the record for this hearing, the Commission is satisfied that this licence renewal will not result in changes to PNGS operations that would cause adverse impacts to any potential or established Aboriginal and/or treaty rights and that no formal duty to consult was triggered in relation to this licence renewal. The Commission is also of the opinion that the engagement activities taken for the review of the PNGS licence renewal application were adequate.<sup>142</sup>
627. The Commission is satisfied that meaningful efforts have been made by CNSC staff on behalf of the Commission. The Commission finds that these efforts, together with the valuable discussion in the hearing process, suggestions for collaboration and the good faith efforts to come, in establishing formal arrangements for that collaboration and continuing discussion, adequately address the Aboriginal interests at stake with the continued operation of the PNGS.
628. The Commission is satisfied that the public was provided with adequate opportunity to participate in this hearing through interventions and funding provided through the CNSC's PFP.
629. The Commission notes that some intervenors expressed that insufficient information was provided by OPG in preparation for this hearing. The Commission directs OPG to review its public consultation process to ensure that intervenors are provided with requested information in a timely manner which allows them to fully participate in the Commission proceedings. The Commission is of the view that OPG should be as transparent as possible in the public availability of non-proprietary or non-protected information, and that, in the absence of previously-established security or confidentiality issues, all documents should be made available to the public upon request.
630. The Commission states that information requests for CNSC documents are to be submitted through the Commission Secretariat and that, in the absence of previously established security or confidentiality issues, requested documents should be made available to the public upon request in a timely manner which allows them to fully participate in Commission proceedings.
631. The Commission, however, also appreciates the level of effort that may be involved in fulfilling voluminous, historical or detailed information request and reminds intervenors that such information requests should be made well in advance of a hearing to ensure that licensees and CNSC staff have adequate opportunity to compile the requested information.

#### **4.16 Decommissioning Plans and Financial Guarantee**

632. The Commission requires that there be operational plans for the decommissioning of the PNGS, including the long-term management of waste produced during its

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<sup>142</sup> *Rio Tinto Alcan v. Carrier Sekani Tribal Council*, 2010 SCC 43[2010] 2 S.C.R. 650 at paras 45 and 49.

lifespan. In order to ensure that adequate resources are available for the safe and secure future decommissioning of the PNGS site, the Commission requires that an adequate financial guarantee for realization of the planned activities is put in place and maintained in a form acceptable to the Commission throughout the licence period.

633. OPG submitted information to the Commission about its decommissioning program, the scope and objective of its preliminary decommissioning plan (PDP) for the PNGS, and information about the four phases of decommissioning activities that would be carried out. OPG also reported that the PDP met the specifications of CSA N294-09, *Decommissioning of facilities containing nuclear substances*,<sup>143</sup> and G-219, *Decommissioning Planning for Licensed Activities*,<sup>144</sup> noting that an updated PDP was submitted to CNSC staff in January 2017. OPG further explained that the PDP demonstrated that the PNGS could be permanently retired from service and the site restored to a predetermined end state that would ensure the health, safety, and security of the public, workers and the environment.
634. CNSC staff submitted that OPG had submitted updated PDPs for the PNGS to the CNSC every five years in accordance with its licence conditions. CNSC staff also reported that OPG had selected a deferred decommissioning strategy for the PNGS site and that CNSC staff was satisfied with OPG's *Pickering Site Strategic Plan*, which provided an overview of the PNGS decommissioning strategy from the ECO in 2024 until site restoration.
635. OPG submitted that the PNGS was included in OPG's consolidated financial guarantee for the implementation of PDPs for all of its nuclear facilities in Ontario. The Commission notes that, following a hearing held in October 2017, the Commission accepted OPG's consolidated financial guarantee for its nuclear facilities in Ontario with the understanding that financial guarantee provides for, in part, the future decommissioning of the PNGS.<sup>145</sup> CNSC staff confirmed that this financial guarantee remained sufficient to fund the future decommissioning activities as anticipated by the PDPs and that OPG met licensing requirements in this regard.
636. In response to the assertion from multiple intervenors that the Canadian regulatory framework for the decommissioning of nuclear facilities was inadequate, the Commission requested comments from CNSC staff on this topic. CNSC staff provided the Commission with details about the robust Canadian regulatory framework in respect of decommissioning and referred to Canada's active and successful participation in the 6<sup>th</sup> *Review Meeting on the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste*

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<sup>143</sup> N294-09, *Decommissioning of facilities containing nuclear substances*, CSA Group, 2009; Update 1, 2014.

<sup>144</sup> CNSC Regulatory Guide G-219, *Decommissioning Planning for Licensed Activities*, 2000.

<sup>145</sup> CNSC *Record of Decision – Ontario Power Generation Inc., Financial Guarantee for the Future Decommissioning of Ontario Power Generation Inc.'s Facilities in Ontario*, issued on November 28, 2017.

*Management*.<sup>146</sup> that was held in May 2018. CNSC staff also stated that several federal acts, including the NSCA and the NFWA, policies and guidance documents in regard to decommissioning were supplemented with CSA Group standards, and that an extensive comparison of IAEA guidance documents with the Canadian framework revealed no gaps. The Commission is satisfied that Canada's regulatory framework as it relates to the decommissioning of nuclear facilities adequately considers international guidance and OPEX, and is adequate.

637. In its intervention, CELA asserted that IAEA guidelines, specifically IAEA GSR Part 6.<sup>147</sup> which suggests that immediate dismantlement would be the preferred decommissioning strategy, were not adequately considered by OPG in the PNGS PDP and associated decommissioning strategy. The Commission invited OPG to respond. The OPG representative informed the Commission that OPG did consider the IAEA GSR Part 6 during the development of OPG's PDP and that, following extensive benchmarking and OPEX consideration, OPG found that there was no international consensus on whether immediate or deferred decommissioning was the superior decommissioning strategy. The OPG representative also provided details about the risk-based factors that were unique to each facility, including safety, radiation protection and the environment, which had to be considered in the development of a decommissioning strategy. CNSC staff concurred with this and noted that through OPEX and research, technologies and strategies for decommissioning and used fuel management were constantly evolving and informing decommissioning planning.
638. Further on this topic, the OPG representative provided the Commission with details on the activities that had to be carried out following the shutdown of a reactor unit, noting that defuelling and allowing the fuel to cool in the IFB took 10 or more years and that complete dismantling could not begin until that point, even with immediate decommissioning as the selected strategy. The OPG representative further explained that, with the longer period of time to allow for the decay through delayed decommissioning, the activity of reactor components would be lower, leading to lower doses to workers, decreased risks to the public and the environment and reduced radioactive waste reduction during dismantlement activities.
639. The Commission has carefully considered the information provided by CELA, OPG and CNSC staff on this topic. The Commission notes that, while the IAEA GSR Part 6, section 5 states indicates a preference for immediate dismantlement, it also recognizes the need for the selected decommissioning strategy to be consistent with the national policy for the management of radioactive waste and that immediate dismantlement may not be practicable when all factors are considered. Based on the information provided, the Commission is satisfied that OPG adequately considered the IAEA GSR Part 6 in the development of the PNGS PDP and associated deferred

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<sup>146</sup> *Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management* (1997), IAEA Doc. INFCIRC/546, 2153 UNTS 357, entered into force 18 June 2001 (Joint Convention).

<sup>147</sup> IAEA Safety Standards, General Safety Requirements Part 6, No. GSR Part 6, *Decommissioning of Facilities*, Vienna, 2014.

decommissioning strategy.

640. The Commission asked for comments regarding the concerns raised in the interventions from CELA, Northwatch, Greenpeace, the OCAA, and individuals about the costs to future generations related to PNGS operations and its decommissioning. CNSC staff informed the Commission that decommissioning and future waste management was an important consideration in the assessment of a nuclear facility's operations and stated that licensees had to demonstrate annually that sufficient funding was available to manage costs over an operation's entire life cycle.
641. The Commission further enquired about when and how the financial guarantee funds could be used by OPG for the decommissioning of the PNGS. CNSC staff explained that the PDP provided information about the estimated timeline and credible cost for decommissioning activities. CNSC staff also explained that the financial guarantee was separate from OPG's operating funds and could only be accessed following Commission approval and only for decommissioning-related activities. The Commission acknowledges the concerns expressed by intervenors regarding the costs to future generations related to the PNGS. Following its consideration of the information provided in this regard by CNSC staff and OPG, the Commission is satisfied that OPG has adequate funding in place to provide for the management of the PNGS site without burdening future generations.
642. In considering the intervention from B. Rhodes, the Commission asked for information about how OPG protected its financial guarantee and decommissioning funds' value against economic instabilities. The OPG representative provided the Commission with clarification about its financial guarantee and decommissioning funds structure, noting that the funds had been shown to be well-managed to protect them from economic instabilities. CNSC staff confirmed this information and stated that the current value of the decommissioning funds was \$21.2 billion with an actual liability estimated at \$16.5 billion. The Commission is satisfied with the information provided on this point.
643. The Commission noted that several intervenors, including the Regional Municipality of Durham, CELA, Northwatch, Greenpeace and individuals expressed views on the end state of the PNGS site following its full decommissioning. In response, the OPG representative provided the Commission with information about its stakeholder engagement activities regarding the decommissioning and future end state of the PNGS, noting that preliminary plans had been shared with stakeholders for their input. The Commission is satisfied that OPG is adequately engaging with its stakeholders in regard to the future of the PNGS site and requests that OPG continues these engagement activities during the renewed licence period.
644. In October 2017, the Commission accepted the updated OPG financial guarantee, which included the PDP and financial guarantee for the PNGS. On this basis and based on the information considered at this hearing, the Commission concludes that the preliminary decommissioning plan and related financial guarantee for the PNGS

are acceptable for the purpose of the current application for the renewal of the PNGS PROL.

645. The Commission notes that, through licence condition G.5, OPG is required to maintain a financial guarantee for the decommissioning of the PNGS that is acceptable to the Commission, and that the next review of OPG's financial guarantee will be in 2022. The Commission also directs CNSC staff to provide annual reports in this regard in the context of the NPP ROR, as proposed during this hearing.
646. Based on the information provided, the Commission is satisfied that OPG's PDP meets licensing and regulatory requirements. Further, the Commission is satisfied that OPG is adequately considering research and OPEX to ensure that its decommissioning planning is based on the best available technologies and methods. The Commission also notes that decommissioning planning is the responsibility of the licensee and the role of the Commission is to ensure that the decommissioning strategy is protective of people and the environment, and is carried out safely.
647. The Commission also notes that OPG has begun considering and planning for the end of life of the PNGS site, following full decommissioning, and requests that OPG continue carrying out stakeholder activities in this regard to ensure adequate active and early stakeholder involvement.

#### **4.17 Cost Recovery**

648. The Commission examined OPG's standing under the *CNSC Cost Recovery Fees Regulations*<sup>148</sup> (CRFR) requirements for the PNGS. Paragraph 24(2)(c) of the NSCA requires that a licence application be accompanied by the prescribed fee, as set out by the CRFR and based on the activities to be licensed.
649. OPG submitted that, pursuant to its obligations under the CRFR, the prescribed fees were remitted on a quarterly basis to the CNSC during the previous licence period. CNSC staff confirmed that OPG was in good standing in respect of its cost recovery payments for the regulation of the PNGS and that there was no concern over future payments.
650. Based on the information submitted by OPG and CNSC staff, the Commission is satisfied that OPG has satisfied, and will continue to satisfy, the requirements of the CRFR for the purpose of this licence renewal.

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<sup>148</sup> SOR/2003-212

#### **4.18 Nuclear Liability Insurance**

651. The Commission notes that OPG is required to maintain nuclear liability insurance for the PNGS. CNSC staff submitted that OPG maintained nuclear liability insurance in accordance with the *Nuclear Liability Act*.<sup>149</sup> (NLA) during the previous licence period until December 31, 2016 and since then, with the *Nuclear Liability and Compensation Act*.<sup>150</sup> (NLCA) that came into force on January 1, 2017. OPG informed the Commission that it had and would continue to maintain the required nuclear liability insurance throughout the renewed licence period.
652. CNSC staff reported to the Commission that NRCan, the federal department responsible for the administration of the NLCA, had confirmed that OPG had satisfied its obligation under the NLCA during the previous licence period. The Commission notes that NRCan has regulatory responsibility and power in the event of any non-compliance with the NLCA.
653. The Commission considered the intervention from E. Butler and enquired about the purpose of the nuclear liability insurance held by OPG under the NLCA. CNSC staff stated that the NLCA imposed financial liabilities on licensees to ensure the protection of members of the public in the event of a nuclear accident and that OPG was required to have nuclear liability insurance to cover these financial liabilities. The Commission is satisfied with the information provided on this point, noting that the purpose of the NLCA is to protect victims in the event of a nuclear accident, not OPG.
654. Based on the information provided on the record for this hearing, the Commission concludes that OPG has satisfied, and will continue to satisfy, the requirements for the maintenance of nuclear liability insurance under the NLCA. The Commission requests annual updates via the NPP ROR in regard to OPG's compliance with the NLCA.

#### **4.19 Licence Length and Conditions**

655. The Commission considered OPG's application for the renewal of the PNGS operating licence for a period of 10 years. CNSC staff recommended the renewal of the licence for a period of 10 years, until August 31, 2028, submitting that OPG is qualified to carry on the licensed activities authorized by the licence.
656. In order to provide adequate regulatory oversight of changes that would not alter the licensing basis and that do not require a licence amendment nor Commission approval, CNSC staff recommended that the Commission delegate authority for certain approval or consent, as contemplated in licence condition 3.2 which contains the phrase "a person authorized by the Commission," to the following CNSC staff:

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<sup>149</sup> R.S.C., 1985, c. N-28 (repealed)

<sup>150</sup> S.C. 2015, c. 4, s. 120

- Director, Pickering Regulatory Program Division
- Director General, Directorate of Power Reactor Regulation
- Executive Vice-President and Chief Regulatory Operations Officer, Regulatory Operations Branch

657. The Commission considered the licence period and the licensed activities that would be carried out following the ECO at the PNGS. The Commission enquired about the appropriateness of the safe shutdown activities in a PROL rather than a decommissioning licence. CNSC staff explained that the safe shutdown state was implemented during outages at all NGS and was already contemplated in PROLs. CNSC staff also provided information about activities that would be carried out by OPG during the transition to safe storage, including reactor defuelling and dewatering, and explained that these activities would decrease the safety risk of the reactors. The OPG representative further stated that the PSR considered the safety case for the timelines submitted in OPG's licence renewal application and stated that the 10-year licence would allow OPG to smoothly transition the reactors into safe storage following the ECO.
658. In considering the renewed licence period, the Commission examined the submissions from intervenors including Greenpeace, Northwatch, the Waterkeeper and individuals which suggested that a renewed licence period of less than 10 years would be more appropriate for OPG's application. The Commission notes that the intervenors suggested shorter licence periods to allow for more frequent public participation in the licensing process and in upcoming decommissioning activities. Intervenors also submitted that interventions helped shape regulatory improvements and that longer licence periods could limit public input into such improvements. The Commission wishes to express its appreciation to these intervenors for participating in these proceedings. The Commission greatly values the information provided to it through interventions and reminds Indigenous groups, members of the public and stakeholders that opportunities for public participation in regard to nuclear facilities include not only hearings but also through consultations on RORs, REGDOCs, and participation in CSA Group standard development.
659. The Commission acknowledges that several interventions, including those from the BPEG, CELA, and individuals questioned the independence of the Commission and suggested that the CNSC's activities were marred by regulatory capture. The Commission wishes to make it clear that each Commission Member's decision in this matter is independent of political, industrial and other external influences, and that Commission Members' decisions are also independent of each other. The Commission is also satisfied that no evidence was provided during these proceedings, or otherwise, to suggest regulatory capture at the CNSC.
660. Based on the information submitted by OPG, CNSC staff and intervenors and as examined by the Commission during the course of this hearing, the Commission is satisfied that a 10-year licence is appropriate for the PNGS. The Commission accepts



the licence conditions as recommended by CNSC staff. The Commission also accepts CNSC staff's recommendation regarding the delegation of authority, and notes that it can bring any matter to the Commission as required.

661. The Commission is satisfied that a 10-year licence is justified on the basis of OPG's past performance, the implementation of the PSR, opportunities for public involvement during the renewed 10-year licence period through annual RORs and the comprehensive mid-term report which will be presented no later than 2023.
662. Further, following its consideration of the interventions submitted in regard to the renewal licence period, the Commission is satisfied that the mechanisms in place through OPG's PIDP, as well as through CNSC Commission meetings, the comprehensive PNGS mid-term report, and CNSC public consultation processes provide many opportunities for intervenors to participate in Commission proceedings and other activities related to the PNGS throughout the renewed licence period. The Commission is also of the view that, as a lifecycle regulator, its regulatory responsibilities in respect of CNSC-licensed activities do not end with this licensing decision and will continue throughout the renewed licence period.
663. With this decision, the Commission states that any application by OPG for the decommissioning of the PNGS will require a public hearing with opportunity for the public to intervene. The Commission also makes it clear that any application to extend commercial operation at the PNGS will require approval from the Commission and an updated PSR establishing the safety case for the PNGS in this regard.

## **5.0 CONCLUSION**

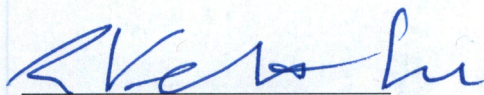
664. The Commission has considered the PNGS licence renewal application submitted by the OPG. Based on its consideration of the information submitted, the Commission is satisfied that the application submitted by the OPG meets the requirements of the NSCA, the GNSCR and other applicable regulations made under the NSCA.
665. The Commission has also considered the information and submissions of the OPG, CNSC staff and all participants as set out in the material available for reference on the record, as well as the oral and written interventions provided or made by the participants at the hearing.
666. The Commission is satisfied that OPG meets the test set out in subsection 24(4) of the *Nuclear Safety and Control Act*. That is, the Commission is of the opinion that OPG is qualified to carry on the activity that the proposed licence will authorize and that it will make adequate provision for the protection of the environment, the health and safety of persons and the maintenance of national security and measures required to implement international obligations to which Canada has agreed.

667. Therefore, the Commission, pursuant to section 24 of the *Nuclear Safety and Control Act*, renews the Nuclear Power Reactor Operating Licence issued to Ontario Power Generation Inc. for the Pickering Nuclear Generating Station located in Pickering, Ontario. The renewed licence, PROL 48.00/2028, is valid from September 1, 2018 until August 31, 2028.
668. With this decision, the Commission authorizes Ontario Power Generation Inc. to operate the Pickering Nuclear Generating Station Units 5 – 8 up to a maximum of 295,000 EFPH.
669. The Commission includes in the licence the conditions as recommended by CNSC staff in CMD 18-H6 and CMD 18-H6.B. The Commission also delegates authority for the purposes of licence condition 3.2,<sup>151</sup> as recommended by CNSC staff.
670. The Commission considers the environmental review that was conducted by CNSC staff to be acceptable and thorough. The Commission is satisfied that an EA under CEAA 2012 was not required for the PNGS licence renewal application and notes that the NSCA provides a strong regulatory framework for environmental protection. Further, the Commission is satisfied that OPG has made, and will continue to make, adequate provision for the protection of the environment and the health of persons throughout the renewed licence period.
671. The Commission notes that CNSC staff can bring any matter to the Commission that merits its attention. The Commission directs CNSC staff to inform the Commission on an annual basis of any changes made to the Licence Conditions Handbook (LCH).
672. With this decision, the Commission directs CNSC staff to report annually on the performance of OPG and the PNGS, as part of the annual NPP ROR. CNSC staff shall present this report at a public proceeding of the Commission, where members of the public will be able to participate.
673. The Commission directs that, around the mid-point of the 10-year licence period and no later than 2023, OPG shall present to the Commission a comprehensive mid-term update on its licensed activities at the PNGS. This mid-term update will take place during a public Commission proceeding in the vicinity of the community that hosts the PNGS. The Commission intends, for this proceeding, that Indigenous groups, members of the public and stakeholders will be able to intervene.
674. The Commission directs OPG to submit to the CNSC its SOP and SAP as detailed during these proceedings. With this decision, the Commission also makes it clear that any application to extend the commercial operation of the PNGS shall be made by OPG as soon as practicable, and no later than 2 years before the current planned ECO on December 31, 2024. Any application in this regard would represent a change in the PNGS licensing basis and would require Commission authorization.

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<sup>151</sup> Licence condition 3.2: “The licensee shall not restart a reactor after a serious process failure without the prior written approval of the Commission, or prior written consent of a person authorized by the Commission.”

675. With this decision, the Commission directs OPG to implement the IIP as detailed on the record for this hearing. The Commission notes that any changes to IIP actions represent a change in the PNGS licensing basis and would require Commission authorization.
676. The Commission notes the commitment expressed by OPG and CNSC to establish formalized engagement mechanisms with Indigenous groups, if so desired by the groups, as soon as practicable. The Commission requests that annual reports about such formalized engagement mechanisms, as well as about CNSC and licensee Indigenous engagement activities, be provided through the annual NPP ROR or other means, as appropriate.
677. The Commission directs that a KI working group between CNSC staff, OPG, the OFMEM, the MOHLTC, other stakeholders, and which would allow for the participation of intervenors in these proceedings, be established as soon as practicable. The Commission is of the view that this working group should establish clear and detailed plans for the distribution of KI pills throughout the IPZ in the event of an emergency at the PNGS. The Commission also directs that this working group examine the pre-distribution of KI pills to all schools within the IPZ and strongly encourages the participation of school boards in the IPZ in the KI working group. Further, the Commission directs that CNSC staff present updates on the progress of this working group during the Nuclear Power Plant Status Updates, which are presented at every Commission meeting.
678. The Commission approves OPG's request to continue the implementation of its Co-60 program, as detailed in PNGS-specific licence condition 15.5.



DEC 20 2018

Rumina Velshi  
President,  
Canadian Nuclear Safety Commission

Date



**Appendix A – Intervenors**

Intervenors – Oral Presentations	Document Number
Reactor Engineering Services Development (RES Development Inc.), represented by P. Sedran	18-H6.20
CANDU Owners Group Inc., represented by F. Dermarkar	18-H6.21
Pickering Nuclear Generating Station Community Advisory Council, represented by J. Vincett, R. Sutton, Z. Moshonas, A.L. Tersigni and B. Houston	18-H6.22 18-H6.22A
Canadian Association of Nuclear Host Communities and the Municipality of Clarington, represented by A. Foster, D. Ryan and G. Weir	18-H6.23
Anna Tilman	18-H6.24 18-H6.24A
Ajax-Pickering Board of Trade, represented by C. Ashton	18-H6.25 18-H6.25A
BWXT Canada Ltd., represented by J. Lundy	18-H6.26
Toronto Regional Board of Trade, represented by J. Parker	18-H6.27
Dan Rudka	18-H6.28
The Organization of Canadian Nuclear Industries (OCNI), represented by R. Oberth	18-H6.29 18-H6.29A
The Ontario Chamber of Commerce, represented by R. Rossi	18-H6.30
Rommel Bellosillo	18-H6.31
North American Young Generation in Nuclear (NAYGN) – Canada, represented by M. Mairinger	18-H6.32
Dominique Bruce	18-H6.33
Evelyn Butler	18-H6.34
Jerry Cuttler	18-H6.35 18-H6.35A 18-H6.35B
D. Tim Seitz	18-H6.36
Canadian Nuclear Workers Council, represented by D. Shier and J. Usher	18-H6.37 18-H6.37A
Sunil Nijhawan	18-H6.38
Kimberly Grant-Stuart	18-H6.39
Canadian Nuclear Society, represented by D. Gammage, P. Easton and C. Hunt	18-H6.40
Canadian Nuclear Laboratories, represented by S. Cotnam	18-H6.41
Darlene Buckingham	18-H6.42
Canadian Nuclear Association, represented by J. Barrett, D. Chambers, A. Ethier and S. Coupland	18-H6.43 18-H6.43A
SNC-Lavalin, represented by N. Badie	18-H6.44
Women in Nuclear Canada, represented by L. McBride and P. Watson	18-H6.45

Intervenors – Oral Presentations	Document Number
Northwatch, represented by B. Lloyd	18-H6.55 18-H6.55A
Durham Nuclear Awareness, represented by J. McNeil and P. Seccaspina	18-H6.56 18-H6.56A
Canadian Environmental Law Association, represented by T. McClenaghan, K. Blaise, M. Poremba and T. Markvart	18-H6.57 18-H6.57A 18-H6.57B
Swim Drink Fish / Lake Ontario Waterkeeper, represented by P. Feinstein	18-H6.58 18-H6.58A
Kirsten Dahl	18-H6.59
Michel Duguay	18-H6.60
Greenpeace, represented by S-P. Stensil	18-H6.62 18-H6.62A 18-H6.62B
Canadian Coalition for Nuclear Responsibility, represented by G. Edwards	18-H6.63
Provincial Council of Women of Ontario, represented by G. Janes	18-H6.64
Ian Fairlie	18-H6.65
Registered Nurses' Association of Ontario, represented by B. Jackson, S. Munro and K. Jarvi	18-H6.66
Regional Municipality of Durham, represented by G. Cubitt, C. Drimmie, W. Leonard and N. Pincombe	18-H6.67 18-H6.67A
Amir Ayazi	18-H6.68
Power Workers' Union, represented by M. Hyatt, A. Clunis and E. Lawrence	18-H6.69 18-H6.69A
Estefany Guecha	18-H6.71 18-H6.71A
Louis Bertrand	18-H6.72 18-H6.72A
Society of United Professional, represented by R. Chatoor, J. Bartley, J. Fierro and R. Caron	18-H6.73 18-H6.73.A
Erin O'Toole, MP, Durham, L. Park , MPP-elect for Durham and P. Bethlenfalvy, MPP-elect for Pickering-Uxbridge	18-H6.74
Belinda Cole	18-H6.75
Canadian Association of Physicians for the Environment, represented by C. Vakil	18-H6.76 18-H6.76A
Ontario Clean Air Alliance, represented by J. Gibbons, I. Fairlie and G. Thompson	18-H6.77
North American Young Generation in Nuclear, Durham Chapter, represented by D. Urrego, M. Saliba, M. Goodchild and K. Palinka	18-H6.79 18-H6.79A
Teachers of the Toronto District School Board and the Toronto District Catholic School Board, represented by A. Montemurro and C. McCarry	18-H6.101 18-H6.101A
Society of Professional Engineers and Associates, represented by M. Ivanco	18-H6.109

Intervenors – Oral Presentations	Document Number
Mohawks of the Bay of Quinte, represented by K. Shipley	18-H6.141
Stuart Smith	18-H6.156

Intervenors – Written Interventions	Document Number
Safe Communities of Pickering and Ajax	18-H6.2
Rotary Club of Ajax	18-H6.3
Durham Nuclear Health Committee	18-H6.4
Durham College	18-H6.5
Women’s Multicultural Resource & Counselling Centre of Durham	18-H6.6
Ajax Pickering Hospital and the Ajax Pickering Hospital Foundation	18-H6.7
Laker Energy Products Ltd.	18-H6.8
Whitby Chamber of Commerce	18-H6.9
Nu-Tech Precision Metals Inc.	18-H6.10
Town of Ajax	18-H6.11
Pickering Naturalists	18-H6.12
Station Gallery	18-H6.13
AECOM Canada Nuclear Operations, Inc.	18-H6.14
Jonathan Schofield	18-H6.15
Black & McDonald Limited	18-H6.16
Oxford Coalition for Social Justice	18-H6.17
Peter Tabuns, MPP, Toronto-Danforth	18-H6.18
David Suzuki Foundation	18-H6.19
E.S. Fox Limited	18-H6.46
Charles Chiarelli	18-H6.47
Karen Walters	18-H6.48
Aecon Group Inc.	18-H6.49
Inès Marchese	18-H6.50
Stéphanie Beausoleil	18-H6.51
Melis Kilic	18-H6.52
Jill Lennox	18-H6.53
Jayanthini Jegatheswaran	18-H6.54
Linda Gasser	18-H6.61
Barbara Pulst	18-H6.70
Andrei Neacsu	18-H6.78
City of Pickering	18-H6.80
Lucy Seidler	18-H6.81
Toronto Environmental Alliance	18-H6.82
Borden Rhodes	18-H6.83
Lori Moncada	18-H6.84
William Douglas	18-H6.85
Maryam Astaneh	18-H6.86
Christopher Small	18-H6.87
Canadian Council for Aboriginal Business	18-H6.88

Intervenors – Written Interventions	Document Number
ATS Automation	18-H6.89
Sylvia Schmidt	18-H6.90
Scientists in School	18-H6.91
City of Toronto	18-H6.92
Maria-Theresia Roemmelt	18-H6.93
Ralf Wieser	18-H6.94
Jeff Brackett	18-H6.95
Rolls-Royce Civil Nuclear Canada	18-H6.96
Lois M. Banks	18-H6.97
Bruce Peninsula Environment Group	18-H6.98 18-H6.98A
Nicole Bafaro	18-H6.99
William L. Shore	18-H6.100
Maimuna Hafiz	18-H6.102
Sonit Nangia	18-H6.103
Harald Simon	18-H6.104
James Ronald	18-H6.105
Joe Dickson, MPP, Ajax-Pickering	18-H6.106
Bruce Power	18-H6.107
Wildlife Habitat Council	18-H6.108
Greater Oshawa Chamber of Commerce	18-H6.110
Jacquelynn Tanner	18-H6.111
Ajax-Pickering Toastmasters Club	18-H6.112
James Scarrow	18-H6.113
Boyd Reimer	18-H6.114
Énergie NB Power	18-H6.115
B.C. Instruments	18-H6.116
Natasha Vaney	18-H6.117
Don and Heather Ross	18-H6.118
Jasmine Bruce	18-H6.119
Sherry Brown	18-H6.120
Bertie D'souza	18-H6.121
Janine Carter	18-H6.122
Fernanda Sierra	18-H6.123
Katie Weston	18-H6.124
Cameco Corporation	18-H6.125
Ontario Federation of Anglers and Hunters	18-H6.126
Mackenzie Floyd	18-H6.127
I-Ping Wong	18-H6.128
University of Ontario Institute of Technology	18-H6.129
Rena Ginsberg	18-H6.130
Arielle Lefang	18-H6.131
Doug Rylett	18-H6.132



Intervenors – Written Interventions	Document Number
Elaine Munro	18-H6.133
Cathy Tafler	18-H6.134
Roger J. Short	18-H6.135
Chaitanya Kalevar	18-H6.136 18-H6.136A
Tracy MacCharles, MPP, Pickering-Scarborough East	18-H6.137
Lingzhi Xia	18-H6.138
Brotech Precision CNC Inc.	18-H6.139
Plug'n Drive	18-H6.140
Steps for Life, Durham Region	18-H6.142
Pickering Rouge Canoe Club	18-H6.143
Ontario Shores Centre for Mental Health Sciences and the Ontario Shores Foundation for Mental Health	18-H6.144
Abilities Centre	18-H6.145
Earth Rangers	18-H6.146
Big Brothers Big Sisters of South-West Durham and Northumberland	18-H6.147
PineRidge Arts Council	18-H6.148
St. Paul's on-the-Hill Community Food Bank	18-H6.149
Community Care Durham	18-H6.150
Kelly Clune	18-H6.151
Ann Truyens	18-H6.152
Tom Smarda	18-H6.153
Brad Blaney	18-H6.154
Frank Greening	18-H6.155 18-H6.155A 18-H6.155B 18-H6.155C

Requests for Ruling	Document Number
Canadian Environmental Law Association (CELA) and Greenpeace on June 25, 2018	18-H6.157
CELA, Greenpeace and Northwatch on June 25, 2018	18-H6.158
CELA, Greenpeace and Durham Nuclear Awareness (DNA) on June 25, 2018	18-H6.159
CELA on June 26, 2018	18-H6.160
Greenpeace on June 28, 2018	18-H6.161