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Canada

Applicability of the DNNP Environmental Assessment to the BWRX-300 Reactor

CNSC Staff Presentation

Commission Hearing

January 23-25, 2024

CMD 24-H2.A

e-Doc (PPT) 7137774
e-Doc (PDF) 7190112

Purpose of this Hearing

- To present CNSC staff's assessment of whether the deployment of up to 4 BWRX-300 reactors at the Darlington site remains within the bounds of the Darlington New Nuclear Project (DNNP) Environmental Assessment (EA)
- To request a Commission decision on applicability of the EA which is required prior to a hearing on OPG's Licence to Construct application

DNNP History (1/4)

ENVIRONMENTAL ASSESSMENT STARTS

OPG applied for a Licence to Prepare Site (LTPS) using a Plant Parameter Envelope (PPE) approach.

2006

JOINT REVIEW PANEL (JRP)

Federal Minister of the Environment referred the DNNP to a JRP.

2008

ENVIRONMENTAL IMPACT STATEMENT

OPG submitted its EIS. Documents reviewed by CNSC and federal authorities.

2009

JRP PUBLIC HEARINGS

17-day Public Hearings occur. Submissions received from Indigenous Nations and communities, environmental groups, and others.

2011

DNNP History (2/4)

JRP DECISION AND EA REPORT

Concluded DNNP unlikely to cause significant adverse environmental effects.

Issued 67 Recommendations

2011
August

GOVERNMENT RESPONSE

Government of Canada accepts JRP Recommendations and agrees with JRP conclusions.

2012
May

SITE PREPARATION LICENCE ISSUED

Commission issues a 10-year LTPS, allowing work to prepare the site for potential construction.

2012
May

The JRP and Government of Canada agree DNNP safe to proceed

DNNP History (3/4)

ONTARIO PAUSED DNNP

The Government of Ontario requested OPG put the project on hold, while maintaining its licence.

2013

FEDERAL COURT REVIEW

EA challenged on PPE approach. The Court determined the PPE was acceptable, but more information was needed on 3 matters.

2014

FEDERAL COURT OF APPEAL REVIEW

Federal Court of Appeal confirmed the EA was complete and met legislative requirements. The LTPS was reinstated.

2015

Federal Court of Appeal decision confirms the EA is complete and the PPE approach is acceptable

DNNP History (4/4)

LTPS RENEWAL APPLICATION

OPG applies to renew the LTPS

2020

LTPS RENEWAL PUBLIC HEARING

One-day Public Hearing held with submissions from Indigenous Nations and communities and environmental groups. Commission renewed the LTPS until 2031.

2021

LICENCE TO CONSTRUCT (LTC) APPLICATION

OPG selects BWRX-300 reactor and applied for an LTC for a **single** reactor. OPG required to evaluate BWRX-300 against EA predictions.

2022
October

EA APPLICABILITY PUBLIC HEARING

Hearing to determine whether EA remains valid for **four** BWRX-300 reactors.

2024
January

Joint Review Panel Recommendations

- The Joint Review Panel concluded that:
  - "... the proposed project is not likely to cause significant adverse environmental effects, taking into account the JRP recommendations and implementation of proposed mitigation measures"
- Joint Review Panel Issued 67 Recommendations including Recommendation #1:
  - "[…] prior to construction, the Canadian Nuclear Safety Commission will determine whether this environmental assessment is applicable to the reactor technology selected by the Government of Ontario for the Project."
- Government of Canada Response
  - "Accepts the intent of this recommendation but acknowledges that any Responsible Authority… will need to determine whether the future proposal is fundamentally different from the specific reactor technologies assessed by the JRP and if a new EA is required..."

OPG'S APPLICATION

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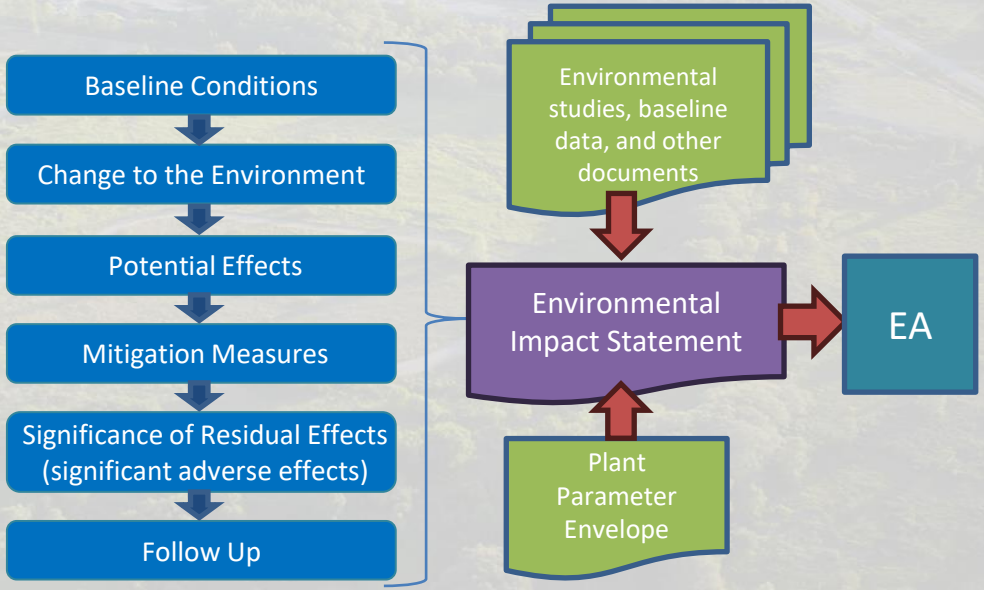
OPG's Application

- OPG's application for a Licence to Construct included documents (Environmental Impact Statement (EIS) Review Report and Plant Parameter Envelope (PPE) Report) which assessed the applicability of the Environmental Assessment (EA)
- OPG was required to review the deployment of 4 reactors against the predictions of the EA, including the Environmental Impact Statement and Plant Parameter Envelope
- CNSC staff conducted a technical review including all supporting documents
  - Federal authorities engaged throughout the review
  - The results of this technical review are outlined in CMD 24-H2 and summarized in this presentation

What is an Environmental Assessment?

- An EA is a planning and decision-making tool, to **predict significant adverse impacts** of a project, considering mitigation measures
- Bounding characteristics may be used to establish scope of the review, using maximum project parameters, regardless of technology
- OPG used the Plant Parameter Envelope (PPE) in the EA to determine the maximum impacts of the project



CNSC Staff Assessment of OPG's PPE Report (1/2)

- **130 parameters were within** the PPE
- **60 parameters were not applicable**:
  - **34** parameters regarding cooling towers which have been removed from the project
  - **22** parameters regarding a separate heat sink, which is not required as the BWRX-300 uses a different system as an ultimate heat sink
  - **4** parameters regarding auxiliary boilers as a backup heat sink which have been removed from the project
- **8 parameters were different** from the original PPE requiring further analysis to confirm the BWRX-300 deployment remains within the predictions of the EA

OPG conducted further analysis on the 8 parameters to assess environmental impacts

CNSC Staff Assessment of OPG's PPE Report (2/2)

CNSC staff reviewed OPG's revised Plant Parameter Envelope Report and noted differences in values for the BWRX-300 compared to the original technologies assessed in the EA:

1. **The foundation depth is deeper**
2. **Airborne radioactive emissions to atmosphere are in different proportions**
3. **The volumetric activity of solid radioactive wastes is in different proportions**
4. Maximum short-term rate of water withdrawal from the lake for fire protection was higher
5. Quantity of water stored in the water supply system was higher
6. The minimum airborne effluent release height is lower
7. Spent fuel cask weight is higher
8. The importance factor (standard) for wind load was revised

Foundation depth, airborne emissions, and solid waste activity are discussed in subsequent slides, the remaining 5 parameters are covered in CMD H24-2

CNSC Staff Assessment of OPG's EIS Review Report

- **CNSC required OPG to comprehensively review the EIS upon technology selection to confirm its applicability**
- **OPG's EIS Review report documents environmental conditions:**
  - Determine whether construction and operation of up to four BWRX-300 reactors is within the bounds of the Environmental Assessment
  - Evaluate existing environmental conditions and assess changes which occurred since the Environmental Assessment

Environmental Assessment Components
Atmospheric
Aquatic
Geological and Hydrogeological
Surface Water
Terrestrial
Human Health

CNSC staff's evaluation of changes to components since the EA are discussed in subsequent slides

Atmospheric Environment
Air Quality and Noise

- Atmospheric environment covers the effects of the DNNP on both air quality and noise
- Predicted atmospheric emissions from construction activities remain within the EA, and within federal air quality standards
  - Most locations are predicted to remain below air quality criterion for NO_2, SO_2 though temporary exceedances are expected for NO_2 and SO_2 during construction
- Overall noise conditions are comparable to the conditions assessed in the EA
  - A reduction in heavy vehicle traffic predicted to reduce overall noise conditions
  - Noise from blasting activities predicted to be comparable to the EA

CNSC staff conclude that changes to the Atmospheric Environment do not alter the EA conclusion

Aquatic Environment
Aquatic Habitat & Biota

- Aquatic environment covers the effects of the DNNP on aquatic habitat and biota
- Smaller size of BWRX-300 deployment reduces predicted impacts to aquatic habitats, including retention of on-site ponds and no infilling of Lake Ontario
- Discharge of liquid radioactive effluent is not predicted to occur during normal operation
- Updated baseline environment studies for aquatic biota and identified findings consistent with the EA
  - Aquatic Species at risk have been added to the federal *Species at Risk Act* or provincial *Endangered Species Act*
- Authorisation from Fisheries and Oceans Canada (DFO), Environment and Climate Change Canada (ECCC), or the Ontario Ministry of Environment, Climate, and Parks (OMECP) will be required for activities that may impact the aquatic environment

CNSC staff conclude that changes to the Aquatic Environment do not alter the EA conclusion

Geological and Hydrogeological Environment (1/2) Foundation Depth Parameter

- Geological and hydrogeological environment covers the effects of the DNNP on groundwater quality, flow and stormwater management
- Reactor foundation depth was assessed in the EA to determine impacts on groundwater quality and flow and to identify necessary mitigation measures.
  - BWRX-300 depth is 38 meters below-grade, deeper than the depth assessed in the EA
- OPG's EIS Review report determined that construction-related effects on groundwater quality and flow would be temporary while the EA assumed groundwater effects would be permanent
- CNSC staff reviewed OPG's PPE report and concluded mitigation measures from the EA remain sufficient to mitigate groundwater effects due to deeper construction. Deeper reactor depth does not result in new or additional environmental impacts

Geological and Hydrogeological Environment (2/2) Groundwater Flow & Quality

- Due to the depth of the excavation, groundwater drawdown during construction is expected to be greater
  - Groundwater inflow is expected to be less due to mitigation measures (cutoff walls, pressure grouting)
- No significant impact on groundwater flow or quantity is expected once construction is completed
- Transfer of radionuclides into groundwater from airborne BWRX-300 releases was re-assessed in the EIS Review:
  - Radioiodines contribute < 0.15% of public dose and was considered negligible
  - Tritium concentrations in groundwater on-site and off-site will remain well below Ontario Drinking Water Quality guidelines

CNSC staff conclude that changes to the Geological and Hydrogeological Environment do not alter the EA conclusion

Surface Water Environment
Lake Circulation, Water Temperature, and Quality

- Surface water environment covers the effects of the DNNP on lake circulation, water temperature, site drainage and water quality and to the shoreline
- Given the smaller footprint of the BWRX-300 lake infilling is not required and effects on circulation and temperature from the creation of an embayment will not occur
- The cooling water intake flowrate is anticipated to be lower than the EA and within the assessed lake circulation effects
- Water quality effects to Lake Ontario remain consistent with the EA
- Shoreline protection is required for multi-unit operations, consistent with the EA, and will have a potential to disrupt sediments near the shoreline

CNSC staff conclude that changes to the Surface Water Environment do not alter the EA conclusion

Terrestrial Environment

- Terrestrial environment covers the effects of the DNNP on vegetation, birds, insects, amphibians and reptiles, mammals and landscape
- Species at risk have been added to the *Species at Risk Act* or *Endangered Species Act*
- Effects of construction on Bank Swallows and their habitat was assessed, with shoreline protection resulting in a net loss of Bank Swallow habitat, consistent with the EA
- Three species of bats have been listed under the *Endangered Species Act* since the EA:
  - Due to the smaller footprint some woodland habitat would be retained which is used by bats
  - Effects on bats are due primarily to lighting; effects due to noise and dust are predicted to be minor and within regulatory limitations
  - OPG will be required to implement mitigation measures to reduce effects on bats

CNSC staff conclude that changes to the Terrestrial Environment do not alter the EA conclusion

Human Health (1/3)
Airborne Radiological Releases Parameter

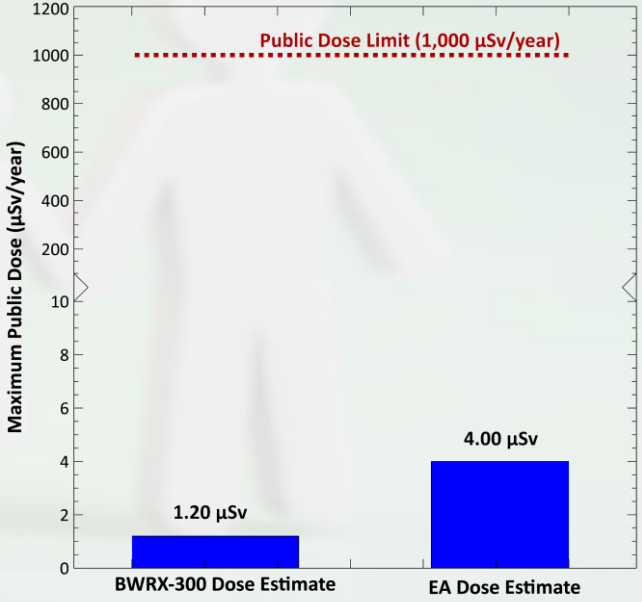
- Human health covers the effects of the DNNP on the public and workers
- BWRX-300 releases the same radionuclides but in different proportions:
  - Carbon-14 and radioiodines are slightly higher
  - noble gases, particulates, and tritium are lower
- CNSC staff conclude that while these releases are in different proportions the estimated total releases are **lower** than for the EA

CNSC staff found that the change in proportion of radioactive emissions did not alter the EA conclusion

Isotope	EA Value (Bq/yr)	BWRX-300 (Bq/yr)	Relative Change (% of EA value)
Carbon-14	1.28 TBq	1.60 TBq	125%
Noble Gases	5,340 TBq	92.2 TBq	2%
Iodines (I-131, I-135)	0.0768 TBq	0.0773 TBq	101%
Particulates	0.007 TBq	0.000469 TBq	7%
Tritium	980 TBq	3.88 TBq	0.4%
Total	**6,321 TBq**	**97.8 TBq**	**1.5%**

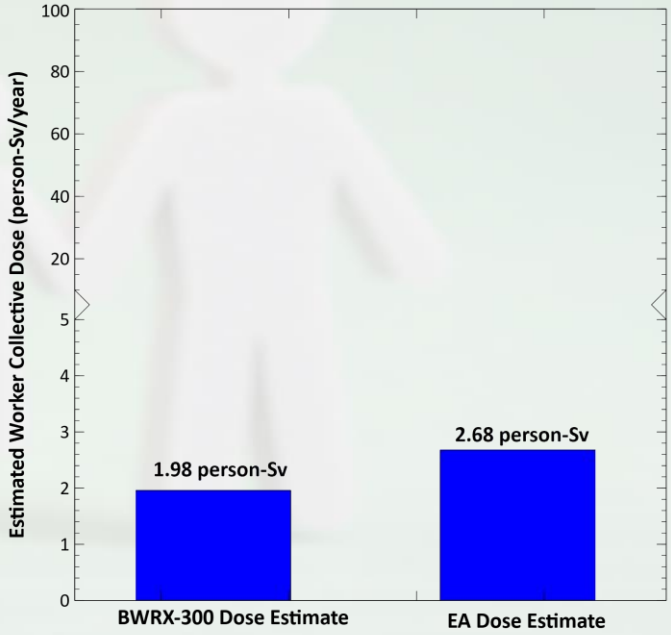
Human Health (2/3)
Physical Well-Being: Health of the Public

- Public doses from BWRX-300 emissions are expected to be less than predicted in the EA
  - The highest public dose was 1.20 µSv per year, compared to 4.0 µSv/year assessed in the EA
- Doses to all receptors are 70% lower than the EA, and well below the regulatory dose limit of 1 mSv/year defined in the *Radiation Protection Regulations*
- Emissions of non-radiological contaminants predicted to be lower than the EA



Human Health (3/3)
Physical Well-Being: Health of Workers

- The EA predicts a collective dose to workers of 2.68 person-Sv from normal operations
- For the BWRX-300 the preliminary collective dose assessment predicts a collective dose of 1.96 person-Sv from normal operations
- Doses to workers are predicted to be below the dose limits in the *Radiation Protection Regulations*



CNSC staff conclude that changes to the Human Health Environment do not alter the EA conclusion

Malfunctions and Accidents (1/2) Probabilistic Safety Assessments

- Safety goals are a design criteria to ensure no unreasonable risk under accident conditions
- CNSC required OPG to revisit the EA results for malfunctions and accidents for BWRX-300, including probabilistic safety assessments, to demonstrate through analysis that safety goals will be met
- Probabilistic safety assessment results for BWRX-300 to date show:
  - estimates for core damage and large release frequencies are orders of magnitude below limits specified by safety goal requirements

Safety Goal (REGDOC-2.5.2)	Limit (Events per reactor year)	BWRX-300 All-Hazards Estimate (Events per reactor year)
Core Damage Frequency	$< 1 \cdot 10^{-5}$	$9.62 \cdot 10^{-8}$
Small Release Frequency	$< 1 \cdot 10^{-5}$	$8.28 \cdot 10^{-8}$
Large Release Frequency	$< 1 \cdot 10^{-6}$	$8.28 \cdot 10^{-8}$

Malfunctions and Accidents (2/2)
Radiological and Transportation Accidents

- Three scenarios were re-assessed in OPG's EIS Review:
  - A "pool fire" where fuel from a handling vehicle is spilled and catches fire next to low-level waste (LLW) containers
  - A "pool fire" adjacent to intermediate-level waste (ILW) containers
  - A dropped spent fuel dry storage canister (DSC) causes damage to fuel assemblies
- Estimated doses to workers and the public from the ILW and DSC accident scenarios, though higher than EA values, remain consistent with EA conclusions

Scenario	EA Dose Estimates (mSv)		BWRX-300 Dose Estimates (mSv)	
	Public	Worker	Public	Worker
Pool Fire – LLW	0.014	14.2	0.00004	0.04
Pool Fire – ILW	0.083	1.43	0.80	13.8
Dropped Dry Spent Fuel Storage Container	0.24	33.9	0.37	45.0

CNSC staff conclude that changes to the Malfunctions and Accidents do not alter the EA conclusion

Solid Radioactive Waste Volume and Activity

- Radioactive waste volume and activity was considered in the EA and documented in the PPE
- Overall, BWRX-300 operations would have a **lower** solid radioactive waste volume per reactor; but the proportion of certain radionuclides are different than assessed in the EA:
  - The volume and activity of select alpha and beta-gamma radionuclides is higher
  - The volume and activity of tritium and carbon-14 is lower
- Given the differences in the proportion of radionuclides found in BWRX-300 solid wastes, a different approach to handling the wastes would be required

CNSC staff found that the change in proportion of activity in solid radioactive waste did not alter the EA conclusion

INDIGENOUS CONSULTATION AND ENGAGEMENT

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Indigenous Consultation and Engagement (1/3)

CNSC staff identified the following Indigenous Nations and communities who have Indigenous and/or Treaty rights in the DNNP area:

- Alderville First Nation
- Curve Lake First Nation
- Chippewas of Beausoleil First Nation
- Chippewas of Georgina Island First Nation
- Chippewas of Rama First Nation
- Hiawatha First Nation
- Mississaugas of Scugog Island First Nation

CNSC staff identified the following Indigenous Nations and communities who have expressed an interest in the DNNP:

- Saugeen Ojibway Nation
- Mohawks of the Bay of Quinte
- Métis Nation of Ontario
- Six Nations of the Grand River

Indigenous Consultation and Engagement (2/3)

CNSC activities included:

- Consultation during the EA process
- Advance notice in May 2022 of expected Licence to Construct Application, offer to develop collaborative approach to consultation and initial meetings
- Opportunity to review and comment on OPG's EIS review and PPE documents. Funding to support participation was made available
- Meetings to discuss OPG's EIS review and PPE documents, initial comments and concerns
- Ongoing meetings and discussions with interested Indigenous Nations and communities about concerns related to the applicability of the EA
- Written responses to concerns raised
- Opportunities to participate in the public Commission hearing. Funding to support participation was made available

CNSC staff have worked to respond to and address identified issues and concerns raised by Indigenous Nations and communities to date

Indigenous Consultation and Engagement (3/3) Summary of Concerns and Comments

- Protection or mitigation measures for newly added species at risk to the *Endangered Species Act* and *Species at Risk Act*
- Importance of consideration of Indigenous worldviews and cultural keystone species when making concluding statements
- Applicability of the PPE approach rather than a detailed assessment of a specific reactor
- Concern about elevated airborne emissions and solid radioactive waste inventories
- Concern the natural environment and land use has changed significantly since the EA
- Storage and transportation of wastes
- Concern about whether the EA Follow-Up Program remains valid, as best practices have changed
- Concern that expectations and understanding of Treaty rights have changed following the signing of the Williams Treaties Settlement Agreement in 2018

PUBLIC ENGAGEMENT

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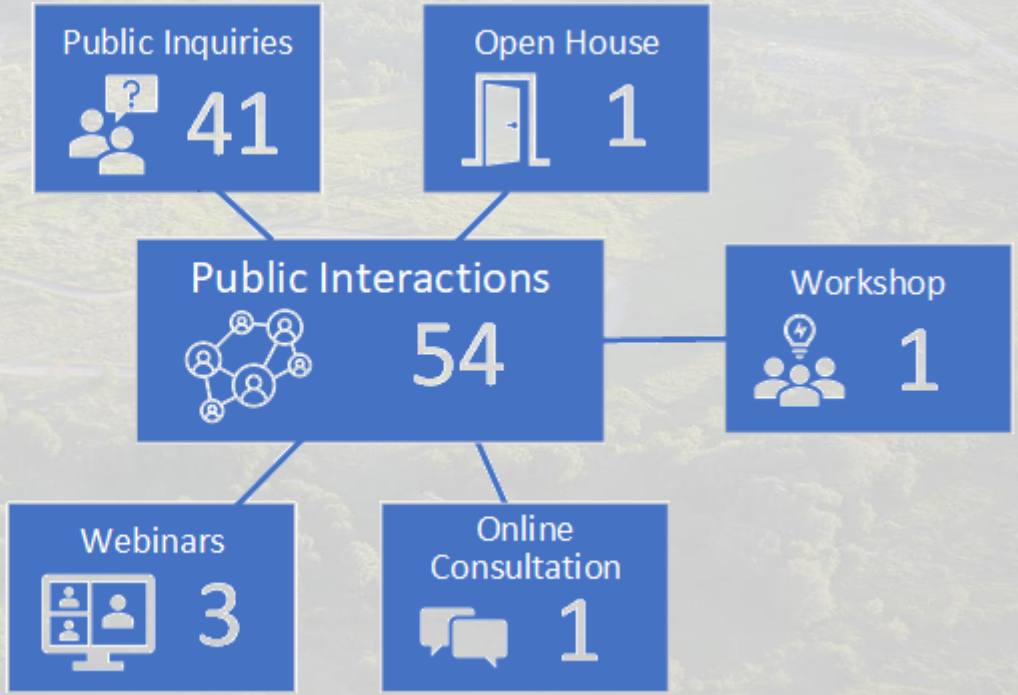
Public Outreach and Engagement

Participant Funding	$263,884
Social Media	31,586 Impressions
Website Visits	9,9411 Pageviews



Participant Funding Program

STAGE ONE	STAGE TWO
For review of OPG EIS and PPE documents $157,594 awarded December 2022	For involvement in the process for Hearing #1 $106,290 awarded June 2023
• Hiawatha First Nation • Mississaugas of Scugog Island First Nation • Saugeen Ojibway Nation • Six Nations of the Grand River • Métis Nation of Ontario • Canadian Coalition for Nuclear Responsibility • Canadian Environmental Law Association • Radiation Safety Institute of Canada • Nuclear Transparency Project • Northwatch	• Hiawatha First Nation • Mississaugas of Scugog Island First Nation • Saugeen Ojibway Nation • Métis Nation of Ontario • Dr. Gordon Edwards • Canadian Environmental Law Association • Radiation Safety Institute of Canada • Nuclear Transparency Project • Northwatch

DNNP Workshop Summary

- In April 2023, the CNSC hosted a workshop with members of the public, Indigenous Nations and communities, civil society and environmental non-governmental organizations to hear comments and concerns on OPG's EIS Review and PPE Report
- The workshop identified key areas including:
  - Environmental Effects and Risks Assessments
  - Waste Management and Decommissioning
  - Design & Analysis and Hazard Assessment
  - Releases, Doses and Emergency Management
- CNSC staff appreciate the opportunity to engage early in the process to hear directly from participants.
- The concerns and issues raised during the workshop aligned with the areas covered in CNSC's technical assessment, ensuring inclusion in this CMD. The concerns raised have been reiterated in the Interventions received for this hearing

Key Themes from Interventions

- Management of radioactive wastes, including spent nuclear fuel
- Mitigation measures for species at risk
- Effects of climate change
- Multi-unit accident scenarios
- Difference of the reactor technology to the reactors assessed in the EA
- CNSC approach to consultation for this project

These themes are similar to those raised in Stage 1 PFP and during the April workshop

CNSC STAFF CONCLUSIONS AND RECOMMENDATION

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CNSC Staff Conclusions and Recommendations

- CNSC staff reviewed the EA, OPG's EIS Review, Plant Parameter Envelope report, supporting documentation, and concluded:
  - The BWRX-300 technology, while different than those assessed in the EA, remains within the bounds of the EA
  - The EA conclusions remain valid
  - The DNNP remains unlikely to cause significant adverse environmental effects

CNSC staff recommend that the Commission determine, in accordance with JRP Recommendation #1 that OPG's selection of the BWRX-300 reactor technology remains within the DNNP Environmental Assessment

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