Canadian Nuclear Safety Commission

Commission canadienne de sûreté nucléaire

Record of Proceedings, Including Reasons for Decision

In the Matter of

Proponent	Ontario Power Generation Inc
Subject	Environmental Assessment Screening Regarding the Proposal to Refurbish and Continue to Operate the Darlington Nuclear Generating Station in the Municipality of Clarington, Ontario
Public Hearing Dates	December 3-6, 2012

Canada

RECORD OF PROCEEDINGS

Proponent:	Ontario Power Generation Incorporated
Address/Location:	1340 Pickering Parkway, Fourth Floor, Pickering, Ontario L1V 0C4
Purpose:	Environmental Assessment Screening Regarding the Proposal to Refurbish and Continue to Operate the Darlington Nuclear Generating Station in the Municipality of Clarington, Ontario
Application received:	April 28, 2011
Date(s) of public hearing:	December 3-6, 2012
Location:	Hope Fellowship Church 1011 Bloor Street East, Courtice, ON, L1H 7K6
Members present:	M. Binder, Chair R. J. Barriault A. Harvey R. Velshi M. J. McDill D.D. Tolgyesi
Secretary:	M.A. Leblanc
Recording Secretary:	L. Casterton
Senior General Counsel:	J. Lavoie

Applicant Represented By	**Document Number**
• P. Tremblay, Deputy Chief Nuclear Officer • D. Reiner, Senior Vice President, Nuclear Refurbishment • B. Duncan, Senior Vice President, Darlington Nuclear • T. Doran, Vice-President, Nuclear Waste Management Division • L. Swami, Vice President, Nuclear Services • M. Elliott, Chief Nuclear Engineer • J. Peters, Manager, Environmental Assessment, Nuclear Services • K. Powers, Director, Public Affairs • C. Lorencez, Director, Nuclear Safety, Nuclear Engineering • D. Pawlowski, Manager, Social Aspects- Environmental Assessment • J. Coles, Director, Emergency Management & Fire Protection	CMD 12-H13.1 CMD 12-H13.1A

CNSC staff			**Document Number**
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• L. Sigouin • G. Frappier • D. Newland • D. Wismer	• D. Howard • P. Adams • Y. Akl	• B. Barker • A. Blahoianu • D. Saumure	

Other Representatives
• Fisheries and Oceans Canada: T. Hoggarth • Environment Canada: N. Ali and S. Leonardelli • Emergency Management Ontario: A. Stuart, T. Kontra and D. Nodwell • Health Canada: J.-P. Auclair • Durham Nuclear Health Commission Committee: R. Kyle and M.-A. Pietrusiak • Durham Emergency Management Office: I. Ciuciura • Natural Resources Canada: J. Adams • Nuclear Waste Management Organization: S. Russell • Natural Resources Canada: J. Hénault and D. McCauley
Intervenors
See appendix A

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INTRODUCTION

1. Ontario Power Generation Incorporated (OPG) proposes to undertake a number of activities required to refurbish all four reactors at the Darlington Nuclear Generating Station (NGS) site, with no more than two reactors being refurbished at any one time, and activities related to the continued operation of the refurbished power reactors. Operation of the units is anticipated to the end of their useful lives in about 2055. This *Record of Proceedings, Including Reasons for Decision* deals specifically with the Environmental Assessment (EA) Screening completed by the Canadian Nuclear Safety Commission[1] (CNSC) staff concerning OPG's intention to refurbish and continue to operate the four reactors at the Darlington NGS. The *Record of Proceedings, Including Reasons for Decision* documents addressing OPG's applications for a Waste Facility Operating Licence renewal with amendments for its Darlington Waste Management Facility has been released simultaneously. The *Record of Proceedings, Including Reasons for Decision* for a licence renewal for the Power Reactor Operating Licence (PROL) for its Darlington NGS was released earlier on February 26, 2013.

2. Pursuant to subsection 24(2) of the *Nuclear Safety and Control Act*[2] (NSCA), the authorization of these activities requires amendments to OPG's PROL and authorization of the construction and operation of two storage buildings under OPG's Waste Facility Operating Licence at the Darlington NGS site. The required amendments to the PROL are anticipated to be considered by the Commission in 2014. The amendments authorizing the construction and operation of the two storage buildings are considered in the *Record of Proceedings, Including Reasons for Decision* for the licence renewal for the Darlington Waste Management Facility Operating Licence.

3. Before the Commission can amend the licences, the Commission must, in accordance with the requirements of the *Canadian Environmental Assessment Act* (CEAA 1992)[3], make a decision on an EA Screening of the proposed project. The CNSC and Fisheries and Oceans Canada (DFO) are the Responsible Authorities[4] (RAs) for the EA. Health Canada (HC), Natural Resources Canada (NRCan) and Environment Canada (EC) were identified as Federal Authorities (FAs) for the purpose of providing expert assistance to CNSC and DFO staff during the EA. No provincial EA is required; however, the Ontario Ministry of the Environment and Ontario Ministry of Natural Resources were kept informed and meaningfully participated throughout the EA process.

4. As part of the Government's plan for Responsible Resource Development, which seeks to modernize the regulatory system for project reviews, the CEAA 1992 was repealed when the new *Canadian Environmental Assessment Act, 2012* (CEAA 2012[5]) came into force on July 6, 2012. In accordance with subsection 124(2) of the CEAA 2012, the Minister of

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[1] 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.
[2] Statutes of Canada (S.C.) 1997, chapter (c.) 9.
[3] S.C. 1992, c. 37.
[4] Responsible Authority in relation to an EA is determined in accordance with subsection 11(1) of the CEAA 1992.
[5] S.C. 2012, c. 19, s. 52

the Environment designated the Darlington NGS Refurbishment and Continued Operation EA to be completed under the requirements of the CEAA 1992.

5. On October 28, 2011, a panel of the Commission issued its decision to approve the EA Scoping Information Document[6]. In its decision, the Commission indicated that the EA Screening Report (Screening Report) would be considered in a public hearing, and pursuant to section 17 of the CEAA 1992, the conduct of technical studies for the screening of this project was delegated to OPG. OPG provided the Environmental Impact Statement (EIS), technical support studies and other relevant information, which underwent a review by experts at the CNSC, DFO and other relevant government departments. This information was then used by CNSC and DFO staff for the preparation of the draft Screening Report. Stakeholders, including the FAs, were provided an opportunity to review the draft Screening Report prior to its finalization and submission to the Commission for this hearing and decision.

6. This *Record of Proceedings, Including Reasons for Decision* describes the Commission's consideration of the Screening Report and its reasons for decisions on the results. The Screening Report of OPG's proposed Darlington NGS Refurbishment and Continued Operation EA is attached as an appendix to CMD 12-H13.

Issue

7. In considering the Screening Report, the Commission was required to decide:

a) whether the Screening Report is complete; that is, whether all of the factors and instructions set out in the approved EA Scoping Information Document and subsection 16(1) of the CEAA 1992 were adequately addressed;

b) whether the project, taking into account the mitigation measures identified in the Screening Report, is likely to cause significant adverse environmental effects;

c) whether the project must be referred to the federal Minister of the Environment for referral to a review panel or mediator, pursuant to paragraph 20(1)(c) of the CEAA 1992; and

d) whether the Commission should proceed with its consideration of an application for licence amendments under the NSCA, consistent with paragraph 20(1)(a) of the CEAA 1992.

[6] Record of Proceedings, Including Reasons for Decision – Ontario Power Generation Inc. – Environmental Assessment Scoping Information Document (Scope of Project and Assessment) for the Proposed Darlington Nuclear Generating Station Refurbishment and Continued Operation. October 28. 2011.

Public Hearing

8. The Commission, in making its decision, considered information presented in a public hearing held on December 3-6, 2012 in Clarington, Ontario. The public hearing was conducted in accordance with the *Canadian Nuclear Safety Commission Rules of Procedure*[7]. During the public hearing, the Commission heard evidence and considered the three applications filed by OPG for the renewal of the PROL for its Darlington NGS, for the renewal of the Waste Facility Operating Licence for its Darlington Waste Management Facility and for the EA for the proposed refurbishment of the Darlington NGS. The Commission received written submissions and heard oral presentations from CNSC staff and OPG, as well as oral and written submissions from 690 intervenors (see Appendix A for a detailed list of interventions), on all three matters. Written submissions from CNSC staff (CMD 12-H13 and CMD 12-H13.A) and OPG (CMD 12-H13.1 and CMD 12-H13.1A) specifically addressed the Screening Report for the proposed refurbishment of the Darlington NGS. Information that was also considered during this hearing pertaining to the licence renewal for the Darlington Waste Management Facility and OPG's application for a licence renewal for its Darlington NGS is dealt with in separate *Records of Proceedings, Including Reasons for Decision*.

9. One member of the public requested before the hearing that Commission Member Rumina Velshi recuse herself from the hearing on the basis of her previous association with OPG. During the hearing, the Toledo Coalition for Safe Energy also made such a request. Member Velshi duly considered this request and decided not to recuse herself from these hearings based on the fact that more than three years had passed since her retirement from OPG and that her activities after the retirement have demonstrated a clear change in professional focus. Member Velshi is satisfied that she has no conflict of interest and that she approached this matter with a fair, impartial and open mind.

10. In its intervention, Conservation Council of New Brunswick (CCNB Action) requested a ruling from the Commission that each Commission member's decision on the EA and Darlington nuclear facility operating licence be made public and all requests for ruling be made public. The Commission notes that all of its decisions are made public, and that the *Record of Proceedings, including Reasons for Decision* provides the reasoning behind the Commission's decisions. The Commission notes that, should there be dissent from one or more Commission members from the decision taken by the majority of Commission members, this would be noted in the *Record of Proceedings*. The Commission also notes that requests from CCNB Action were addressed and made public through the appropriate *Records of Proceedings*, notably in the *Record of Proceedings* regarding the renewal of the Darlington NGS.

[7] Statutory Orders and Regulations (SOR)/2000-211.

Mandate of the Commission

11. The Commission states that it has the independence necessary to fulfill its mandate and that the process in place to obtain the information necessary for making informed decisions is open and transparent. The Commission, as a quasi-judicial administrative tribunal, considers itself independent of all political, governmental or private sector influence in its decision-making.

12. Several intervenors raised questions on the future of nuclear energy in Ontario. In particular, they asked why more consideration is not given to alternative forms of energy, such as solar or wind power. Others, such as the Canadian Coalition for Nuclear Responsibility, CCNB Action and United Church of Canada, have asked the CNSC to recommend a national public inquiry on the use of nuclear power. The Commission notes that, as the regulatory authority over nuclear matters in Canada, its mandate is not to evaluate alternative energy sources or make energy policy decisions, but to ensure, in accordance with the NSCA, the regulation of the development, production and use of nuclear energy to prevent unreasonable risk to the environment and to the health and safety of persons. The choice of a source of energy or the consideration of economic benefits of a project is not within the Commission's authority. These decisions fall under the purview of other governmental authorities.

DECISION

13. Based on its consideration of the matter, as described in more detail in this *Record of Proceedings,* the Commission decides that:

a) the Screening Report appended to CMD 12-H13 is complete; that is, the scope of the project and assessment were appropriately determined in accordance with section 15 and 16 of the CEAA 1992, and all of the required assessment factors were addressed during the assessment;

b) the project, taking into account the mitigation measures identified in the EA Screening Report, is not likely to cause significant adverse environmental effects;

c) it will not refer the project to the federal Minister of the Environment for his referral to a federal EA review panel or mediator;

d) it will proceed to consider the application for licence amendments under the provisions of the NSCA, consistent with paragraph 20(1)(a) of the CEAA 1992.

14. Prior to the undertaking of refurbishment activities, OPG must complete the CNSC licensing process. The Commission has requested a number of actions to be completed in support of the anticipated licensing public hearing in 2014 concerning OPG's application

for a licence renewal with amendments allowing for the undertaking of refurbishment activities. In accordance with this *Record of Proceedings, Including Reasons for Decision*, the following actions shall be completed pursuant to the timelines indicated:

- Presentation by OPG to the Commission in 2014 regarding the results of the thermal effects study on aquatic biota, as outlined in paragraph 53.
- Update by OPG to the Commission in 2014 concerning the characterization of the 2009 Injection Water Storage Tank spill of tritium, as outlined in paragraph 65.
- Update by CNSC staff to the Commission in 2014 concerning the allowable levels of radiation in foodstuffs during emergencies, as outlined in paragraph 98.
- In response to concerns regarding lower probability malfunction and accident events, presentation by CNSC staff to the Commission in 2014 regarding the Integrated Improvement Plan, as outlined in paragraph 147.
- Update by CNSC staff to the Commission in September 2013 on the assessment of health and environmental consequences of severe accident scenarios, as outlined in paragraph 153.
- Update by CNSC staff to the Commission in 2014 on the discussions or issues raised by Aboriginal groups, as outlined in paragraph 186.
- Presentation by CNSC staff to the Commission in 2014 regarding concrete integrity, as outlined in paragraph 212.

ISSUES AND COMMISSION FINDINGS

15. The findings of the Commission are based on the Commission's consideration of all the information and submissions available for reference on the record for the hearing.

Completeness of the Screening Report

16. In its consideration of the completeness of the Screening Report, the Commission considered whether the assessment had adequately addressed an appropriately defined scope of project and assessment factors.

17. CNSC staff reported that they had assessed effects of the project on the environment and considered activities related to the normal operations and the effects of possible malfunctions and accidents. They had also considered effects of the environment on the proposed project.

18. CNSC staff further reported that the Screening Report had been developed based on the review of the EIS and technical studies submitted by the proponent and in accordance with the approved EA Scoping Information Document.

19. Based on the Commission's review of the EA Scoping Information Document and Screening Report, the Commission concludes that the scope of the project and the scope

of the factors for the assessment are appropriate and that all of the required factors were addressed during the assessment.

20. The Commission also concludes that the Screening Report is complete and compliant with the requirements of the CEAA 1992.

Likelihood and Significance of Environmental Effects

21. This section contains the Commission's findings with respect to whether the project is likely to cause significant adverse environmental effects, taking into account the identified mitigation measures.

Adequacy of the Assessment Methods

22. In their submission, CNSC staff confirmed that OPG followed, in its EIS and supporting technical studies, the structure outlined in the EA Scoping Information Document approved by the Commission.

23. CNSC staff noted that the assessment of the direct and indirect effects of the project on the environment had been carried out in a step-wise manner, including the following steps:

- Identifying potential interactions between the project and the environment;
- Determining if each interaction is likely to result in a measurable adverse change to the environment;
- Identifying measures to mitigate the environmental effects; and
- Determining the significance of residual environmental effects.

24. CNSC staff explained that each project-environment interaction was assessed using criteria such as regulatory standards and guidelines, existing conditions, scientific literature and professional judgement to determine whether they were likely to result in a measurable change to the environment. Each potential adverse effect resulting from a measurable change in the environment was considered to identify, where appropriate, possible means of mitigation to eliminate, reduce or control the effect.

25. CNSC staff added that, following the identification of feasible mitigation measures, each likely adverse effect was re-evaluated to identify if there were any residual adverse effects. All residual adverse effects that remained after the application of the mitigation measures were then evaluated for their significance.

26. Based on its review of the Screening Report and the submitted information, the Commission concludes that the EA methods were acceptable and appropriate.

Effects of the Project on the Environment

27. CNSC staff reported that the proposed Screening Report provides an illustration of the potential project-environment interactions during the Refurbishment and Continued Operation Phase. A description of each interaction and an assessment of the potential effects are described in detail in section 6.0 of the proposed Screening Report. The assessment is based on the identification of 9 project works and activities during the Darlington NGS Refurbishment Phase and 17 project works and activities during the Darlington NGS Continued Operation Phase. The environment was divided into 12 environmental components and interactions expected to result in measurable effects were further analyzed to consider the application of mitigation measures.

28. CNSC staff noted that measurable effects were identified and assessed for the following environmental components: atmospheric environment, surface water environment, aquatic biota, terrestrial environment, hydrogeological environment, land use, traffic and transportation, socio-economic environment, physical and cultural heritage, aboriginal interests, human health, and non-human biota. This involved quantification of the effects when possible, and identification of appropriate mitigation measures to reduce or eliminate any adverse effects generated by the project. These measures are discussed in section 6.0 of the proposed Screening Report. The effects remaining after mitigation are referred to as residual effects.

29. CNSC staff reported that the analysis of the assessment of the effects of the project on the environment showed 3 potential adverse residual effects: two under normal operations and one under malfunctions and accidents. The identified adverse residual effects of the project on the environment are the following:

- Impingement and entrainment effects on aquatic biota;
- Thermal effects on round whitefish embryo survival; and
- Human health effects in the event of the bounding nuclear-related accident scenario assessed in the EA.

These effects are discussed in detail in section 6.0 and 7.0 of the proposed Screening Report. These adverse residual effects are described in the following paragraphs under the headings “aquatic environment effects” and “human health effects”.

Aquatic Environment Effects

Impingement and Entrainment of Aquatic Biota

30. CNSC staff reported that impingement and entrainment have been identified as likely adverse residual effects during the project, due to the operation of the once-through cooling water system.

31. CNSC staff noted that the main species impinged, round goby, is an invasive species. The other main species impinged, alewife, has losses that are small in the context of the high

abundance and wide geographic distribution of the species. These species are also of little commercial value. CNSC staff also stated that entrainment numbers are relatively low compared to the high abundance and wide geographic distribution of the dominant species entrained (rainbow smelt, alewife and common carp). Aquatic invertebrates are also entrained, but CNSC staff reported that power plant studies conducted elsewhere have shown high entrainment survival rates for them.

32. OPG reported that there has been minimal interaction of the intake with aquatic species considered important to the Lake Ontario fisheries. The residual effect of the project, expected to be not significant in terms of population abundance and conservation, will continue to be moderated by the design and operational principles intended to minimize impingement of fish. OPG also noted that future rates of impingement and entrainment are expected to be similar to those during past operation.

33. CNSC staff confirmed that, to date, the operation of the Darlington NGS once-through cooling water system has resulted in relatively low estimated losses of fish from impingement and entrainment.

34. OPG has committed to monitor losses during continued operation with an adaptive management framework as an element of the EA follow-up program. Given that the mix of aquatic species could change with time, CNSC staff proposed an adaptive management program to address this matter. This program, agreed by the Commission, would require OPG to research and incorporate additional mitigation measures to an extent that is reasonably and economically feasible, and to possibly implement habitat compensation measures to address any potential significant loss to the fisheries.

35. CNSC staff and DFO conclude that the likely impingement and entrainment effects from the project are not significant.

36. Intervenors, including Lake Ontario Waterkeeper, expressed concerns on the impact of impingement and entrainment on the fish population in Lake Ontario. The Commission asked for more information in this regard. The DFO representative reported that recent work in Lake Michigan concerning alewife showed that 99.98% of fish that hatch die after a 40-day period. In addition, there is a massive mortality rate that occurs over the winter. The DFO representative explained that if a total of 17 million larvae hatch, only 870 to 900 fish would remain after one year. The DFO representative explained that alewife are not well suited to live in fresh water and have adapted to survive by producing large numbers of eggs, with an average female alewife laying up to 50,000 eggs at once; therefore, only 320 females are required to lay 17 million eggs.

37. The DFO representative also noted that the Ministry of Natural Resources does annual surveys, and estimated the biomass of alewife in Lake Ontario to be 3000 metric tonnes, equating to many millions of fish. CNSC staff and DFO concluded that the likely eggs and larvae entrainment effects from the project are not significant.

38. The Commission asked for confirmation on the number of fish impinged and how

significance is determined. CNSC staff reported that approximately 275,000 fish are impinged, primarily alewife (85.9%) and round goby (8.5%). CNSC staff also stated that the magnitude of the effect is considered low, as losses are low relative to metrics such as populations, species at risk, fishery management agency abundance estimates, and commercial catches. CNSC staff added that the spatial extent of the effect is also low and limited to the site study area. CNSC staff considered additional criteria; however, given that the magnitude and spatial extent were rated low, CNSC staff and DFO concluded that the residual adverse effect is minor in nature and not significant. The DFO representative added that round goby mortality is discounted in their assessment, as it is an invasive species and DFO is working to eradicate round goby altogether. The DFO representative added that there is still a residual impact; therefore, under the *Fisheries Act*[8] and current policies, DFO is in discussions with OPG over offsetting the loss due to impingement and entrainment with the creation of habitat.

39. The Commission asked for clarification on the effects of impingement and entrainment on whitefish. The DFO representative responded that they have expressed concern on whitefish, and are continuing to work with OPG and the CNSC on assessing the impacts. The DFO representative explained that, currently, the amount of impingement and entrainment of round whitefish is extremely low at the site. The DFO representative added that the American eel is listed provincially, but not federally, as endangered, and even though only one was entrained, DFO will assess through monitoring and follow-up whether mitigation measures are required.

40. The Williams Treaties First Nations, in their intervention, raised concerns regarding habitat compensation being unsuccessful. CNSC staff reported a number of successful habitat compensation projects under the *Fisheries Act*, including: Pamour Gold Mine Expansion, Holland Marsh Drainage System Improvement, Consumers Drive Widening, and Colston Creek Culvert Realignment. CNSC staff reported that compensatory measures to address any potential loss to the fisheries are prioritized as follows on 1) habitat restoration, 2) creation, and 3) enhancements.

41. CNSC staff reported that appropriate habitat compensation projects would be evaluated and selected over time, in consultation with DFO, with advice from the CNSC, Ontario Ministry of Natural Resources and Conservation Authorities, in support of native species conservation on the north shore of Lake Ontario.

42. In response to Lake Ontario Waterkeeper's concern regarding a more thorough review of closed-cycle cooling, the Commission requested an explanation on whether cooling towers were considered in the assessment. An OPG representative responded that cooling towers were considered in the business planning process, but were not included in the EA as Darlington aquatic studies have shown the environmental impact is not significant. The OPG representative added that a full assessment was completed for the EA for the Darlington New Nuclear Power Plant Project and, in accordance with the Joint Review Panel recommendation, OPG completed a best available technology economically

[8] R.S.C., 1985, c. F-14

achievable (BATEA) study. This study concluded that the Darlington NGS once-through cooling water design with a submerged intake and velocity cap is effective for mitigating fish loss. OPG further explained that they are committed to continuing to study fish loss and, should an impact be observed, will implement appropriate mitigation measures. CNSC staff responded that ongoing follow-up activities are conducted to ensure the effectiveness of the deep offshore intakes, and should there be a potential fish population risk, CNSC staff would require OPG to implement appropriate mitigation measures.

43. The Commission requested further information on the status and availability of the BATEA study. OPG responded that the study has been submitted to the CNSC for review. CNSC staff confirmed that the study is currently under review by CNSC and DFO staff and this review is anticipated to be completed by February 2013. OPG added that the study included a consultation program with stakeholders and, although it is undergoing review by CNSC staff, the study is already publicly available on OPG's Web site. OPG added that there were many more studies completed as part of the Joint Review Panel process for the Darlington New Nuclear Power Plant Project.

44. Lake Ontario Waterkeeper, in its intervention, discussed new regulations in the United States (US) regarding closed-cycle cooling. The Commission asked whether the current once-through cooling system would be considered acceptable by the US Environmental Protection Agency (US EPA) in light of new requirements and regulations in the US *Clean Water Act*[9]. CNSC staff responded that the new requirements require performance equivalent to cooling towers for new plants, but do not specifically require that cooling towers be used. CNSC staff noted that the requirements for existing plants will not be finalized until the summer of 2014, but that these requirements are proposed to be an 88% reduction in impingement relative to an onshore surface intake system. CNSC staff added that the Darlington NGS has an offshore submerged intake system with a velocity cap that reduces intake velocity to below the swimming speed of most fish. CNSC staff stated that, based on this information, the once-through cooling system at the Darlington NGS meets the proposed US EPA requirements for existing plants.

45. CNSC staff further explained that entrainment is harder to decrease using retrofit technology; therefore, the US EPA consider a site-specific determination and options analysis in lieu of specific requirements. CNSC staff added that there are many other options besides cooling towers to mitigate entrainment, and if determined appropriate based on EA follow-up monitoring activities, mitigation measures can be identified and implemented through adaptive management.

46. The Commission asked for clarification on the New York State policy concerning fish impingement and entrainment. CNSC staff explained that the New York State policy also requires performance equivalent to cooling towers, but does not require cooling towers themselves. CNSC staff further explained that the policy also requires an assessment of all advantages and disadvantages of cooling towers to ensure the final decision is proportional to the risk. CNSC staff added that this policy lists a number of negative

[9] 86 Stat. 816 (1972).

factors to consider, including the following:

- Visual impacts
- Noise issues
- Fogging and icing
- Salt deposition
- Air quality
- Water loss due to evaporation
- Terrestrial impacts related to construction

47. A representative from OPG added that their reports have identified a number of concerns with cooling towers as well, including the need for a chemical system to manage the water chemistry in the cooling tower, adding to emissions and safety concerns regarding handling of chemicals. OPG added that fogging and icing of the Darlington facility would have an impact on existing equipment, which could cause problems whether from a safety perspective for staff, or an equipment issue on the operation of the facility.

48. Based on the information provided, the Commission agrees with CNSC staff and DFO conclusions and considers that the effects of impingement and entrainment on the aquatic biota are negligible. The Commission is also of the view that the current once-through cooling system is acceptable. The Commission acknowledges OPG's efforts in monitoring the situation and taking measures to minimize the impact of the Darlington operations on fish impingement and entrainment.

Thermal Effects

49. OPG reported that the Darlington NGS discharge diffuser was designed to minimize thermal and flow effects of the discharge, and that various studies and monitoring programs spanning several years, up to the spring 2012, show that the current performance of this system is consistent with the original design expectation and is effective at protecting round whitefish populations.

50. CNSC staff reported that round whitefish was selected as the representative fish species due to its thermal sensitivity, and management and conservation interest by DFO and the Ontario Ministry of Natural Resources. CNSC staff added that round whitefish spawning habitat is unknown in the vicinity of the Darlington site; however, a conservative approach was used in the assessment, assuming spawning could be occurring within the vicinity of the diffuser thermal plume.

51. CNSC staff reported that thermal effects to round whitefish have been identified as a likely adverse residual effect from the project, due to the operation of the once-through cooling water system. CNSC staff and DFO added that the effects have been assessed, concluding that the likely thermal effects to round whitefish are minor in nature and not significant.

52. OPG has committed to monitor thermal effects during continued operation through the adaptive management framework as an element of the follow-up program. CNSC staff reported that, in the event that future monitoring determines increased effects from changing thermal emission, OPG would conduct a review of available thermal discharge mitigation techniques to determine if additional technically and economically feasible opportunities are available to further reduce potential effects.

53. In response to concerns expressed by several intervenors, including Williams Treaties First Nations and Lake Ontario Waterkeeper, on thermal effects from the diffuser at the Darlington NGS, the Commission asked if there were plans to update the Griffith's (1980)[10] study on thermal effects from the diffuser on the aquatic biota, and if this would impact the current analysis. OPG responded that, in winter 2011-2012, they began to repeat the study using the same methodology and approach as Griffith, but with modern laboratory techniques, codes and standards. OPG added that no effects from diffuser operation based on the known performance and thresholds have been assessed to date. OPG confirmed that the results of the new study will be available for the licensing hearing planned for 2014.

54. CNSC staff added that thermal effects on round whitefish eggs have been assessed, concluding that there was no significant adverse effect.

55. CNSC staff reported that, due to the potential impacts of the Darlington NGS on round whitefish, a Round Whitefish Action Plan (RWAP) has been initiated to better understand the population status. As part of the RWAP, CNSC staff and DFO requested OPG to conduct a series of assessments on the potential impact of the diffuser on the survival of round whitefish eggs and larvae. These studies indicate that potential thermal effects would only occur at depths that are on the fringe of known preferred spawning habitat for the round whitefish. Therefore, if there is an effect, it would occur on the very fringe of the preferred spawning habitat and result in a small percentage decrease in the potential spawning success. CNSC staff and DFO do not consider this to be a significant effect.

56. Based on the information provided, the Commission agrees with CNSC staff and DFO conclusion that thermal effects on round white fish are not significant. The Commission also notes that the evaluation of thermal effects will be included in the follow-up program.

Zebra Mussels

57. The Commission asked for more information regarding the issue of the accumulation of zebra mussels affecting the operation of certain cooling systems. An OPG representative responded that OPG was using chlorination in order to manage the zebra mussel issue and maintain the flow of water in its cooling system. The OPG representative noted that OPG continues to monitor this area, and that it works with the Ontario Ministry of the

[10] Griffiths, J.S. 1980. Potential Effects of Unstable Thermal Discharge on Incubation of Round Whitefish Eggs. Ontario Hydro Research Division Report No. 80-140-K.

Environment to ensure that it meets the applicable requirements and regulations.

Surface Water Effects

58. OPG reported that the Darlington NGS currently discharges liquid effluents through discharge diffusers and a stormwater management system, operated under the authority of a Certificate of Approval (now known as Environmental Compliance Approval) issued by the Province of Ontario. OPG added that good industry management practices with respect to storm water management (e.g., erosion and sediment control, secondary containment of storage tanks) and continued diffuser discharge will continue through both the refurbishment and continued operation of the Darlington NGS. Liquid effluents released from the station are monitored and treated as needed to meet the concentration limits required by the provincially-issued Environmental Compliance Approval and Municipal Industrial Strategy for Abatement.

59. CNSC staff reported that, considering good industry management practices, including compliance with current regulatory requirements, no residual adverse effects are expected.

60. CNSC staff added that, given that full characterization of liquid effluent last occurred in the 1990s and has not been repeated, a follow-up program to confirm that there are no residual adverse effects to water quality from liquid effluents is outlined in section 12 of the Screening Report.

61. The Commission agrees with CNSC staff and concludes that no residual effects on surface water are expected from the project.

Hydrogeological Environment Effects

62. OPG reported that, during the refurbishment phase, there is a potential for effects on soil and groundwater quality. OPG added that these potential effects will be mitigated through the development and use of good industry management practices and prescribed protocols for groundwater protection and contaminated soil handling (e.g., spill containment for storage tanks, collection and management of groundwater within excavations, and effluent treatment and management as necessary).

63. In response to concerns by the International Institute of Concern for Public Health regarding the Injection Water Storage Tank (IWST) spill of tritium in 2009 considered by CNSC staff as outside the scope of the EA, CNSC staff reported that the spill in 2009 is part of the baseline conditions for which the project was assessed. CNSC staff added that potential interactions were identified with potentially contaminated groundwater when undertaking excavations in the Protected Area and mitigation measures to deal with this matter were identified. CNSC staff further explained that an environmental site assessment is underway to further define the distribution and extent of contamination of the IWST spill in groundwater, including peak concentrations, and will serve as the basis to determine appropriate mitigating actions.

64. CNSC staff is of the opinion that OPG's monitoring and analysis of the 2009 spill, in combination with the proposed path forward for further characterization, is sufficient to reach a conclusion of minimal risks to nonhuman biota on site and to drinking water supplies off site. Tritium levels measured in groundwater are below generic considerations for the potential of such spills to reach Lake Ontario and impact drinking water.

65. The Commission requests that OPG provide an update on the work completed to characterize the IWST spill in 2009 in support of the Darlington NGS licence renewal with amendments, at the anticipated licensing hearing in 2014.

66. CNSC staff concluded that no residual adverse effects are expected given the implementation of mitigation measures in dealing with effluents, spill prevention, and soil, groundwater and stormwater management.

67. The Commission concludes that, taking into account appropriate mitigation measures, no residual effects are expected on the hydrogeological environment from the project.

Human Health Effects

Radiation Dose to the Public

68. OPG reported that radioactivity in the environment relative to Darlington NGS and its associated dose to humans is monitored through the radiological environmental monitoring program. Dose rate calculations are performed annually for members of the public, and continuously for the monitoring of workers.

69. CNSC staff reported that the dose estimates for members of the critical receptor group[11] that reside in the vicinity of the Darlington NGS represent the maximum realistic impact to humans of radiological emissions from the Darlington NGS. CNSC staff also reported that the total dose calculated for the most exposed critical group (i.e., infant at a dairy farm in Clarington) in 2011 as a result of operation of the Darlington NGS was 0.0006 millisieverts (mSv)/year. This dose is less than 1% of the regulatory limit for members of the public of 1 mSv/year.

70. Some intervenors, including individuals, Citizens for a Safe Environment and the Committee for Safe Sewage, stated that the limit for tritium in drinking water in Ontario is set at 7,000 becquerels per litre (Bq/L), which is higher than in some countries in Europe and the US. Intervenors also stated the 2009 Ontario Drinking Water Advisory Council recommendation that Ontario reduce the limit for tritium in drinking water from 7,000 Bq/L to 20 Bq/L. The Commission sought further information on this matter. CNSC staff responded that the 7,000 Bq/L limit was set by HC, based on a recommendation from the World Health Organization, and corresponds to a dose of 0.1 mSv/year (10% of the

[11] Members of the critical receptor group represent individuals whose location, habits or diet may cause them to receive a higher dose (on average) than individuals in other exposed population groups.

annual dose limit), for an average consumption of two litres per day. CNSC staff further noted that many of the lower limits cited by intervenors were design objectives or screening values used to indicate the possible presence of other radionuclides, rather than regulatory limits.

71. In response to intervenor concerns regarding the concentrations of tritium in drinking water, CNSC staff reported that concentrations of tritium in municipal drinking water sources close to Canadian nuclear facilities vary from 7 Bq/L to 18 Bq/L. The Commission enquired about the levels of tritium in drinking water around the Darlington NGS. CNSC staff responded that the levels are below 10 Bq/L, in the order of 5-6 Bq/L. CNSC staff added that the refurbishment of the Darlington NGS will not change these concentrations and the Ontario Water Drinking Quality Criteria will be respected. CNSC staff further explained that these values are well below both the current Canadian drinking water quality guideline of 7,000 Bq/L and also below the proposed Ontario Drinking Water Advisory Council limit of 20 Bq/L.

72. Families Against Radiation Exposure raised concerns that the International Commission on Radiological Protection (ICRP) model for determining radiation exposure does not adequately consider internal exposures to alpha radiation. The Commission asked for more information on the consideration of internal and external radiation exposure in the ICRP model. CNSC staff explained that a large number of cohort studies and radiation exposed populations to internal and external emitters are considered in the ICRP model. CNSC staff provided examples, such as external gamma radiation data from atomic bomb survivors, and internal radiation data, including radon (an alpha emitter) from the radium dial workers and uranium miners. CNSC staff added that the ICRP also considers internal exposure to tritium, including organically bound tritium.

73. Many intervenors, including individuals, the International Institute of Concern for Public Health, and Families Against Radiation Exposure, expressed concerns about radiation risks, including the potential health effects associated with exposure to radiation. Some intervenors were of the opinion that the existing regulatory limits were too high and others suggested that there is no safe dose of radiation.

74. The Commission asked for more information regarding the regulatory limits for radiation releases and associated health effects. CNSC staff responded that the radiation protection requirements in Canada are based on international requirements and are well within the safe limits of any exposure to radiation. CNSC staff stated that it uses the linear no-threshold (LNT) model as the basis for the dose limits and the ALARA (as low as reasonable achievable) requirements in its *Radiation Protection Regulations*, and noted that doses to workers and members of the public from the operation of the Darlington NGS are well below the regulatory limits. CNSC staff further stated that the regulatory limits are far below levels where health effects have been observed in studies and are protective of all members of the public, including infants. CNSC staff explained that there is a good understanding of the health effects of radiation due to the combination of epidemiological studies of human populations exposed to radiation and laboratory studies on cells and molecules. CNSC staff stated that these studies have shown that health risks

in people exposed to radiation doses of 100 mSv/year or less are low, and that cancer rates in people exposed to these radiation doses have not been observed to be higher than cancer rates from non-radiological causes in the general population. CNSC staff noted that an epidemiological study of 42,000 Canadian nuclear power plant workers found that there is no increased risk to workers, who are more exposed than members of the public, from their radiation exposures.

75. An intervenor raised concerns that the dose conversion and weighting factor for tritium are underestimated in determining the dose to the public and applicable dose limits. The Commission asked for further information on this matter. CNSC staff responded that the dose conversion factor considers physiology and biokinetics, and tritium is well understood as it acts like water in organisms, including humans. CNSC staff further responded that the weighting factor is set by the ICRP. CNSC staff added that recommendations to the ICRP to consider changing the weighting factor have been made, but the ICRP position is that the current weighting factor is protective. CNSC staff noted that research in this area is being co-funded by the CNSC and the French Institute for Radiological Protection and Nuclear Safety, and noted that other organizations are also researching the weighting factor. Therefore, should it be appropriate, the CNSC could change the weighting factor for dose calculations.

76. OPG reported that emissions are not expected to increase beyond current levels during refurbishment or ongoing operation; therefore, the estimated doses for members of the public are not expected to increase beyond current conditions. CNSC staff concurred with OPG that doses to the public are not expected to increase.

77. CNSC staff reported that no adverse effects are predicted to the public as a result of radiation and radioactivity effects from the Project.

78. Based on the above information, the Commission concludes that the health effects to the public from radiation doses received from the Darlington NGS operations are not significant. The Commission notes that acceptable measures are currently in place to minimize the public exposure from radiation emitted by the Darlington NGS.

Psycho-social Effects

79. CNSC staff reported that, in the event of the bounding nuclear accident, psycho-social effects could occur at both the individual and community level, constituting a potential adverse residual effect. Psycho-social effects are described further in paragraph 143 of this document.

Radiation Dose to Workers

80. OPG reported that the radiation protection program at the Darlington NGS complies with CNSC requirements pertaining to radioactive contamination control and radiation safety. Furthermore, all doses are controlled in accordance with the ALARA principle and all occupational doses to Nuclear Energy Workers (NEWs) are monitored through the

dosimetry program.

81. CNSC staff added that OPG's radiation protection program protects workers from all radiological hazards and includes recent enhancements regarding alpha monitoring and control. These new enhancements will protect workers during the removal of reactor components where workers may be exposed to alpha radiation.

82. The International Institute for Concern for Public Health noted an event that occurred during the refurbishment of Bruce Power's Bruce A NGS where workers were unexpectedly exposed to alpha radiation, and questioned whether the lessons learned from this event had been applied at other nuclear generating stations. The Commission asked for more information concerning the protection of workers for outage work and the implementation of lessons learned from this event. An OPG representative responded that OPG uses planning, as well as training plans and procedures, to ensure that the workers have that operating experience for maintenance outages or any significant work. An OPG representative noted that one key lesson learned was to rehearse the work in advance of working on the unit. Regarding the above-noted alpha event in particular, CNSC staff stated that the CNSC developed requirements that were implemented by each power reactor licensee.

83. OPG reported that collective dose to workers during refurbishment activities will be higher than during continued operations. OPG added that some increased dose may result during periods of major maintenance activities, for example, if steam generators were to be replaced.

84. The Commission also asked for more information regarding the tracking of dose information for workers. CNSC staff responded that the dose is monitored and tracked for every individual worker of nuclear facilities in Canada, including contract workers, and sent to HC's National Dose Registry. CNSC staff noted that the long-term monitoring data is also analyzed and used for health studies.

85. CNSC staff reported that the radiation doses to NEWs at the Darlington NGS are known to be well below the regulatory limits of 50 mSv in any one year and 100 mSv over 5 years. The average individual doses to workers in 2008 and 2009 were 1.2 and 1.5 mSv, respectively. CNSC staff added that the same overall regulatory compliance will be the case during project activities.

86. CNSC staff is of the view that the maximum annual doses to individual workers during refurbishment and continued operations are expected to be below regulatory limits.

87. Based on the information provided, the Commission concludes that proper measures are currently in place to minimize radiation exposures to the workers at the Darlington NGS.

Conventional Health and Safety

88. OPG stated that the goal of its conventional safety program is to ensure that workers work

safely in a healthy and injury-free workplace by managing the risks associated with the activities, products and services of OPG's operations. OPG noted that it reduces risks by following operational controls that were developed using risk assessment and safe work planning. OPG further stated that it has two Joint Health and Safety Committees that work to identify and recommend solutions to health and safety problems in the workplace. OPG explained that it evaluates all conventional safety-related events through its corrective action process to identify potential trends and areas for improvement. OPG also provided information regarding its occupational health and safety performance, noting that it had only two lost-time injuries between May 2008 and March 2012.

89. CNSC staff reported that OPG's conventional health and safety program, as well as its implementation, were compliant with the *Canada Labour Code*[12]. CNSC staff noted that the CNSC and the Ontario Ministry of Labour signed a Memorandum of Understanding in July 2011 to establish a formal mechanism for cooperation and for the exchange of information and technical expertise related to their respective areas of jurisdiction, such as occupational health and safety practices at nuclear facilities. CNSC staff further stated that OPG's performance regarding occupational health and safety has exceeded regulatory requirements.

Environmental Monitoring and Reporting

90. OPG stated that its radiological environmental monitoring program includes both radiological and hazardous substances monitoring. OPG explained that its program is designed to measure environmental radioactivity and radiation in the vicinity of the Darlington NGS. OPG explained that environmental samples for air and liquids are collected from various onsite and offsite locations and tested, and that data from the program are used to assess public doses.

91. The Commission enquired about OPG's implementation of the updated CSA standard N288.4-10, *Environmental Monitoring Programs at Class I nuclear facilities and uranium mines and mills*[13]. CNSC staff responded that, while OPG currently has an acceptable radiological environmental monitoring program in place at the Darlington NGS, OPG had to conduct a review and gap analysis of the requirements for the updated N288.4-10 before it could be implemented. CNSC staff noted that it accepted OPG's implementation plan and that OPG is expected to have its first environmental monitoring program report compliant with N288.4-10 in 2014.

92. The Commission asked for more information on monitoring of foodstuffs. CNSC staff explained that monitoring of foodstuffs, such as milk, vegetables and meat, is conducted and considered in terms of public dose. The OPG representative added that information on the sampling locations is provided on their Web site, as well as the annual Radiological Environmental Monitoring Report which lists all of the types of samples that are collected

[12] R.S.C., 1985, c.L-2
[13] Canadian Standards Association, N288.4-10 - *Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills*, 2010.

and analyzed. The OPG representative explained that most doses to wildlife are determined by modelling based on samples of vegetation and other contributing pathways. This information is then used to determine the impact on public dose.

93. The Darlington Nuclear Community Advisory Council, in its intervention, stated that OPG monitors produce from local gardens as part of its radiological environmental monitoring program. The Commission asked if the community receives the data from this program. The Darlington Nuclear Community Advisory Council confirmed that it receives the environmental reports from OPG.

94. In response to an intervenor requesting OPG to test fish and plants for organically bound tritium (OBT), the Commission asked whether current monitoring considers OBT in fish and plants. A representative from OPG confirmed that OPG does sample for OBT in the radiological environmental monitoring program, and OBT is considered in calculating the dose to the public. The OPG representative added that the radiological environmental monitoring report and the EIS, which also includes information on OBT, are available on the OPG Web site. CNSC staff reported that OBT is measured in fish for human consumption and for dose to non-human biota, and the values observed in 2009 range from 14 Bq/L to 37 Bq/L in fish tissue. CNSC staff added that the assessment of effects to non-human biota, such as fish, considered OBT and concluded that no adverse effects are expected.

95. The Commission requested information on the establishment of levels of radiation allowed in foodstuffs. CNSC staff explained that there are regulations that set the levels of radionuclides that are acceptable in food. The Food and Agricultural Organization of the United Nations has guidelines for levels of radionuclides in different foodstuffs which are not legal limits, but are adopted by countries and regulators for different purposes. CNSC staff added that HC has guidelines on restriction of radioactivity in food and water in Canada, and levels are also set for emergency scenarios. CNSC staff added that the International Atomic Energy Agency and the European Commission are discussing bringing consistency across nations.

96. The Commission asked for more information on allowable levels of radiation in foodstuffs during emergencies, in response to the submission by the National Farmers Union Waterloo Wellington Local. CNSC staff reported that the Provincial Nuclear Emergency Response Plan (PNERP) describes the responsibilities for monitoring the impacts on food following a severe nuclear accident. This includes the responsibility of the Ministry of Agriculture, Food and Rural Affairs to prepare plans with the Canadian Food Inspection Agency to provide information to farmers and food processors for the initial stages of an emergency. As well, prior to an emergency, they must plan and prepare ingestion control measures, and assist in the preparation of plans and procedures for province wide monitoring. The PNERP addresses ingestion control measures within the Secondary Zone (out to 50 km).

97. The National Farmers Union Waterloo Wellington Local, in its intervention, raised concerns regarding monitoring of foodstuffs following a nuclear accident. The

Commission asked for information concerning monitoring of foodstuffs following a nuclear accident. CNSC staff reported that, with respect to food safety following a nuclear accident, there are limits on the acceptable level of radioactivity in foods which have been derived by HC to protect the public from health risks associated with radiation exposure. These limits are referred to as action levels and represent a threshold above which foods and water should be withdrawn from sale or distribution and substituted from the diet. The Canadian Food Inspection Agency (CFIA) is responsible for monitoring and enforcing these limits for food safety by restricting the sale of radioactively contaminated foods to the public. The limits for radionuclides in public drinking water are to be enforced by provincial, territorial and municipal governments following a nuclear emergency.

98. CNSC staff reported that they are currently working with HC to update allowable levels of radiation in foodstuffs during emergencies, and will report to the CNSC on the status of this initiative in 2014.

99. In response to the National Farmers Union Waterloo Wellington Local concerns regarding monitoring of imported and exported foodstuffs, the Commission asked for clarification on the responsible authority for foodstuffs entering Canada. CNSC staff responded that Canadian Border Services Agency and CFIA are responsible for monitoring and would request CNSC assistance when necessary. CNSC staff added that, in an emergency, the provincial emergency response plan calls for a monitoring group comprised of both provincial ministries and federal departments, such as CFIA and HC.

100. The Commission asked for information on reporting requirements to the CNSC. CNSC staff explained that the licence has release and reporting limits which are protective of the workers, the environment and the public. CNSC staff further explained that release limits for radionuclides are based on a 1 mSv/year regulatory dose limit for a member of the public. CNSC staff added that the licensee must also establish action levels and administrative levels that are fractions of the health limits for potential health effects. CNSC staff explained that reporting to the CNSC takes place when an action level is exceeded as it is an indication of potential loss of control of the program, and the CNSC will investigate and ensure corrective actions are in place. CNSC staff reported that the dose to members of the public, the most critical individual, which is an infant living close to the facility, has remained constant and is at 0.0006 mSv/year, a fraction of the regulatory dose limit.

101. Based on the information provided, the Commission concludes that the environmental monitoring programs in place are acceptable, and that the regulations in place effectively protect the public against unreasonable radiation exposure through contaminated food.

Health Studies

102. Some intervenors, including Sierra Club Canada and Ontario Chapter, and the Canadian Association of Physicians for the Environment, cited studies, such as the German KiKK[14] study, suggesting that there is an increased risk of leukemia in children living around nuclear power plants. The Commission asked for more information regarding this matter. CNSC staff responded that the study only observed a cluster of childhood leukemia around the Krümmel power plant. CNSC staff explained that an expert committee had reviewed the study and determined that there was no relationship between the cluster of childhood leukemia near the Krümmel power plant and radiation exposure, noting that other childhood leukemia clusters were identified in areas that were not near nuclear power plants. CNSC staff added that the KiKK study made no statements regarding the cause of the observed increase in cancer rates and the study concluded that the observed increase risk of cancer remains unexplained. CNSC staff further explained that the reassessment indicated that living in an urban or rural region had a greater impact on the incidence of childhood leukemia and the increased incidence was not related to radiation dose.

103. CNSC staff added that the incidence of radiation and childhood leukemia is well known, and the studies completed to date indicate that a fairly significant exposure (10 to 20 mSv to a foetus in utero according to Brenner et al.[15]) is required to see an increased incidence of childhood leukemia. CNSC staff reported that, around the Darlington NGS, the average yearly dose to a member of the public is only 0.0006 mSv/year.

104. The Commission asked for an explanation regarding links between the German KiKK study and the French Geocap[16] study. CNSC staff responded that the French study repeated the methodology from the German KiKK study by looking at cancer, including childhood leukemia, with distance from the nuclear power plants. The Geocap study also found a relationship between distance from a nuclear power plant and childhood luekemia. However, the study also considered radiation dose. CNSC staff further explained that the French study concluded that, when radiation dose was considered, no relationship between childhood leukemia and radiation dose from the nuclear power plant was observed.

105. The Commission asked whether other studies have been completed, and what the results of these studies indicate. CNSC staff responded that other studies have been completed in Finland[17] and Switzerland[18] where, unlike the German KiKK study, individuals were tracked to determine residency in the region. Neither the Finnish study nor the Swiss

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[14] Kaatsch et al. (2008a). Childhood Leukemia in the Vicinity of Nuclear Power Plants in Germany. Dtsch Arztebl 105(42): 725–732. .

[15] Brenner et al. (2003). Cancer risks attributable to low doses of ionizing radiation: assessing what we really know. Proc Natl Acad Sci USA. Nov 25;100(24):13761-6.

[16] Sermage-Faure et al. (2012). Childhood leukemia around French nuclear power plants – the Geocap study, 2002-2007. Int J Cancer. 131(5):E769-80.

[17] Heinavaara et al. (2010). Cancer incidence in the vicinity of Finnish nuclear power plants: an emphasis on childhood leukemia. Cancer Causes Control 2010;21(4):587-595.

[18] Spycher et al. (2011). Childhood cancer and nuclear power plants in Switzerland: a census-based cohort study. Int J Epidemiol. 40:1247-60.

study found any relationship between distance to a nuclear power plant and childhood leukemia. CNSC staff added that international studies have found no evidence that there is an increased incidence in childhood leukemia related to radiation doses from nuclear power plants. This statement is supported by the 14th Committee on Medical Aspects of Radiation in the Environment[19] report in the U.K. that completed a reassessment of all the studies on this topic and came to the same conclusion.

106. The Commission asked if health information was available for the Region of Durham. The Medical Officer of Health for the Region of Durham provided an overview of several studies that had been conducted in the Region of Durham, noting that they did not find any significantly elevated rates of childhood cancers or childhood leukemia. The Medical Officer of Health for the Region of Durham provided information on a 2007 ecological study[20] of the Region of Durham that looked at 18 types of cancer, five types of congenital anomalies and still births at certain time periods around the start-up of the Pickering NGS and Darlington NGS. A public health epidemiologist from the Region of Durham stated that the results of the 2007 study did not indicate any significantly elevated rates of cancer, specifically childhood cancers, including leukemia. The Medical Officer of Health for the Region of Durham commented that there are many factors within a population, such as socioeconomic status, that can affect health.

107. The Canadian Association of Physicians for the Environment also indicated in their intervention that a study conducted in the United Kingdom (U.K.) by Wakeford et al.,[21] estimated that 20 percent of cases of children with leukemia in the U.K. is attributed to background radiation. The Commission asked for more information on this study. CNSC staff responded that the study did not actually study children in the U.K. but used the LNT model, used to calculate dose limits, to predict how many childhood leukemia cases could be estimated in the U.K. based on the Atomic Bomb survivors. CNSC staff added that the LNT model is effective in designing radiation protection and ALARA programs, but international organizations, including the ICRP as well as CNSC staff, agree that the model is not appropriate to estimate the number of cancers in individuals that are exposed to low doses. CNSC staff concluded that this is demonstrated by a recent assessment of 42,000 Canadian nuclear power plant and Atomic Energy of Canada Limited workers, who are more exposed to radiation than members of the public and which concluded that there is no relationship between cancer incidence and dose.

108. The International Institute of Concern for Public Health raised concern that the 2005 International Agency for Research on Cancer (IARC) 15-Country study[22] and the

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[19] Committee on Medical Aspects of Radiation in the Environment (COMARE). (2011). Fourteenth Report. Chairman: Professor A Elliott. Health Protection Agency. ISBN 978-0-85951-691-4.
[20] Durham Region Health Department (2007). Radiation and Health in Durham Region 2007. Whitby, Ontario: The Regional Municipality of Durham.
[21] Wakeford et al. (2009). The proportion of childhood leukaemia incidence in Great Britain that may be caused by natural background ionizing radiation. Leukemia. 23(4):770-6.
[22] International Agency for Research on Cancer (IARC). (2005). Cancer risk following low doses of ionising radiation – a 15-country study. IARC, Lyon, France.

Zablotska et al.,[23] study (based on the Canadian cohort included in the IARC study) showed an increase risk in cancer for NEWs. The Commission asked for further information on these findings. CNSC staff responded that an independent research scientist found that dose information from the HC National Dose Registry was missing in these studies. CNSC staff added that a re-analysis was completed taking into consideration the missing dose information. A summary report[24] is available on the CNSC Web site and a scientific paper has been submitted for publication in a peer reviewed journal. The summary report[25] concluded that, for approximately 42,200 NEWs there was no increase in risk of solid cancer mortality due to occupational radiation exposures; however, a group of 3,088 Atomic Energy of Canada Limited NEWs, first employed before 1965 (1956-1964), showed an increase risk of solid cancer mortality. The re-analysis found outstanding issues with the dose records for the Atomic Energy of Canada Limited cohort, and noted that follow-up epidemiological study will be undertaken once the dose data is corrected.

109. The Commission asked for clarification regarding an intervention that reported an increased incidence of thyroid cancer in children in Japan following the Fukushima events. CNSC staff responded that the Fukushima Prefecture reports cited by the intervenor clearly state that there has been no effect on children thyroids as a result of the Fukushima accident. CNSC staff explained that one report in September 2012 found no effects from the Fukushima accident after testing 80,000 children's thyroids in the Fukushima Prefecture. CNSC staff added that another report dated December 1, 2012 shows normal rates of thyroid cysts in Fukushima children compared to Tokyo.

110. Based on the information provided during the hearing, including the health studies discussed during the course of this hearing, and the Commission's understanding of studies conducted by the United Nations Scientific Committee on the Effects of Atomic Radiation[26] and other international and peer-reviewed scientific publications and research, the Commission is satisfied that the existing regulatory limits are protective of all members of the public, including infants. The Commission is satisfied that that there is no increased risk to a member of the public and workers from radiation exposure resulting from the operation of a nuclear power plant, including the Darlington NGS.

Atmospheric Effects

111. OPG reported that additional traffic during the refurbishment phase will contribute to increased potential for dust and noise. OPG added that a pro-active program of mitigation measures with a focus on proven good industry management practices (e.g., use of dust suppressants, cleaning road surfaces of soil tracking, proper equipment maintenance and

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[23] Zablotska et al. (2004). Analysis of mortality among Canadian Nuclear Power Industry Workers after chronic low-dose exposure to ionizing radiation. Radiation Research. 161: 633-641.
[24] Canadian Nuclear Safety Commission. (2011). Verifying Canadian Nuclear Energy Worker Radiation Risk: A Reanalysis of Cancer Mortality in Canadian Nuclear Energy Workers (1957-1994) - Summary Report (INFO-0811).
[25] Information confirmed in CNSC INFO document (INFO-0811) after the completion of the hearing.
[26] United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) 2008. United Nations. Effects of Ionizing Radiation. 2006 report to the General Assembly, with scientific annexes.

noise muffling) will serve to ameliorate potential effects on air quality and noise during refurbishment and continued operation.

112. CNSC staff reported that all of the predicted air concentrations from refurbishment and continued operation are well below applicable limits. CNSC staff added that the noise level increase during refurbishment is predicted to not be measurable and, during continued operation, noise levels would be comparable to baseline conditions. CNSC staff concluded that no residual adverse effects on air quality and noise are expected.

113. In response to Sierra Club Canada and Ontario Chapter's concern on transboundary air pollution, a representative from EC responded that the Canada-US Air Quality Agreement (AQA) would only apply to the Darlington NGS Refurbishment and Continued Operation EA if the emissions were changing from what was previously occurring at the facility. The representative from EC confirmed that the emissions profile would not change as a result of the project and would therefore not trigger a notification under Article 5 of the Canada-US AQA.

114. In response to Sierra Club Canada and Ontario Chapter's concern on EC's interpretation of the Canada-US AQA, the Commission requested EC to submit their interpretation in writing. EC submitted their interpretation as CMD 12-H13.214 on December 5, 2012, and concluded that the changes to current emissions resulting from refurbishment activities and continued operation of the Darlington NGS will not be at levels that would trigger notification under the AQA.

115. The Commission provided an opportunity to all intervenors to respond to the submission by EC. Sierra Club Canada and Ontario Chapter submitted a supplemental CMD 12-H13.2A, concluding that EC failed to provide adequate disclosure and production of information concerning their interpretation, and requested the opportunity to make further submissions when new and relevant information is provided.

116. The Commission is satisfied that, based on the information presented during the hearing and CMD 12-H12.214 submitted by EC, the refurbishment and continued operation of the Darlington NGS will not trigger notification under the AQA.

117. Several intervenors, including individuals and Durham Nuclear Awareness, questioned the validity of OPG's monitoring results and expressed the need for independent, third-party monitoring. The Commission enquired about this issue. Representatives from HC and the Ontario Ministry of Labour (MOL) confirmed that their organizations do conduct independent monitoring in the environment around the Darlington NGS site, and that the information is published on an annual basis. The Commission asked if the information, including real-time monitoring results, could be made more readily available to the public. Representatives from HC and the MOL responded that they would be looking into the possibility of making the information more readily available. CNSC staff noted that the CNSC has started an independent monitoring program and plans to put monitoring information on the CNSC Web site. CNSC staff noted that it would work with the MOL and HC.

118. The Commission agrees with CNSC staff and concludes that no residual effects on air quality and noise are expected. The Commission considers that the atmospheric monitoring programs in place are sufficiently independent. The Commission invites CNSC staff, the MOL and OPG to make the monitoring information more readily available to the public.

Non-human Biota Effects

119. OPG reported that an ecological risk assessment (ERA) was completed that evaluated the impacts on non-human biota of chemicals and ionizing radiation associated with the refurbishment and continued operation of the Darlington NGS. The ERA concluded that there was minor evidence of elevations in some risk factors, but the exposures were such that an adverse effect on the ecological populations would be unlikely.

120. CNSC staff reported that all risk factors are well below threshold values, indicating that there will be no adverse effects to ecological receptors exposed to radionuclide releases. CNSC staff added that the assessment of effects to non-human biota also considered the cumulative effects associated with the Darlington New Nuclear Power Plant Project.

121. The Commission agrees with CNSC staff that no adverse effects on non-human biota are expected.

Conclusion on Effects of the Project on the Environment

122. Based on its review of the Screening Report and the above-noted information and considerations, the Commission concludes that the proposed project, taking into account the identified mitigation measures, is not likely to cause significant adverse environmental effects.

Effects of the Environment on the Project

123. CNSC staff reported that they had considered a range of credible physical hazards and their potential influence on the performance of project activities, as well as the potential for these hazards to damage the Darlington NGS and cause adverse effects on the environment. The physical hazards that were identified include: flooding, severe weather (tornadoes, tropical cyclones, thunderstorms, hail storms, and freezing rain), and seismic-related events (e.g., earthquakes, seismic-induced tsunamis). CNSC staff considers the probability of occurrence of any such events to be low. As discussed in section 8.0 of the proposed Screening Report, the reactors, as well as other important safety systems and structures, are designed to limit the consequences of such events, reducing the potential that the environment would have effects on the project that would, in turn, adversely affect the environment.

124. CNSC staff reported that further detailed examination of physical hazards is also being

undertaken as part of the ongoing Integrated Safety Review (ISR) process for the Darlington NGS against current codes and standards for all potential external hazards.

125. CNSC staff also reported that they had considered a range of credible natural hazards that may interact with the once-through cooling water system. The natural hazards that were identified include the presence of invasive mussels, attached algae, fish, ice and silt. Mitigation measures include the implementation of a semi-continuous chlorination program to reduce invasive mussels, and the screen house debris system to deal with mussel shell build up, algae and fish impingement. Additionally, taking into consideration the design and location of the condenser cooling water system, ice and silt are not expected to affect the project.

126. CNSC staff noted that the potential effects of climate change on the project were also considered. The climate change parameters that may have an interaction with the Darlington NGS physical structures and systems include precipitation, extreme weather events and Lake Ontario water temperature and water level. CNSC staff concludes that, in spite of possible changes to the climate in the future, none of the climate change parameters would have an effect on the physical structures or systems that would result in a risk to either the public or the environment.

127. The Commission asked NRCan for clarification on the largest possible magnitude of earthquake expected at the Darlington NGS. A representative from NRCan explained that engineers and seismic hazard specialists consider shaking level, which has been defined for the Darlington NGS as approximately 0.3g[27], corresponding to a magnitude 6 earthquake 15 km away, or a magnitude 7 earthquake 35 km away. The NRCan representative stated that the seismic hazard assessment includes an earthquake as large as magnitude 7.5.

128. Some intervenors raised concerns about severe earthquakes exceeding the Darlington NGS design value. The Commission asked for more information on the standards or criteria that are used regarding seismicity when building a nuclear facility. A representative from OPG stated that the N289.1 CSA standards, related to seismic requirements of nuclear power plants, are used in Canada, and were updated recently. The OPG representative added that the Darlington NGS was originally built to the old standard of a 10^{-3} seismic qualification (the strength of an earthquake with a probability of occurrence of 10^{-3}); and that even at the new standard of 10^{-4} seismic qualification, the Darlington NGS could withstand the earthquake, keeping the reactor safe. The representative from OPG explained that all new structures proposed for the refurbishment will be built to the new standard. CNSC staff confirmed that OPG completed a seismic probabilistic safety assessment, concluding that Darlington NGS is seismically qualified.

129. In response to an intervenor concern regarding the magnitude of earthquakes appearing to increase, the Commission asked if there was any supporting evidence. A representative from NRCan stated that no evidence has been observed that indicates the rate of natural

[27] g is defined as the acceleration due to earths gravity. Peak ground acceleration is expressed in g.

earthquakes is increasing in the Darlington area; however, there does appear to be an increase in the Eastern United States. The representative of NRCan stated that, due to improvements in earthquake monitoring, there may be a perception that the number of earthquakes is increasing.

130. Based on the above information, the Commission concludes that the environment is not likely to cause significant adverse effects on the project, taking into consideration design and operational measures to prevent or reduce potential effects.

Effects of Accident and Malfunction Events

131. OPG reported that the EIS considered credible conventional and radiological / nuclear-related accidents and malfunctions.

132. CNSC staff informed the Commission about their assessment of possible environmental effects of accidents and malfunctions. CNSC staff added that they had considered credible scenarios of such events, identified available means to prevent or mitigate the possible effects, and determined the significance of any residual effects.

133. Overall, for malfunctions and accidents, CNSC staff and DFO conclude that the effects from the project are not significant.

134. The potential accidents or malfunctions identified by CNSC staff at the Darlington NGS site are the following:

- Conventional (non-radiological) malfunctions and accidents, which are events that involve only non-radiological substances with no potential for a release of radioactivity. Taking into consideration the implementation of mitigation measures, no adverse residual effects were identified.
- Radiological malfunctions and accidents, which are events that involve radioactive components (e.g., processing, handling and storing nuclear wastes; removal and preparation of steam generators for transportation) and the potential for release of radioactivity. Taking into consideration the implementation of mitigation measures, no adverse residual effects were identified.
- Transportation accidents, which are those malfunctions and accidents related to the off-site transportation of low and intermediate-level radioactive wastes. No measurable environmental effect is anticipated; therefore, no residual adverse effects were identified.
- Out-of-core criticality accidents, which are those malfunctions and accidents that involve criticality events outside of the reactor core which may result in an acute release of radioactivity to the environment. No plausible accidents and malfunctions that warrant further consideration have been identified given that storage and handling of fresh or spent fuel bundles outside the reactor core will be subcritical under normal and credible abnormal conditions.

- Nuclear accidents, which are events that are assumed to involve the operation of the reactor and may involve damage to the fuel bundles and/or the reactor core and which could result in an acute release of radioactivity to the environment.

A summary of the accident and malfunction scenarios, including appropriate mitigation measures, is provided in section 7 of the proposed Screening Report.

Conventional Malfunctions and Accidents

135. OPG reported that conventional accident events were deemed credible if they exhibited a 5% or greater probability of occurrence over the life of the project. The bounding credible accident scenarios assessed in detail included spills of fuel into Lake Ontario, spills of transformer oil and hydrazine on land, and a fuel oil storage tank explosion and fire. Taking into account the preventative and mitigation measures and emergency response capability onsite, the assessment concluded that the credible conventional events evaluated are unlikely to cause long-term or residual adverse effects. CNSC staff concurred with OPG.

Radiological Malfunctions and Accidents

136. OPG reported that potential radiological accident events that could occur during the project were screened to identify bounding scenarios that could reasonably be expected to result in potential adverse effects, taking into consideration prevention and control features to pre-empt the occurrence, as well as mitigation measures available to address the possible effects. OPG added that this evaluation conservatively established that any associated radiation doses to workers, the public and non-human biota would be well below the applicable regulatory limits and, consequently, will not result in significant residual effect. CNSC staff concurred with OPG.

Transportation Accidents

137. OPG reported that off-site transportation-related accidents involving radioactive waste materials were evaluated, taking into account OPG's record of safe transport of radioactive shipments and the applicable regulatory regime. OPG stated that extensive mitigation measures are in place to prevent a release of radioactivity resulting from a transportation accident involving a shipment of low or intermediate-level waste. OPG further noted that all 6 transportation accidents that occurred over the last 35 years were minor and there were no releases to the environment due to the robustness of the packaging and the other precautions taken to ensure the safety of workers and members of the public. Because of the well-demonstrated history of safe transportation of radioactive waste materials, OPG does not anticipate that a measurable environmental effect will result from a transportation accident.

138. CNSC staff confirmed that transportation accident scenarios were not assessed in detail given the robust regulatory framework for the transportation of radioactive materials and OPG's program for managing this matter.

139. Some intervenors expressed concerns regarding the transport of used nuclear fuel. The Commission asked for more information on this subject. An OPG representative responded that OPG performs a limited number of used fuel transfers each year to facilities operated by Atomic Energy of Canada Limited. The OPG representative stated that each transport is performed safely, in accordance with regulatory requirements. CNSC staff noted that the transportation of nuclear material is regulated by the CNSC under the *Packaging and Transport of Nuclear Substances Regulations*[28].

Out-of-core Criticality Accidents

140. CNSC staff reported that natural uranium or depleted uranium in fresh or spent fuel bundles cannot sustain nuclear chain reactions in air or in light water. Therefore, there is no criticality concern during storage and handling of natural or depleted uranium fuel bundles. CNSC staff concluded that storage and handling of fresh or spent fuel bundles outside the reactor core will be subcritical under normal and credible abnormal conditions, and there are no plausible accidents and malfunctions that warrant further consideration.

Nuclear Accidents

141. CNSC staff reported that, based on the approved Scoping Information Document, nuclear malfunctions and accident events with potential off-site consequence that have a frequency greater than 1×10^{-6} occurrences per year were identified for consideration in the EA. The nuclear accident sequence selected to bound the estimated radiological release was a spontaneous pipe rupture in the Heat Transport System inside containment. CNSC staff reported that the accident would result in a delayed release (1.5 days) of noble gases through a filtered air discharge system for a prolonged duration, resulting in an individual dose at 1 km from the release point of 5.7 mSv to a member of the public, without taking into consideration mitigation measures. CNSC staff added that this dose is within the Emergency Management Ontario (EMO) emergency response, and in accordance with the Protective Action Levels in the PNERP, sheltering may be required up to 3 km from the release point. CNSC and DFO staff concluded that, given the relatively low magnitude, limited spatial extent and low duration, and implementation of appropriate mitigation and follow-up measures, no significant residual adverse effects were predicted.

142. OPG reported that three nuclear accident scenarios were identified as having a frequency greater than 1×10^{-6} per year. OPG added that at no point is the dose predicted to exceed the Provincial Protective Action Level for evacuation for the bounding nuclear accident. OPG explained that a thorough review of the safety of the plant currently in place and the

[28] SOR/2000-208.

improvements planned as part of refurbishment was included in the EA. No residual effects on individuals, the population within 100 km, or non-human biota present in the environment as a result of nuclear accidents were identified. CNSC staff concurred with OPG.

143. CNSC staff stated that, should a nuclear accident occur, socio-economic effects (i.e., psycho-social) could occur at both the individual and community level. The severity and duration of these effects would be related in part to the length of time the protective actions were in place and the amount of radiation released from the Darlington NGS site. CNSC staff added that, given the relatively low magnitude, limited spatial extent and low duration, psycho-social effects are possible in the short term, but not generally of concern to the public provided OPG implements mitigation measures that would likely enable the community to return to normalcy and lessen the likelihood of long-lasting effects. Mitigation measures could include regular publication of radiation monitoring results, an information centre providing information regarding issues such as decontamination activities, repairs to the reactor, or any anticipated changes to emergency response and alerting procedures. CNSC staff noted that no significant residual adverse effects were predicted from this scenario given the proposed mitigation measures.

144. The Commission asked for clarification on how a probability of occurrence of 1×10^{-6} is selected for EA purposes. CNSC staff explained that a probability of occurrence of 1×10^{-6} is a modern international[29] standard threshold in EAs, corresponding to a safety goal for a new power reactor. CNSC staff added that the proposal for accidents that may occur as defined in the CEAA was first made in 1999 for the Pickering A Return to Service EA with what are called "design basis accidents". CNSC staff added that, at a minimum, design basis accidents are ones that may occur; however, in nuclear safety, it is necessary to go beyond what was then regarded as the standard of 1×10^{-5}. CNSC staff went to 1×10^{-6}, considered "beyond design basis accidents". CNSC staff concluded that by going to 1×10^{-6}, this includes an order of magnitude beyond the accidents that the station is designed to experience.

145. The Commission asked whether the EA took into consideration the ISR and the Fukushima Lessons Learned. CNSC staff responded that the analysis conducted for the EA took into consideration the installation of safety enhancements identified in the ISR and Fukushima Lessons Learned, as this accurately reflects the post refurbishment operations of Darlington. A representative from OPG noted that four new Safety Improvement Opportunities (SIOs) features, to be completed before refurbishment, are the following:

- A containment filtered venting system;
- A third emergency power generator (a seismically qualified generator);
- Improvements to the power house steam venting system; and
- An emergency heat sink (an alternate and independent supply of water as an

[29] International Atomic Energy Agency INSAG-12; "Basic Safety Principles for Nuclear Power Plants 75-INSAG-3 Rev.1", INSAG-12, IAEA, Vienna, 1999.

emergency heat sink).

The OPG representative added that some Fukushima improvements, such as the new portable equipment, were not considered in the EA, but have been and continue to be implemented nonetheless.

146. In response to concerns raised by Greenpeace regarding the inclusion of SIOs in the EA, the Commission asked for clarification on how the SIOs would affect the probability of occurrence of 1×10^{-6} used in the EA. CNSC staff stated that emergency measures, such as the SIOs, are considered mitigation measures if there is an off-site release, hence they were taken into consideration in the EA. CNSC staff added that the EA bounding scenario considered the Darlington NGS post-refurbishment; thus, upgrades to safety systems identified in the ISR and the Fukushima Task Force report were taken into consideration. CNSC staff added that these improvements decreased the frequency of certain accidents, and the EA assessed a representative accident with a probability of occurrence of 1×10^{-6}. CNSC staff further noted that the EA is only a planning tool and that work under the ISR will continue. Lessons learned from Fukushima will also continue to be implemented. CNSC staff added that, under the EA follow-up program, there is a requirement for CNSC to verify and confirm that the mitigation measures will be implemented.

147. In response to Greenpeace's concerns regarding malfunction and accident events with a probability of occurrence less than 1×10^{-6}, the Commission asked what additional work and information will be completed as part of the licensing process before the licensing hearing planned for 2014. CNSC staff explained that, in terms of accidents beyond those in the EA, there is a licensing requirement that the ISR will consider severe accident and malfunction scenarios with a lower probability of occurrence than 1×10^{-6}, considered beyond design basis, in accordance with Regulatory Document RD-360, *Life Extension of Nuclear Power Plants*[30]. CNSC staff added that several deterministic analyses, independent of the probability of occurrence, are completed to ensure defence in depth against unknown accidents or malfunctions beyond 1×10^{-6}. CNSC staff explained that the Integrated Implementation Plan (IIP) will ensure improvements identified in the ISR and EA follow-up actions are implemented. CNSC staff confirmed that the IIP, planned to be presented in the anticipated licensing hearing in 2014, will address the mitigation measures, both in the physical design and in the emergency management programs.

148. CNSC staff further explained that the Fukushima action plan does not consider frequency or probability, thus implementation of the action plan will also include integration of the enhancements to the emergency response plan. CNSC staff added that the expectation is that, under licensing, OPG is obligated to ensure implementation of the IIP and revise emergency management measures in coordination with EMO.

149. When assessing the preparedness of the station to deal with events that could potentially exceed their design bases, OPG identified several areas where additional measures would provide further protection and additional assurance that public safety would not be

[30] CNSC Regulatory Document RD-360, *Life Extension of Nuclear Power Plants*, February 2008.

compromised. Examples of these initiatives include:

- Opportunities for improvement to flood protection have been identified and implemented;
- Improved instructions have been provided to operations staff for events resulting in loss of coolant in the irradiated fuel bays;
- Severe Accident Management Guidelines that provide direction to assist operators in managing extreme events where cooling functions may be compromised have been implemented;
- Emergency Mitigation Equipment that can supply emergency electrical power and cooling has been procured; and
- The installation schedule of additional hydrogen mitigation has been accelerated. Passive autocatalytic recombiners are being installed at all Darlington NGS units during planned shutdowns with completion planned for 2014.

OPG expressed its commitment to the safe operation of its nuclear generating stations and intends on continuing to review information and experience from the Fukushima event to ensure that all lessons learned are implemented in a timely manner.

150. The Commission, in response to intervenor concerns, requested clarification on how multi-unit stations are considered in the assessment of accidents and malfunctions. CNSC staff responded that CNSC safety goals are stated in terms of events per reactor year, therefore, for multiple unit stations, the impact from adjacent units is taken into consideration. OPG added that the safety systems at Darlington NGS have the capability to respond to single unit and multiple unit accidents. CNSC staff noted that multiple unit accidents were considered in the probabilistic safety assessment, but had a lower probability of occurrence than 1×10^{-6}. However, they are being considered under the Fukushima Task Force.

151. In response to intervenor concerns, including Greenpeace and the Canadian Environmental Law Association, that the EA did not consider equivalent accident and malfunction scenarios to Fukushima, CNSC staff reported that the probability of occurrence of a Fukushima scenario was lower than 1×10^{-6}, therefore was considered outside the scope of this EA. CNSC staff added that, based on the findings of the Fukushima Task Force, actions are being carried out under the authority of the NSCA and its associated *General Nuclear Safety and Control Regulations*[31]. The Commission is satisfied with CNSC staff's response, and notes that accidents and malfunctions beyond the scope of the EA are addressed in the *Record of Proceedings, Including Reasons for Decisions* in the matter of OPG's Application to Renew the Power Reactor Operating Licence for the Darlington NGS, released February 26, 2013.

152. A number of intervenors, including Greenpeace, raised concerns regarding EMO's letter requesting that the CNSC consider malfunction and accident scenarios with a probability of occurrence of 1×10^{-7}. The Commission asked for an explanation concerning EMO's

[31] SOR/2000-202.

letter to CNSC staff regarding the inclusion of a multi-unit failure scenario and a scenario with a probability of 1 x 10^{-7} in the EA. CNSC staff clarified that EMO did not request the EA to consider 1 x 10^{-7} events, but requested that the EA consider the same type of accident that was considered in the Pickering refurbishment EA. CNSC staff added that the approach to accident and malfunction scenarios was identical, using a probability of 1 x 10^{-6} in both EAs. CNSC staff explained that, due to the four SIOs, the representative accident at Darlington for a probability of 1 x 10^{-6} was different than Pickering. CNSC staff further explained that multi-unit failures and the associated emergency response planning are action items currently being undertaken under the Fukushima Task Force. CNSC staff added that they met with EMO in November 2012 to discuss how the issues raised are fully addressed within the regulatory framework, not just the EA, but moving forward in terms of the Fukushima lessons learned and the refurbishment. EMO staff confirmed that they were satisfied with CNSC staff's response.

153. The Commission asked for more information on the environmental effects of a more severe accident, notwithstanding it is considered outside the scope of the EA. CNSC staff responded that, under licensing, it is currently identifying safety improvements. CNSC staff further explained that it would be feasible to take these improvements into consideration and assess the health and environmental consequences of a more severe accident. CNSC staff added that the World Health Organization published a report in 2012 on the Fukushima accident, and that the United Nations Scientific Committee on the Effects of Atomic Radiation is due to submit an independent report to the General Assembly in April 2013. CNSC staff, because of public concern, agreed to provide an information document or equivalent assessing health and environmental consequences of more severe accident scenarios discussed by intervenors and intends on updating the Commission on this topic in fall 2013.

154. Several intervenors, including individuals, Greenpeace and the Canadian Environmental Law Association, expressed concerns regarding the emergency response in the event of a severe accident that may necessitate an evacuation beyond the 10-km Primary Zone. The Commission asked for more information on this subject from the Durham Emergency Management Office (DEMO) and EMO. A representative from DEMO stated that the plan that is in place for the 10-km zone could be expanded as necessary, noting that the structure in place to respond to emergencies includes response centres, police services and traffic management. A representative from EMO noted that the existing PNERP is flexible and includes plans for sheltering, evacuation and the distribution of potassium iodide (KI) pills. The EMO representative stated that it would be reviewing the lessons learned from the Fukushima accident to ensure that changes are made to the PNERP, if necessary. CNSC staff confirmed that, in addition to the formal plans for an evacuation in a defined emergency planning zone of 10 km, the PNERP also explicitly considers provisions for a 20-km evacuation, if necessary.

155. The Municipality of Clarington, in its intervention, expressed support for OPG's emergency planning. The Commission asked the Municipality representatives to elaborate on this position. The representative for the Municipality of Clarington responded that information is available to the community, including public education events, and noted

that a public alerting system is in place and tested regularly. The representative for the Municipality of Clarington also noted the importance of training. The Regional Municipality of Durham expressed similar views, noting its support for OPG and the existing emergency response plans for the region. The representative for the Regional Municipality of Durham explained that the existing plans in place include measures for evacuation and public alerting.

156. The Commission notes that a number of intervenors raised concerns that the EA did not consider evacuations in response to an emergency. The Commission is satisfied that emergency planning was sufficiently considered as it pertains to the bounding nuclear accident scenario assessed in the EA, noting that sheltering may be considered under the PNERP, but evacuation would not be triggered. The Commission also notes that emergency planning beyond the scope of the EA, relating to evacuation, was addressed in the *Record of Proceedings, Including Reasons for Decisions* in the matter of OPG's Application to Renew the Power Reactor Operating Licence for the Darlington NGS, issued February 26, 2013.

Conclusion on Accident and Malfunction Events

157. Based on the above information and considerations, the Commission concludes that sufficient measures are in place to ensure that conventional, radiological, transportation, out-of-core criticality, and nuclear accidents are not likely to cause significant adverse effects on the environment.

Cumulative Effects

158. OPG informed the Commission that two meetings of the Darlington Planning and Infrastructure Information Sharing Committee had been held to discuss the project with a specific focus on any potential cumulative effects. OPG stated that they continuously receive feedback from the public and stakeholders, and that one of the raised areas of interest includes cumulative effects. OPG representatives stated that no significant issues or concerns had been raised.

159. With respect to non-human biota, OPG informed the Commission that the EA studies included an ERA and evaluation of the impacts of chemicals and ionizing radiation associated with the past, current and continued operation of Darlington NGS, including the potential cumulative effects. The results of the assessment have shown that existing conditions on the site do not pose an ecological risk, and that observed minor elevations in toxicity reference values were such that an adverse effect on the ecological populations would be unlikely. The same had been determined for cumulative ecological risk associated with the continued operation of the Darlington NGS and the combined future operation of the Darlington NGS and Darlington New Nuclear Power Plant Project.

160. CNSC staff reported that the residual effects of the project were assessed together with other past, proposed and existing projects and activities in the area to determine the

cumulative effects of the project. The cumulative effects assessment is presented in section 9 of the proposed Screening Report. CNSC staff noted that cumulative effects can only occur for environmental components for which residual effects have been identified, not including accident and malfunction scenarios. Residual adverse effects from the Darlington NGS Refurbishment and Continued Operation EA were identified for the aquatic environment, resulting from impingement and entrainment losses, and potential residual thermal effects on round whitefish embryo survival associated with continued operation of the once-through cooling water system.

161. CNSC staff added that the main sources of cumulative effects for the project resulted from the following:

- Darlington NGS operation (pre-refurbishment operations in parallel with refurbishment outages);
- Darlington New Nuclear Power Plant Project operation;
- PNGS operation;
- St. Marys Cement operation; and
- Operation and expansion of other municipal water treatment and pollution control plants.

162. CNSC staff concluded that adverse effects of the impingement and entrainment losses associated with the once-through cooling water intakes and other industrial/municipal water intakes is not measurable for aquatic life at the population level. CNSC staff also concluded that thermal contributions from other industrial/municipal water users are likely negligible given the low intake flows when compared to the current and future nuclear generating stations. Impingement and entrainment losses, as well as thermal effects on aquatic life, are discussed in paragraphs 30-56 of this document.

163. CNSC staff concluded from the results of the assessment that potential cumulative effects are not likely to cause significant adverse environmental effects, taking into consideration the implementation of mitigation measures identified in the proposed Screening Report.

164. Based on the information received, the Commission concludes that, taking into account the identified mitigation measures, significant adverse cumulative effects are not expected to occur as a result of the project.

Follow-Up Program

165. A follow-up program under CEAA is a program to verify the accuracy of the EA of a project and to determine the effectiveness of any measures taken to mitigate the adverse environmental effects of the project.

166. OPG informed the Commission that a key feature of their approach to the follow-up program would be an adaptive management framework that would incorporate

measurement metrics and performance thresholds suitable for the sensitivity and nature of the measured parameters (e.g. impingement, entrainment, etc.). The aim of such an approach would be to respond appropriately to changing conditions in the environment as determined through systematic monitoring for change and effects, based on selected performance measurement thresholds. OPG added that this follow-up program would be finalized in cooperation with other stakeholders, would complement other operational monitoring programs as well as focusing on confirming and responding to the suitability and effectiveness of mitigation measures.

167. OPG further informed the Commission that the follow-up program would include pre-project monitoring elements to establish EA baseline conditions and elements intended specifically to improve the understanding of the environmental impact of the project. Two monitoring campaigns were scheduled to be performed before the shutdown of the first unit to be refurbished. The first, completed in 2011-2012 after the EIS submission, was monitoring of water temperature and warm water plume characteristics associated with the cooling water discharge and possible effects on aquatic habitat and biota. The second one, targeted for 2013-2014, includes entrainment mortality monitoring associated with the Darlington NGS cooling water intake.

168. As per subsection 38(1) of the CEAA 1992, CNSC and DFO, as RAs, consider that a follow-up program for this project is appropriate in the circumstances and delegate the design of the follow-up program (as per subsection 17(2) of the CEAA 1992) to OPG. Details of the program will be developed in consultation with CNSC and DFO staff, and other expert agencies as appropriate. The program and any results will be shared with Aboriginal groups and other stakeholders as appropriate. The CNSC licensing and compliance programs and the DFO authorization process will be used as the mechanisms for ensuring the proper final design and implementation of the follow-up program activities and for the reporting of results should this project proceed to licensing under the NSCA or authorization under the *Fisheries Act*.

169. Follow-up programs for the following environmental components have been identified for the Darlington NGS Refurbishment and Continued Operation EA:

- Surface water (liquid effluents and stormwater quality);
- Aquatic environment (impingement, entrainment and thermal effects);
- Malfunctions and accidents (safety improvement opportunities); and
- Effects of the environment on the project (liquefaction potential of fill materials).

In addition, adaptive management plans have, under the EA follow-up, been identified for impingement and entrainment to aquatic biota and thermal effects to round whitefish.

A summary of the follow-up program activities, including the adaptive management plans, are provided in section 12 of the proposed Screening Report.

170. CNSC staff added that the CNSC licensing and compliance programs would be used as the mechanisms for ensuring the proper final design, implementation and reporting of

results of follow-up program activities and adaptive management plans, if the Commission proceeds to consideration of a licence amendment under subsection 24(2) of the NSCA.

171. The Commission is satisfied that the proposed scope of the follow-up program will be adequate for verifying and, if necessary, identifying where additional mitigation measures may be required during the project implementation.

Conclusions on the Likelihood and Significance of Adverse Environmental Effects

172. Based on the considerations and reasons noted above, the Commission concludes that the proposed project is not likely to cause significant adverse environmental effects, taking into account the identified mitigation measures.

173. The Commission is satisfied that the likelihood and significance of the effects have been identified with reasonable certainty.

Aboriginal Consultation

174. The common law Duty to Consult with Aboriginal communities and organizations applies when the Crown contemplates actions that may adversely affect established or potential Aboriginal or treaty rights. The CNSC ensures that all its EA decisions under the CEAA uphold the honour of the Crown and consider Aboriginal peoples' potential or established Aboriginal or treaty rights pursuant to section 35 of the *Constitution Act*, 1982.

175. CNSC staff provided information concerning the Aboriginal consultation activities it conducted for the Darlington NGS Refurbishment and Continued Operation EA in conjunction with OPG's licence renewal application and the licence application for the Darlington Waste Management Facility. CNSC staff explained that, upon receipt of the licence applications from OPG, CNSC staff conducted research that led to a preliminary list of Aboriginal groups that may have an interest in the EA and licensing decisions.

176. CNSC staff reported that the following engagement activities with the 18 identified Aboriginal groups and organizations outlined in CMD 12-H13 have been undertaken with respect to the EA:

- Notification letter regarding the EA, sent early July 2011;
- Copy of the draft Scoping Information Document, requesting their comments, sent in late July 2011;
- Notification letter regarding the opportunity for participant funding for participation in the EA, sent in January 2012;
- Information package on the EA and OPG's applications related to the Darlington NGS, including the licence renewal application and the licence application for the DWMF, sent April 2012; and

- Copy of the draft Screening Report, requesting their comments, sent in June 2012.

177. CNSC staff noted that the Williams Treaties First Nations applied for and were granted funding under the CNSC Participant Funding Program.

178. CNSC staff reported that, in July 2012, CNSC staff met with representatives of the Williams Treaties First Nations to discuss the draft Screening Report and the two licence renewal applications. CNSC staff added that the Williams Treaties First Nations was the only Aboriginal group to submit comments on the draft Screening Report.

179. The Williams Treaties First Nations raised issues regarding: traditional knowledge, fish impingement and entrainment, groundwater, physical and cultural heritage, Aboriginal interests, malfunctions and accidents, and follow-up. CNSC staff explained that a disposition table addressing all concerns raised can be found in Appendix B of the Screening Report. CNSC staff added that no other comments from Aboriginal groups were received.

180. OPG reported that a project notification letter was sent to identified Aboriginal groups on November 24, 2010 seeking to discuss the project, the EA process and how traditional knowledge could inform the EA work. OPG added that three EA Project Update letters were sent to the same Aboriginal groups at key stages in the EA and prior to Community Information Sessions.

181. OPG stated that information sessions were conducted on the following dates:

- May 21, 2010 with representatives from the Metis community;
- November 24, 2011 with representatives from Alderville and Scugog Island First Nations; and
- April 11, 2012 with representatives from Scugog Island First Nation

182. OPG reported that a number of concerns have been expressed to date and OPG responded directly to these concerns as they were raised. OPG also worked to address concerns regarding archaeological work on the Darlington site and to follow-up on inquiries regarding the inclusion of traditional knowledge.

183. The Mississaugas of the New Credit First Nation, in their intervention, expressed the desire to further build its relationship with both the CNSC and OPG and to be engaged in meaningful consultation on future licence applications. The Commission asked about the existing communications between the Mississaugas of the New Credit First Nation and OPG. An OPG representative responded that OPG has met with the Mississaugas of New Credit First Nation a number of times and provided information regarding its projects. The OPG representative noted OPG's commitment to continue to develop their relationship.

184. The Commission enquired about the CNSC's consultation with the Mississaugas of New Credit First Nation. CNSC staff responded that it had interacted with them and provided

information on OPG's activities, as well as on the CNSC's Participant Funding Program. The Commission asked the Mississaugas of New Credit First Nation why they did not apply for participant funding. The Mississaugas of New Credit First Nation explained that it has a limited ability to go through all of the paperwork in its office and that it had been occupied with other matters. CNSC staff noted that there would be further opportunities for participation in future hearing processes related to the Darlington NGS, and stated that it would continue to engage Aboriginal groups on these matters. CNSC staff further stated that it would continue to look for ways to improve its consultation activities.

185. The Commission asked if the CNSC has a straightforward way of informing Aboriginal groups and members of the public of its upcoming hearings and the deadlines associated with participation in these hearings, including funding. CNSC staff responded that there is information on the CNSC Web site and noted that all interested parties can subscribe to receive electronic notices from the CNSC. CNSC staff noted that it would follow-up with the Mississaugas of New Credit First Nation on this matter.

186. CNSC staff stated that it would continue to engage with and provide all the identified Aboriginal groups with project information. CNSC staff will also update the Commission at the hearing for the next licence renewal in 2014 of any subsequent discussions or issues raised.

187. CNSC staff stated that no adverse impacts to established or potential Aboriginal and treaty rights associated with the EA have been identified by Aboriginal groups contacted.

188. Based on the information provided to the Commission in the Screening Report and the evidence submitted during the hearing, the Commission is satisfied that the consultation process followed in this particular instance provided Aboriginal groups sufficient information on the project and opportunities to participate in the hearing process to express their views and concerns on the project. The Commission encourages CNSC staff and OPG to continue to enhance their consultation with Aboriginal groups and peoples. The Commission is satisfied that the consultation process followed for this project was adequate to meet duty to consult requirements and concludes that the project is not likely to have any adverse impacts on potential or established Aboriginal or Treaty rights.

Public Consultation

189. CNSC staff reported that the Darlington NGS Refurbishment and Continued Operation EA represents the first EA for which CNSC participant funding has been provided since the coming into force of the provision in the NSCA in 2010. A Funding Review Committee, independent from the CNSC, was established to review funding applications received, and make recommendations on the allocation of funds to eligible applicants. Based on the recommendations of the Funding Review Committee, the CNSC awarded a total of $107,778.40 funding to:

- International Institute of Concern for Public Health

- Williams Treaty First Nations
- Lake Ontario Waterkeeper
- East Toronto Youth Nuclear Group
- Northwatch
- Durham Nuclear Awareness

190. A notice of availability of the draft Screening Report and draft Scoping Information Document were posted on the CNSC Web site and the Canadian Environmental Assessment Registry, and e-mailed to all subscribers on the CNSC subscription list.

191. CNSC staff provided a 30-day public review and comment period on the draft EA Scoping Information Document initiated in July 2011. CNSC staff reported that, in response to public comments received on the draft Scoping Information Document, CNSC staff increased the public review period for the draft Screening Report from 30 to 45 days.

192. CNSC staff solicited public comments on the draft Screening Report for a 45-day review period starting on June 4, 2012. The draft Screening Report was sent directly to federal authorities, relevant provincial authorities, participant funding recipients, Aboriginal groups and was available at the Oshawa, Bowmanville and CNSC libraries.

193. CNSC staff reported that fifteen requests for the draft Screening Report were received, in addition to those parties that received the document directly. Nineteen different groups or individuals submitted comments on the draft Screening Report. CNSC staff reported that input received from these consultations was considered in the EA process.

194. Issues raised during the public review and comment period on the draft Screening Report included, but are not limited to: nuclear malfunctions and accidents; malevolent acts; emergency management; Fukushima-related matters; steam generator replacement; the consideration of the IWST spill in 2009; transboundary effects; concrete integrity; human health effects from radiation; aquatic effects; feasibility of cooling towers; long-term waste management; socio-economic effects; as well as the EA process conducted.

195. CNSC staff added that all comments received have been dispositioned in Appendix B of the proposed Screening Report and addressed in the document as appropriate. Furthermore, these issues were discussed during the course of the hearing and some responses have been documented in this *Record of Proceedings, Including Reasons for Decision*.

196. OPG reported that a specific Communication and Consultation Program was developed for the EA to enhance opportunities for the public and stakeholders to obtain information, provide comments and input, and to identify and discuss any concerns. OPG stated that all areas of concern were addressed as they were raised, either directly, in writing, or through the EIS and technical support documents.

197. CNSC staff noted that the EIS and supporting technical study documents and other related

information were also posted on OPG's Web site regarding the EA.

198. The East Toronto Youth Nuclear Group, in its intervention, presented the results of a survey it had conducted to gauge youth's awareness of the Darlington NGS. The East Toronto Youth Nuclear Group stated that it found that youth are generally not well-informed about nuclear power and the operations at the Darlington NGS but had a desire to learn more about this subject and other energy issues. The Commission noted the results of the survey and asked for more information regarding OPG's engagement of youth. OPG responded that it has a number of activities to engage with schools in the community, including grade-specific educational programs for the Ontario curriculum. OPG noted that it also has an active Web site and uses social media, and stated that it would continue to look for ways to improve its communication with youth. The Darlington and Pickering Nuclear Advisory Councils, in their interventions, expressed support for OPG's public information program.

199. OPG reported that community information sessions in Bowmanville, Newcastle, Courtice and Oshawa were conducted in June 2011 to provide an update to community residents with preliminary results from the EA studies, solicit public feedback and inform residents about details of the project.

200. CNSC staff added that OPG provided funding to the Municipality of Clarington and the Region of Durham to enable them to undertake independent, technical peer reviews of the EIS and ensure that municipal concerns were addressed.

201. Based on the information provided in the Screening Report and during the hearing, the Commission is of the view that there was sufficient opportunity for the public to be informed and express its views on the project.

Nature and Level of Public Concern

Long-term Waste Management Strategy

202. A number of intervenors, including Northwatch and the Canadian Coalition for Nuclear Responsibility, expressed their concerns that long-term waste management was not included in the EA. CNSC staff reported that the plan for the long-term storage of nuclear waste is outside of the scope of the EA. CNSC staff added that the Nuclear Waste Management Organization (NWMO) is responsible for the implementation of Adaptive Phased Management, Canada's plan for the safe, long-term care of used nuclear fuel. With respect to consultation and public involvement related to the NWMO's Adaptive Phase Management, the CNSC is committed to operating with a high level of transparency. Engaging stakeholders, including Aboriginal peoples, early and in advance of submissions for proposed new nuclear projects through a variety of consultation opportunities ensures effective dialogue and information sharing.

Steam Generators

203. In response to concerns raised by the International Institute of Concern for Public Health, the Commission requested further information on the replacement of the steam generators. CNSC staff responded that, as a precautionary measure and to have an EA that is inclusive, OPG has included potential steam generator replacement in the current EA. CNSC staff added that the effects of steam generator replacement were considered in the Screening Report, and an accident scenario concerning the steam generator activity was considered by OPG in their EIS. However, this scenario was not advanced for detailed analysis as it was deemed to be bounded by other scenarios.

204. CNSC staff reported that, based on current assessments of the continued fitness for service for the steam generators, OPG concluded that the steam generators should last to the end of extended station life. A representative from OPG explained that steam generators are monitored at every outage for existing degradation mechanisms that are known to occur in steam generators around the world. Monitoring for new degradation mechanisms is also conducted.

Malevolent Acts

205. Intervenors, including Northwatch and the International Institute of Concern for Public Health, raised concerns regarding malevolent acts not being assessed in the EA. CNSC staff reported that there is no requirement under the CEAA to consider malevolent acts. The consideration of malevolent acts as part of the Darlington New Nuclear Power Plant Joint Review Panel was the first of its kind. CNSC staff observed that the consideration of malevolent acts was done at a fairly high level due to the prescribed nature of most of the information.

206. CNSC staff added that a thorough consideration of malevolent acts and facility specific-design does occur through the CNSC's licensing and compliance processes. The CNSC, in conjunction with other federal authorities, has developed a Design Basis Threat assessment for all Canadian nuclear power plants, which is augmented with site specific information. This Design Basis Threat is updated whenever new intelligence information warrants a change. Licensees are required to provide security measures which effectively counter the Design Basis Threat at all times. Similar to Severe Accident Management Guidelines, Beyond Design Basis Threat events are also considered and mitigated. Regular CNSC compliance inspections confirm licensee security measures and readiness. All specific security information is prescribed by Regulation and cannot be discussed in an open forum.

Nuclear Liability Act

207. Several intervenors, including individuals, Greenpeace, Bruce Peninsula Environment Group, County Sustainability Group Prince Edward County, Physicians and Scientists for a Healthy World and the Provincial Council of Women in Ontario, expressed the view that the current maximum liability amount of $75 million in the *Nuclear Liability Act*[32]

[32] R.S.C., 1985, c. N-28.

would not be sufficient to cover the costs of a severe accident. The Commission asked for more information concerning the *Nuclear Liability Act*. A representative from NRCan provided an overview of the *Nuclear Liability Act*, explaining that the purpose of the legislation is to clarify the liability and compensation regime in the event of a nuclear accident. The NRCan representative stated that the *Nuclear Liability Act* establishes that the operator, in this case OPG, would be absolutely liable for any damages associated with the accident. The NRCan representative acknowledged the concerns from intervenors that the amount of $75 million was not consistent with the liability limits in other countries, and stated that the legislation was under review. The representative from NRCan noted that, although recent attempts to pass new legislation were not successful due to prorogation and the dissolution of Parliament, NRCan was in the process of preparing new recommendations for consideration in Parliament. A representative from OPG expressed support for NRCan's efforts to revise the *Nuclear Liability Act*.

Concrete Integrity

208. Some intervenors, including individuals and Sierra Club Canada and Ontario Chapter, expressed concerns regarding the possible degradation of concrete in the reactor structures, particularly due to an alkaline silica reaction. The Commission asked for more information on this matter. OPG stated that the alkaline silica reaction was known at the time of the construction of the Darlington NGS and, as such, the silica that could cause this reaction was not used. OPG noted that it regularly inspects the concrete and stated that no degradation has been detected to date.

209. CNSC staff stated that the alkaline silica reaction is a well-known degradation mechanism, which was observed in Hydro-Québec's Gentilly-II NGS, and noted that the CNSC currently has an ongoing research project further examining its effects. CNSC staff explained that this is one of the reasons that licensees must be compliant with Regulatory Document RD-344, *Aging Management for Nuclear Power Plants*[33], and CSA standard N287.7, *In-service examination and testing requirements for concrete containment structures for CANDU nuclear power plants*[34]. CNSC staff added that it is satisfied that OPG conducts regular inspections and testing of concrete, and that it is confident that the Darlington NGS does not exhibit any symptoms or any signs of degradation.

210. In response to intervenor concerns, the Commission asked if concrete inspection results are available. CNSC staff confirmed that regular, type-2 inspections are completed and the results are available. CNSC staff added that, every few years, more in depth testing is completed and includes pressure testing of structures, core sampling, and various non-destructive testing.

211. The Commission asked for more information concerning aging management for containment structures, including the vacuum building. An OPG representative responded

[33] CNSC Regulatory Document RD-334, *Aging Management for Nuclear Power Plants*, June 2011.
[34] Canadian Standards Association, N287.7-08 - *In-service examination and testing requirements for concrete containment structures for CANDU nuclear power plants*, 2008.

that OPG conducts ongoing inspections and tests to ensure that containment structures, components, equipment and seals are not deteriorating. OPG's representative noted that, if any degradation were identified, OPG would conduct further investigation to determine what actions would be needed to address the issue.

212. The Commission asked, assuming an application for refurbishment, if additional engineering data about the status of the concrete throughout the plant can be provided in 2014. CNSC staff confirmed that, for 2014, a full analysis of the soundness of the concrete can be included.

St Marys Cement

213. Some intervenors, including Williams Treaties First Nations and individuals, also had concerns regarding induced seismicity from fracking and blasting at the St Marys Cement (St Marys) quarry that neighbours the Darlington Nuclear site. The Commission asked for more information on this matter. The representative from NRCan stated that, in general, while induced seismicity may increase the frequency of small seismic events, it would not increase the severity. Regarding fracking, CNSC staff stated that the seismic events would be less than a magnitude-2 earthquake. CNSC staff noted that, unlike other provinces such as New Brunswick, there were no known resources along Lake Ontario that would result in the development of such an industry utilizing fracking in Ontario.

214. The Commission asked for more information concerning the operation of the St Marys quarry. A representative from OPG responded that OPG has a formal agreement in place with St Marys to ensure that St Marys operations do not result in ground movement greater than three millimetres per second, and noted that St Marys' current operations do not approach that level. The OPG representative further noted that the ground movement would have to be 10 times or more greater than three millimeters per second before it could have any effect on the operation of the Darlington NGS.

Referral to Joint Review Panel

215. In their submissions, a number of intervenors requested that the EA for this project be elevated from an EA Screening to a review by a joint review panel. Intervenors raised concerns that a joint review panel would be more technically rigorous, and would include an evaluation of "need for and alternatives to" the project.

216. During the hearing, the Commission asked for clarification regarding the difference between the EA Screening undertaken for this project, which included presentation of the Screening Report to the Commission for determination, and a review panel under the provisions of the CEAA 2012, and whether a referral is possible under the new CEAA 2012. CNSC staff responded that an assessment under a panel review would not have changed the depth of the technical assessment that was conducted by OPG, nor the depth of the technical assessment and reviews that were done by CNSC staff, DFO and other federal expert authorities. CNSC staff added that, in accordance with the requirements under the CEAA 1992, the "need for and alternatives to" the project are optional for EA

Screenings, and was not considered part of the scope of factors for this particular project, consistent with past refurbishments EAs. CNSC staff further explained that these factors have been removed from the CEAA 2012 and would no longer be considered should the review be done by a joint review panel.

217. CNSC staff further explained that, under the CEAA 2012, the transitional provisions provide that, for an EA Screening commenced under the former Act, if the project is a designated project under the new Act, then the EA is to be continued and completed as if the former Act had not been repealed. For projects that are not designated projects under the new law, then the Minister of the Environment, under section 124(2) of the CEAA 2012, had the authority to, and did in fact designate the Darlington NGS EA to be continued as an EA Screening under the CEAA 1992.

218. CNSC staff added that, under the CEAA 2012, the CNSC is the RA for all projects that are regulated under the NSCA and that under the new CEAA 2012, the Minister of the Environment cannot refer "to a review panel the EA of a designated project for which the responsible authority is" the CNSC. More specifically, CNSC staff mentioned that, considering the provisions of section 38 of the CEAA 2012, the Minister cannot refer nuclear matters to a review panel and that an EA of this project, conducted under the requirements of the new CEAA 2012, would be undertaken by the CNSC as the RA and the Commission would then be tasked with making the EA determination.

219. The Commission is of the opinion that the EA Screening process was the appropriate process to fully assess the environmental effects of this project. Based on the information provided in the Screening Report and during the hearing, the Commission is of the view that there was sufficient opportunity for the public to be informed and express its views on the project. The Commission is satisfied that the public concerns raised during the EA process, including during the public hearing, have been adequately addressed. The Commission considers that the remaining concerns are of a nature that does not warrant a referral of the project to the Minister of the Environment for his referral to a review panel or mediation. The Commission is satisfied that the remaining issues can be addressed in the follow-up program and consideration of the future licence amendment application. The Commission therefore decides not to refer the project to the Minister of the Environment for referral to a review panel or mediator under paragraph 20(1)(*c*) of the CEAA.

CONCLUSION

220. The Commission concludes that the environmental assessment Screening Report attached to CMD 12-H13 is complete and meets all of the applicable requirements of the *Canadian Environmental Assessment Act*.

221. The Commission concludes that the project, taking into account the appropriate mitigation measures identified in the Screening Report, is not likely to cause significant adverse environmental effects.

222. Furthermore, the Commission also concludes that, at this time, it will not request the federal Minister of the Environment to refer the project to a review panel or mediator in accordance with the provisions of the CEAA.

223. Therefore, the Commission, pursuant to paragraph 20(1)(*a*) of the CEAA, can proceed with the consideration of a licence amendment under the *Nuclear Safety and Control Act* which, if approved, would allow the project to proceed.

M. Binder

MAR 1 3 2013

Michael Binder
President,
Canadian Nuclear Safety Commission

Date

Appendix A – Intervenors

Intervenors	Document Number
Sierra Club Ontario, represented by C. Elwell; K. Jackson and B. Cheng	CMD 12-H13.2
Tim Seitz	CMD 12-H13.3
Canadian Environmental Law Association, represented by T. A. McClenaghan	CMD 12-H13.4
Canadian Association of Nuclear Host Communities, represented by L. Thompson, Mayor of the Municipality of Port Hope	CMD 12-H13.5
Canadian Association of Physicians for the Environment, represented by Dr C. Vakil	CMD 12-H13.6 CMD 12-H13.6A
Laura Moyihan	CMD 12-H13.7 CMD 12-H13.7A
Durham Nuclear Health Committee	CMD 12-H13.8
Environmental Earth Angels	CMD 12-H13.9
Marilyn McKim	CMD 12-H13.10
Don and Heather Ross	CMD 12-H13.11
Whitby Chamber of Commerce	CMD 12-H13.12
Carlene Jimenez	CMD 12-H13.13
County Sustainability Group	CMD 12-H13.14
Emilio Antonio Aljure	CMD 12-H13.15
AECL's Port Hope Area Initiative Management Office	CMD 12-H13.16
Rick Norlock, MP, Northumberland-Quinte West	CMD 12-H13.17
Julie Lamb	CMD 12-H13.18
Green Party of Saskatchewan	CMD 12-H13.19
Darlene Buckingham	CMD 12-H13.20
Brenda Thompson	CMD 12-H13.21
Timothy Law	CMD 12-H13.22
Ajax-Pickering Board of trade	CMD 12-H13.23
Municipality of Kincardine, represented by Mayor L. Kraemer	CMD 12-H13.24 CMD 12-H13.24A
The Firehouse Youth Centre	CMD 12-H13.25
Pickering Nuclear Community Advisory Council, represented by J. Vincett, J. Dike, D. Shier, P. Mattson, J. Sarley, J. Earley	CMD 12-H13.26
Michelle Xuereb	CMD 12-H13.27
Joanna Bruszewski and her grandchildren	CMD 12-H13.28
Big Brothers Big Sisters of Clarington	CMD 12-H13.29
Municipality of Clarington Represented by Mayor A. Foster and G. Weir	CMD 12-H13.30 CMD 12-H13.30A
Ysabeault d'Valar-Alba	CMD 12-H13.31
Monica Whalley	CMD 12-H13.32 CMD 12-H13.32A
Dan Rudka	CMD 12-H13.33

Jessica Rowland	CMD 12-H13.34
Jill Lennox	CMD 12-H13.35
Jack Murphy	CMD 12-H13.36
Carrie Lester	CMD 12-H13.37
The Valleys 2000 (Bowmanville) Inc.	CMD 12-H13.38
Nadine Hawkins	CMD 12-H13.39
Melita Fernandes	CMD 12-H13.40
Mike Darmon	CMD 12-H13.41
William and Edith Shore	CMD 12-H13.42
Karen Lock	CMD 12-H13.43
James M. Ker	CMD 12-H13.44
Harry Blundell	CMD 12-H13.45
Lilly Noble	CMD 12-H13.46
Frank Farrell	CMD 12-H13.47
Barbara J. Moore	CMD 12-H13.48
Larraine Roulston	CMD 12-H13.49
Eryl Court	CMD 12-H13.50
Linda and Gord Hicks and Family	CMD 12-H13.51
Shane Mulligan	CMD 12-H13.52
Tony McQuail	CMD 12-H13.53
Dan Holtl	CMD 12-H13.54
Tania Gill	CMD 12-H13.55
Renee Cotton	CMD 12-H13.56
Andrea Peloso	CMD 12-H13.57
Clarington Board of Trade and Office of Economic Development, represented by S. Hall	CMD 12-H13.58
Bruce Power, represented by F. Saunders	CMD 12-H13.59 CMD 12-H13.59A
University of Ontario Institute of Technology, represented by M. Owen and G. Bereznai	CMD 12-H13.60
Provincial Council of Women of Ontario, represented by G. Janes	CMD 12-H13.61
Citizens for a Safe Environment and The Committee for Safe Sewage, represented by K. Buck and D. Done	CMD 12-H13.62
Chaitanya Kalevar	CMD 12-H13.63
Raymond Leistner	CMD 12-H13.64
Jo Hayward-Haines	CMD 12-H13.65
Eclipsall Energy Corporation, represented by D. Archer	CMD 12-H13.66
Lake Ontario Waterkeeper, represented by J.Bull and E. Rotenberg	CMD 12-H13.67
Andrei Neacsu	CMD 12-H13.68
Jen Mooney	CMD 12-H13.69
Mary McGillis	CMD 12-H13.70
Rabeya Alam	CMD 12-H13.71
Paul Courey	CMD 12-H13.72
Karen Kwok	CMD 12-H13.73

Erika Tran	CMD 12-H13.74
Port Hope and District Chamber of Commerce	CMD 12-H13.75
Don Chisholm	CMD 12-H13.76
Community Living Oshawa-Clarington	CMD 12-H13.77
Norm and Donna Boychuk	CMD 12-H13.78
Power Workers' Union, represented by B. Walker	CMD 12-H13.79 CMD 12-H13.79A
Canadian Nuclear Workers Council, represented by D. Shier, J. Usher and C. Leavitt	CMD 12-H13.80 CMD 12-H13.80A
Women in Nuclear-Canada, represented by C. Cottrill and J. Donegan	CMD 12-H13.81
Deborah Cherry	CMD 12-H13.82 CMD 12-H13.82A
Organization of CANDU Industries, represented by R. Oberth	CMD 12-H13.83 CMD 12-H13.83A
Robert C. Azzopardi	CMD 12-H13.84
Bhavnita Shah	CMD 12-H13.85
Candu Energy, represented by F. Yee and B. Pilkington	CMD 12-H13.86
Mark Reid	CMD 12-H13.87
The Regional Municipality of Durham, represented by G. Cubitt	CMD 12-H13.88
Ontario Ministry of Labour, represented by W. Ng	CMD 12-H13.89
Durham College	CMD 12-H13.90
Jenny Carter	CMD 12-H13.91
Braven R. Corby	CMD 12-H13.92
Michelle Bode-Simeunovich	CMD 12-H13.93
Robin Penney	CMD 12-H13.94
Peter Tabuns, MPP, Toronto-Danforth	CMD 12-H13.95
Rotary Club of Courtice	CMD 12-H13.96
Rick Maltese	CMD 12-H13.97
Don Weitz	CMD 12-H13.98
Marc Green	CMD 12-H13.99
St. Marys Cement (Canada)	CMD 12-H13.100
Rhea Baluyut	CMD 12-H13.101 CMD 12-H13.101A
Jennifer Deguire	CMD 12-H13.102
John O'Toole, MPP, Durham	CMD 12-H13.103
Marina Moudrak	CMD 12-H13.104 CMD 12-H13.104A
Ontario Clean Air Alliance	CMD 12-H13.105
Michael O'Morrow	CMD 12-H13.106
Kimberly L. Townley-Smith	CMD 12-H13.107
Fred Twilley	CMD 12-H13.108 CMD 12-H13.108A
FullCircle Energy Solutions Inc., represented by C. Young	CMD 12-H13.109

	CMD 12-H13.109A
Families Against Radiation Exposure, represented by D. Kelly	CMD 12-H13.110
Hamish Wilson	CMD 12-H13.111
Paul Gasztold	CMD 12-H13.112
Jurgen Schmutz	CMD 12-H13.113
Harold Fassnacht	CMD 12-H13.114
Kelly Carmichael	CMD 12-H13.115
Alison J. Petten	CMD 12-H13.116
Robert Hunter	CMD 12-H13.117
Glen and Margaret Woolner	CMD 12-H13.118
Debra Reed	CMD 12-H13.119
Canadian Unitarians for Social Justice	CMD 12-H13.120
Genevieve Delmas Patterson	CMD 12-H13.121
Environmental Coalition of Prince Edward Island	CMD 12-H13.122
Greater Oshawa Chamber of Commerce	CMD 12-H13.123
Blake Reid	CMD 12-H13.124
Eva Torn Thomas	CMD 12-H13.125
Sheila-Marie Richardson	CMD 12-H13.126
Louisette Lanteigne	CMD 12-H13.127
Dick O'Connor	CMD 12-H13.128
Azreen F. Sikder	CMD 12-H13.129
Vijanthan Thiruchelvarajah	CMD 12-H13.130
Dominique Bruce	CMD 12-H13.131
Robert Kiley	CMD 12-H13.132
Trixie Deveau	CMD 12-H13.133
Anita Nickerson	CMD 12-H13.134
Meghan Robinson	CMD 12-H13.135
Louis Bertrand	CMD 12-H13.136 CMD 12-H13.136A
Canadian Nuclear Association, represented by H. Kleb	CMD 12-H13.137 CMD 12-H13.137A
Alan Guettel	CMD 12-H13.138 CMD 12-H13.138A
Borden Rhodes	CMD 12-H13.139
A. J. Kehoe	CMD 12-H13.140
Clemente Ciamarra	CMD 12-H13.141
E. Grant	CMD 12-H13.142
A. Lukacs	CMD 12-H13.143
S. Pharand and family	CMD 12-H13.144
L. Neilans	CMD 12-H13.145
D. Varga	CMD 12-H13.146
P. Stubbins	CMD 12-H13.147
N. Matoba	CMD 12-H13.148
K. Murtrie	CMD 12-H13.149

Science for Peace	CMD 12-H13.150
B. Blaney	CMD 12-H13.151 CMD 12-H13.151A
University of Ontario Institute of Technology, represented by T. Price, A. Saberi and N. Menon	CMD 12-H13.152
J. McNeill	CMD 12-H13.153
L. Gasser	CMD 12-H13.154
Canadian Coalition for Nuclear Responsibility, represented by G. Edwards	CMD 12-H13.155
Darlington Nuclear Community Advisory Council, represented by J. Cryderman	CMD 12-H13.156
E. Olmsted	CMD 12-H13.157
North American Young Generation in Nuclear, represented by L. Corkum, S. Khanna and V. Jayasinghe	CMD 12-H13.158 CMD 12-H13.158A
I. Rabinovitch	CMD 12-H13.159
Women's Healthy Environments Network, represented by Dr. G. Rosenberg	CMD 12-H13.160
S. Chowdhury	CMD 12-H13.161
A. Chan	CMD 12-H13.162
Pembina Institute	CMD 12-H13.163
S. Vettese	CMD 12-H13.164
D. Slater and B. Hunter	CMD 12-H13.165
Cameco Corporation	CMD 12-H13.166
M. Hathaway	CMD 12-H13.167
J. Dupont	CMD 12-H13.168
K. Colvin	CMD 12-H13.169
C. Psarrou-Rae	CMD 12-H13.170
J. Carter	CMD 12-H13.171
Bruce Peninsula Environment Group	CMD 12-H13.172
P. Bouchard	CMD 12-H13.173
National Farmer’s Union, Ontario Division	CMD 12-H13.174
Veterans Against Nuclear Arms	CMD 12-H13.175
National Farmers Union Wellington Waterloo Local	CMD 12-H13.176
J. Adler	CMD 12-H13.177
N. Chaloner	CMD 12-H13.178
S. Sinayuk	CMD 12-H13.179 CMD 12-H13.179A
P. McNamara	CMD 12-H13.180
Greenpeace, represented by S.-P. Stensil	CMD 12-H13.181 CMD 12-H13.181A
B. Stevenson	CMD 12-H13.182
S. Sherman	CMD 12-H13.183
Toledo Coalition for Safe Energy, represented by M. Leonardi	CMD 12-H13.184
G. Cockburn	CMD 12-H13.185

Ontario Voice of Women for Peace, represented by S. Grady	CMD 12-H13.186
K. Clune	CMD 12-H13.187
Mississaugas of the New Credit First Nation, represented by C. King	CMD 12-H13.188
K. Cumbow	CMD 12-H13.189
Williams Treaties First Nations, represented by K. S. McKenzie	CMD 12-H13.190
N. Caine	CMD 12-H13.191
Don't Nuke TO	CMD 12-H13.192
G. Cowan	CMD 12-H13.193
F. Tahsin	CMD 12-H13.194
C. Winter	CMD 12-H13.195
City of Oshawa	CMD 12-H13.196
Committee for Future Generations	CMD 12-H13.197
M. Climenhaga	CMD 12-H13.198
Physicians and Scientists for a Healthy World	CMD 12-H13.199
Durham Nuclear Awareness, represented by J. Brackett	CMD 12-H13.200 CMD 12-H13.200A
International Institute of Concern for Public Health, represented by A. Tilman, L. Harvey and G. Albright	CMD 12-H13.201 CMD 12-H13.201A
Nothwatch, represented by B. Lloyd, G. Thompson and M. Resnikoff	CMD 12-H13.202 CMD 12-H13.202A
East Toronto Youth Nuclear Group, represented by E. Butler, A. Baskaran, L.Ye and Ms. Aishwaria	CMD 12-H13.203 CMD 12-H13.203A
The Nucleus	CMD 12-H13.204
CCNB Action, represented by S. Murphy and C. Rouse	CMD 12-H13.205 CMD 12-H13.205A
United Church of Canada, represented by V. Obedkoff	CMD 12-H13.206
M. Duguay	CMD 12-H13.207 CMD 12-H13.207A
Green Party of Ontario, represented by M. Schreiner	CMD 12-H13.208
M. Paul	CMD 12-H13.209
K. Chung	CMD 12-H13.210
D. McGorman	CMD 12-H13.211
S. Leahy	CMD 12-H13.212
Letter Writing Campaign (479 letters)	CMD 12-H13.213