Federal and Provincial Technical Review

Comment Table on the Draft Environmental Impact Statement for the Nuclear Power Demonstration Closure Project

No.	Department / Ministry	Section, Table or Figure	Pg. #	Information Request or Summary of Comment	Response (to be completed by CNL)
General					
1.	Canadian Nuclear Safety Commission (CNSC)	General	N/A	**Comment:** The Environmental Impact Statement (EIS) should reference the title of the current version of CNSC's REGDOC-2.9.1, which is "REGDOC-2.9.1, *Environmental Protection: Environmental Principles, Assessments and Protection Measures*". **Expectation to Address Comment:** Please revise accordingly.	
2.	CNSC, ECCC, Health Canada	General	N/A	**Comment:** While the EIS makes reference to technical supporting documentation and other detailed studies to support the analysis, and Canadian Nuclear Laboratories (CNL) is encouraged through cross-referencing to make use of existing information, a brief summary or narrative which explains the purpose of referencing each supporting document, as well as any relevant information it contains (e.g., data, methodology, conclusions drawn) should be provided in the EIS. It is not always clear which sections of a referenced document (e.g., Athuada-Arachchige 2015, Seto 2014) are relevant to the discussion in the EIS, especially given that some of these documents are quite lengthy. **Expectation to Address Comment:** The EIS should explain at a high-level how the information is organized in the document, as well as how it is supported by referenced documentation. Consistent with Section 3.3.3 of CNSC's *Generic EIS Guidelines* (p.6), where existing documents are referenced, the EIS should: • Specify which portion of the information or data in the document applies to the Nuclear Power Demonstration (NPD) Closure Project • Explain how it applies, and any assumptions, limitations or differences • Distinguish factual evidence from inference • Note any limitations on inferences or conclusions that can be made	
3.	Government of Quebec	General	N/A	**Comment:** In general, the information provided in the draft EIS (main body) is insufficient. In the context of radiation protection, the draft EIS does not make it possible to assess the safety of the proposed project and its impact on the health of the Quebec populations potentially affected. This lack of detailed documentation is not consistent with best practices in the management of nuclear waste. In addition, the process to gain access to Technical Supporting Documents (TSDs), which are not available on the Canadian Environmental Assessment Registry, should be clearer. Otherwise, this poses a barrier to information access for the public, Indigenous groups and technical experts who may not know how to obtain this key documentation. TSDs, quoted repeatedly in the draft EIS, contain information essential to the evaluation of the impacts of the various phases of the project, as well as the health risk analysis in situations of chronic exposure and emergency. Only the conclusions are conveyed in the	

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				public documentation. **Expectation to Address Comment:** For transparency and to provide a complete picture of the relevant information regarding the proposed project, please ensure that a mechanism exists that allows all parties invited to comment on the draft EIS to have easy access to the TSDs.	
4.	Environment and Climate Change Canada (ECCC)	General	N/A	**Comment:** The various TSDs that rely upon modeling generally describe the model and assumptions used to evaluate the evolution of the monolith under different scenarios. A separate TSD exists for each model; however, many of the models appear to rely on the data outputs of one or more other models. For example, outputs of the groundwater model, the alkaline plume modeling, cement degradation modeling, and lead solubility modeling are used as inputs for the safety assessment and Ecological Risk Assessment (EcoRA). It is noted that the uncertainty associated with a particular scenario or model run is also relevant to any subsequent use of the model outputs. In the TSDs where "predictive uncertainty" is discussed, the discussion is limited to the uncertainty associated with the model that is the basis of the TSD. It does not describe the uncertainty that is carried forward when outputs of one model are used as input for others (e.g., for safety assessments, or for the conclusions made in the draft EIS). Where multiple models are interrelated and rely upon each other (i.e., the outputs of several models are combined either in parallel or in series), the uncertainties will accumulate and/or compound across the models. In order to understand the potential risks to the environment from the proposed project, the uncertainty of the information provided should be better articulated, as per the information requirements related to uncertainty in Section 3.2 (p. 5) of CNSC's *Generic EIS Guidelines*. This includes acknowledgement that uncertainties will accumulate and / or compound. **Expectation to Address Comment:** Please review and update the Draft EIS and TSDs to: • Indicate all of the uncertainty, reliability and sensitivity of each model used to reach conclusions. • Identify all significant gaps in knowledge and understanding related to key conclusions, and the steps to be taken to address these gaps. This includes gaps associated with information and modeling used to arrive at each key conclusion. • Clearly identify the interrelationships between models. • Identify which data outputs from a model are used as inputs for other models / modeling exercises. • Clearly identify, describe and assess the uncertainties that carry forward from model to model, and the resulting effect on the uncertainty of the downstream model outputs. • Update the overall predictive uncertainty to include both the model being run and cumulative uncertainty brought forward when model outputs are used as inputs.	
5.	CNSC	General	N/A	**Comment:** The EIS should present clear figures to support the information presented in	

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				the text. All figures should be properly referenced in the text. **Expectation to Address Comment:** Please make sure that all figures contain sufficient and clear information, and that they are properly referenced in the text. In particular, please revise/correct the following figures or in-text references to figures. • In Section 3.3 (NPD Site and Facility Description, p.3-10), the first sentence refers to Figures 3.1-3 and 3.1-4, instead of Figures 3.1-4 and 3.1-5. Please revise accordingly. • Several figures throughout Section 8 (Description of the Existing Environment) are missing a title, including a figure number and a page number (e.g., p.8-40, 8-44, 8-68, 8-74, 8-76, 8-111). Please make sure that every figure in the EIS has a title, a figure number and an associated page number. • In Section 8.3.4 (Surface Water Quality), the last paragraph on p.8-41 refers to Figure 8.3-1 instead of Figure 8.3-2 (which shows the tile drain layout). Please revise accordingly. • In Section 8.5.3 (Soil Quality), the radiological subsection of page 8-75 refers to Figure 8.5-4 instead of figure 8.5-5. Please revise accordingly. • In Figure 8.10-1 (Section 8.10.3 Land Use, p.8-151), not all of the geographical features (including the captions) are visible. Please make sure that all geographical features and captions are visible in Figure 8.10-1. Consider choosing a lighter basemap that would allow the reader to better visualize the geographical features (including the captions) on the map.	
Main EIS					
1. Glossary					
6.	CNSC	N/A	p.1-4	**Comment:** CNL use the following definition for grout: "Grout – a mixture of Portland Cement and water that produces a pourable, concrete-like, mixture." This definition seems incorrect and incomplete. The binding material may not necessarily be Portland cement. Also, there are typically other ingredients (e.g., fine aggregate), which should not be precluded by the definition. An example of good industry definition is available from the American Concrete Institute: "Grout – mixture of cementitious materials and water, or other binding medium, with fine aggregate" CNL provide insufficient grout design information in the EIS submission for CNSC staff to be able to judge the correctness of the definition against CNL's actual grout design. Based on CNL's current definition, it seems as though the grout will consist precisely and exclusively of Portland Cement and water. **Expectation to Address Comment**: Please use the definition of the term "grout" commensurate with the industry's established terminology and your own grout design.	
2. Executive Summary					
7.	CNSC	Section 2.1 Introduction, Table	p.2-2	**Comment:** CNL does not clearly indicate the number of years after which they expect to	

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		2.1-1		reach clearance from regulatory control (i.e., clearance level from CSA N292.3, *Management of Low- and Intermediate Level Radioactive Waste*). This determination should account for waste categorization and decay (as presented in Section 4.4.1.1) and is necessary for establishing the design life and performance of the barriers that are to confine the waste for that period. **Expectation to Address Comment**: Please provide the number of years after which you expect to reach the clearance level. The analysis associated with this determination should be included in the submission in order to be reviewed.	
8.	Government of Quebec	Section 2.2.1 Purpose	p.2-3	**Comment:** The draft EIS states that "[t]he purpose of the project is to safely carry out the decommissioning of the NPDWF using the in-situ decommissioning approach to isolate the contaminated systems and components inside the below-grade structure." The IAEA does not recommend this type of approach, with the exception of unique cases (IAEA 2007, 2014a). Furthermore, in the references section, the following scientific article can be found; however, it is never cited in the main body of the draft EIS: Laraia, M. 2014. *Entombment: A Viable Decommissioning Strategy for Research Reactors?* International Nuclear Safety Journal. 3(4): 1-10. November. This scientific article is perplexing, because none of the cases it presents is similar to the proposed project, for example: • "To achieve a safer configuration of a shutdown reactor in a country or institution lacking basic infrastructure (e.g. dismantling expertise or funds, waste disposal prospects, etc.). • When adequate surveillance of the entombed facility can be ensured, typically when the facility is situated in a wider site bound to remain operational or under institutional control for a long time. A fundamental component of this approach is proper record-keeping. • The use of entombment is limited to a small number in a given country, particularly to remote sites, in order to prevent the uncontrolled proliferation of waste disposal sites. • Leave it open the option of dismantling entombed structures in a not-too-distant future…" **Expectation to Address Comment:** Please address the above concerns and revise the References section accordingly. **References:** IAEA (2007) *Decommissioning Strategies For Facilities Using Radioactive Material*, IAEA Safety Report Series No. 50 IAEA (2014a) *Decommissioning of Facilities*, IAEA General Safety Requirements Part 6	
9.	Government of Quebec	Section 2.2.1 Purpose	p.2-3	**Comment:** The draft EIS states: "The footprint above the reactor vessel will be capped with reinforced concrete…" Why is the reinforced concrete placed only there? According to Figure 3.3.1 (p. 3-11), the reactor vault communicates directly with the storage room, storage bay, dump tank room, header service area, and the boiler room. Will these rooms, potentially contaminated, be	

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				under the concrete cap? **Expectation to Address Comment:** Please address the above questions.	
10.	Government of Quebec	Section 2.2.3 Wastes and Emissions	p.2-4	**Comment:** The draft EIS states: "Radionuclides will be present in these materials in two forms: […] as contamination on surfaces, mainly resulting from the handling of fuel elements which had suffered failure of their protective cladding…" What type of defect is CNL referring to? **Expectation to Address Comment:** Please address the above question.	
11.	ECCC	Section 2.2.3 Wastes and Emissions Also applicable to Section 4.4.1 Waste Types, p.4-25	p.2-4	**Comment:** CNL has identified non-radiological contaminants, such as mercury, lead, asbestos and polychlorinated biphenyls (PCBs), and has provided an inventory of such wastes. However, emissions for these substances generated by the project have not been included in the air quality assessment. **Expectation to Address Comment:** Please provide mercury, lead, asbestos and PCB emissions resulting from the project in the air quality assessment.	
12.	ECCC	Section 2.2.3 Wastes and Emissions Also applicable to Section 2.2.5 Government Communications (p.2-5), Section 4.4.1 Waste Types (Table 4.4-2), and Section 8.3.3 Surface Water Releases (Table 8.3-3)	p.2-4	**Comment:** The draft EIS outlines CNL's proposal and discussions with ECCC to entomb a small number of PCB-containing light ballasts in the NPD Waste Facility (NPDWF) due to inaccessibility. Table 4.4-2 also states that there is an estimated 2.97 kg of PCBs located in light ballasts. Table 8.3-3 reports that the concentration of total PCBs in the Wells Area Sump was 4.9 to 6.0 ug/L based on a sampling campaign conducted in 2015. This indicates that PCBs are capable of being released to the environment. PCBs are very persistent and do not readily degrade over time. Therefore, their risks will remain even over the timeframes considered for permanent decommissioning. Under the proposed project, if PCB sources are grouted in place within the monolith, they will eventually be released to the environment. The project will need to be in compliance with the PCB Regulations, which are administered by ECCC. Discussions are still ongoing between ECCC and CNL in order for CNL to identify appropriate management options for radiologically-contaminated PCB waste. Based on a site visit performed by ECCC staff in November 2017, ECCC believes it is possible to access and remove the ballasts. During this visit, ECCC advised CNL that, for PCBs in concentrations equal to or greater than 50 ppm: • Grouting the PCBs within the monolith would not be in compliance with the regulations • If the PCBs are radiologically contaminated, an extended storage period may be recognized until such a time that the PCBs can be destroyed, as required by the federal PCB Regulations. **Expectation to Address Comment:** Please propose PCB management options that are in compliance with the PCB Regulations. This would apply to the PCB ballasts and any effluent (e.g., Wells Area Sump water) or other wastes contaminated by PCBs. In addition, please describe how the proposed project and waste acceptance criteria complies with the PCB Regulations, and how the November 2017 advice provided by ECCC on the	

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				management of PCB waste has been incorporated.	
13.	Government of Quebec	Section 2.3 Scope of EA	p.2-6	**Comment:** Section 2.3 states: "The Site Study Area extends 50 m into the Ottawa River and includes […] areas that will not necessarily be affected during decommissioning activities but will require work during the site restoration (e.g., due to prior contamination)." More information should be provided on this "prior contamination" (duration, type, scope, etc.). **Expectation to Address Comment:** Please provide more details on this contamination.	
14.	CNSC	Section 2.5 Aboriginal Engagement	p.2-11	**Comment:** The Executive Summary does not indicate whether Métis communities were also provided with opportunities to participate in the archaeological assessment field studies (as were First Nation communities). **Expectation to Address Comment:** Please revise accordingly or explain why Métis communities were not provided the same opportunities as First Nation communities.	
15.	CNSC	Section 2.5 Aboriginal Engagement	p.2-10 to 2-11	**Comment:** While CNL has provided a summary of consultation with First Nation and Métis groups, CNL has not included a complete summary of the concerns and issues raised by the identified groups and the responses provided to address these concerns and issues (which is an information requirement of the Executive Summary as per CNSC's *Generic EIS Guidelines*, p.8). **Expectation to Address Comment:** Please provide a complete summary of the concerns and issues raised by the identified Indigenous groups, as well as CNL's responses to each of concern or issue.	
16.	Government of Quebec	Section 2.6.1 Atmospheric Environment (Baseline Environment)	p. 2-11	**Comment:** Section 2.6.1 states: "Current releases to air at the NPD site are via operation of the ventilation system… These releases are below applicable guidelines." What is the source of these releases? The draft EIS states that if the ventilation system is started, concentrations in the air are reduced, but then they increase again. This indicates that there is an active source. **Expectation to Address Comment:** Please provide more details on current releases to air from the ventilation system.	
17.	CNSC	Section 2.6.4 Geological and Hydrogeological Environment Also applicable to the Updated Groundwater Modeling Report	p.2-12	**Comment:** The EIS makes reference to lithology as "quartz and granite gneiss". Quartz is a mineral, while granite is a rock type that by definition contains quartz. Do you mean that there are quartz ribbons within a granitic gneiss? In the Updated Groundwater Modeling Report, the bedrock is briefly described as "granitic Precambrian biotite and hornblende gneisses" and "hornblende-biotite-gneiss with quartz-feldspar injection". This is inconsistent with limited rock type descriptions in other documents (i.e., EIS, Postclosure Safety Assessment TSD). **Expectation to Address Comment:** Please document rock type consistently, and include petrographic observations and modal mineral assemblages.	
18.	Government of Quebec	Section 2.8.2 Why are there No	p.2-22	**Comment:** Section 2.8.2 states: "In-situ decommissioning provides containment and	

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		Adverse Residual Effects? Also applicable to Section 4.1.1 Robustness of the System, p. 4-2		isolation of the NPDWF inventory for a sufficiently long time to ensure that the long-term environmental concentrations do not cause adverse effects to human health or the environment." What is this statement based on? **Expectation to Address Comment:** Please clarify the above statement.	
19.	Government of Quebec	Section 2.8.3 Natural Analogues	p.2-23 to 2-24	**Comment:** Section 2.8.3 presents no details about the grout, except the comparison with Roman or Mycenaean cements. All the characteristics of the grout should be presented. **Expectation to Address Comment:** Please provide the precise characteristics of the grout that CNL plans on using for this proposed project.	
20.	CNSC	N/A	N/A	**Comment:** The Executive Summary does not provide sufficient detail for the reader to learn and understand the project's proposed follow-up and monitoring program (which is an information requirement of the Executive Summary as per CNSC's *Generic EIS Guidelines*, p.8). **Expectation to Address Comment:** Please provide a description, in the Executive Summary, of the project's proposed follow-up and monitoring program.	
3. Introduction					
21.	CNSC	Section 3.1 Location of the Project	p.3-1 to 3-4	**Comment:** From the description of the location, the map and the photograph, it is clear that the project is located near the Ottawa River. However, no distance between the NPD facility and the Ottawa River is provided in this section or in Section 8.3.2.1 (Surface Water Environment). CNSC's Generic EIS Guidelines specify (on p.8) that the project location description "should include those aspects of the project and its setting that are key to understanding the project's potential adverse environmental effects", such as proximity to a water body. **Expectation to Address Comment:** Please provide in the EIS the distance between the NPD facility and the Ottawa River.	
22.	CNSC	Section 3.1 Location of the Project	p.3-3	**Comment:** CNSC's *Generic EIS Guidelines* require (on p.8) that geographical maps of the project location show any important environmental features. Figure 3.1-2 does not clearly show the important environmental features and environmentally sensitive areas surrounding the project (e.g., forests, lakes, river systems, wetlands). Because the basemap chosen consists of a dark background, some geographical features (including captions) are difficult to see on the map. In addition, the legend for Figure 3.1-3 does not explain what the blue perimeter represents or what "NPD" represents (i.e., is it the area of the NPD facility?). Lastly, the in-text references to these figures are incorrect (e.g., on page 3-4, Figure 3.1-3 is referenced instead of Figure 3.1-4, which shows the two landfills; no reference to Figure 3.1-5 is made in the text). **Expectation to Address Comment:** Please revise the above-mentioned figures (and related text) to provide a clearer visual representation of the project location. When applicable, consider choosing a lighter basemap that would allow the reader to better	

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				visualize the geographical features (including all captions) on the map.	

23.	Government of Quebec	Section 3.3 NPD Site and Facility Description	p.3-10 to 3-13	**Comment:** The following information on the NPD site and facility is missing and should be included in the draft EIS:
				• The power capacity of the facility (20 or 25 MW according to the IAEA), its theoretical and actual annual electricity production for each year of useful life, its utilization factor, and the reasons for output gaps over its 25 years of operation
				• All incident reports filed by year
				• The level of radioactivity at the NPD site and the equipment concerned
				• The reactor core, the pressure tubes and the heat transfer ducts that would still be present at the NPD site, including their level of contamination in detail
				• The total quantity of waste at the NPD site (in cubic metres) and their level of contamination in percentage (low, medium and high)
				• An explanation for:
				  ○ The reasons leading to the reactor shutdown in 1987
				  ○ The reasons for not extending the life of the reactor over a period of 25 to 30 years and the origin of any specific cause (e.g., site contamination, radioactive incident or weakening of the equipment through operation)
				  ○ The possible partial melting of the reactor core, and whether or not the corium was deposited at the bottom of the reactor or in its drain tank
				• The radioactive state of the contaminants present at the base of the reactor and its drain tank
				• The planned decommissioning schedule for the facilities and an explanation of the decisions regarding the dates of these decommissioning activities
				• The size and location of the concrete cap and engineered barrier system
				Expectation to Address Comment: Please provide the information requested above.	

24.	ECCC	Section 3.3.1 Structures at the NPD site	p.3-10	**Comment:** The draft EIS does not indicate the size of any diesel storage tanks or if any tanks are subject to the Fuel Storage Tank Regulations under the *Canadian Environmental Protection Act, 1999* (CEPA 1999). The text states that the remaining permanent structures at the NPD site include diesel-generator equipment, which provides emergency power to mitigate power interruptions at the facility. The batch mixing plant is expected to run on electrical power. However, a generator will provide backup power to the batch mixing plant if needed. The backup generator, as well as the heavy machines on-site, will run on diesel. Thus, it would be expected that diesel storage tanks will be needed on site. Please note that, under these regulations which are administered by ECCC, a petroleum storage tank registration may be required depending on the size of the diesel tanks installed to support the project. **Expectation to Address Comment:** Please provide the number, size and location of any	

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				fuel storage tanks required for each phase of the proposed project, and identify which tanks will be subject to the *Fuel Storage Tank Regulations*.	
25.	Government of Quebec	Section 3.3.2 NPDWF Description, Figures 3.3-1 and 3.3-2	p.3-11 to 3-12	**Comment:** The terms used in the draft EIS do not correspond to those used in Figures 3.3-1 and 3.3-2. **Expectation to Address Comment:** Please revise accordingly.	
26.	ECCC	Section 3.5.3 Additional Regulatory Authorities & Legislation (Environment Canada) Also applicable to Appendix A, p.A-1	p.3-17	**Comment:** On November 17, 2017 an order amending Schedule 1 of the *Species at Risk Act* (SARA) was registered in *Canada's Gazette* Part II. As a result, additional species at risk have been listed on Schedule 1 of SARA, which may occur at the NPD site. This order came into force on the day at which it was registered. The text of the order, including a list of relevant species, is available online at: http://www.sararegistry.gc.ca/default.asp?lang=En&n=EC2CD677-1. **Expectation to Address Comment:** Please update "the species list" referred to in Section 3.5.3.1 based on the November 17, 2017 amendments to Schedule 1 of SARA, where needed. If baseline information about a newly listed species has not been provided, please identify the missing information and propose a plan to collect it during the environmental assessment (EA) review phase. If a species has been listed and could potentially be impacted by the project, provide an additional analysis, including: • A Description of potential impacts • A list of proposed mitigation measure, where appropriate • Anticipated residual effects	
27.	ECCC	Section 3.5.3 Additional Regulatory Authorities & Legislation (Fisheries and Oceans Canada)	p.3-18	**Comment:** In the main EIS and other documents provided, the role of ECCC in relation to the pollution prevention provisions of the *Fisheries Act*, specifically subsection 36(3), was not identified. **Expectation to Address Comment:** Please revise the EIS to note that ECCC administers the pollution prevention provisions of the *Fisheries Act* (including subsection 36(3)). Furthermore, discuss and assess the potential adverse effects on the aquatic environment from all possible liquid effluent releases from the project. Identify measures that will be taken to mitigate impacts to water quality. If treatment of effluent is being considered as a mitigation measure, discuss the treatment technology to be used.	
28.	CNSC	Section 3.5.3 Additional Regulatory Authorities & Legislation (Canadian Standards Association)	p.3-18 to 3-19	**Comment:** In Section 3.5.3, the Canadian Standards Association (CSA) standards seem to be considered only as external or guidance documents. However, some of the referenced documents are part of the Compliance Verification Criteria (CVC) in the current NPD Licence Condition Handbook (LCH) (e.g., CSA N292.3, *Management of Low- and Intermediate Level Radioactive Waste*). **Expectation to Address Comment**: Please differentiate between the documents that are part of the CVC in the current NPD LCH (and therefore that need to be complied with), and those that are external or guidance documents.	
4. Project Description					

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29.	Government of Quebec	Section 4.1 Purpose of Project	p.4-1	**Comment:** The Government of Quebec would like to understand what the urgency for decommissioning quickly is, when the site has been dormant for 30 years. **Expectation to Address Comment:** Please respond to the above question related to the need and purpose of the proposed project.	
30.	CNSC, ECCC	4.1.2 Natural Analogues	p.4-2 to 4-3	**Comment:** New (specific to the project) and existing research could not be identified to support the argument for barrier performance, including, but not limited to the following topics: durability, deterioration, degradation, defects, permeability and corrosion. Roman and other ancient cements are cited (in Section 4.1.2) as analogues for the long-term performance of the monolith grout. However, there is no technical discussion that establishes the similarities between the project and the examples provided (e.g., materials, technology, environmental conditions), which are key to making analogies. For example, it is not clear whether these ancient cements use a similar formulation to the one proposed for the NPD Closure Project or whether analogues have been exposed to conditions that are similar to those anticipated for the NPD Closure Project. The comparison is only valid if both of the above conditions are met. The technical justification for barrier performance is therefore lacking. This technical justification should include the following building blocks: • A literature review for, and analysis of, available information that is used in justifying the performance of the barriers • The identification of any gaps, where there may not be sufficient technical basis, to support the performance of a barrier • The plan for bridging those gaps, as needed. **Expectation to Address Comment**: Please provide the technical information and research, from academia and existing projects (nuclear or non-nuclear) with similar challenges, to justify the performance of the barrier. Where references are made to natural analogues, a discussion that supports the analogy is needed. In particular, please provide a description of the conditions that the ancient cement analogues have been exposed to and the comparability of these conditions to those that exist at the NPD site. Also, please review the EIS to include only the analogues that fulfill these conditions.	
31.	Government of Quebec	Section 4.1.1 Robustness of the System	p.4-2	**Comment:** Section 4.1.1 states: "For most of the assessed period, only a small percentage of the initial total radioactivity is released from the NPDWF as soluble contaminants. Even after 50,000 years, the vast majority of the radioactivity (i.e., over 98%) remains in the NPDWF." What is this statement based on? **Expectation to Address Comment:** Please clarify the above statement.	
32.	Government of Quebec	Section 4.1.1 Robustness of the System	p.4-2	**Comment:** Since the proposed project results in a definitive nuclear waste disposal after 100 years, the site should have warning signs to inform visitors in the absence of any Institutional Controls, when human intrusion could pose a risk (IAEA 2014b, 2017;	

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				Trauth et al., 1993). Nothing in the draft EIS indicates that this will be the case. **Expectation to Address Comment:** Please explain what the passive access controls at the site will be (e.g., physical barriers, stinging vegetation, additional layer of soil, warning signs, etc.) to ensure safety of the site in the long-term. **References:** AIEA (2014b) Near surface disposal facilities for radioactive waste. IAEA Safety standards series, no. SSG-29 AIEA (2017) HIDRA - The International Project On Inadvertant Human Intrusion in the context of Disposal of RadioActive Waste, Version 2.1: Comments addressed January 2017 Plenary Meeting, 25 Jan 2017 Trauth, K. M., Hora, S. C., & Guzowski, R. V. (1993) Expert judgment on markers to deter inadvertent human intrusion into the Waste Isolation Pilot Plant (No. SAND–92–1382). Sandia National Labs., Albuquerque, NM (United States).	

33.	CNSC	Section 4.1.1 Robustness of the System	p.4-2	**Comment:** The EIS acknowledges that barriers will degrade over time; however, a specific time period and performance requirements for the barriers, commensurate with the characteristics of the waste they are to confine, are not established. CNSC's REGDOC-2.9.1 requires the design, maintenance and monitoring of barriers. Sufficient information about the barriers is not provided, and therefore, barrier performance over time cannot be established and supported.
				
				Expectation to Address Comment: Please address the following points for existing barriers (e.g., metal components, existing building):
				
				• Did CNL asses the current conditions of the existing barriers against the original design requirements and function (e.g., presence of defects, permeability, cracks, corrosion, water ingress, required repairs, maintenance, etc.). If so, please provide such analysis; otherwise, please justify why it should be considered acceptable.
				
				• Did CNL assess the confinement function of the existing barriers? This includes:
				  ○ The original design
				  ○ The current condition
				  ○ An assessment of the degradation mechanisms that the barrier may experience during the life of the facility, and its ability to perform its function (note: this is presumably up to the point where the clearance level for the waste will be reached (as in CSA N292.3, *Management of Low- and Intermediate Level Radioactive Waste*), unless CNL provides a justification for an alternate duration)
				  ○ A demonstration of the barrier's ability to perform efficiently its function
				
				Please provide the following information for new barriers (e.g., grout, plugs, and engineered cover):
				
				• The design requirements
				
				• An assessment of the degradation mechanisms that the barrier may experience during the life of the facility, and its ability to perform its function (note: this is	

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				presumably up to the point where the clearance level for the waste will be reached (as in CSA N292.3, *Management of Low- and Intermediate Level Radioactive Waste*), unless CNL provides a justification for an alternate duration) • A demonstration of the barrier's ability to perform efficiently its function	
34.	Government of Quebec	Section 4.1.1 Robustness of the System	p.4-2	**Comment:** The properties of the grout are fundamental for controlling the diffusion of radioisotopes for a period of up to 100,000 years. During part of this period, the metals are subjected to an alkaline environment and the diffusion of radioisotopes is largely determined by the absorption coefficients (Kp) in the mineral matrix (Sullivan, 2014). Comparing the parameter values given by Sullivan (2014) with the most critical radioisotopes, we note that carbon-14, chlorine-36 and strontium-90 are most likely to be released in large quantities into the natural environment, supporting the findings of Helbrecht (2002). However, no mention is made of the presence of radioactive corrosion products (i.e., Chalk River unidentified deposit or Corrosion related unidentified deposit) contaminating the interior of the pipes, which could be much more mobile than the radioisotopes confined in the metal, while their presence is predictable (Kim et al., 2018). **Expectation to Address Comment:** Please clarify why radioactive corrosion products are not considered in the draft EIS. **References:** Kim, W. S., Nam, S., Chang, S., Kim, H., & Um, W. (2018). Removal of Chalk River unidentified deposit (CRUD) radioactive waste by enhanced electrokinetic process. Journal of Industrial and Engineering Chemistry, 57, 89-96. Helbrecht, R.A. (2002) Summary of feasibility studies on in situ disposal as a decommissioning option for nuclear facilities (IAEA-TECDOC--1273). IAEA Sullivan, T. (2014) Recommended values for the distribution coefficient (Kd) to be used in dose assessments for decommissioning the Zion Nuclear Power Plant (No. BNL–105442–2014–IR). Brookhaven National Laboratory (BNL).	
35.	CNSC	Section 4.1.2 Natural Analogues Also applicable to Section 4.5 Potential Project-Related Releases to the Environment, Table 4.5-1 Also applicable to the Alkaline Plume Modeling Report	p.4-2 to 4-3	**Comment:** A high-level description of some anthropogenic analogues is provided on page 4-3, with one citation stated to be recent, but which is in fact 15 years old. Information from the Maqarin natural analogue would add an element of robustness to the long-term safety case, in line with CNSC's Guide G-320, *Assessing the Long-Term of Radioactive Waste Management*, especially in light of the alkaline plume modeling (which is discussed in CNL's Alkaline Plume Modeling Report). Data about the future evolution and consequences of the alkaline plume that is associated with project-related releases in Table 4.5-1 (p. 4-29) should be further constrained using information from this well-studied natural analogue. **Expectation to address comment:** Please consider the Maqarin natural analogue to add robustness to the long-term safety case, with data that could verify / constrain the consequences of the creation of the alkaline plume.	
36.	CNSC	4.1.2 Natural Analogues	p.4-3	**Comment:** This section states: "The PostSA assumes that the grout will gradually degrade as the cement constituents are slowly leached out upon contact with groundwater.	

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				The cement being considered for radioactive disposal systems is similar to early cements used in the 3rd century and approximately 1,000 years earlier." However, the technical information about the grout mix design, testing and assessment could not be found in the EIS submission. It seems as though CNL did not have a grout design available at the time of the EIS submission. Therefore, the establishment and verification of efficient grout performance (using the actual grout design) and its relation to the analogies used is not possible due to the lack of sufficient information. **Expectation to Address Comment**: Please confirm and provide information on the development of the grout mix design, grout production (batch plant) and grout placement technology with their respective QA/QC requirements (which includes testing).	
37.	Government of Quebec	4.1.2 Natural Analogues	p.4-3	**Comment:** While in-situ decommissioning is practised in the United States (mainly in Savannah River), it was only after conducting extensive research into the long-term behaviour of grout. In the case of this proposed project, the draft EIS provides no indication that such research has been performed. For example, the references demonstrating that the selected grout lasts 2,000 years are not available. In addition, there is no detailed plan for tracking and measuring data, which is essential given the technical uncertainties associated with the proposed project. **Expectation to Address Comment:** More evidence is needed to prove that the grout will have a useful life that is long enough to allow for radiation levels to decrease**.** Please provide information on the long-term behaviour of grout, including any studies carried out for this proposed project.	
38.	Government of Quebec	Section 4.2 Alternative Means of Carrying out the Project	General	**Comment:** The Quebec Government is concerned with the proposed in-situ decommissioning approach and believes that CNL should shift its attention from economic criteria (i.e., cost) to potential environmental risks and impacts in the alternative means assessment. The Quebec Government finds it difficult to grasp the advantage of in-situ decommissioning as a solution, given: • The risks associated with drainage changes with respect to keeping the facility inactive, as has been the case for 38 years • The proximity of the NPD site to the Ottawa River and the significant risk of contamination of the watershed • The proximity of the NPD site to the Quebec border (1 km away), Rapides-des-Joachims (3 km away) and areas visited for tourism and recreational activities • The proximity of the NPD site to urban centres, such as Gatineau and Ottawa (about 200 km northwest) where many people live (e.g., as many as 300,000 people for the southern portion of the Outaouais Region) **Expectation to Address Comment:** Please better document the above elements of concern in the EIS and provide a better rationale for choosing the in-situ decommissioning option.	
39.	Government of Quebec	Section 4.2 Alternative Means of Carrying out the Project	General	**Comment:** The in-situ decommissioning approach has the advantage of being minimalistic, quick, and probably inexpensive compared to the other alternatives assessed. However, it is more difficult to unquestioningly accept that this option is less risky on the	

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				long-term for the environment than the Partial or Full Dismantling and Removal options (2 and 3). In order to reduce the long-term risks, it seems appropriate to examine in further detail the option of extracting the highly radioactive components from the reactor core, while leaving the activated concrete in place. This option should eliminate any risks of persistent environmental contamination after the 100-year Institutional Controls period. While the NPD reactor was still in operation, two pressure tubes were removed in 1984, followed by the removal of another tube in 1987. When examined, these tubes were found to have significantly degraded due to the presence of hydrogen – and this lead to the closure of the reactor. During that same period, three pressure tubes (zirconium alloy) and one tube from the calandria (aluminium alloy) were removed for research purposes (Lewis 1988). In 1988, the total radioactivity of the NPD site was estimated to be 2×10^{15} Bq, whereas in 2018, it is estimated to be 4.7×10^{13} Bq, which represents a reduction by a factor of 43. Therefore, if the removal of radioactive components was possible in 1988, shouldn't it be easier to perform today? **Expectation to Address Comment:** Please justify the decision of leaving radioactive components in place rather than removing and storing them at CRL or elsewhere. **Reference:** Lewis, R. E. 1988. *Decommissioning of NPD Generating Station*, Summary of the 9th Annual Congress of the Canadian Nuclear Society, June 13-15 1988, Winnipeg.	
40.	Government of Quebec	Section 4.2 Alternative Means of Carrying out the Project	General	**Comment:** The Government of Quebec notes that in-situ decommissioning does not meet international standards. First, the IAEA does not recommend in-situ decommissioning, except under special circumstances (e.g., when other options are unfeasible, ineffective or prohibitive). It appears that the NPD site does not constitute an exceptional situation warranting in-situ decommissioning. Second, entombing the NPD facility would result in a permanent near-surface disposal facility after the 100-year Institutional Controls period (IAEA 2006, 2007). In-situ decommissioning may be an acceptable solution if half-lives are short (less than 31 years for ILW) or if long-lived radionuclides are present in very low quantities; otherwise radioactive waste should be buried tens or hundreds of metres underground (IAEA, 2011). Given the presence/nature of ILW and long-lived radionuclides at the NPD site, in-situ decommissioning does not meet international standards for the final disposal of nuclear waste. Finally, there is expertise in Canada to carry out the dismantling of the reactor; a deep geological repository is currently being developed; and the NPD site is not particularly isolated, nor at the centre of an operational nuclear site. **Expectation to Address Comment:** For all the reasons outlined above, CNL should better demonstrate that in-situ decommissioning is the preferred option. **References:** IAEA. 2006. *Decommissioning of research reactors: Evolution, State of the Art, Open Issues*. IAEA Technical Reports Series No. 446. IAEA. 2007. *Decommissioning Strategies For Facilities Using Radioactive Material*. IAEA Safety Report Series No. 50. IAEA. 2011. *Disposal of Radioactive Waste*. IAEA Safety standards series, no. SSR-5.	

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41.	CNSC	Section 4.2 Alternative Means of Carrying out the Project	p.4-7 (also applicable to p.4-11)	**Comment:** On page 4-7, the EIS indicates the following: "The environmental effects of each alternative means were assessed with respect to the key VCs identified in this study." However, Tables 4.2-2 to 4.2-4 only show that alternative means were assessed for key environmental components (e.g. atmospheric environment, surface water environment, etc.), <u>not for key Valued Components (VCs).</u> **Expectation to Address Comment:** Please explain or revise accordingly. The main body of the EIS should summarize information that is available in TSDs in sufficient detail to serve as a stand-alone document.	
42.	Government of Quebec	Section 4.2 Alternative Means of Carrying out the Project, Tables 4.2-2 to 4.2-4 Also applicable to Section 2.2.2 Alternatives, p.2-3 to 2-4	p.4-8 to 4-10	**Comment:** Section 2.2.2 states: "Although each of the four alternative means were determined to be technically feasible based on the use of reliable technology, regulatory compliance, and cost, the in-situ decommissioning offers a lower risk option than all other alternatives." What supports this statement? CNL should provide references, a methodology, risk calculations, etc. Tables 4.2-2 to 4.2-4 only present synthetic results of the relative risks associated with each alternative mean, without providing a technical discussion. According to those tables, in-situ decommissioning would pose fewer environmental risks during the Decommissioning Execution stage, because the likelihood of radioactive materials being released is much lower, and workers' exposure to radiation would also be lower. For the Institutional Controls period, in-situ decommissioning would pose fewer risks to the atmospheric, surface water, aquatic, and geological and hydrogeological environments. In the case of health effects, in-situ decommissioning would be much less risky than the other options, including continued SwS, which raises questions given that at this stage, the reactor would remain under Institutional Controls, with only the content of nuclear material changing from one option to another. For the Post-Institutional Controls period, the risk analysis is even more difficult to understand, and in-situ decommissioning is presented as significantly less risky than all other options. Moreover, in the case of socio-economic effects and effects on Aboriginal people's interests, it is difficult to understand how there can be differences between each option when all cases involve the abandonment of the NPD site. **Expectation to Address Comment:** Please justify the in-situ decommissioning choice in the context of relative risk for all three project phases, and address the above-noted concerns.	
43.	Government of Quebec	Section 4.2 Alternative Means of Carrying out the Project, Tables 4.2-2 to 4.2-4	p.4-8 to 4-10	**Comment:** Although the risk of radiation exposure to workers is lower for the in-situ decommissioning option than for the other options assessed (e.g., there is a 50% greater risk for full dismantling compared to in-situ decommissioning, according to Unsworth (1979)), the absolute radiological risk would remain minimal, because in all cases, the maximum dose for workers is less than 1 mSv (based on Section 9 of the draft EIS). **Expectation to Address Comment:** Please justify the in-situ decommissioning choice in the context of worker health. **Reference:**	

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				Unsworth, G.N. 1979. *Decommissioning of the CANDU-PHW reactor – Decommissioning of Nuclear Facilities*, Summary of International Symposium organized by the International Energy Agency and the OECD, Vienna, November 13-17, 1978.	
44.	Ontario Ministry of the Environment and Climate Change (MOECC)	Section 4.3.1 Project Components and Activities	p.4-12 to 4-13	**Comment:** As per Section 34 of the *Ontario Water Resources Act*, a Permit to Take Water may be required for water takings associated with cement / grout mixing, if takings from the Ottawa River may exceed 50,000 L/day. More information can be found here: https://www.ontario.ca/page/guide-permit-take-water-application-form **Expectation to Address Comment**: Please confirm if a Permit to Take Water will be required for any component or activity associated with the NPD Closure Project.	
45.	CNSC, Government of Quebec	Section 4.3.1 Project Components and Activities	p.4-13	**Comment:** Section 4.3.1, among other sections (e.g., sections 3.2, 4.1, etc.), states that an engineered barrier will be placed over the entire grouted facility to reduce / mitigate infiltration. Depending on its design, the barrier could be impacted by external events (e.g., seismicity), which might impact the safety of the project. However, sufficient details on the engineered barrier design have not been provided. **Expectation to Address Comment**: Please provide the design of the engineered barrier in sufficient detail to support the EIS and the safety assessment.	
46.	Government of Quebec	Section 4.3.1 Project Components and Activities	p.4-13	**Comment:** The draft EIS lacks information about the process of grouting below-grade structures. More specifically: • How will gaps be avoided? • Will the pipes, tanks and reactor core be filled with grout? • Will pathways towards the ventilation stack and the Ottawa River be filled with grout? • Hydrogen release is expected when grouting, because of chemical reactions with aluminium. If the risk of explosion is mitigated, what are the consequences of such a release into the grout? This is unclear, especially given that hydrogen attacks most metals and may create less sealed space near aluminium tubing. Due to these uncertainties, it is difficult to predict the long-term structural integrity of cavities within the facility, which represent many pathways for water infiltration. Similarly, the several layers of grout could produce cold joints, which are also potential pathways for water infiltration. **Expectation to Address Comment:** Please address the questions and concerns above.	
47.	MOECC	Section 4.3.1 Project Components and Activities	p.4-12 to 4-14	**Comment:** The EIS seems to indicate that all penetrations of the concrete structure (i.e., inlet and outlet pipes) and all buried utilities and systems (i.e., subsurface drains) will be disconnected and capped, but left in place. However, the EIS does not appear to adequately address the potential for infrastructure left in place to act as a preferential pathway for groundwater migration to the Ottawa River, which represents a significant concern. Furthermore, it is unclear whether the subsurface drains (Drain 1 and Drain 2) will be	

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				retained to direct surface water and groundwater away from the grouted structure. Retention of the drains would not be considered an acceptable alternative due to the potential for interception and discharge of contaminated groundwater to the Ottawa River. Any infrastructure that exits the NPD walls / foundations should be removed and the exit point sealed. A simple plug/cap is insufficient. A compromised plug/cap may cause the pipe to become highly transmissive and accelerate the flow of groundwater through and out of the monolith. In addition, corrosion of infrastructure where it exits at the NPD walls / foundations may also create an enhanced seepage pathway. Leaving these connections in place and not sealed creates a risk that contaminated groundwater exiting the monolith can travel more rapidly through these pipes. **Expectation to Address Comment**: Please explain which pipes and drains will be left in place, and discuss their potential to act as a preferential pathway for groundwater migration to the Ottawa River. Clarify if the subsurface drains will be retained to direct surface water and groundwater away from the grouted structure, and if so, provide a rationale for why it is an acceptable alternative. Evaluate the benefit of leaving these drains in place versus the potential risk they may pose (e.g., as enhanced pathways for contaminant migration) and describe how potential risks of these features could be mitigated (e.g., by removing them or sealing exit points).	
48.	Government of Quebec	Section 4.3.1 Project Components and Activities	p.4-13 to 4-15	**Comment:** Section 4.3.1 states: "Grouting is the process of placing, by pumping, a mixture of Portland Cement and water that produces a pourable, concrete-like, mixture to ensure filling of gaps and crevices throughout the facility. […] Any remaining aggregate or sand will be used as backfill in the facility before final capping, thereby minimizing or eliminating waste generation (Aikens 2017)." CNL should clarify whether the aggregates and sand are in the grout. More generally, CNL should explain what the grout will be composed of. Moreover, Table 4.3-1 mentions fly ash, but nowhere is it mentioned that fly ash is a component of the grout. **Expectation to Address Comment:** Please provide more information on the grout composition and its potential inputs.	
49.	CNSC	Section 4.3.2 Project Schedule, Table 4.3-1	p.4-15 to 4-16	**Comment:** CNSC's *Generic EIS Guidelines* require (on p.11) that the EIS include a schedule of the project with the following information: time of year, frequency, and duration for all project activities. Table 4.3-1 is missing information on the frequency of project activities. **Expectation to Address Comment:** Please revise accordingly.	
50.	CNSC	Section 4.3.2 Project Schedule, Table 4.3-1	p.4-15 to 4-16	**Comment:** The term "WBS" is not defined in the header of the third column. This acronym is not defined in the glossary either. In addition, the number list under this column is not explained (e.g., 8.1.003 for Decommissioning Works). Does this series of numbers have a specific meaning (e.g., serve as a reference in another document)? **Expectation to Address Comment:** Please revise accordingly.	
51.	CNSC	Section 4.3.2 Project Schedule, Table 4.3-1	p.4-15 to 4-16	**Comment**: This table is inconsistent with Table 3.2-1 (p.3-9) in terms of the duration of the Institutional Controls Phase. Table 3.2-1 indicates that this phase will last 100 years while Table 4.3-1 indicates "To be determined".	

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				Expectation to Address Comment: Please revise accordingly.	
52.	CNSC	Section 4.3.2 Project Schedule, Table 4.3-1	p.4-15 to 4-16	**Comment**: To allow the reader to quickly refer to the EIS Interaction Matrix, please provide its location in the EIS in the header of the fourth column (where it is mentioned). **Expectation to Address Comment:** Please revise accordingly.	
53.	CNSC	Section 4.3.2 Project Schedule, Table 4.3-1	p.4-15 to 4-16	**Comment:** CNSC's *Generic EIS Guidelines* require (on p.10) a description of the activities to be carried out during each phase of the project. The following physical activity is listed in Table 4.3-1, but is not explained in sufficient detail in the table or in the text: "Systems Preparation Large Vessels". **Expectation to Address Comment:** Please provide sufficient detail to enable the reader to understand what this activity entails.	
54.	Government of Quebec	Section 4.3.3 Scope Changes	p.4-17	**Comment:** The Project Description indicates that the ventilation stack will be demolished and placed below-grade, which is different from the plans detailed in the draft EIS document. **Expectation to Address Comment:** Please clarify the current plans for the ventilation stack.	
55.	Government of Quebec	Section 4.3.3 Scope Changes	p.4-18	**Comment:** Section 4.3.3 states: "As a result of this decision it requires clarification that the engineered barrier is intended to be installed over the Main Building footprint of the disposal facility and not just over the grouted reactor system and components." Why and how will this engineered barrier be designed? **Expectation to Address Comment:** Please provide more information on the engineered barrier, and if possible, include the plans and specifications developed to date.	
56.	Government of Quebec	Section 4.4.1 Waste Types	p.4-19	**Comment:** Section 4.4.1 states: "The radiological inventory comprises the radionuclides that would remain in NPDWF as part of the in-situ decommissioning strategy. These will primarily be associated with […] historic drummed waste." **Expectation to Address Comment:** Please provide the following information: • The number of drums • Their content • Their level of radioactivity • Their final storage location (Chalk River or elsewhere) • If they will be entombed, and if so, their behaviour in the grout	
57.	Government of Quebec	Section 4.4.1 Waste Types	p.4-19 to 4-20	**Comment:** The main radioactive parts of the reactor are underground, and therefore, water infiltration into the facility is a potential problem. Surface contaminants present on metal components, pipes, etc. can be released instantaneously (i.e. radionuclides of the "instant released surface contamination" type), and thus possibly causing additional risks. **Expectation to Address Comment:** Please explain how the proposed measures will limit	

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				the dissolution of readily soluble surface contaminants.	
58.	Government of Quebec	Section 4.4.1 Waste Types	p.4-20	**Comment:** Section 4.4.1 states: "The majority of the radioactivity, i.e., 75%, is contained in the reactor vault, mainly associated with the disused reactor vessel, the calandria." If all activities provided in Table 4.4-1 are added, the percentage obtained is 93%, not 75%, why? Moreover, how does this percentage reconcile with the 98% stated in Section 4.1.1 (p. 4-2)? **Expectation to Address Comment:** Please respond to the above questions.	
59.	Government of Quebec	Section 4.4.1 Waste Types, Table 4.4-1 (a and b)	p.4-21 to 4-24	**Comment:** According to Table 4.4-1, the bulk of the activity (89%) is contained in aluminium, stainless steel and zircaloy within the reactor vault. CNL states that about 125 m^3 of the waste could be classified as intermediate-level waste (ILW). **Expectation to Address Comment:** For more clarity, please identify the radioactive elements that form the ILW present on-site, and specify their radioactive properties as well as their fate in the environment during the Institutional Controls and Post-Institutional Controls phases.	
60.	Government of Quebec	Section 4.4.1 Waste Types, Table 4.4-1 (a and b)	p.4-21 to 4-24	**Comment:** Table 4.4-1 indicates that a large portion of the radionuclides have a half-life that is long enough for decay to be minimal, even for the 100-year Institutional Controls period. Therefore, the following radionuclides will exceed by 1,000 times the exemption limit for 1,000 years: • Carbon-14 • Chlorine-36 • Nickel-59 and -63 • Zirconium-93 • Niobium-93m • Silver -108m • Plutonium-239 and -240 • Americium-241 and 243 To these are added the following radionuclides, which exceed by 100 times the exemption limit for 100 years: • Calcium-41 • Cobalt-60 • Strontium-90 • Tin-121m • Cesium-137 • Europium-152 • Plutonium-238 and -241	

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				Similarly, quantities greater than 100,000 times the radioisotope exemption limit for plutonium and americium are not small amounts (IAEA, 2012). In light of this data, it appears that the in-situ decommissioning approach does not comply with the established rules of best practice. **Expectation to Address Comment:** Please address the above-noted concerns. **Reference**: IAEA, *The Safety Case and Safety Assessment for the Disposal of Radioactive Waste*, IAEA Specific Safety Guide No. SSG-23, 2012.	
61.	Government of Quebec	Section 4.4.1 Waste Types, Table 4.4-1 (a and b)	p.4-21 to 4-24	**Comment:** Helbrecht (2002) appears to be the most relevant source for the performance of the in-situ decommissioning approach for the NPD site with respect to containment of radioactive materials. However, there are significant differences between the list of radioactive elements presented in this article and the list presented in the draft EIS. In particular, tritium, uranium, plutonium and americium isotopes are absent from Helbrecht (2002). Conversely, iron-55 is present. **Expectation to Address Comment:** Please clarify the applicability of the list of radioactive elements from Helbrecht (2002) to the proposed project, and explain the differences with the list presented in the draft EIS. **Reference:** Helbrecht, R.A. 2002. *Summary of feasibility studies on in situ disposal as a decommissioning option for nuclear facilities* (IAEA-TECDOC--1273). International Atomic Energy Agency.	
62.	Government of Quebec	Section 4.4.1 Waste Types	p.4-25	**Comment:** Section 4.4.1 states: "CSA 292.0-14 (2014b) guidance […] suggests limiting the amount of long-lived beta and/or gamma emitting radionuclides (C-14, Cl-36, Ni-63, Zr-93, & Nb-94) in LLW to an average of up to tens of kBq/g. Radionuclides such as C-14, Ni-63 and Zr-93 are present in the reactor system at concentrations exceeding this value." Why are certain radionuclides present in the reactor system exceeding the concentration limit in CSA 292.0-14? **Expectation to Address Comment:** Please provide a justification for exceeding CSA 292.0-14 guidance.	
63.	CNSC	Section 4.4.1 Waste Types	p.4-26, 2nd paragraph	**Comment:** What does the acronym "PPE&C" mean? It is not defined in the glossary (only "PPE" is). **Expectation to Address Comment:** Please revise accordingly.	
64.	Government of Quebec	Section 4.4.2 Waste Characterization	p.4-26 to 4-27	**Comment:** The Government of Quebec would like to know what would be the long-term evolution (up to 10 000 years) of the radioisotope content at the NPD site. **Expectation to Address Comment:** Please respond to the above question related to the radiological inventory of the NPD facility in the long-term.	

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65.	Government of Quebec	Section 4.5 Potential Project-Related Releases to the Environment, Table 4.5-1	p.4-28 to 4-29	**Comment:** In Table 4.5-1**,** for the Execution and Closeout phases, more information should be provided on the type and concentrations of the radiological and non-radiological contaminants (organic and inorganic) that will be contained in the settling ponds and occasionally discharged into the Ottawa River. For this purpose, the exposure pathways and doses (if any), to which Ottawa River users, including the vulnerable population (infants and children), would be subject (e.g., source of drinking water, swimming, fishing, etc.) should also be provided. **Expectation to Address Comment:** Please provide the above-mentioned information.	
66.	CNSC	Section 4.5 Potential Project-Related Releases to the Environment, Table 4.5-1	p.4-28 to 4-30	**Comment:** There is a lack of consistency in the EIS with respect to the description of the project phases. Why does Table 5.4-1 show four project phases, whereas in the earlier sections of the EIS (e.g., p.2-2, p.3-9, p.4-7, etc.), only three phases are described? **Expectation to Address Comment:** Please revise accordingly.	
5. Scope of the Environmental Assessment					
67.	CNSC	Section 5.1 Factors to be Considered	p.5-1, last paragraph	**Comment:** "Environment and Climate Change Canada" is the correct name for this federal department. **Expectation to Address Comment**: Please correct the name in the last paragraph.	
68.	CNSC	Section 5.2 Scope of Factors, Table 5.2-1	p.5-8 to 5-10	**Comment:** Table 5.2-1 indicates where there are "potential interactions" or "positive interactions" between the project and the environment. This classification, however, is confusing since both types of interactions have the potential to occur. Do the diamonds identify "potential adverse interactions", while the squares identify "potential positive interactions"? **Expectation to Address Comment**: For clarity, please revise accordingly.	
69.	Health Canada	Section 5.2.1 Spatial and Temporal Boundaries, Figure 5.2-2	p.5-5	**Comment:** The general Local Study Area appears to exclude certain areas without providing an explanation. It seems to exclude roads and other areas south of the Site Study Area, and includes a very limited portion of the Ottawa River. **Expectation to Address Comment:** Please provide additional detail and rationale regarding the determination of study area boundaries, including why certain roads and other areas in the Local Study Area, where human receptors may be present, were excluded.	
70.	CNSC	5.2.1 Spatial & Temporal Boundaries	p.5-6	**Comment:** The design life value of the barriers (i.e., the existing structure, grout, metal equipment/piping and engineered cap) is missing in the EIS. The design life should be based on the specific waste that is to be in the NPD facility, as well as on the design used to confine the waste. The current estimate of the waste activity shows periods significantly longer than the 100 years mentioned in Section 5.2.1.The design life should be consistent with the time when the clearance level is expected to be reached. **Expectation to Address Comment**: Please provide information on the target design life (in terms of number of years), including a rationale, for the following barriers: the existing structure, grout, metal equipment/piping and engineered cap.	

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71.	CNSC	Section 5.2.3 Constituents of Potential Concern Also applicable to Section 9.2.3 Identification of Residual Effects (Atmospheric Environment), p.9-19 to 9-20	p.5-11 to 5-13	**Comment:** The selection of chemical contaminants of potential concern (COPCs) in section 5.2.3 of the EIS indicates that the NO_2 (for NO_x), SO_2 and $PM_{2.5}$ were identified as COPCs based on existing site conditions. Asbestos, lead, PCBs and mercury were also identified as COPCs as a result of knowledge of the hazardous substances present at the facility. Later in the EIS, in Section 9.2.3.3, in addition to the three COPCs identified (e.g., NO_2, SO_2 and $PM_{2.5}$), VOCs (as represented by acrolein), CO, TSP and PM_{10} are also considered in the assessment of the atmospheric environment of the project. The presentation of how COPCs were screened is confusing. It is not clear from the information presented if asbestos, lead, PCBs and mercury were considered as COPCs for the atmospheric environment, nor is it clear how VOCs, CO, TSP and PM_{10} were added to the list of COPCs. A complete list of all COPCs which were considered for atmospheric environment should be clearly listed. This list of COPCs should remain consistent throughout the assessment. In addition, it should be clearly demonstrated how each COPC was screened for further assessment. **Expectation to Address Comment**: Please clarify the full suite of COPCs that were considered for the atmospheric environment. It should be clearly demonstrated how each COPC was screened for further assessment.	
72.	CNSC	Section 5.2.3 Constituents of Potential Concern	p.5-11 to 5-13	**Comment:** Section 5.2.3.2 (Chemical COPCs) states that hazardous substances, such as asbestos, lead, mercury and PCBs, are known to be in the facility. It is not clear from the description in the EIS if there could be any halocarbon-containing inventories present in refrigeration or air-conditioning systems at the facility. The EIS should clarify whether there are any halocarbon-releasing systems that may meet the reporting requirements of the Federal Halocarbon Regulations, 2003. **Expectation to Address Comment**: Provide clarification regarding the presence of any halocarbon-containing systems, and if they meet the reporting requirements of the Federal Halocarbon Regulations, 2003.	
73.	MOECC	Section 5.2.3 Constituents of Potential Concern	p.5-11 to 5-13	**Comment:** Given the limited baseline characterization for non-radiological parameters, combined with the high level of uncertainty in groundwater models and degradation scenarios, and potential for preferential pathways (i.e., granular materials associated with drains and pipes left in place), there is uncertainty on whether the proposed list of COPCs for surface water and sediment is comprehensive enough, or if changes from baseline will be promptly captured through ongoing monitoring. For example, Table 5.2-2 does not include parameters known to be at high concentrations in subsurface drains or the Wells Area Sump (WAS), or metals exceeding relevant guidelines in sediment with the potential to be elevated in discharge(s) from the site. **Expectation to Address Comment**: Please consider a more comprehensive characterization of water quality within the Ottawa River offshore from the NPD site in order to assess the assimilative capacity of the receiving waters, consistent with the MOECC's Procedure B-1, *Water Management Policies, Guidelines and Provincial Water Quality Objectives* (1994). Include as COPC any parameter with the potential to be released at concentrations exceeding relevant water or sediment quality guidelines.	

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74.	CNSC	Section 5.2.4 Valued Components, Table 5.2-3 (d) Also applicable to Section 9.5 Geological and Hydrogeological Environment, p.9-55	p.5-17	**Comment:** There are no VCs for the geological and hydrogeological environment. Therefore, the identification of VCs for the geological and hydrogeological environment requires further assessment. Based on the pathways and rationales presented, and the described project, specific VCs that have the highest relevance (in terms of being affected by the project) should be identified in Table 5.2-3 (d). Specific VCs that should be used to assess the effects of the NPD Closure Project on the geological and hydrogeological environment include: overburden soil quality, overburden groundwater characteristics (quality, flow) and shallow bedrock groundwater characteristics. Natural factors that can impact the VCs of the geological and hydrogeological environment, and that are relevant for this project, which proposes to isolate and contain waste for up to 50,000 – 100,000 years, include future seismicity and erosion. In addition, project -related processes that seem to be relevant include waste degradation and resaturation of the grout material. **Expectation to Address Comment:** Please identify specific VCs for the geological and hydrogeological environment. The approach proposed by CNL, to "transfer the effect to another environmental component (e.g., surface water environment, aquatic environment)" is not acceptable for a project that relies on specific site characteristics. How are the natural and project-related factors likely to influence VCs? Please provide supporting evidence and discussion.	
75.	CNSC	Section 5.2.4 Valued Components, Table 5.2-3 (g) and (i)	p.5-20 to 5-21	**Comment:** As required under paragraph 5(1)(c) of the *Canadian Environmental Assessment Act, 2012* (CEAA 2012), the EIS should describe the effects of any changes the project may cause to the environment, with respect to Aboriginal peoples, on health and socio-economic conditions, physical and cultural heritage, the current use of lands and resources for traditional purposes, or any structure, site or thing that is of historical, archaeological, paleontological or architectural significance. However, there is no specific and distinct discussion of any effects on the health and socio-economic conditions of Aboriginal peoples resulting from a change to the environment. In particular, there are no VCs related to Aboriginal health identified in Section 5.2.4 (Valued Components), Section 9.8 (Human Health) or Section 9.10 (Socio-Economic Environment). **Expectation to Address Comment**: Please include a stand-alone section that provides a specific discussion of any effects on the health and socio-economic conditions of Aboriginal peoples resulting from a change in the environment. In situations where the EIS has identified changes to the environment, provide a description and analysis of how these changes could affect the health and socio-economic conditions of Aboriginal peoples.	
6. Public and Stakeholder Engagement					
76.	Government of Quebec	Section 6.2 Engagement Methods and Activities	p.6-2 to 6-18	**Comment:** According to Section 6.2 of the draft EIS, to inform the Quebec population, CNL held information sessions in the municipality of Rapide-des-Joachims, as well as an information meeting with the Council of Mayors of the Pontiac Regional County Municipality. However, it would have been relevant for information sessions to also have	

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				been held in other municipalities bordering the Ottawa River. **Expectation to Address Comment:** Please indicate which public engagement activities were intended for the Quebec population, as well as what the results were (e.g., concerns and opinions heard), and the way these results were taken into account as part of the proposed project.	
77.	CNSC	Section 6.2.7, Participant Funding Also applicable to Section 5.0 Participant Funding of the Stakeholder Engagement Technical Supporting Document, p.5-1	p.6-18	**Comment:** CNL mentions the CNSC Participant Funding Program in their EIS submission. This is a CNSC-driven program, and should not be considered as part of CNL's consultation efforts. **Expectation to Address Comment:** CNL must remove this section in the EIS and Stakeholder Engagement TSD.	
78.	Government of Quebec	Section 6.3.4 Planned Future Engagements	p.6-26	**Comment:** Section 6.3.4 states: "CNL has additional engagements planned for the remainder of 2017 […] for which the records and feedback will be summarized in future final revisions of the EIS (or EIS addendum)." CNL should specify the communication plan established until the end of the EA process, as well as during the Execution and Institutional Controls phases, in order to inform the neighbouring population of the project's progress and environmental monitoring results. **Expectation to Address Comment:** Please provide more information on planned future engagements.	
7. Aboriginal Engagement					
79.	CNSC	Section 7.5 Engagement Activities Completed, Table 7.5-1	p.7-7 to 7-29	**Comment:** Information is missing in Table 7.5-1. • Please make sure that all rows are filled and that no date or other type of information is missing (e.g., date missing on p.7-10). • In the last column, please make sure that the number and document title of each referenced Appendix is provided (e.g., the second to last row on p. 7-18 only indicates "See Appendix for presentation"). **Expectation to Address Comment**: Please revise the table accordingly.	
8. Description of the Existing Environment					
80.	CNSC	Section 8.1 Baseline Characterization Approach	p.8-1 to 8-4	**Comment:** The need for an environmental monitoring program is based on criteria set out in CSA N288.4-10, *Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills*. CNL indicates that there is no Environmental Risk Assessment (ERA) for this facility, that there are no stakeholder concerns related to this project, and therefore, that an environmental monitoring program is not required. It could be argued that the EIS is a predictive ERA with uncertainties related to the release rates of COPCs from the facility. Hence, there is an ERA for this facility. There are also stakeholder concerns with this proposed project. **Expectation to Address Comment**: Please provide a justification for not including, at a	

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				minimum, groundwater and atmospheric monitoring programs at the NPD site.	
81.	Government of Quebec	Section 8.1 Baseline Characterization Approach, Table 8.1.1	p.8-2	**Comment:** Table 8.1-1 states (as Monitoring Criteria under row (c): "The effective dose to members of an off-site critical group from all radioactive releases from the site during normal operations and anticipated transients is estimated to exceed $5x10^{-5}$ Sv (or 0.05 mSv) per year." However, in other sections, the choice of acceptable exposure level is different (e.g., 250 µSv/year or 1,000 µSv/year (p. 9-121)). This choice should be clarified, because it does not appear to be used consistently in the draft EIS. Furthermore, as a comparison, the Swedish acceptable exposure level is 14 mSv/year (Andersson et al., 2016) and the conditional clearance criterion, as defined in the *Nuclear Substances and Radiation Devices Regulations*, is 10 µSv/year. **Expectation to Address Comment:** Please clarify what the acceptable exposure level is for this proposed project. **Reference:** Andersson, E., Källström, K., Morén, L., Skagius, K., Hjerpe, T., & Smith, G. 2016. *Assessment of Human Intrusion and Future Human Actions–Example from the Swedish Low and Intermediate Level Waste Repository SFR* (No. IAEA-CN–242).	
82.	CNSC	Section 8.1 Baseline Characterization Approach	p.8-4, 2nd and 3rd paragraphs	**Comment:** Please clarify the meaning of the following sentences as they seem to contradict each other: "…the Local and Regional study areas are outside the project footprint, and are likely to capture a larger area than where effects are expected. For many of the environmental components, data from the Regional Study Area can be assumed to be relevant for the baseline characterization of the Site and Local Study Areas." If the effects are not likely to be expected outside of the Site Study Area, then why is CNL relying on data from the Regional Study Area to represent the Site and Local Study Areas? If impacts are likely to be localized (i.e., onsite impacts), the baseline environment at the project site becomes particularly important and would need to be well characterized. **Expectation to Address Comment:** Please clarify this assumption and explain with more clarity the general role of each study area (or spatial boundary) in assessing the potential adverse environmental effects of the project. Refer to CNSC's *Generic EIS Guidelines* (p.13 to 15) for a definition of each study area.	
83.	CNSC	Section 8.2 Atmospheric Environment	p.8-4 to 8-5 and p.8-26	**Comment:** The Regional Study Area for the atmospheric environment was defined to extend 5 km beyond the Site Study Area. The defined Regional Study Area is not large enough to consider other projects that might result in cumulative effects. It should be sufficiently large to encompass the cumulative effects of other reasonable foreseeable projects occurring in the region (e.g., those activities occurring at the Chalk River Laboratories (CRL) site). Additionally, meteorological data from CRL was used to represent the Regional Study Area. If data from CRL is used in the assessment to represent this area, then it should be expanded to include the CRL site. **Expectation to Address Comment**: The size of the Regional Study Area should be expanded to encompass the CRL site to ensure that other projects that might result in cumulative effects are considered, and to justify the use of the data from the CRL site for the Regional Study Area.	

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84.	CNSC	Section 8.2.2 Climatic Data	p.8-6	**Comment:** There is no site-specific meteorological data for the NPD site. CNL has used meteorological data from the climate stations located at various locations at the CRL site to describe meteorological conditions for the Site, Local and Regional Study Areas. Although site-specific data is preferred, the approach used by CNL can be appropriate if no site-specific data is available. However, the EIS should include a discussion regarding the validity and uncertainty associated with using meteorological data from the CRL site to describe the climatic and meteorological conditions for the NPD site. **Expectation to Address Comment**: Please provide a discussion regarding the validity and uncertainty associated with using meteorological data from the CRL site for the description of climatic data for the NPD site.	
85.	CNSC	Section 8.2.2 Climatic Data	p.8-10	**Comment:** The EIS states that the "meteorological data used as model input consists of five years of hourly data." Although details on the air dispersion modelling are presented in Appendix C and Appendix F of the Decommissioning Safety Assessment TSD, the main EIS should provide enough details regarding the meteorological data used in subsequent modelling work. Additional details regarding where the meteorological data was obtained from, and the five-year period covered, should also be described in the main EIS. **Expectation to Address Comment**: The source of the meteorological data used as input for the air dispersion model should be specified in the main EIS.	
86.	ECCC	Section 8.2.2 Climatic Data (Precipitation), Tables 8.2-3 and 8.2-4	p.8-10 to 8-12	**Comment:** Section 8.2.2 states: "…Table 8.2-3, shows a similar pattern and seasonal distribution as the climate normals for 1981 to 2010, Table 8.2-4." With respect to this statement, ECCC is of the position that there is substantial variation in the monthly averages between the 5-year series and the 30-year series. For example: • For February, the monthly average precipitation is 24.7 mm from the 5-year series, and 43.7 mm from the 30-year series • For August, the monthly average precipitation is 95.3 mm from the 5-year series, and 80.7 mm from the 30-year series Existing long-term data sets should be used preferentially. It is typical to use the 30-year climate normal, but other data sets may be relevant depending on the context. For example, design storms would be used to ensure appropriate sizing of water management infrastructure, such as drainage ditches and stormwater management ponds. For a water balance model, one would use data sets that considered wet and dry periods that are relevant to upper and lower percentile bounds (e.g., 10th percentile and 90th percentile data). It is not clear for what purpose CNL has used the 5-year data set. **Expectation to Address Comment:** Please consider removing from the EIS the quote referenced above and any other related text that makes similar statements or conclusions. Furthermore, please identify what the 5-year data set is being applied to, and for what purpose, and consider revising, where necessary, any analyses or conclusions that used the 5-year precipitation data set. In such instances, apply the 30-year climate normal and other data sets (e.g., design storms), as may be appropriate to the purpose. For projects with a very long timeframe, the potential effects of climate change upon the project also need to be considered.	

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87.	CNSC	Section 8.2.2 Climatic Data Also applicable to Appendix C (Atmospheric Dispersion Modelling) of the Decommissioning Safety Assessment Technical Supporting Document, p.C-11 to C-12	p.8-14 to 8-15	**Comment**: Section 8.2.2.3 presents wind direction and speed data obtained from the CRL site. The data is obtained from the top of an office building in the CRL main campus, at approximately 40 meters and at heights of 30 and 60 meters from Perch Lake. As outlined in Appendix C.2 (Atmospheric Dispersion Modelling for Normal Operations), the regional data set for Ottawa, as prepared by the MOECC, was used for the dispersion modelling for normal operations. Appendix C.2 further states that the CRL dataset was combined with the Ottawa dataset for dispersion modelling using AERMOD and CALPUFF in screening mode. The information in the main EIS does not make reference to the use of the Ottawa regional meteorological dataset in the description of the climatic conditions for the NPD site. If the meteorological dataset for the Ottawa region was used, as obtained from the MOECC, it should also be presented in the main EIS along with a discussion regarding the validity and uncertainty associated with using this dataset compared to the dataset for the CRL site. **Expectation to Address Comment**: The regional meteorological dataset used in the dispersion modelling for normal operations (Appendix C) should also be presented in Section 8.2.2.3 of the main EIS, along with a discussion of the uncertainty associated with using this dataset versus the dataset for the CRL site.	
88.	CNSC	Section 8.2.4 Air Quality	p.8-25 to 8-27	**Comment:** In Section 5.2.3 (Constituents of Potential Concern), the assessment identified COPCs by considering hazardous substances that are known to be in the facility, such as asbestos, lead, PCBs and mercury and other contaminants such as metals and PAHs. Baseline air quality for these COPCs is absent from Section 8.2.4 (Air Quality). Knowledge of the baseline air quality for these hazardous substances is needed to demonstrate how they were screened for further assessment. **Expectation to Address Comment**: Please provide the baseline air quality for asbestos, lead, PCBs and mercury, as well as for other contaminants such as metals and PAHs. If this information is not available, a narrative should be provided regarding how these constituents were screened in the assessment for the atmospheric environment.	
89.	CNSC, ECCC	Section 8.2.4 Air Quality Also applicable to Appendix F (Air Quality Assessment for the NPD Project) of the Decommissioning Safety Assessment Technical Supporting Document	p.8-26 to 8-27	**Comment:** CNL used the National Ambient Air Quality Standards as screening criteria in the air quality assessment. These standards have been superseded by the Canadian Ambient Air Quality Standards (CAAQS) for $PM_{2.5}$, NO_2, SO_2 and ozone. CAAQS for SO_2 have been recently released and come into effect in 2020, while CAAQS for $PM_{2.5}$ came into effect in 2015. CAAQS for NO_2 have recently been endorsed and come into effect in 2020. The appropriate standards should be used as screening criteria in the assessment of chemical COPCs for the atmospheric environment, especially given that the CAAQS for fine particulate and ozone are set at lower (more stringent) levels than the National Ambient Air Quality Standards and Ontario Ambient Air Quality Guidelines used by CNL. **Expectation to Address Comment:** The screening criteria for the air quality should be updated to incorporate the CAAQS for $PM_{2.5}$, NO_2 and SO_2. More specifically, the air quality should be screened against the standards for 2015 and 2020, as the project execution phase may still be ongoing beyond 2020. Furthermore, CNL should assess if the	

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				revised values change any of the conclusions reached in the EIS. For additional information on the new SO_2 standards, visit: https://www.ccme.ca/en/resources/air/air/sulphur-dioxide.html For additional information on the new $PM_{2.5}$ standards, visit: http://www.ccme.ca/en/resources/air/pm_ozone.html For additional information on the new NO_2 standards visit: https://www.ccme.ca/en/current_priorities/air/caaqs.html	
90.	CNSC, Health Canada	Section 8.2.4 Air Quality	p.8-26 to 8-27	**Comment**: The four closest ambient air monitoring stations (i.e., Petawawa, Napanee, Ottawa and North Bay) were considered as the sources of background air quality data. It was noted that not all stations measure all the constituents. From the information in the EIS, it seems the following assumptions were used: • NO_2 data from North Bay • $PM_{2.5}$ data from Petawawa No ambient air monitoring station was indicated as the source of the SO_2 background air quality data. In addition, limited explanations were provided regarding the validity or uncertainty of using one monitoring location versus another. There is also no information regarding the year(s) from which the data was obtained. In addition, the distance between the NPD site and each station is not provided. **Expectations to Address Comment**: Please clearly indicate the ambient air monitoring stations used as the source of background air quality for each of the COPCs (i.e., this information is missing for SO_2). Include a discussion of the validity and uncertainty associated with using one monitoring site versus another, along with the year(s) from which the data was obtained. Furthermore, specify the distance between the NPD site and each station used to determine the background air quality concentrations.	
91.	CNSC	Section 8.3.2 Hydrology, Figure 8.3-3	p.8-34	**Comment:** There is no legend for Figure 8.3-3, which makes it difficult for the reader to understand the Ecological Land Classification Designations that are present near the NPD site. Also, not all of these designations are defined in the text on p.8-33. **Expectation to Address Comment:** Please include a legend that defines all the Ecological Land Classification Designations shown on Figure 8.3-3.	
92.	CNSC	Section 8.3.3 Surface Water Releases Also applicable to Section 8.3.4 Surface Water Quality and Section 8.3.5 Sediment Quality	p.8-37	**Comment:** Table 8.3-1 provides the number of discharges, total volume (m^3), as well as concentrations of I-131, Cs-137, Ce-144, C-14, Co-60, HTO (tritiated water), gross beta and gross gamma. However, the regional monitoring water quality data (Table 8.3-7, p.8-46 to 8-49) only reports for HTO, Cs-137 and Sr-90. Similarly, radionuclide concentrations in sediment samples (Table 8-3.9, p.8-54) are not provided for C-14, Co-60, I-131 and Ce-144. **Expectation to Address Comment:** Please justify why the radionuclides released are not consistently reported in surface water and sediment for Tables 8.3-1, 8.3-7 and 8.3-9.	
93.	CNSC	Section 8.3.3 Surface Water Releases	p.8-38, 1st paragraph	**Comment:** The first sentence on this page indicates that data from "1997 – 2007" is presented in Table 8.3-1. However, this table covers data from 1997 to 2015.	

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				Expectation to Address Comment: Please revise accordingly.	
94.	MOECC	Section 8.3.3 Surface Water Releases	p. 8-41	**Comment:** Routine monitoring does not appear to have included testing for non-radiological parameters, nor do release limits appear to have been established for conventional contaminants. Summary data for a single sampling event are provided for non-radiological parameters in discharge from the WAS, which reveal that a number of parameters exceeded the Canadian Counsel of Ministers of the Environment (CCME) Environmental Quality Guidelines, some of them by several orders of magnitude (i.e., Cd, Cu, Pb, PCB). **Expectation to Address Comment:** Please provide a more complete dataset for non-radiological parameters in effluent from the WAS, which would increase the reliability of the risk assessment with respect to the identification of COPCs.	
95.	MOECC	Section 8.3.4 Surface Water Quality	p.8-41 to 8-49	**Comment:** Several issues were identified with respect to the dataset provided for surface water quality from subsurface drains. • On page 8-31, the EIS indicates that MH-3 has been routinely dry in recent years, while data presented in Table 8.3-4 indicates that dry conditions were encountered in 6 years (2007 - 2012) of the past 23 years (1993 - 2015). Measured discharge volumes do not appear to be available. It is unknown if flow in Drains 1 or 2 have been affected by maintenance activities or other work undertaken at the site in recent years, which may account for the dry conditions and/or apparent restoration of flow in Drain 2. Without quantified flows from each drain, the precautionary approach should be employed in interpreting water quality data (i.e., presume ongoing discharge). • Data for non-radiological parameters in effluent from subsurface drains seems limited. The EIS indicates that data collected in 2014 was compared to Health Canada's drinking water criteria. Please note that drinking water criteria are not applicable to the assessment of discharge to surface water receivers as, in some cases, guidelines for protection of aquatic life and/or recreational value may be orders of magnitude lower than drinking water criteria for the same parameter. Given that data is apparently very limited, comparison of all available data to relevant criteria is expected. • High tritium concentrations in drains (especially in Drain 1, which is understood to sustain more consistent flows) may suggest that the drain is intercepting and discharging contaminated groundwater. This does not appear to have been sufficiently addressed within the subject proposal, as it relates to the potential for impacts to surface water. • Subsurface drains and surrounding granular material may represent a preferential pathway for migration of contaminants in groundwater towards, and discharging to the Ottawa River. (Refer to comments no.26 and no.212 for more details). **Expectation to Address Comment:** Taking into account the aforementioned issues, please revise Section 8.3.4 of the EIS. Also, consider providing a more robust dataset for the quality and quantity of effluent from subsurface drains, which would permit a more reliable assessment of the potential risks to surface water resources associated with this	

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				project.	
96.	CNSC	Section 8.3.4 Surface Water Quality	p.8-45	**Comment:** Section 8.3.4.1 states that chemical levels in surface water in the part of the Ottawa River located in the Site and Local Study Areas are not available. If these data have not been obtained, how can follow-up monitoring of the surface water environment be reliably conducted and contrasted during the undertaking and completion of the project in order to demonstrate chemical contaminants are not entering the Ottawa River? **Expectations to Address Comment:** Given the stipulations in CSA N288.4-10, *Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills* (Sections 5.2.1 and 5.2.2), please justify why it is unnecessary to have baseline chemical data of the Ottawa River within the Site and Local Study Areas prior to commencement of the project. Acquiring this data would help develop a robust description of the baseline environment in order to reliably demonstrate that the project is not impacting surface water quality in the Ottawa River during follow-up monitoring.	
97.	ECCC	Section 8.3.5 Sediment Quality	p.8-51	**Comment:** In 2014, a river sediment study near the NPD outfall pipe was conducted. The radiological parameter Cs-137 and a set of Naturally Occurring Radioactive Materials (K-40 and U-238 decay series radionuclides) were reported for about 30 stations, both upstream and downstream of the NPD outfall pipe. In 2016, sediment samples were collected at 16 locations both upstream and downstream of the NPD site. The 2016 samples were collected 15 centimeters below the "ground" surface, and were analyzed for metals. With respect to the 2014 study, it is not clear at what depth below sediment surface the radiological samples were collected. With respect to the 2016 study, there is no information with respect to spatial distribution of the sampling stations for the campaign. It is not possible to identify areas with potentially elevated levels of metals without an understanding of the spatial locations of the stations along with a station-to-station analysis of the data. It also is not clear if the depth of the 2016 samples is appropriate to capture the influence of the NPD site, because no additional information on natural sediment depositional rates was given. **Expectation to Address Comment:** A more detailed assessment of the adequacy of the baseline sediment data is not possible without the additional information requested as follows: • Provide information on the natural depositional rates in the Ottawa River • Provide a justification for the depth of sediment sampling, in consideration of the historical period that the NPD facility has operated and existed • Provide a map that identifies the 2016 sediment sampling locations, along with a metals analysis at each of the 16 stations sampled • Demonstrate that radiological sampling parameters were appropriate to those that could potentially be associated with releases from the NPD facility (e.g., fission and activation products, such as Cs-137, Ac-228). Additional sampling may be required.	
98.	CNSC	Section 8.3.5 Sediment Quality,	p.8-53 to 8-54	**Comment:** In the Postclosure Safety Assessment TSD (in Table 5-5), a maximum tritium	

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		Tables 8.3-8 and 8.3-9 Also applicable to the Postclosure Safety Assessment Technical Supporting Document, Table 5-5, p.5-14		concentration of 2000 Bq/kg is predicted in sediments, 40 years into the Institutional Controls phase. How does this value compare to current tritium concentrations in sediments around the NPD site? Tritium seemingly has not been included in the suite of radionuclides analyzed in Tables 8.3-8 and 8.3-9. Is there tritium data available from sediment samples around the NPD site to describe baseline conditions? **Expectations to Address Comment:** Please indicate if tritium data is available for the sediment sample locations described in Tables 8.3-8 and 8.3-9. If no tritium data is available, CNL should justify why no analysis of river sediments for tritium were conducted, especially considering it is estimated to be the primary contributor of radiation in river sediment predicted in the post closure TSD.	
99.	CNSC	Section 8.3.5 Sediment Quality, Tables 8.3-8 and 8.3-9	p.8-53 to 8-54	**Comment:** Tables 8.3-8 and 8.3-9 present results for a subset of sample locations shown in Figures 8.3-10 and 8.3-11. No explanation is provided for why 8 sampling locations were selected to conduct a 24-hour count analysis, while 22 sampling locations were selected to conduct a 4-hour count analysis. For some locations, no results are presented in Tables 8.3-8 and 8.3-9 (e.g. P-31, P-32, P-33, etc.). **Expectation to Address Comment:** Please explain the distribution of results in Tables 8.3-8 and 8.3-9, and why not all locations are associated with sample results in these tables.	
100.	Health Canada, MOECC	Section 8.3.5 Sediment Quality	p.8-55	**Comment:** Several issues were identified with respect to the analysis of non-radiological parameters in sediment. • No differentiation is made between sediment quality upstream and downstream of the facility outfalls. • When collecting samples in support of establishing natural background conditions, samples should be collected from an area with similar environmental conditions located away from potential anthropogenic contamination. However, no information is provided with respect to the selection of sampling sites (i.e., water depth or current, depositional areas) or substrate characteristics (i.e. grain size, organic content, etc.). • Upon examination of individual sample results, it is noted that, while there are no exceedances of applicable standards upstream of the NPD site, some metals exceed guideline values at downstream stations (i.e., exceedances of standards for nickel, copper, arsenic and cadmium). This may suggest some influence from the site (i.e., discharge of effluent from WAS or subsurface drains with elevated concentrations of metals, or seepage of impacted groundwater to the river). **Expectation to Address Comment:** Please provide a more detailed assessment to better inform decisions on acceptable release criteria and to permit more reliable monitoring for potential impacts. Establish acceptable release criteria to prevent further deterioration of sediment quality for parameters exceeding applicable guidelines at downstream stations. In addition, demonstrate that the sample locations have not been impacted by anthropogenic sources and are reflective of natural background conditions.	
101.	Health Canada	Section 8.3.5 Sediment Quality	p.8-55 to 8-56	**Comment:** The location of background samples for non-radiological concentrations in sediment are purportedly shown on a map in Ethier and Hart 2013 and Golder 2017,	

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				without providing a summary of the results, conclusions and applicability to the NPD site. **Expectation to Address Comment:** Please include a figure in the EIS that clearly delineates sampling and reference locations, and demonstrate their appropriateness for this assessment.	
102.	Health Canada	Section 8.3.5 Sediment Quality	p.8-56	**Comment:** It is not clear what is meant by the following passage: "there were reported exceedances of several metals in both reference sites and sites affected by CRL operations. Due to the high levels in unaffected sites, these exceedances were considered to be baseline conditions." **Expectation to Address Comment:** Please clarify whether the concentrations were similar at both reference sites and sites affected by CRL operations to justify the conclusion that exceedances were due to background conditions rather than existing contamination from CRL activities.	
103.	CNSC	Section 8.5.2 Geology	p.8-63	**Comment:** CNL states that the potential for liquefaction has not been assessed because the foundation of the NPDWF is well within the bedrock. Although the liquefaction of the overburden adjacent to the NPD foundation might not affect the structural integrity of the NPDWF, as the soils do not support the structure, it might compromise the integrity of the engineered barrier overlying the concrete cap depending on the barrier design (e.g., if part of the engineered barrier is overlying the overburden) and have implications on the safety of the facility. **Expectation to Address Comment**: Please determine if the liquefaction of the overburden would compromise the integrity of the engineered barrier. If the impact is likely, the liquefaction of the overburden should be assessed and its implication to the safety of the facility should be evaluated.	
104.	CNSC	Section 8.5.2 Geology Also applicable to the Postclosure Safety Assessment Technical Supporting Document	p.8-63 to 8-65	**Comment:** The location of the project within the Ottawa-Bonnechere graben – the structure of regional importance with respect to active seismicity in this part of the world – is not proportionate with the very limited baseline information provided to support the EIS. This insufficiency of information affects CNSC staff's ability to evaluate the safety assessment scenarios and long-term safety case for the proposed project. The existing geological environment is characterized over only a few pages in the main EIS, providing an extremely limited overview of the geosphere. This information is required to assess a project of this scope and scale, which proposes to safely isolate and contain the radioactive source material for many tens of thousands of years. There are no scientific or technical references provided for the regional or site geology that refer to the published peer-reviewed literature. Section 8.5.2 refers to King (2017) and McCrank (2016). King (2017) is a historical site assessment made for the NPD site; McCrank is a geological model prepared for the CRL site, and is not specific to the NPD site. The scientific literature appears not to have been consulted. There appears to have been almost no site-specific characterization of the geological and hydrogeological environment, to verify and constrain statements made throughout the EIS and supporting documents. Information is either not provided (e.g., documentation of the structural geology at local and regional scales, geological setting and history of the region, tectonic setting, three-	

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				dimensional geological framework model) or limited (e.g., characterization of the seismic hazard of the site [linked to regional geological structures and the tectonic setting, potential for fault / shear zone reactivation], characterization of overburden materials, such as their physical, hydrogeological, mechanical, and geochemical properties). This will impact both the environmental effect and safety assessments. For instance, the existence of large-scale discontinuities at or near the facility might constitute preferential groundwater flow and contaminant migration pathways, impacting the safety of the facility. **Expectation to Address Comment**: Please provide a synthesis of the complete geosphere characteristics that are relevant for this project to support the EIS and the safety assessment, and as an important component of the overall safety case. Please review and refer to the scientific literature.	
105.	CNSC	Section 8.5.2 Geology	p.8-65	**Comment:** The description of the existing geological environment is not consistent with CNSC's REGDOC-2.9.1. Bedrock geology is only briefly described in a few hundred words on page 8-65 (Section 8.5.2.2 Regional study area). No maps were provided (the bedrock geology map of Ontario and the Wikipedia map provided in Appendix B of the Postclosure Safety Assessment TSDare insufficient for this project). Though reference is made to a descriptive geological site model that was completed for the CRL site, this model is not provided in the submission – and would likely not represent the conditions at the NPD site. Section 8.5.2 appears to be the section that will provide the information to meet the requirement for baseline geological information in the EIS, as outlined in CNSC's REGDOC 2.9.1 (Section B.4). This information is required for CNSC's evaluation of the EIS and the VCs (refer to Comment no.68). The EIS should include a geological model that incorporates the site characteristics (e.g., overburden characteristics, bedrock characteristics), and that explicitly states uncertainties in the model, as well as any need for further characterization field work that would be required to reduce those uncertainties. **Expectation to Address Comment:** Please provide a full description of the geosphere to support the EIS and fulfill the requirement for baseline geological information of the existing environment. Consistency should be ensured with CNSC's REGDOC-2.9.1. This information will support assessments of the NPD site's future evolution, over the extended safety assessment timeframe.	

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106.	ECCC	Section 8.5.3 Soil Quality Also applicable to the Baseline Report (Wills 2013), Section 5.2.5 Soil, Tables 5-26 to 5-28	p.8-65	**Comment:** The only reported soil baseline data for radionuclides in the vicinity of the NPD site includes: • A monitoring record of tritiated water (HTO) in soil at 8 sampling stations around the NPD site from 1988-2015 • A 1996 sampling campaign for gamma emitting radionuclides in soil The 1996 data reported naturally occurring radionuclides, Cs-137 and Ac-228, as well as gross alpha and gross beta, which comprise a reasonable set of relevant radionuclides for the NPD facility. However, since 1996, HTO has been the only radiological constituent reported in the EIS for soil. Also, for both sampling programs, no maps were provided to show the locations that were sampled. This made it difficult to interpret the soil data, and to identify if the sampling programs provide adequate baseline information. Regarding baseline non-radiological soil surveys, a few soil sampling campaigns took place between 1989 and 2008 at the NPD site. It is noteworthy that the 1990 sampling campaign also analyzed for metals, oil, grease and PCBs. Tables 5-26 to 5-28 of the Baseline Report (Wills 2013) show the results from borehole samples, but no information is given related to the depths of the boreholes or at what depth the samples were taken. Also, no map is provided in this document to show where the sampling stations are. Figure 8.5-4 of the main EIS seems to include soil sampling station names that correspond to the stations that are reported in the Baseline Report, but this has not been clarified. Even so, Test pit site TP-N, which shows elevated levels of some metals, PCB's and Phenols, is not visible on Figure 8.5-4. Although almost all of the hydrocarbon / organics data reported seem to be below detection limits, there are some parameters (e.g., 2,4,6 Trichlorophenol) for which the detection limits are higher than the guidelines for Residential / Parkland (0.05ug/g vs 0.5ug/g). Furthermore, it would have been useful to use the 2016 campaign to confirm previous findings regarding hydrocarbon levels and identify if any residual contamination exists. A more recent soil sampling campaign for metals was reported to have been conducted in 2016. Sampling was conducted at 96 locations throughout the NPD exclusion area; however, none of those sites are identified on a map. It is not possible to interpret the monitoring data without a spatial understanding of the sampling locations. **Expectation to Address Comment:** A more detailed assessment of the adequacy of the baseline soil data is not possible without the additional information requested as follows: • Provide maps that clearly identify all soil sampling locations associated with the 1990 and 2016 sampling campaigns • Identify any monitoring results for which the detection limit is greater than the applicable guideline (e.g., some instances were noted in the 1990 campaign) • Provide the depths of the borehole samples that were collected in the 1990 soil sampling campaign • If available, hydrocarbon and organics data should be reported for the 2016	

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				sampling campaign • In addition to the recent HTO data, provide current soil radiological information that includes other fission and activation products	
107.	Government of Quebec	Section 8.5.5 Hydrogeology	p.8-76	**Comment:** Section 8.5.5 states: "Groundwater seepage into the facility is directed to the lowest point at the WAS and is less than 10 m^3/a in the last 5 years." In the long-term, this rate represents a significant amount of water. What are the concentrations of radioactive elements in this water? **Expectation to Address Comment:** Please address the above question and concern.	
108.	Government of Quebec	Section 8.5.5 Hydrogeology	p.8-77	**Comment:** Section 8.5.5 states: "The process effluent drain is in service and is valved out inside the building. The access to the area is controlled to authorized personnel only. This drain is used for batch discharges from the WAS…" Given that the base of the WAS is well below the drains, how will batch discharges be performed? Will the link between the WAS and the drains be blocked or filled with cement? Are these the drains that follow the pipes to the river or the drains surrounding the building? **Expectation to Address Comment:** Please clarify how CNL plans on performing batch discharges and explain the current and future status of the drain(s) mentioned in Section 8.5.5.	
109.	CNSC	Section 8.6.5 Regional Provincial Parks and Protected Areas, Figure 8.7-1	p.8-106	**Comment:** Seven provincial parks and protected areas are located within the Regional Study Area, shown on Figure 8.6-1 (p.8-84). To help the reader better understand the existing terrestrial environment surrounding the NPD site and how the project could affect terrestrial VCs, provincial parks and protected areas should be depicted on Figure 8.6-1. **Expectation to Address Comment:** Please revise accordingly or provide an explanation for why these environmental sensitive areas are not visible on Figure 8.6-1.	
110.	CNSC	Section 8.9.2 Traditional Land Use	p.8-133	**Comment**: Section 8.9.2 states that "[t]he project occurs within the general area of the Algonquins of Ontario Settlement Boundary." It should be noted that the NPD site is also located within the known traditional territory of the Métis Nation of Ontario (MNO).	

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				Expectation to Address Comment: Please confirm whether or not CNL has undertaken research on Métis traditional land use, as per REGDOC-3.2.2, which advocates considering traditional territories and traditional uses of land. CNL should review the MNO's research on the Métis' traditional land use in and around the Mattawa and Ottawa rivers. This research can be found here: http://www.Métisnation.org/news-media/news/historic-research-report-on-métis-community-in-mattawanipissing-region-released/.	
111.	CNSC	Section 8.9.2 Traditional Land Use	p.8-134	**Comment**: Section 8.9.2 identifies that the Regional Study Area intersects with two designated Trapline Areas (PE026 and PE027) and states that "[i]t is possible but not yet determined whether there are Aboriginal people holding these traplines." **Expectation to Address Comment**: Please clarify whether CNL has been in contact with those who have trapping rights / licence for traplines PE026 and PE027. Explain if there is active hunting or trapping in these adjacent traplines, as well as on adjacent private (patent) lands, more specifically if they are being used by any of the identified Aboriginal groups, in accordance with guidance provided in REGDOC-3.2.2 and CNSC's *Generic EIS Guidelines*.	
112.	CNSC	Section 8.9.2 Traditional Land Use	p.8-135	**Comment:** Section 8.9.2 states that "[t]he Regional Study Area includes provincial, federal and private lands where hunting may also be occurring. It is unknown whether hunting on these private lands is being undertaken by Aboriginal peoples." **Expectation to Address Comment:** As per REGDOC-3.2.2 and CNSC's *Generic EIS Guidelines*, please clarify whether First Nation or Metis groups hunt on these lands, and if so, what engagement activities has been conducted with the identified groups to address their concerns.	
113.	CNSC	Section 8.9.2 Traditional Land Use	p.8-137	**Comment**: Section 8.9.2 states that"[i]t is likely that there is fishing by Aboriginal people on the Ottawa River in the vicinity of the NPD site." The Ottawa River is highly valued by local First Nation or Metis groups, and it is likely that there is fishing by Aboriginal peoples in the regions around the NPD site. **Expectation to Address Comment:** As per CNSC's *Generic EIS Guidelines* (Sections 2.4, 3.3.2 and 5.2.1), please clarify the following with respect to fishing by Aboriginal peoples near the NPD site: • Which potentially affected First Nation or Metis groups are referred to on p.8-137 • If those groups are included within CNL's list of identified Aboriginal groups • How CNL has adequately engaged with those groups regarding potential impacts to VCs of interest to Aboriginal peoples, including fish resources in the Ottawa River	
114.	CNSC	Section 8.9.2 Traditional Land Use	p.8-138	**Comment:** Section 8.9.2 states that "[i]t is possible that there may be some gathering activities in the Local Study Area within private lands adjacent to the Federal lands… Aboriginal people also likely gather plan materials and other resources on provincial land in the Regional Study Area." **Expectation to Address Comment:** As per CNSC's *Generic EIS Guidelines*, please	

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				clarify the following with respect to gathering by Aboriginal peoples near the NPD site: • Which potentially affected First Nation or Metis groups are referred to on p.8-138 • If those groups are included within CNL's list of identified Aboriginal groups • How CNL has adequately engaged with those groups regarding potential impacts to VCs of interest to Aboriginal peoples, including gathering activities with the Ottawa Valley	
115.	CNSC	Section 8.9.3 Cultural Resources and Ceremonies	p.8-138 to 8-139	**Comment:** As per CNSC's *Generic EIS Guidelines*, CNL is expected to work with First Nation and Métis groups to identify and mitigate potential environmental effects to a structure, site or thing that is of archeological significance. **Expectation to Address Comment:** Please include an update on the level of community interest expressed with regards to any of the archaeological sites and artifacts identified on the NPD site. Also, indicate how CNL has engaged with identified First Nation and Métis groups, the level of interest they have expressed with regards to the archaeological finds, and how CNL will work with any interested groups and communities on preserving and managing the structures, sites or things that are of archeological significance.	
116.	CNSC	Section 8.9.3 Cultural Resources and Ceremonies	p.8-139	**Comment**: Section 8.9.3 states that "CNL acknowledges that there are proposed Algonquin land claim settlement lands located near the NPD site (near Tee Lake) that likely are of significance to certain members of the Algonquins of Ontario." **Expectation to Address Comment**: Please indicate whether CNL has engaged with the Algonquins of Ontario to confirm the significance of these lands, and if there are any potential cultural ceremonies associated with the Regional Study Area in accordance with CNSC's *Generic EIS Guidelines*.	
117.	CNSC	Section 8.11.2 Seismicity	p.8-157	**Comment:** The characterization of seismic hazard of the site is insufficient. Similarly, the characterization of regional seismic sources (and regionally important geological structures), presentation of regional geological setting and history, and tectonic setting is limited. The NPD site lies within the Ottawa-Bonnechere Graben, within the Western Quebec Seismic Zone (WQSZ), a zone with moderate seismic hazard. References to the earthquake events of the WQSZ are incomplete. No seismic hazard assessment was conducted in accordance with the defined assessment timeframe since the probability of a major earthquake increases with time – and with respect to long-term safety for this project, that time is 50,000 years. The two paragraphs devoted to describing seismic events require further development and supporting documentation. A seismic hazard assessment should be conducted and supported by documentation of the geological environment, including documentation of regional seismic sources, their related geological structures, and tectonic setting. Information on paleoearthquakes, such as in Doig (1991) and Aylsworth et al. (2000) among many others, should be cited to support the assessment, as appropriate. **Expectation to Address Comment**: Please conduct a seismic hazard assessment of the site corresponding to the defined timeframe and assess its impact on the NPD facility. **References:**	

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				Doig, R. 1991. *Effects of strong seismic shaking in lake sediments, and earthquake recurrence interval, Témiscaming, Quebec*. Canadian Journal of Earth Sciences 28, 1349-1352. Aylsworth, J.M., D.E. Lawrence and J. Guertin. 2000. *Did two massive earthquakes in the Holocene induce widespread landsliding and near-surface deformation in part of the Ottawa Valley, Canada?* Geology 28, 903-906.	
118.	ECCC	Section 8.11.4 Floods Also applicable to Section 9.13.2 Climate Change and Section 9.13.6 Flood Also applicable to the Decommissioning Safety Assessment Technical Supporting Document, Section 4.3 (p.4-9) and Section 9.6.3 (p.9-65 to 9-69)	p.8-161 to 8-164	**Comment:** CNL indicates that construction will occur over the period 2019-2020 and the "Effects of the Environment on the Project" are considered for two future time periods: 1. Decommissioning Execution phase – Decommissioning Safety Assessment TSD (2020-2120) 2. Post-Institutional Controls phase – Postclosure Safety Assessment TSD (2120+) CNL defines baseline floods for the study area in Section 8.11.4 of the main EIS. They indicate that flooding could occur due to: (i) flooding of the Ottawa River, (ii) heavy precipitation, or (iii) failure of upstream dams. Many of the values described in this section appear to be based on the observational climate record (e.g., major floods in Ontario 1990-2015, heavy rainfall, PMP and 100-year snowpack). The scientific literature points to an increased probability and intensity of extreme heavy precipitation events in the future with continued climate change. In addition to the projected changes in precipitation with climate change, the number of exceedances of many fixed design values, for example the capacity of stormwater management structures, will likely increase over the longer time period (e.g., into the Post-Institutional Controls phase). No estimates of how the observation-based values used to estimate flood risks (e.g., heavy rainfall, PMP and 100 year snowpack from observations) may change with future climate change have been provided in the EIS documentation (e.g., Sections 9.13.2 and 9.13.6 of the draft EIS, and Section 9.6.3 of the Decommissioning Safety Assessment TSD). **Expectation to Address Comment:** Please evaluate the effects of climate change upon precipitation, and its resultant effect upon potential flooding of the NPD site, as well as the potential for this flooding to cause adverse effects.	
9. Assessment and Mitigation of Environmental Effect					
119.	Government of Quebec	Section 9.1 Effects Assessment Approach	N/A	**Comments:** Figure 1 in the Helbrecht (2002) article shows that short-term radioactive contamination is dominated by the rapid release (15 years) of chlorine-36 contained in the concrete of the reactor vault. The reason for this behaviour is that chlorine ions travel freely in the concrete. The emission peak is only a factor of 2 below the standard imposed by the CNSC (at the time the article was being written). A second peak appears around 1,000 years for the same source. Towards the end of the proposed Institutional Controls period (100 years), strontium-90 is released instantaneously, which is the main source of radioactivity. After 1,000 years, the radioactivity is initially dominated by the diffusion of chlorine-36 contained in aluminium parts. A second radioactive peak arrives at around 10,000 years and is caused by the release of carbon-14 in aluminium parts. The release of chlorine-36 from zircaloy parts is also observed at this time.	

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				Figure 2 in the same article shows the behaviour of the released radioactivity as a function of the adopted decommissioning strategy. It is noted that the options to minimize radiological risk in the short-term (<100 years) consist in removing the radioactive components, adding a layer of clay to inhibit the mobility of radioisotopes, and hydraulically isolate the site or imposing institutional controls. If all these approaches are effective in reducing the short-term risk, only the removal of radioactive components would allow the NPD site to be safely abandoned. This seems to be the only method that complies with nuclear waste management best practices. **Expectation to Address Comment:** Please address the above analysis of Helbrecht (2002) in light of the proposed project as part of the alternative means assessment. **Reference:** Helbrecht, R.A. 2002. *Summary of feasibility studies on in situ disposal as a decommissioning option for nuclear facilities* (IAEA-TECDOC--1273). International Atomic Energy Agency.	
120.	ECCC	Section 9.1 Effects Assessment Approach	p.9-1	**Comment:** Section 9.1.1. (Background) states that "[d]isruptive event scenarios are designed to address uncertainties that have arisen during the definition of scenarios and conceptual models. Each is a variant on the normal evolution scenario (NES) and is described with scenario-specific assumptions." Considering the sensitivity of the project to water infiltration and its proximity to a major river, another scenario that should be evaluated is long-term flooding of the monolith by the Ottawa River. **Expectation to Address Comment:** Please consider, in this scenario, including the possibility of waters not receding for decades or longer. This scenario should evaluate the impacts from, and on, surface water due to physical, chemical, biological and other limnological processes that may occur under conditions of long-term flooding.	
121.	CNSC	Section 9.1 Effects Assessment Approach, Figure 9.1-2	p.9-4	**Comment:** The effects of seismicity on the NPD facility are not considered in the Normal Evolution Scenarios, but they are in the Disruptive Event Scenarios (DES). This is acceptable only if the facility is designed to resist a Design Basis Earthquake (DBE), which must be selected taking into consideration the assessment timeframe (50,000 years). The impact of a seismic event beyond a DBE can be considered and assessed within a DES. **Expectation to Address Comment**: Please add a link between the "Normal Evolution Scenarios" and the "Effects of the Environment on the Project" in Figure 9.1-2. Clearly define a DBE that is commensurate with the assessment timeframe and provide evidence that the NPD facility can resist the DBE. Also, please include the impacts associated with a seismic event beyond a DBE as part as the DES.	
122.	CNSC	Section 9.1 Effects Assessment Approach	p.9-4	**Comment:** Section 9.1.1.1 (Supporting Documents) states that the radiological exposure of workers during the Institutional Controls phase is not expected to be any greater than the current ambient dose rates (< 0.0005 mSv/hour). A conservative dose estimate over a defined time period (e.g., annual) is not provided in the EIS. Furthermore, the basis for the dose estimate information could not be found in the Decommissioning Safety Assessment	

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				TSD or in the Postclosure Safety Assessment Report TSD. **Expectation to Address Comment:** Please provide the basis supporting the conservative dose estimate to workers during the Institutional Controls phase for care and maintenance work activities.	
123.	ECCC	Section 9.2.3 Identification of Residual Effects (Atmospheric Environment), Table 9.2-3	p.9-18	**Comment:** The proposed mitigation measures and monitoring for effects on air quality and GHG emissions from construction equipment and vehicles are based on qualitative analysis and estimates (e.g., visual inspections for dust or estimation of combustible gases). The main EIS has provided some information, but lacks critical details such as: • Frequency of site inspections and vehicle maintenance • Type of engine technology for vehicles and off-road equipment • Control efficiencies associated with the application of specific mitigations • Thresholds for corrective management actions (e.g., what other adaptive measures or mitigation will be in place to reduce the impact further in case particulate matter levels approach/exceed criteria) • Description of the monitoring program that will facilitate timely management actions • Record keeping to demonstrate adoption of actions Proposed monitoring should include the collection of real time data, and this should be included as a trigger to implement proposed mitigation measures. The proposed monitoring program and mitigation needs to be described in greater detail and integrated so that there is a clear understanding of what mitigations will be implemented in response to monitored levels of contaminants, and the potential effectiveness of those mitigations to achieve air quality objectives. This will ensure that effective mitigation measures are being undertaken and that air quality effects will be consistent with EIS predictions. ECCC is aware of construction equipment and vehicles available that meet the newest emission standards. These could help to mitigate effects on air quality from these sources. **Expectation to Address Comment:** Please provide a table of mitigation measures including: type of vehicle and construction equipment, the control efficiency (with references), and frequency of implementation of each mitigation assumed in the development of the air quality modeling. Indicate if vehicles or construction equipment meet current emission standards. If not, please provide a rationale. Also, please provide more specific details about the air quality monitoring parameters, methods, sampling locations, applicable standards, monitoring frequencies and duration. The follow-up monitoring program for air quality should be based on real time data, and clearly outline specific thresholds and the additional proposed mitigation actions that they are proposed to trigger. Should high levels of dust occur, real time monitoring for dust and particulate matter should be considered for the demolition and concrete batching activities (with analysis of metals such as lead and mercury) to verify the effectiveness of mitigation measures and implement adaptive management, as necessary.	

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124.	Health Canada	Section 9.2.3 Identification of Residual Effects (Atmospheric Environment) Also applicable to Section 8.2.5 Ambient Noise	p.9-19	**Comment:** Section 9.2.3 states: "the effects of noise in the Site and Local Study Area are assessed qualitatively. Due to the nature of the work, quantity and nature of equipment on site, and proximity to Highway 17, no noise effects are expected." This statement has not been sufficiently supported in the EIS. Decommissioning activities have the potential to be louder and more annoying (e.g., due to tonality and frequency) than historic traffic or generator use described in the EIS. Humans may perceive and respond to changes in sound characteristics other than loudness. Examples of these characteristics include frequency, sound modulation, impulsiveness and tonality (e.g., sizing of material such as cutting steel beams, use of pavement breaker, or crushing masonry for fitting into void areas). In addition, it is reasonable to assume that off-site employee traffic would be ongoing / concurrent with operation of equipment and should therefore also be included in the noise assessment. **Expectation to Address Comment:** • Please include a discussion on changes in sound characteristics other than loudness to support the use of a qualitative assessment of noise. If these sound characteristics are not relevant to the project, this statement should be made. Please refer to Health Canada's *Guidance for Evaluating Human Health Impacts in Environmental Assessment: Noise*, available here: https://www.canada.ca/en/health-canada/services/publications/healthy-living/guidance-evaluating-human-health-impacts-noise.html • Please include all relevant noise sources in the noise assessment.	
125.	Health Canada	Section 9.2.3 Identification of Residual Effects (Atmospheric Environment)	p.9-19	**Comment:** In the following statement, the term "exceptional circumstances" is not clearly defined: "Operation of batch mixing plant restricted to between 7 am and 7 pm only to be allowed outside this period in exceptional circumstances." **Expectation to Address Comment:** Please expand and clarify what is intended by the term "exceptional circumstance".	
126.	Health Canada	Section 9.2.5 Monitoring and Follow-up (Atmospheric Environment), Table 9.2-4 Also applicable to Section 12 Follow-up Program	p.9-26 to 9-27	**Comment:** Investigative action and monitoring are not mitigation measures on their own. It is unclear which monitoring activities are part of an ongoing monitoring program for the NPD Closure Project, and which are part of existing CRL and NPD "SwS" monitoring programs. **Expectation to Address Comment:** Please provide additional details about the proposed monitoring program. Clarify what mitigation or follow-up action may be implemented following investigative action. Mitigation measures should include a communications plan that specifies how potential receptors will be notified in the event of contaminant release due to disruptive events and/or unexpected exceedances identified during monitoring.	
127.	CNSC	Section 9.2.5 Monitoring and Follow-up (Atmospheric Environment)	p.9-28 to 9-29	**Comment:** The EIS outlines non-periodic event-based monitoring for non-radiological and radiological parameters of concern in air. It has been indicated that this monitoring may be done either through measurement or estimation methods. No justification has been provided for why routine environmental monitoring for the atmospheric environment	

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				during the Decommissioning Execution phase is not warranted to confirm the predictions of the EIS. **Expectations to Address Comment:** Please provide justification regarding why routine environmental monitoring during the Decommissioning Execution phase is not warranted.	
128.	ECCC	9.3.3 Identification of Residual Effects (Surface Water Environment) Also applicable to Sections 9.3.5 and 9.3.6 and Tables 9.3-2 and 9.3-4	p.9-31	**Comment:** Section 9.3.3 states: "Monitoring activities, such as inspection of site drainage properties and analyzing discharges for parameters of concern, will verify the accuracy of the EA predictions and effectiveness of measures implemented to mitigate potential adverse environmental effects." The primary method of mitigation to prevent release of contaminants and radionuclides to the environment that the proposed project relies upon is the grouting of the NPD building. Considering that the grouting will eventually degrade, and considering that this will occur in the post-closure phase when there will be no institutional oversight or control, it is expected that no additional mitigation measures could be applied at that point. Since there is a high degree of uncertainty as to what the environmental effects might be as the grout degrades through time – either in a normal scenario or one where a release of radionuclides is earlier, faster or larger – additional mitigation measures should be incorporated into the project design to provide a greater margin of safety. The "defense in depth" concept, which requires multiple layers of defense to prevent harmful environmental outcomes, should be a fundamental principle incorporated into the design of the project, particularly since there will be no opportunities for human intervention after the Institutional Controls period. **Expectation to Address Comment:** Please consider evaluating additional mitigation measures that can be incorporated into the project design to provide a greater margin of safety and address uncertainty related to potential adverse environmental effects that may result should the grout degrade over time. Also, consider proposing action levels that will trigger additional mitigations during the Institutional Controls phase.	
129.	Government of Quebec	Section 9.3.3 Identification of Residual Effects (Surface Water Environment), Table 9.3-2	p.9-31 to 9.32	**Comment:** Table 9.3-2 notes that starting at Step 3 (Removal of Above Grade Structure), precipitation will infiltrate the facility. How will precipitation water be managed once the roof of the facility is demolished? Will radioactive material be grouted before the roof is demolished? **Expectation to Address Comment:** Please respond to the above questions regarding water infiltration during the Decommissioning Execution phase of the project.	
130.	ECCC, MOECC	Section 9.3.3 Identification of Residual Effects (Surface Water Environment)	p.9-33	**Comment:** Proposed mitigation measures for the surface water environment are reportedly based on MOECC's *Guidelines for Evaluating Construction Activities Impacting on Water Resources*. CNL seems to have applied an out-of-date version of these guidelines; a newer version is available at: https://www.ontario.ca/page/b-6-guidelines-evaluating-construction-activities-impacting-water-resources. Also, very limited information is provided on specific mitigation measures proposed. As such, it is difficult to determine whether or not mitigation measures are appropriate and/or sufficient, even at the conceptual scale. Furthermore, given the apparent limited	

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				knowledge of surface water and effluent quality, uncertainty related to water quality should be further acknowledged in this section of the EIS. **Expectations to Address Comment:** Please provide a complete list of proposed measures to mitigate potential impacts to the surface water environment, as well as additional information to identify and describe proposed surface water management facilities (e.g., ditching, stormwater management ponds, etc.) and their location. In addition, please update the text to reflect the most current version of the MOECC Guidelines.	
131.	MOECC	Section 9.3.3 Identification of Residual Effects (Surface Water Environment)	p. 9-34	**Comment:** Water quality in the Ottawa River upstream of the facility has been characterized; however, surface water quality data for the area in the immediate vicinity of the NPDWF (i.e., Site and Local Study Areas) is not available. Radiological data upstream and downstream of the site is provided within supplementary documentation. Non-radiological data is generally lacking. The EIS does not comment on the applicability of upstream data for the purpose of assessing suitability of proposed discharge criteria. Supplementary documentation indicates that water and sediment sampling was completed in 2002, but that data should be interpreted with caution as no report was produced or data provided. **Expectations to Address Comment:** Please evaluate the applicability of available water quality data from upstream locations with respect to the assimilative capacity of the receiving area of the Ottawa River for discharges associated with this proposal (radiological and non-radiological), and with the ability to identify impacts to surface water through monitoring. Also, consider anticipated water quality for any project-related releases to surface water.	
132.	ECCC	Section 9.3.3 Identification of Residual Effects (Surface Water Environment) Also applicable to Section 9.6.3 (Table 9.6-2) Also applicable to the Decommissioning Safety Assessment, Technical Supporting Document (Table 7-3) and Section 8.4.1 (p.8-12)	p.9-37	**Comment:** CNL has not identified the preferred location for the batch mixing plant. Based on several statements made in the EIS documentation (e.g., in Sections 9.3.3.4 and 9.6.3.4 of the main EIS, and Table 7-3 of the Decommissioning Safety Assessment TSD), it is understood that some of the proposed locations for project infrastructure could impact species at risk or their habitat. It is also understood that the potential batch mixing plant location at the west side of the main building is also the location of Monarch butterfly habitat. If so, Monarch butterfly habitat may be overprinted during the decommissioning phase. The Monarch butterfly is known to be present in the Site Study Area. No habitat-related effects are predicted by CNL, as they are proposing to conduct site sweeps, and no clearing of milkweed is proposed to take place during the early life stages. Milkweed will not be removed outside of the Site Study Area. Depending on where the batch mixing plant is located, there may be an impact on Monarch butterflies due to loss of milkweed from that site. A process is currently underway to reclassify Monarch from “Special Concern” to “Endangered” under SARA. Additionally, the location at the west side of the main building is horizontally closer to habitat for Chimney Swifts, and the ground is at a higher vertical elevation than the ground at the chimney location. This means that the batch mixing plant will be closer to the chimney opening, and this could potentially impact the amount of dust, noise or disturbance for the Chimney Swifts.	

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				Since potential environmental effects may depend on the siting of these project components and activities, it will be important to identify the location of all project components and activities once known. Bearing in mind CNL's commitments to minimize disturbance to species at risk (e.g., Chimney Swift), CNL should site the various project components / activities in a manner that minimizes these disturbances. Similarly, the siting of Project components / activities should also have consideration for potential effects upon surface water quality. **Expectation to Address Comment:** Please provide a map(s) containing detailed project site information for the decommissioning phase, including locations of the batch mixing plant, staging areas, raw material storage areas, on-site trucking routes, etc. Please describe the methodology applied to determine the final site plan. In addition, please compare the alternatives, including potential impacts on surface water quality, species at risk (including habitats), and other VCs, and identify applicable mitigation measures and anticipated residual effects, as appropriate. With respect to Monarch butterflies, please provide more information on how much milkweed will be cleared in the Site Study Area and re-assess potential effects of habitat loss to Monarch butterflies, and if there is an effect, propose mitigation and monitoring**.**	
133.	MOECC	Section 9.3.3 Identification of Residual Effects (Surface Water Environment), Table 9.3-3	p.9-38	**Comment:** During the Institutional Controls and Post-Institutional Controls phases, there is potential for residual effects to arise primarily from groundwater flow into the eventually degraded grouted structure, and eventually to the Ottawa River, with potential impacts to surface water, river and shoreline sediment. Such discharge, should it occur, would have the potential to impact both surface water and sediment; however, due to the sparsity of water quality information, the potential severity of that impact is unclear. **Expectation to Address Comment:** Please include the potential for interception of contaminated groundwater, with discharge to the Ottawa River by way of the preferential pathways associated with infrastructure capped and left in place (i.e., drains and inlet / outlet pipes) in the assessment of potential impacts to surface water.	
134.	Government of Quebec	Section 9.3.3 Identification of Residual Effects (Surface Water Environment), Table 9.3-3	p.9-40	**Comment:** In Table 9.3-3, for "Surface Water: Water Quality (radiological)" under Institutional Controls and Post-Institutional Controls, will sand been placed between the concrete walls and the existing rock? If so, the NPD site is surrounded by a layer of permeable sand that allows groundwater to flow around the areas that will be grouted, which would reduce groundwater flow through the grouted facility. **Expectation to Address Comment:** Please provide clarity with respect to in-design mitigation measures to reduce the potential of groundwater contamination during the postclosure period.	
135.	CNSC, MOECC	Section 9.3.5 Monitoring and Follow-up (Surface Water Environment)	p.9-38 to 9-42	**Comment:** Section 9.3.5 indicates that CNL will conduct periodic inspections as they relate to site drainage, as well as periodic water quality sampling in the Ottawa River. However, the surface water monitoring program is described in very general terms and lacks sufficient detail to be able to comment on its ability to identify developing surface water issues in a timely manner. For example, it is unclear if routine sampling will be conducted throughout the lifecycle of the project, including during the Decommissioning Execution phase. There seems to be no mention of routine sampling analysis of Ottawa River water prior to the Institutional	

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				Controls phase. CSA N288.4-10, *Environmental monitoring programs at Class I nuclear facilities and uranium mines and mills* (Section 5.2.2) states that "[t]he operator of a nuclear facility may also measure the contaminants in the environment where there are other business reasons, i.e., stakeholder concerns, due diligence, etc." Given public involvement in this project, ensuring a robust environmental monitoring program is in place for the Ottawa River would be prudent. **Expectation to Address Comment:** At a minimum, please include the parameters to be monitored (physical and chemical), the minimum number of monitoring locations and the frequency of monitoring for the conceptual surface water monitoring program. In addition, please clarify whether or not routine sampling analysis of water quality in the Ottawa River will be conducted throughout the lifecycle of the project, and not only during the Institutional Controls phase. If not, please justify why no monitoring and follow-up activity for water quality in the Ottawa River is necessary.	
136.	Government of Quebec	Section 9.3.5 Monitoring and Follow-up (Surface Water Environment), Table 9.3-4	p.9-44	**Comment:** CNL's proposed follow-up monitoring program has been designed to detect water infiltration into the facility and contaminant transport to the Ottawa River. However, this program does not track uranium descendants in the Ottawa River. It is therefore recommended that descendant of uranium be added to the surface water monitoring program, particularly radium, which has a half-life of 1,600 years. Indeed, considering that a secular equilibrium could be established in the cells once the waste is buried, the analysis of a representative of the uranium decay chain having a half-life greater than 10 days, such as radium, is recommended. Many studies have shown that radionuclides that have a non-negligible impact on organisms and that must be retained during a radiotoxic risk assessment are those with a half-life greater than 10 days (CEAEQ, 2015). In addition, since radium is considered the most soluble element, it is more likely to leach in the event of groundwater infiltration into the grouted facility. In the event that radium would be detected, CNL's contingency plan could be implemented, in particular to identify the origin of this contamination. **Expectation to Address Comment:** Please confirm if a descendant of uranium could be added to the surface water monitoring program, particularly radium.	
137.	CNSC	Section 9.4 Aquatic Environment, Table 9.4-1	p.9-45	**Comment**: In Table 9.4-1, it is unclear if First Nation and Métis groups were given an opportunity to provide input on which fish species were chosen as VCs. **Expectation to Address Comment**: As per CNSC's *Generic EIS Guidelines*, and considering that fish resources have high value for Aboriginal peoples, please clarify whether CNL has engaged with First Nation and Métis groups regarding which fish species are of importance to them. Also, specify if the resulting information helped define the rationale for the selection of VCs for the aquatic environment.	
138.	MOECC	Section 9.4.3 Identification of Residual Effects (Aquatic Environment), Table 9.4-2	p.9-47	**Comment:** Project-environment interactions in the aquatic environment relate exclusively to exposure; no possible habitat interactions are identified. However, physical impacts to habitat are possible if releases from the site contain excess concentrations of suspended solids or sediment, which may cause siltation / sedimentation of the receiving waters (i.e., the Ottawa River) and associated benthic habitat. **Expectation to Address Comment**: Please consider the physical effects of the project on	

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				the aquatic habitat.	
139.	ECCC	Section 9.4.3 Identification of Residual Effects (Aquatic Environment) Also applicable to the Postclosure Safety Assessment Technical Supporting Document, Figures 5.7 and 5.8	p.9-48	**Comment:** Figures 5.7 and 5.8 in the Postclosure Safety Assessment TSD suggest that if the monolith is permeated by groundwater and starts leaching after 70 years (instead of 100), the total activity of the radionuclides becomes substantially higher for multiple components. Elsewhere in the EIS, it has been stated that the monolith might become saturated within a period of decades. It is also plausible that the lower portions of the monolith (where most of the radionuclide inventory resides) will become saturated and begin to release contaminants prior to saturation of the entire monolith. **Expectation to Address Comment:** Please assess the risk to the environment associated with early saturation of the monolith for the time period of 0-100 years, including as it relates to COPCs and radionuclides, and assess the risk to the environment associated with partial saturation (e.g., lower portions of the monolith – where most of the radionuclide inventory resides).	
140.	Government of Quebec	Section 9.5.3 Identification of Residual Effects (Geological and Hydrogeological Environment)	p.9-59 to 9-60	**Comment:** The demolition of the roof of the facility will allow precipitation water to flow into radioactive rooms. Will this water be removed and treated before grouting? It would be possible to immobilize the water by using grout containing an excess of bentonite, which would absorb the water. **Expectation to Address Comment:** Please explain how precipitation water will be dealt with once the roof of the facility is removed.	
141.	CNSC, MOECC	Section 9.5.5 Monitoring and Follow-up (Geological and Hydrogeological Environment)	N/A	**Comment:** Limited details regarding the groundwater monitoring program are provided in the EIS. The EIS generally states that a groundwater monitoring program will be conducted over the Institutional Controls period intermittently. No information regarding the location and frequency of monitoring is provided. It is also not clear if monitoring is to be conducted utilising the existing monitoring well network, which may not meet the requirements of monitoring associated with this project. **Expectation to Address Comment:** Consistent with Section 12 of CNSC's *Generic EIS Guidelines* (p.19-20), please provide sufficient details on the groundwater monitoring program "to allow independent judgement as to the likelihood that it will deliver the type, quantity and quality of information required to reliably verify predicted effects (or absence of them) and confirm the effectiveness of mitigation measures."	
142.	Government of Quebec	Section 9.6.3 Identification of Residual Effects (Terrestrial Environment), Table 9.6-2 Also applicable to Section 3.3.2 NPDWF Description, Figures 3.3-1 and 3.3-2, p.3-11 to 3-12	p.9-73	**Comment:** Table 9.6-2 states: (at Step 3.15) "Grout furnace room and adjacent areas to ground level" and (at Step 3.16) "Demolish above grade portion of pressure relief pit. Fill with grout." The furnace room or pressure relief pit components are not shown in Figures 3.3-1 and 3.3-2. **Expectation to Address Comment:** Please provide a figure that contains all these components.	
143.	ECCC	Section 9.6.3 Identification of Residual Effects (Terrestrial Environment), Table 9.6-2	p.9-74	**Comment:** Table 9.6-2 (row 5.2) indicates that ancillary equipment would be removed from the ventilation stack during Ventilation Stack Isolation (e.g., ladder, lights), and that modifications would be made to the stack to maintain the Chimney Swift roosting requirements (i.e., creating an opening for continued venting near the base). It is	

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				unknown, however, what impact removing the ancillary equipment from the stack will have on the Chimney Swifts. Also, there are no details on what will be undertaken to modify the ventilation stack and what the potential impacts to Chimney Swifts would be. Also, the existing lights on the stack may be expected to be present for aviation navigation safety purposes. Any removal of these lights should be done in consultation with Transport Canada, who regulates this aspect. Furthermore, Table 9.6-2 (Row 5.3) states: "Demobilizing the site will result in dust and decrease some of the habitat-related benefits of the decommissioning." It is unknown if dust will accumulate in the stack and what impact that would have on Chimney Swifts. The dust suppression measures outlined in Section 9.2.3.2 do not mention dust accumulation in the stack. **Expectation to Address Comment:** • Please provide details on how the ventilation stack will be modified and describe the potential impacts on Chimney Swifts. • Please consult with Transport Canada regarding the proposed removal of the existing lights from the ventilation stack. If necessary, update Section 3.5.3 and other relevant sections of the EIS to reflect the results of the consultation. If consultation with Transport Canada has already occurred, please provide an update. • Please discuss the potential for dust accumulation in the stack and identify mitigation measures to address potential impacts to Chimney Swifts and monitoring to verify the effectiveness of mitigation measures.	
144.	ECCC	Section 9.6.3 Identification of Residual Effects (Terrestrial Environment), Table 9.6-3	p.9-75	**Comment:** Wildlife exclusion fencing is only mentioned briefly in Table 9.6-3 (p.9-83) and nowhere else in the EIS. Given that there is a high potential for road mortality of wildlife (specifically for Eastern Milksnake), this should be adequately addressed in the EIS. There is insufficient information to understand the potential effects of the wildlife exclusion fencing on road mortality for the Eastern Milksnake (SARA listed as "Special Concern"). **Expectation to Address Comment:** Please update this section of the EIS to include additional details on the wildlife exclusion fencing in order to mitigate road mortality to terrestrial wildlife, in particular to the Eastern Milksnake. These details should include the fencing material, height, mesh size or porosity, installation locations, timing of installation, installation process, monitoring, and maintenance and repair.	
145.	CNSC	9.7.3 Identification of Residual Effects (Ambient Radioactivity)	p.9-96	**Comment:** The section states" Mitigation measures with respect to radiation doses to humans are discussed in Section 9.8.3.2". There is no mention on mitigation measures with respect to doses to the environment. There is no information on limits in monitoring points/wells that would establish an acceptable performance of barriers. Those limits are necessary in order to establish the point at which mitigation measures may need to be triggered. **Expectation to Address Comment**: CNL needs to explain the mitigation measures with	

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				regard to releases to the environment they will consider. As part of this the limits which may trigger those measures need to be presented.	
146.	CNSC	Section 9.8.1 Selection of Valued Components (Human Health)	p.9-102	**Comment:** The proposed project occurs within the general area where Aboriginal groups practice traditional land use activities, including but not limited to hunting, trapping, and fishing. In the selection of VCs, however, Aboriginal receptors were not included in the assessment of human health. How has this been considered in the Human Health Risk Assessment (HHRA)? **Expectation to Address Comment**: Aboriginal receptors should be included in the HHRA, taking into account their cultural practices and their higher reliance (compared to the general Canadian population) on traditional and country foods.	
147.	Government of Quebec	Section 9.8.3 Identification of Residual Effects (Human Health)	p.9-107	**Comment:** Section 9.8.3 states: "Emergency response capability is available from local municipalities. Does CNL consider the municipality of Rapides-des-Joachims as a local municipality with emergency response capability? Has CNL checked the ability of this municipality to respond to a nuclear emergency? Has CNL collaborated with the *Organisation régionale de sécurité civile de l'Outaouais* (ORDCO) to include the competent Quebec authority in the emergency response plan for the proposed project? The Outaouais Region has an external nuclear Emergency Response Plan (ERP) for Chalk River Laboratories (*Plan de mesures d'urgence nucléaire externe – Laboratoires de Chalk River*). The ERP was developed by the ORDCO under the coordination of the Quebec Department of Public Security (known as MSP). The ERP specifies the response structure, as well as the role played by the various government departments and agencies that are likely to intervene in case of emergency. The ORDCO, which includes representatives of Quebec government departments and agencies present in the region and coordinates the commitment of resources to support municipalities when they are no longer able to cope with a disaster, was only informed of the proposed project once it was well under way. It would have been relevant for the ORDCO to be informed in the early stages of the EA. **Expectation to Address Comment:** Please respond to the above questions related to the emergency response capability in Quebec. Also, explain how the current ERP is adequate for the Decommissioning Execution period of the proposed project. In addition, consider amending the ERP to account for the potential long-term effects of the proposed project, if needed.	
148.	CNSC	Section 9.8.3 Identification of Residual Effects (Human Health) Also applicable to the Decommissioning Safety Assessment Technical Supporting Document	p.9-108	**Comment:** Section 9.8.3.3 (Effects After Mitigation) states that the maximum total dose for workers received during grouting and emplacement is predicted to be 1.79 x 10^{-5} mSv/year, as per the Decommissioning Safety Assessment TSD. Sections 8.5.2 (Grout Fill Nuclear Area) and 8.6.4 (Emplace Demolition Material and Grout) of the Decommissioning Safety Assessment TSD provides worker doses for work activities involving grout filling of the nuclear area and all other areas (noting that doses for grouting all other areas are predicted to be bounded by the estimates for the grout filling of the nuclear area). In particular, Table 8-12 (on p. 8-33) provides the predicted dose estimate to workers for this activity as 1.35 x 10^{-5} mSv/year, which is lower than what is stated in section 9.8.3.3 of the EIS. In addition, this dose estimate only considers inhalation and immersion pathways. There is no discussion on external radiation dose	

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				rates or a conservative dose estimate provided for the external dose component during all grouting activities. **Expectation to Address Comment:** • Please clarify the discrepancy between the EIS and the Decommissioning Safety Assessment TSD regarding the worker dose estimate for grouting and emplacement activities. • Please clarify why external radiation dose rates were not considered in worker dose estimates during grouting and emplacement activities.	
149.	CNSC	Section 9.8.3 Identification of Residual Effects (Human Health) Also applicable to the Decommissioning Safety Assessment Technical Supporting Document	p.9-108	**Comment:** Section 9.8.3.3 (Effects After Mitigation) states that the maximum total dose received by a driller while creating slip pipe access is predicted to be 0.436 mSv. This predicted dose is substantiated in the Decommissioning Safety Assessment TSD. However, it assumes one driller drilling each of three holes (i.e., a total of three workers) and does not consider internal dose (i.e., via dust inhalation and immersion). Section 8.4.4.6 (Provide Slip Access to Nuclear Area – Effects on Worker Health) of the Decommissioning Safety Assessment TSD indicates that for the drilling activities, it is assumed that dust and inhalation safeguards will be in place, such that inhalation of dust is mitigated. However, no further information is provided. For completeness, the effects on worker health due to inhalation and immersion of airborne radionuclides should be assessed. Section 9.1.6 (Bounding Scenario 6: Accidental Exposure to Radioactivity) of the Decommissioning Safety Assessment TSD notes that CNL's radiological work control process requires radiation surveyor coverage during drilling work activities. There is no discussion provided regarding radiological effects on the radiation surveyor present during the drilling work activities. **Expectation to Address Comment:** • Please clarify if the dose estimate for the driller creating slip pipe access is bounding, since it assumes three different drillers (although not explicitly stated), and therefore, the dose estimate is not cumulative. For instance, if only one driller will drill all three slip pipe access holes, this scenario may not be bounding. • Please justify why internal dose due to dust inhalation and immersion is not considered in the dose estimate for the driller while creating slip pipe access. • Please clarify whether the radiological effects on the radiation surveyor that is expected to be present during the slip pipe access work activities are bounded by the radiation dose estimates for the driller. If not, provide the dose estimate for the radiological surveyor.	
150.	Government of Quebec	Section 9.8.3 Identification of Residual Effects (Human Health)	p.9-110	**Comment:** Section 9.8.3 states: "In the normal evolution scenario dose estimates, the highest dose was received by an adult hunter (0.0001 mSv/y)." In all likelihood, this risk (of 0.1 µSv/year) would come from chlorine-36. This value is much lower than the value given by Helbrecht (2002) of 22 µSv/year. **Expectation to Address Comment:** Please provide the technical explanation to help	

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				understand this difference. **Reference:** Helbrecht, R.A. 2002. *Summary of feasibility studies on in situ disposal as a decommissioning option for nuclear facilities* (IAEA-TECDOC--1273). International Atomic Energy Agency.	
151.	CNSC	EIS, Section 9.8.3 Identification of Residual Effects (Human Health) Also applicable to the Postclosure Safety Assessment Technical Supporting Document	p.9-112	**Comment:** Section 9.8.3.4 (Prediction Confidence and Uncertainty – Human Health) states: "There is some uncertainty in the characterization of potential effects to Aboriginal groups, due to lack of site-specific information on diet and lifestyle. However, this has been accounted for by using conservative assumptions." The intake rates specified for the recreational/hunter group should conservatively reflect what was learned from local Indigenous groups during consultation. **Expectation to Address Comment:** Please confirm that dietary intake rates conservatively reflect those of local Indigenous groups. This may be based on what was learned from Indigenous engagement activities.	
152.	Government of Quebec	Section 9.8.3 Identification of Residual Effects (Human Health)	p.9-102 to 9-119	**Comment:** The draft EIS covers the assessment and mitigation of environmental impacts on human health. In a context where we recognize health as "a state of complete physical, mental and social well-being", CNL does not seem to consider the assessment of the potential social and psychological impacts that may arise from the perception of risks associated with decommissioning activities. Moreover, on page 9-111, the draft EIS clearly states that the spatial boundaries of the project (Site and Local Study Areas) are restricted to lands that are "owned by the federal government", and therefore, where "there are no residents present." However, there are Quebec residents living at less than 5 km away from the NPD site. **Expectation to Address Comment:** Please explain the lack of assessment of potential social and psychological impacts of the proposed project in the draft EIS. In addition, please justify why the proximity of Quebec residents to the NPD site was not considered as part of the human health assessment, and in the light of the existing literature, knowledge, and outcomes from public engagement activities with residents living near the site (including Rapides-des-Joachims). In the final EIS, CNL should also highlight whether new mitigation measures will be implemented, which could, for example, require adjustments to future engagement activities with Quebec residents.	
153.	CNSC	Section 9.9 Aboriginal Land and Resource Use, Table 9.9-1	p.9-119	**Comment:** Based on Table 9.9-1**,** it is unclear how CNL identified the Aboriginal Land and Resource Use VCs**.** **Expectation to Address Comment:** As per Section 3.3.2 of CNSC's *Generic EIS Guidelines*, please indicate if Aboriginal traditional knowledge was considered when identifying the Aboriginal Land and Resource Use VCs, and if so, what potentially affected Aboriginal groups were engaged with to develop those VCs, if any.	
154.	CNSC	Section 9.9.2 Assessment Boundaries (Aboriginal Land and Resource Use)	p.9-121	**Comment:** It is unclear whether CNL considered Aboriginal traditional knowledge when determining the assessment boundaries to measure the project's effects on Aboriginal Land and Resource Use VCs. **Expectation to Address Comment:** Please indicate whether CNL considered Aboriginal	

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				traditional knowledge, as identified in CNSC's *Generic EIS Guidelines*, when determining the assessment boundaries to measure the project's effects on Aboriginal Land and Resource Use VCs.	
155.	CNSC	Section 9.9.3 Identification of Residual Effects (Aboriginal Land and Resource Use)	p.9-125	**Comment:** As per CNSC's *Generic EIS Guidelines*, CNL is required to discuss potential environmental effects and mitigation measures with First Nation and Métis groups. **Expectation to Address Comment:** Please indicate whether CNL has engaged with First Nation and Métis groups when developing mitigation measures for potential impacts on Aboriginal Land and Resource Use VCs, and confirm which groups were engaged and how their input was addressed.	
156.	CNSC	Section 9.9.3 Identification of Residual Effects (Aboriginal Land and Resource Use), Table 9.9-2	p.9-125	**Comment**: Table 9.9-2 (Post-Institutional Controls Section, p.9-125) states that "Land Use may change during and/or after the Institutional Controls phase. Renaturalization of site may lead to an increase of wildlife and may benefit trapping, hunting, and gathering activities." Has CNL engaged with First Nation and Métis groups regarding this renaturalization process? **Expectation to Address Comment**: While the renaturalization process may benefit trapping, hunting, and gathering activities, please indicate if First Nation and Métis groups have been engaged on this renaturalization process given the importance of these activities to Aboriginal peoples.	
157.	CNSC	Section 9.9.3 Identification of Residual Effects (Aboriginal Land and Resource Use)	p.9-126	**Comment:** On page 9-126, it is stated that "…no potential undue effects have been predicted for terrestrial or aquatic biota." However, Table 9.9-2 (Post-Institutional Controls Section, p.9-125) states that "[g]roundwater will enter the eventually degraded grouted structure. Contaminant release from the grouted structure may affect non-human biota (e.g., game and fish species) health and/or populations." **Expectation to Address Comment:** Please include a discussion on the potential impacts to First Nation and Métis fishing rights that could potentially occur during the Institutional Controls and Post-Institutional Controls phases. Also, explain how CNL has engaged with First Nation and Métis groups with regards to addressing / mitigating these impacts, as per CNSC's *Generic EIS Guidelines*.	
158.	Health Canada	Section 9.9.3 Identification of Residual Effects (Aboriginal Land and Resource Use)	p.9-126	**Comment:** "CNL will minimize potential nuisance effects (i.e., noise) on nearby land users (e.g., hunters, trappers, and gatherers) by instituting restrictions on construction hours and days of the week. Other nuisance-related mitigation measures (i.e., dust suppression) are discussed in section 9.2.3.2 of the EIS." Restricting construction hours is not an effective measure to mitigate potential nuisance noise effects on traditional land use, since it is reasonable to assume that hunting, trapping and gathering activities are likely to coincide with construction / daylight hours. **Expectation to Address Comment:** Please provide mitigation measures that are likely to be effective at addressing disturbance from noise emissions.	
159.	CNSC	Section 9.9.3 Identification of Residual Effects (Aboriginal Land and Resource Use), Table 9.9-3	p.9-128	**Comment:** According to Table 9.9-3, no residual effects on any of the Aboriginal Land and Resource Use VCs are predicted during all phases of the project. **Expectation to Address Comment:** Please demonstrate how engagement activities with First Nation and Métis groups have informed CNL's conclusion that there will be no	

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				residual effects on Aboriginal Land and Resource Use VCs during all phases of the project.	
160.	Government of Quebec	Section 9.11 Accidents and Malfunctions	p.9-143 to 9-144	**Comment:** CNL should outline the impacts of a worst-case scenario combining failures and natural hazards (e.g., scenario including the failure of grout and a flood or earthquake). **Expectation to Address Comment:** Please clarify if such a combination of scenarios was considered, and if not, explain if it will be considered in the final EIS.	
161.	Government of Quebec	Section 9.11 Accidents and Malfunctions	p.9-143 to 9-144	**Comment:** In Section 9.11.2, CNL assesses accident and malfunction scenarios during the Decommissioning Execution and Institutional Controls phases, without considering the Post-Institutional Controls phase. **Expectation to Address Comment:** Please explain why accidents and malfunctions are not assessed for the Post-Institutional Controls phase.	
162.	CNSC	Section 9.11.4 Radiological Accidents and Malfunctions Effects Also applicable to the Decommissioning Safety Assessment Technical Supporting Document	p.9-151	**Comment:** In section 9.11.4.2 (Accidental Exposure), the accidental exposure to the radiation bounding scenario (Scenario #6) results in doses to both members of the public and workers that is below their respective acceptance criteria. The two scenarios considered are: 1. A worker spends additional time drilling, thereby increasing exposure time. 2. The source is stronger than originally estimated, resulting in additional exposure. This predicted dose is substantiated in the Decommissioning Safety Assessment TSD. Since a total of three holes are required for slip pipe access into the reactor vault, it is unclear if only considering these scenarios happening at one location is bounding (i.e., should the bounding scenario evaluate an accident / malfunction occurring at all three locations?). Section 9.1.6 (Bounding Scenario 6: Accidental Exposure to Radioactivity) of the Decommissioning Safety Assessment TSD notes that CNL's radiological work control process requires radiation surveyor coverage during drilling work activities. There is no discussion provided regarding radiological effects on the radiation surveyor present during the drilling work activities. **Expectation to Address Comment:** • Please clarify if the radiation dose estimates for Scenario #6 are bounding, as the scenario assumes an accident / malfunction occurring at only one of three holes being drilled into the reactor vault. • Please clarify whether Scenario #6 is bounding for the radiation surveyor that is expected to be present during the slip pipe access work activities. If not, provide the dose estimates for the radiation surveyor.	
163.	CNSC	Section 9.11.4 Radiological Accidents and Malfunctions Effects	p.9-153	**Comment:** Section 4.3.3 indicates that the intended future life of the ventilation stack is 50 years, with periodic inspections every 5 years (or after a trigger event like an earthquake) to establish the condition of the stack and its ability to perform its intended function. It is necessary to confirm the following with regard to the stack:	

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				• That the present condition of the stack is well known and documented (e.g., through periodic civil inspections) to be used as a reference point in establishing degradation in the future • That the entombed state of the facility will not have a negative effect on the stack, especially on its foundation (e.g., that there will be no changes to the drainage around the foundation, or if there are, that they will be acceptable; that the additional topsoil added will not have negative impacts on the stack and will provide additional lateral support for the part of the stack that will be below-grade – this below-grade part may benefit from improved detailing, such as water insulation, to ensure its durability) • That the degradation mechanisms that may affect the stack during the next 50 years, based on the actual conditions and environment, will be evaluated • That a periodic inspection program is in place and sets the activities, methods and acceptance criteria ○ While visual inspection may be the starting point for such inspection, CNL should confirm if it will be strictly limited to visual examination and no other options (e.g., non-destructive testing), as suggested in the follow-up program (on p.12-9). • That a plan explaining how the almost 50-meter tall structure will be inspected is in place • That radiological and conventional health and safety measures are considered in the periodic inspection program to ensure the well-being of the staff performing the inspection • That consideration is given to possible maintenance and repair approaches **Expectation to Address Comment**: Please confirm/clarify the aforementioned points.	
164.	CNSC	Section 9.11.4 Radiological Accidents and Malfunctions Effects	p.9-153	**Comment:** Section 9.11.4.4 only discusses radiological consequences from stack failure, which is one of the accident scenarios considered. It is unclear why non-radiological consequences are not accounted for. **Expectation to Address Comment**: Please clarify / confirm if a possible stack failure could have impacts on certain parts of the site (e.g., the entombed waste, security fence, future monitoring wells). Also, please clarify how the well-being of workers, who may be in the vicinity of the stack to conduct some activities (e.g., periodic civil inspections, access to monitoring wells, etc.), albeit for limited periods of time, will be guaranteed.	
165.	Government of Quebec	Section 9.12.2 Assessment of Cumulative Effects	p.9-159	**Comment:** Section 9.12.2 states: "Since the project has no residual effects, cumulative effects assessment is therefore not required." In previous sections of the draft EIS, however, several assessments of risk of various contaminants are presented, without taking into account the sum of the radiological and non-radiological impacts on the environment and the human health. **Expectation to Address Comment:** Please carry out a cumulative impact assessment of radiological and non-radiological contaminants, including all risks to which the public	

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				could be exposed to.	
166.	Government of Quebec	Section 9.13.6 Flood and Section 9.13.7 Earthquake	p.9-162 to 9-163	**Comment:** It seems appropriate to examine flood and earthquake impacts with a recurrence period of 10,000 years and not only 100 years. In fact, the power of earthquakes with a 100-year recurrence period has a 63% probability of being exceeded during the Institutional Controls period. In the case of floods, the annual risk of $7.3x10^{-3}$ translates into a 52% probability of occurrence over 100 years. In both cases, these are neither rare nor exceptional events. This is of particular concern because the soil surface layer of the NPD site is composed of sand or filling materials (based on Figure 8.5-7), which increases the risk of long-term erosion. **Expectation to Address Comment:** Please consider assessing flood and earthquake impacts with a recurrence period of 10,000 years instead of 100 years. Otherwise, justify why this type of assessment is not needed.	
167.	CNSC	Section 9.13.7 Earthquake	p.9-162	**Comment:** The effects of an earthquake on the NPD facility should be conducted in the Normal Evolution Scenario with a DBE commensurate with the defined assessment timeframe. The assessment should also include the seismic impact on the stability of the slopes of the NPDWF site, since slope failure could result in exposure of and/or damage to the concrete monolith, and impact the safety of the facility. There are low to moderate slopes at the NPD site, which are stable under current conditions. However, these slopes may experience higher earthquakes during the post-closure period and could fail. The earthquakes could also cause liquefaction of the overburden, which could compromise the integrity of the top engineered barrier. **Expectation to Address Comment**: Please conduct stability analyses of the slopes at the NPD site with a DBE corresponding to the defined assessment timeframe. If the slope failure is expected, its impact on the facility should be assessed.	
10. Mitigation Measures					
168.	Government of Quebec	General	General	**Comment:** Most of the scenarios set out in the draft EIS address the potential effects of in-situ decommissioning without considering site-specific data; rather, they are based on general, historical studies. CNL believes that mitigation measures to limit the radiological and non-radiological contamination of groundwater, the Ottawa River and the air will result in a gradual removal of contaminants without high concentrations. However, no guarantee is provided as to the effectiveness of these mitigation measures or the frequency of monitoring. **Expectation to Address Comment:** Please demonstrate clearly how the planned mitigation measures will ensure that contamination is eliminated (by disintegration, attenuation or dilution) and that hazardous levels of radionuclides will not persist in the future. Also, provide more information on the long-term monitoring, including the contamination threshold values that would trigger corrective action.	
169.	CNSC	Section 10.1 Regulatory Requirements	p.10-2	**Comment:** This section makes reference to the International Atomic Energy Agency (IAEA) Safety Guide SSG-29, *Near Surface Disposal Facilities for Radioactive Waste*. This guide "… does not apply to intermediate level waste (ILW) that will not decay to safe levels over a period of a few hundred years or to high level waste (HLW), as both are	

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				unsuitable for near surface disposal (Section 1.11)." **Expectation to Address Comment**: Please clarify if you agree with Section 1.11 of the IAEA SSG-29 (and why), in order to establish applicability of this document to the NPD Closure Project.	
170.	Health Canada	Section 10.3 Scope, Table 10.3-1	p.10-6	**Comment:** The proposed mitigation measures include locating "the batch mixing plant at least 1 km from nearby residences (if possible)". The location of residences is known and it should therefore be possible to determine if the batch mixing plant can be located at least 1 km from residences. **Expectation to Address Comment:** Please determine the location of the batch mixing plant. If this is not possible, then identify what additional information is required to determine its location, and when this determination will be made. Any potential changes to the assessment of air and noise effects resulting from a change to the siting of the batch mixing plant should be identified.	
11. Conclusion on Significance					
171.	CNSC	Section 11.2 Confidence in Assessment Findings	p.11-1	**Comment:** Section 11.2 states that "[t]he proposed technologies are known and proven. In-situ decommissioning has been in use for at least 50 years." Section 1.10 of the IAEA General Safety Requirements (GSR) Part 6, *Decommissioning of facilities* states that "[e]ntombment, in which all or part of the facility is encased in a structurally long lived material, is not considered a decommissioning strategy and is not an option in the case of planned permanent shutdown. It may be considered a solution only under exceptional circumstances (e.g. following a severe accident)." **Expectation to Address Comment**: Please provide additional information on how this decommissioning strategy compares to the IAEA GSR Part 6.	
12. Follow-Up Program					
172.	CNSC, ECCC	Section 12.5 Preliminary EA Follow-up Monitoring Program, Table 12-5.1	p.12-3 to 12-11	**Comment:** Section A.3.10 of REGDOC-2.9.1 requires that the EIS present a framework or preliminary follow-up program. Section 12 of CNSC's *Generic EIS Guidelines* (p.19) specifies that the EIS should include, among other requirements: • The specific monitoring objective for each monitoring activity • A planned schedule (timing, frequency and duration of monitoring) • The roles and responsibilities to be played by the proponent, regulatory agencies, Aboriginal peoples, local and regional organizations and others in the design, implementation and evaluation of the program results • Information management and reporting (reporting frequency, methods and format) • A description of any contingency procedures or plans or adaptive management provisions The information presented in the summary provided in Section 12 lacks sufficient detail on the information requirements above. For example, listed below are elements of the	

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				proposed groundwater follow-up monitoring program (taken from Table 12.5-1 for the Institutional Controls phase), with comments provided after each element to illustrate what level of detail would be expected at this stage. • "Proposed monitoring: Routine groundwater analyses for parameters of concern related to degradation (e.g., pH), as per geological and hydrogeological environment above. Trigger for further action: If groundwater monitoring results indicate potential for degradation or other performance issues (after accounting for changes to baseline), assess need to confirm integrity of concrete monolith." Other than pH, no other groups of parameters are listed. Broad categories of parameters should be included such as "metals", "radionuclides", "alkalinity", etc. In addition, triggers need to be more clearly defined, even though a numerical trigger may not be necessary during the EA phase. • "Monitoring Program Objective: Verify EA predictions (i.e., no degradation or performance issues during the Institutional Controls phase)." Additional detail would be required to outline the parameter types and measures that would be used to assess "no degradation or performance issues", such as target ranges for pH and alkalinity, upper bounds for metals and radionuclides. Although it is not expected that specific numerical limits be included for the purpose of the EA, identification of the key parameters and measures to "verify EA predictions" should be provided. • "Suggested Duration: Sampling and analysis of groundwater: periodic." The proposed frequency "periodic" is quite vague; something more definitive such as "quarterly" or "semi-annually" would be appropriate for the purposes of the EA. Also, there should be a description of whether or not the monitoring frequency will remain the same throughout the Institutional Controls phase, or whether there may be changes in frequency over that timeframe, and the reasons why a change in frequency might be contemplated. **Expectation to Address Comment:** Please include further details on the requirements stated above (from CNSC's *Generic EIS Guidelines*), including the monitoring timing and frequency, parameters, locations, triggers and potential adaptive management actions for each follow-up element.	
173.	Government of Quebec	Section 12.5 Preliminary EA Follow-up Monitoring Program, Table 12.5-1	p.12-5 to 12-6	**Comment:** In Table 12.5-1 (for Soil and Groundwater Quality during the Decommissioning Execution Phase), are the strainers of the observation wells placed at the right depths to provide representative samples, considering that the groundwater circulates mainly in the horizontal plane? **Expectation to Address Comment:** Please address the above question regarding proposed follow-up and monitoring activities for groundwater.	
174.	Government of Quebec	Section 12.6 Conclusions	p.12-12	**Comment:** In Section 12.6, the draft EIS states: "Due to the conceptual nature of the NPD closure project at this point, further details of the follow-up program (e.g., statistical analyses and confidence, probable effect sizes) and schedule (e.g., timing, frequency, duration) will be developed at a later date according to the CNSC EIS guidelines…"	

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				Environmental monitoring during the Institutional Controls period is not clearly established. Furthermore, CNL should pay particular attention to the monitoring of surface water quality in the Ottawa River in the final EIS. **Expectation to Address Comment:** Please clarify what EA follow-up monitoring activities will be conducted during the Institutional Controls period. At a minimum, in the final EIS, please describe the nature of the radiological and non-radiological contaminants being monitored, as well as their frequency and duration. Moreover, please outline the emergency response plan in the case of contamination of the Ottawa River.	
175.	CNSC	General	General	**Comment:** For all existing and new barriers, a plan should be provided explaining how the effectiveness of the barriers will be monitored. It is understood that this will occur through environmental monitoring. For example, will the wells at the site be monitored because the barriers themselves will be inaccessible? Limits / acceptable levels should be established for environmental monitoring results in order to indirectly demonstrate the satisfactory performance of the barriers. When determining the ability for waste to migrate from its original position of immobilization inside the facility structure towards the environment, site-specific data and studies that support the analytical models should be used. This analysis should be established in a verifiable and traceable way, prior to a licence decision, and should be subject to confirmation the at implementation phase only (i.e., it should not be conducted during the implementation phase). In addition, contingency planning and mitigation measures should be in placed (and provided to the CNSC) in case limits / acceptable levels for environmental monitoring are exceeded. **Expectation to Address Comment**: In considering the aforementioned points, please provide a plan that shows how the effectiveness of all existing and new barriers will be monitored. Also, clarify if remote sensing technology is to be used to monitor the structural health of the barriers.	
Technical Supporting Documents					
Aboriginal Engagement Technical Supporting Document					
176.	CNSC	General	General	**Comment**: It is not clearly indicate whether CNL has gathered any traditional knowledge from identified First Nation and Métis groups to inform the EIS, including the identification of VCs. **Expectation to Address Comment**: As per the CNSC's *Generic EIS Guidelines*, please identify if First Nation or Métis groups have been engaged to obtain their input and any traditional knowledge they are willing to share to inform the EIS, including the identification of VCs	
177.	CNSC	General	General	**Comment:** References to any requests from First Nation or Métis groups to undertake, or have undertaken, traditional knowledge, traditional land use or other studies in relation to the EIS are missing. **Expectation to Address Comment**: Please indicate if any of the identified First Nation or Métis groups have requested any additional studies to be conducted by CNL in relation to	

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				the EIS, including traditional land use or traditional knowledge studies, as per the guidance of CNSC's *Generic EIS Guidelines* and promoted within REGDOC-3.2.2.	
178.	CNSC	Section 3.0 Description of Aboriginal Communities, Table 3-1 Also applicable to the main EIS, Section 7.3 Identified First Nation and Métis Communities, Table 7.3-1, p.7-3	p.3-1	**Comment:** Table 3-1 (and Table 7.3-1 in the main EIS) identifies the following rationale for the Algonquin Anishinabeg Nation Tribal Council (AANTC): "Comprehensive Land Claim". This rationale is not accurate as there has been no formal submission from the Algonquins of Quebec to the Government of Canada to commence a Lands Claims process. Instead, the rationale should speak to the fact that the project is located within the vicinity of known traditional territory. Specifically, the AANTC, which represents seven First Nations with potential or established Aboriginal and treaty rights, have asserted rights and title to the region within the project's vicinity **Expectation to Address Comment**: Please revise Table 3-1 (and Table 7.3-1 in the main EIS) accordingly.	
179.	CNSC	Section 4.5 Engagement Activities Completed, Table 4-1 Also applicable to the main EIS, Section 7.5 Engagement Activities Completed, Table 7.5-1	p.4-5 to 4-30	**Comment:** While Table 4-1 provides a list of engagement activities with First Nation and Métis groups, the final report needs to go into more detail on whether important issues were raised during or as a result of those activities and what actions CNL has taken to address them. For example, the table indicates that the Métis Nation of Ontario (MNO) met with CNL staff on July 20, 2016. However, it is unclear what specific issues or concerns the MNO raised to CNL during the meeting (i.e., were the concerns only about chimney swifts?). **Expectation to Address Comment:** Please provide more detail in the final report on whether CNL has received any important information or correspondence from First Nation and Métis groups as a result of engagement activities, and what actions CNL has taken to address them.	
180.	CNSC	Section 4.5 Feedback Received to Date Also applicable to the main EIS, Section 7.6 Feedback Received to Date	p.4-15 [sic] (p.4-31)	**Comment:** As per CNSC's REGDOC-3.2.2, *Aboriginal Engagement* and CNSC's *Generic EIS Guidelines*, CNL is expected to identify issues raised by First Nation and Métis groups, and demonstrate how those issues will be addressed, including how their input on potential mitigation measures has been taken into consideration. Currently, this is not clearly defined within the Aboriginal Engagement TSD or the main EIS. **Expectation to Address Comment:** Please include further details on specific concerns and questions raised by First Nation and Métis groups, especially those related to impacts on any potential or established Aboriginal and/or treaty rights. Also include how CNL is addressing those issues and concerns (e.g., mitigation measures).	
181.	CNSC	Section 4.5 Feedback Received to Date Also applicable the main EIS, Section 7.6 Feedback Received to Date	p.4-15 [sic] (p.4-31)	**Comment:** Section 4.5 states that "[t]o date, biodiversity and cultural heritage studies have been identified by communities as topics of interest." **Expectation to Address Comment:** Please identify which First Nation and Métis communities have come to CNL expressing interest in conducting biodiversity and cultural heritage studies, and whether or not any such studies have been submitted and results taken into consideration as advocated within Section 3.3.2 of CNSC's *Generic EIS Guidelines*.	
182.	CNSC	Section 4.6 Planned Engagement Activities	p.4-16 to 4-18 [sic] (p.4-32 to 4-33)	**Comment:** There is no a schedule of proposed engagement activities and meetings with First Nation and Métis groups.	

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				Expectation to Address Comment: Please include a schedule of proposed engagement activities and meetings with First Nation and Métis groups, as per the requirements of REGDOC-3.2.2.	
183.	CNSC	Section 4.6 Planned Engagement Activities Also applicable to the main EIS, Section 7.7 Planned Engagement Activities	p.4-16 [sic] (p.4-32)	**Comment:** As per Sections 4.2.3 and 4.2.4 of REGDOC-3.2.2, CNL is required to develop and provide updates on their Aboriginal engagement plans. **Expectation to Address Comment:** Please include an update on the status of the development of CNL's Aboriginal Engagement work plans.	
Alternative Means Assessment Technical Supporting Document					
184.	CNSC	Section 2.2 Definition of Alternative Means Also applicable to Section 4.2 Alternative Means of Carrying out the Project of the main EIS, p.4-5 to 4-6	p.2-2 to 2-3	**Comment:** The type of waste associated with each alternative is missing in Section 4.2 (Alternative Means of Carrying out the Project) of the main EIS, as well as in Section 2.2. (Definition of Alternative Means) of the Alternative Means Assessment TSD. More specifically, these sections should indicate if the reactor system and components qualify as intermediate-level waste because, although near-surface disposal is acceptable for low-level waste, it requires further justification for intermediate-level waste, as indicated in the International Atomic Energy Agency's Disposal of Radioactive Waste Specific Safety Requirements No. SSR-5 (2011). **Expectation to Address Comment:** CNL should provide clarification regarding the type of waste associated with each alternative in Section 4.2 of the main EIS, as well as in the Alternative Means Assessment TSD.	
185.	CNSC	Section 4.3 Environmental Effects of Alternative Means	p.4-4 to 4-11	**Comment:** The risks to the atmospheric environment, surface water, aquatic environment, and radiation and radioactivity environment are considered to be lower for in-situ decommissioning relative to the partial or full dismantling and removal of the reactor and its components, because CNL assumes that off-site storage of the reactor components will increase the risk during the Institutional and Post-Institutional Controls periods at the CRL site. It would be quite surprising should the reactor core be stored at the CRL site for such a long period and not be disposed of within a deep geological repository. Therefore, it seems as though the dismantling and removal of the reactor comes with a much lower risk than in-situ decommissioning. The presented decommissioning alternatives no.2 and no.3 appear to be systematically biased, since CNL assumes that the removed activated products are stored in an interim (e.g., open end / no solution) storage facility. Considering this method as a final disposal solution for the activated products would reflect a long-term waste management solution. Would such a solution change the outcome of this systematic comparison of alternative disposal methods (e.g., p. 4-5, 4-8 and 4-18)? **Expectation to Address Comment:** Please justify using long-term storage of the reactor core at the Chalk River site over the Institutional and Post-Institutional Controls periods as an argument for in-situ decommissioning. Also, please include a discussion addressing the apparent bias.	
186.	CNSC	Section 4.3 Environmental Effects of Alternative Means	p.4-2 to 4-53	**Comment**: Sufficient detail should be available to justify the relative risks associated with each environmental component (per alternative), and these risks should be consistent	

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				across environmental components (or matrices). For example, on page 4-21 (Radiation and Radioactivity Environment), part of the description of the relative risk associated with "3. Full Dismantling and Removal" for the Post-Institutional Controls timeframe says that "[a]t the storage site, it is expected that the gamma fields will be higher than those in the "1. Continued SwS" alternative, due to the limited shielding." On page 4-40 (Public Health), however, the description of relative risk also associated with "3. Full Dismantling and Removal" for the Post-Institutional Controls timeframe says that "[t]he off-site storage facility will have lower risks than "1.Continued SwS" due to the containers limiting the releases of contaminants." These two descriptions seem contradictory and should be further justified to ensure that the relative risks are clear and consistent across environmental components. **Expectation to Address Comment:** CNL should provide sufficient detail to justify the relative risks associated with each environmental component. CNL should also make sure that these risks are consistent across environmental components (or matrices).	
Decommissioning Safety Assessment Technical Supporting Document					
187.	Health Canada	Section 4.1.6 Non-Radiological Benchmarks Also applicable to Section 8.5.2.5 Effects on Public Health and Table 8-17	p.4-4	**Comment:** A screening index / hazard quotient approach may not fully address the human health effects of non-threshold contaminants. To fully address the health effects of non-threshold contaminants, like $PM_{2.5}$ and NO_2, the attributable health risk can be determined based on relative risk above background for the specific population that would experience air quality changes. For remote locations where few people reside, this may not be necessary. Note that the Air Quality Management System (AQMS) includes Management Levels set below the CAAQS. Management Level 1 is based on actions for keeping clean areas clean; Management Level 2 is based on actions for preventing air quality deterioration; and Management Level 3 is to prevent exceedance of the CAAQS. More information on air management threshold values and actions is available in the *Guidance Document on Air Zone Management* produced by the Canadian Council of Ministers of the Environment (CCME) found here: http://www.ccme.ca/files/Resources/air/aqms/pn_1481_gdazm_e.pdf **Expectation to Address Comment:** Please demonstrate that the use of screening indices adequately addresses the potential human health effects of non-threshold contaminants.	
188.	Health Canada	Section 5.2 Non-Radiological Compounds Also applicable to Section 10.2 Malfunctions & Accidents Assessment, Figure 10-7	p.5-10	**Comment:** It is unclear whether the volumes and types of contamination referred to in Section 4.4.1.3 (Generated Waste) of the main EIS are known and accounted for in the modeling. Furthermore, the sensitivity of models to the accuracy of the inventory estimates are not discussed, particularly for contaminant releases that result in exposures approaching the specified criteria (e.g., for asbestos in some accident and malfunction scenarios – see Tornado (Non-Rad) (EF2) in Figure 10-7). **Expectation to Address Comment:** Please include additional information regarding the volumes of non-radiological contaminants and the sensitivity of the exposure scenario conclusions to the accuracy of asbestos and lead inventory estimates. Also, clarify the potential for release of asbestos from the sealand container. If contaminants are not accounted for in the modeling, a statement similar to the one provided for the radiological inventory in Section 4.4.1.3 of the main EIS should be provided (i.e., "the projected volumes are trivial and the total radiological inventory will be negligible and bounded by	

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				the reference radiological inventory”).	
189.	Health Canada	Section 5.2.4 PCBs	p.5-11	**Comment:** Section 5.2.4 discusses the “potential for PCBs to be present in paint and caulking in the NPD facility by noting that paint and caulking samples collected at Whiteshell facilities - of similar vintage - all contained less than the regulated level of 50 mg/kg of PCBs in solids. Thus, the assumption for NPD is that any paint or caulking will contain less than the regulated level of 50 mg/kg of PCBs in solids.” However, it is not clear whether PCBs in paint were included in the estimated total PCB inventory of 2.97 kg at NPD. **Expectation to Address Comment:** Please clarify if the estimated PCB inventory of 2.97 kg is inclusive of PCBs present in paint and/or caulking. Indicate potential contingency plans and mitigation measures that may be required if the PCB content of the paint is greater than anticipated.	
190.	CNSC	Section 6.2.2 Atmospheric Dispersion Factor	p.6-5 to 6-8	**Comment**: Atmospheric Dispersion Factors (ADFs) were calculated for accident scenarios using CALPUFF. ADFs were also calculated for normal operations using both AERMOD and CALPUFF. It was determined that for normal operations, the ADFs calculated using CALPUFF were more conservative than those calculated using AERMOD. Based on this comparison, it was determined that “CALPUFF-derived ADFs for normal operations are used in subsequent calculations.” It is not clear from this statement or in Appendix C under what scenarios or circumstances the CALPUFF-ADFs apply. **Expectation to Address Comment**: Additional clarity and explanation should be provided regarding when the CALPUFF-derived ADFs are applied later in the assessment.	
191.	CNSC	Section 6.2.2 Atmospheric Dispersion Factor	p.6-5 to 6-8	**Comment**: The text in the third paragraph of page 6-6 states that “[m]odelling results for fire scenarios are presented in Table 6-5 as ADFs (in g/m^3 per g/s) and 1-hour concentrations (in $\mu g/m^3$) at discrete receptor locations.” The subsequent sentence indicates that the same information is provided in Table 6-6 for non-fire scenarios. However, the 1-hour concentrations are absent from both tables for fire and non-fire scenarios. **Expectation to Address Comment:** Please update Tables 6-5 and 6-6 to include the 1-hour concentrations at the discrete receptor locations.	
192.	CNSC	Section 7.4 Existing Measures/Safeguards	p.7-14	**Comment:** Section 7.4 lists radiation safeguards for the decommissioning work, including: “…[c]ontinuous air monitors, dosimeters, and bioassay will be used as appropriate to detect the spread and uptake of contamination before it exceeds limits”. However, there is no mention of provisions for other radiological monitoring and surveys that should also be performed to identify adverse radiological conditions. **Expectation to Address Comment:** Please clarify if radiological surveys (including dose rate and contamination monitoring) will be conducted during decommissioning work activities.	
193.	CNSC	Section 7.9.2 Severity Screening	p.7-22	**Comment:** Regarding the severity criteria, particularly that for radiological effects, it is unclear whether the criteria have been applied in the bounding scenarios for dose to workers and dose to members of the public, along with the rationale for applicability.	

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				Upon examination of the 10 bounding scenarios, it does not appear that the radiological effects severity screening criterion was actually used, as the scenarios were assessed against dose acceptance criteria for both workers and the public, by frequency (i.e., events / year), as presented in Table 4-2). **Expectation to Address Comment:** Please clarify the use of the radiological effects severity screening criteria for the bounding scenarios.	
194.	Health Canada	Section 8.3.2 Assumptions on Operational Practices	p.8-5	**Comment:** The statement that air emissions during decommissioning are "unlikely to have any effect on the surrounding airshed" is misleading. Although the duration of the cause of the effect (i.e., the emissions) is short, it does not necessarily mean that the duration of the potential health effects will be short. **Expectation to Address Comment:** Please provide additional rationale to support this statement.	
195.	CNSC	Section 8.4.2 Stockpile Grout Ingredients	p.8-14	**Comment:** Section 8.4.2.4 (Radiation & Radioactivity Environment) states that fly ash will be a part of the grout ingredients. There are low concentrations of radionuclides in fly ash, and therefore, CNL indicates that a dose assessment will be completed when more site-specific fly ash information becomes available, as part of the radiological assessments conducted for specific tasks. No other information is provided. **Expectation to Address Comment:** Please provide additional information regarding the use of fly ash, including a preliminary analysis of the radiological effects to workers and whether an alternative was considered to avoid an additional radiological hazard to workers.	
196.	CNSC	Section 8.5.2 Grout Fill Nuclear Area Also applicable to Section 9.8.3 Identification of Residual Effects	p.8-29	**Comment:** Section 8.5.2.4 (Radiation and Radioactivity Environment) states that during the grouting procedure, the air that is currently in the facility will be displaced due to the pouring of grout. The air within the facility contains low levels of tritium. However, there is no discussion on whether there is potential for other radionuclides in the air that is displaced during the grouting process. Proposed mitigation measures in Section 9.8.3.2 (Proposed Mitigation Measures) and Table 9.8-4 (p.9-118) of the EIS include air monitoring for parameters of concern; however, it is unclear if air monitoring will include other radionuclides besides tritium. **Expectation to Address Comment:** Please clarify if other radionuclides besides tritium are expected in the air displaced during the grouting process. Also, include information on how this assumption will be confirmed during decommissioning work activities.	

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197.	CNSC	Section 8.6.1 (Demolition of Above Grade Structures) Also applicable to the main EIS, Section 9.9 (Aboriginal Land and Resource Use), p.9-119	p.8-37 to 8-38	**Comment:** This TSD refers to the Derived Release Limits (DRL) and compares release rates during decommissioning activities to DRLs in order to estimate public dose. It was noted in the DRL document for the NPDWF that one family in Rapides-des-Joachims raises chickens for their own meat; however, this intake pathway was ignored for the residential group. Furthermore, the following traditional land and resource uses are identified in the EIS (Section 9.9): • Hunting large game (deer, moose, and possibly black bear) • Hunting small game (waterfowl, rabbits, grouse, etc.) • Fishing walleye, northern pike, smallmouth bass, etc. • Gathering plants (including medicinal), berries, mushrooms However, it is unclear if all of these traditional land and resource uses are considered in the decommissioning and post-closure assessment of dose to the recreational/hunter group. **Expectation to Address Comment:** • Please include the ingestion of local chickens as part of the assessment of public dose. • Please clarify if, and how, each of the traditional land and resource uses are considered in the decommissioning and post-closure assessments of dose to the recreational/hunter group.	
198.	Health Canada	Section 8.6.1 Demolition of Above Grade Structures	p.8-38	**Comment:** The description of the sensitivity case in this section should refer to "dose rates" rather than "dose". The statement should read: "The decrease in total demolition time does not affect the total amount of radiation being released, but results in a faster release of the same amount, thereby resulting in higher dose **rates**." **Expectation to Address Comment:** Please ensure that "dose" and "dose rate" are used correctly throughout the document.	
199.	Health Canada	Section 8.6.2 Sizing Material	p.8-41	**Comment:** Section 8.6.2 does not identify PCB-containing paint dust as a potential air contaminant. Deposition of dust containing PCBs from paint on soil does not appear to have been assessed as a potential source in direct contact or ingestion exposure scenarios. **Expectation to Address Comment:** Address the potential effects from the release of PCB-containing dust from paint during decommissioning and sizing of materials, or provide a rationale for excluding it.	
200.	Health Canada	Section 9.4.2 Public Receptors	N/A	**Comment:** The EIS notes that countermeasures can be put in place to reduce exposure from the ingestion pathway, but does not identify any specific countermeasures. The potential harms or disadvantages of long-term restrictions on the consumption of food/water/beverages (i.e., the countermeasures) may in turn have an effect on human health. Dose from ingestion is not expected to significantly increase total dose or change the conclusions of the assessment; however, additional information is required to support	

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				this conclusion. **Expectation to Address Comment:** Please assess potential doses due to ingestion to confirm whether countermeasures would be required. If so, discuss the effects of these countermeasures on local producers and consumers, including Indigenous people.	
201.	Health Canada	9.4.2 Public Receptors, Table 9-36	p.9-43 to 9-44	**Comment:** Additional rationale for the use of a 1-hour exposure time for each scenario would provide additional clarity. However, given that there is also an assumption that the entire source term is released and contributes to dose, a longer exposure time would not be expected to change the conclusions of the report. **Expectation to Address Comment:** Please provide additional rationale for the use of a 1 hour exposure time for each scenario.	
202.	CNSC	Appendix F Air Quality Assessment for the NPD Project, Section F.2 Air Quality Regulations, Table F-1	p.F-1	**Comment**: Table F-1 cites the National Air Quality Objectives and the Canada Wide Standards for Particulate Matter and Ozone, as applicable to air quality criteria. These standards have been superseded by the CAAQS for $PM_{2.5}$, NO_2, SO_2 and ozone. These health-based federal standards are meant to establish ambient air targets for air pollutants that apply throughout Canada. **Expectation to Address Comment**: The air quality screening criteria for background air quality should be updated to the CAAQS for $PM_{2.5}$, NO_2 and SO_2. More specifically, the background air quality should be screened against the standards for 2015 and 2020, as the project execution phase may still be ongoing beyond 2020.	
203.	Health Canada	Appendix F Air Quality Assessment for the NPD Project, Section F.3 Air Dispersion Model Configuration	N/A	**Comment:** Employee traffic and non-truck traffic to and from the NPD site do not appear to have been included in the air dispersion model. Also, it is not clear if ventilation for the purposes of hydrogen gas mitigation has been accounted for in the air dispersion model. Ventilation may have an effect on air emissions for other contaminants. Excluding emissions from certain activities may underestimate the overall pollutant concentrations and exposure levels, and therefore, underestimate potential health risks. This is especially important for pollutants such as PM and NO_2 that have no threshold for health effects. **Expectation to Address Comment:** Please revise the assessment of air emissions to include all relevant sources, or provide a rationale for their exclusion.	
204.	CNSC	Appendix F Air Quality Assessment for the NPD Project, Section F.3.5 Source Characterization	p.F-8 to F-9	**Comment**: One maximum scenario of the predominant project activities, which were identified to interact with the atmospheric environment (air quality), was modelled in the assessment. Given the number of unknowns associated with the proposed project, justification should be provided for why one modelling scenario was sufficient to assess and bound the effects of the project. **Expectations to Address Comment**: Please provide justification for why additional modeling scenarios were not carried out for air quality. If sensitivity analyses were conducted, a summary should be included in the TSD.	
205.	Health Canada	Appendix F Air Quality Assessment for the NPD Project, Section, Section F.4 Air Modelling Results, Table F-7	p.F-13	**Comment:** Table F-7 indicates that the 1-hour average upwind background NO_2 emissions fall within the CAAQS category of Green Management Level. Predicted emissions would result in air quality within the Yellow Management level. The new CAAQS for NO_2 considers NO_2 to be a non-threshold substance; therefore, any increase	

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				in exposure will result in an incremental population risk. $PM_{2.5}$ has no population-health threshold for human health effects. Guideline values should not be construed as limits to which "polluting up to" is allowed. For additional information, refer to the CAAQS at: https://www.ccme.ca/en/current_priorities/air/caaqs.html. **Expectation to Address Comment:** Acknowledging that $PM_{2.5}$ and NO_2 have no threshold for health effects, please include mitigation measures which reflect the principles of keeping clean areas clean and continuous improvement, which aim to reduce population exposure associated with the proposed project. In addition, as per Comment no.148, the air quality screening criteria for background air quality should be updated to the new CAAQS for PM2.5, NO_2 and SO_2.	
206.	Health Canada	Appendix F Air Quality Assessment for the NPD Project, Section, Section F.4 Air Modelling Results, Table F-7	p.F-13 to F-14	**Comment:** The statement that "[t]he predicted 24-hour and average annual NO_2 concentrations are also less than the baseline concentrations" appears to conflict with the data presented in Table F-7. **Expectation to Address Comment:** Please clarify the conflicting information provided in the text and Table F-7.	
207.	ECCC	Appendix F Air Quality Assessment for the NPD Project, Tables F-7, F-8 and F-9	p.F-13 to F-16	**Comment:** The cumulative maximum predicted concentrations for NO_2, SO_2 and particulate matter are shown for sensitive receptors (R1, R2, R3 and R4), but not at the site study boundary or property line of the facility. The analysis of air quality should incorporate the cumulative maximum ground level concentrations for NO_2, SO_2 and particulate matter at the study boundary and at the property line. In order to implement appropriate mitigation and monitoring to verify EA predictions, the air quality assessment should be based on property line concentrations. **Expectation to Address Comment:** Please provide the modeling results for cumulative maximum concentrations at the property line in the appropriate tables of Appendix F and shown on isopleths for each of the pollutants.	
208.	Health Canada	Appendix F Air Quality Assessment for the NPD Project, Section, Section F.4 Air Modelling Results, Table F-9	p.F-16	**Comment:** The metric for annual $PM_{2.5}$ in the CAAQS is based on the 3-year average of the annual average concentrations, not of the 98th percentile as indicated in the footnote to Table F-9. **Expectation to Address Comment:** Please confirm that the predicted concentrations are presented in the same format as the regulatory criteria.	
Ecological Risk Assessment Technical Supporting Document					
209.	CNSC	Section 2.1 Site Characterization Also applicable to Section 8.5.3 Soil Quality of the main EIS	p.2-1	**Comment:** Section 8.5.3 of the main EIS provides a thorough description of soil quality at the NPD site. Clause 6.2.2 of CSA standard N288.6-12, *Environmental risk assessments at class I nuclear facilities and uranium mines and mills* makes reference to Annex C (Site Characterization Components), which provides the number and range of characteristics and parameters that could be considered as part of the site characterization (e.g., relevant background concentrations (including soil, vegetation, etc.), physical and chemical characteristics of soil (including soil type, soil texture, bulk soil density, etc.), identification of plumes and migration, and anticipated contaminant behaviour). This	

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				information does not appear to be present in the main EIS or the EcoRA TSD, although it is needed in order to fully assess all potential environmental pathways, which may be impacted by the proposed project. **Expectation to Address Comment:** The main EIS should provide a thorough description of the site characterization components indicated above for consistency with CSA N288.6-12 and in order to support the results of the EcoRA screening for COPCs, as appropriate.	
210.	CNSC	Section 2.2 Receptor Selection Also applicable to Section 4.2 Toxicological Benchmarks, Table 4.6, p.4-9	p.2-2	**Comment:** Toxicity reference values (TRVs) used in the assessment of SARA-listed species were derived as a fraction (10%) of the literature-derived TRVs used for indicator / surrogate species. While this approach is acceptable, it is unclear what, if any, species-specific criteria were used in this selection / substitution. For example, it appears that a shrew was used as a surrogate for eastern wolf, a protected species. A surrogate receptor can be used to evaluate risk for a SARA-listed species; however, the risk characterization must be cognizant of differences in the assessment and measurement endpoints. Surrogate selection for SARA-listed species may be done using published scientific literature (e.g., Weins et al., 2008, Banks et al., 2010), as well as other reliable sources, such as the U.S. Environmental Protection Agency (Dwyer *et al*., 1995) and the U.S. Fish and Wildlife Service (Dwyer *et al*., 2005). **Expectation to address comment**: The selection of surrogate species for SARA-listed species should be based on available, credible and scientifically defensible information. **References:** Banks, J.E., A.S. Ackleh, and J.D. Stark (2010). *The use of surrogate species in risk assessment: using life history data to safeguard against false negatives*. Risk Analysis. 30 (2): 175-182. Dwyer, F.J., L.C. Sappington, D.R. Buckler, and S.B. Jones (1995). *Use of surrogate species in assessing contaminant risk to endangered and threatened species.* U.S. Environmental Protection Agency, Final Report – September, 1995. EPA/600/R-96/029. 78 pp. Dwyer, F.J., F.L. Mayer, L.C. Sappington, D.R. Buckler, C.M. Bridges, I.E. Greer, D.K. Hardesty, C.E. Henke, C.G. Ingersoll, J.L. Kunz, D.W. Whites, T. Augspurger, D.R. Mount, K. Hattala, and G.N. Neuderfer (2005). *Assessing contaminant sensitivity of endangered and threatened aquatic species: Part I*. Acute toxicity of five chemicals. Arch. Environ. Contam. Toxicol, 48: 143-154.	
211.	CNSC	Section 2.2 Receptor Selection, Tables 2.2 and 2.4 Also applicable to Section 5.3 Species at Risk, p.5-11	p.2-11 and 2-13	**Comment:** In the selection of aquatic receptors, the American eel (*Anguilla rostrata),* a species identified as Threatened under the Committee on the Status of Endangered Wildlife in Canada (2012) and as Endangered under the *Ontario Endangered Species Act* (2007), has not been assessed. **Expectation to Address Comment**: Please provide a justification for excluding the American Eel in the selection of aquatic receptors in the EcoRA.	
212.	ECCC	Section 2.4.2 EcoRA Screening Also applicable to the main EIS, Section 8.7 Ambient	p.2-16	**Comment:** It is necessary to understand the existing conditions and corresponding existing impacts on the environmental components and VCs prior to evaluating effects of the project. Section 8.7 of the main EIS includes information regarding existing	

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		Radioactivity, Table 8.7-2		conditions of radioactivity (i.e., dose rates based on thermoluminescent dosimeters (TLDs)). However, TLD data (in Table 8.7-2) is appropriate for HHRAs rather than EcoRAs. An example of missing EcoRA information is the lack of a risk assessment to non-human biota on-site soil concentrations of radiological COPCs. **Expectation to Address Comment:** Please revise the EcoRA to include a full risk assessment (radiological and non-radiological) of baseline environmental conditions at the NPD site, and offsite in the Local and Regional Study Areas, where possible.	
213.	CNSC	Section 2.4.2 EcoRA Screening	p.2-16 to 2-18	**Comment:** It is unclear why a number of non-radiological hazardous substances were not considered in the assessment of exposure to workers (e.g., diesel exhaust and biological substances (mold spores)). **Expectation to Address Comment**: Please provide a rationale for excluding the above-noted COPCs from the assessment of exposure to workers.	
214.	ECCC	Section 2.4.2 EcoRA Screening Also Applicable to Section 3.4 Exposure Point Concentrations (p.3-4 to 3-18)	p.2-16 to 2-38	**Comment:** The EcoRA seems to have used the same methodology for assessing radiological risk as for non-radiological risk. That is, individual radiological COPCs that did not exceed the "No Effects Concentration" levels were screened out of the EcoRA. This approach resulted in all radionuclides being screened out except for one (i.e., Ag-108m). Generally, this method is standard and acceptable for non-radiological COPCs since synergistic toxicological effects between chemical COPCs are difficult to ascertain. On the other hand, radiological dose is typically a function of all forms of ionizing radiation due to radioactive substances that "radiate" with common mechanisms. Therefore, radiological dose is typically calculated as an aggregation for all radiological COPCs, and expressed as a total dose for the purposes of assessing risk. In this EcoRA, all of the dominant radionuclides (e.g., tritium, C-14, Cl-36, Nb-59) were screened out. Therefore, the dose calculations in the EcoRA underrepresent the total potential radiological dose. The radiological risk assessment is therefore incomplete. **Expectation to Address Comment:** Please include all dominant radiological COPCs in the calculation of total radiation dose for all biota evaluated, in all three project phases, at relevant (ecological and regulatory) locations.	
215.	CNSC	Section 2.4.2 EcoRA Screening	p.2-17	**Comment:** Section 2.4.2 states that radionuclide concentrations in air "were converted" to corresponding soil concentrations using available partition coefficients (K_d values) and screened against available benchmarks (No-Effect Concentrations) for non-human biota. This statement is somewhat questionable as soil concentrations cannot be derived from air concentrations using K_d values only. In fact, a dynamic compartment model is often used for this purpose, which expresses changes of radionuclide concentrations in soil as the balance between the input of activity due to wet and dry deposition from the air, and losses due to various removal processes, including radioactive decay, erosion, leaching, volatilization and cropping (refer to Clause 6.3.2 in CSA N288.1-14, *Guidelines for calculating derived release limits for radioactive material in airborne and liquid effluents for normal operation of nuclear facilities*). Given that the EcoRA does not appear to identify and discuss the soil model and the uncertainties associated with the model, the results of the radionuclide soil concentration screening, and validity of respective conclusions, are difficult to ascertain. Furthermore, the EcoRA is not in formal	

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				compliance with CSA N288.6-12, *Environmental risk assessments at class I nuclear facilities and uranium mines and mills*, which specifically states that "the ERA shall identify and discuss the soil model and the uncertainties associated with the model and data used in preparing the assessment" (refer to Clause 8.2.2). **Expectation to Address Comment:** The EcoRA TSD should identify and discuss the soil model used and the uncertainties associated with the model. It should also discuss the data used in preparing the assessment for consistency with CSA N288.6-12 and to support the results of the EcoRA screening for COPCs, as appropriate.	
216.	CNSC	Section 2.4.2 EcoRA Screening	p.2-17	**Comment:** The Decommissioning Safety Assessment model was used to predict radionuclide concentrations at each receptor location considered in the assessment. Similarly, the Postclosure Safety Assessment model was used to predict radionuclide concentrations over time in all affected environmental media, such as groundwater, soil, sediments and surface water, in each scenario considered. It is, however, unclear what model input parameters and assumptions were used in making these predictions and the resulting radionuclide concentrations used in the screening process. **Expectation to address comment**: Please provide information on the two aforementioned models used, including but not limited to input parameters, assumptions and uncertainties with respect to the predicted radionuclide concentrations used in the screening.	
217.	CNSC	Section 2.4.2 EcoRA Screening	p.2-17	**Comment:** CSA N288.1-14, *Guidelines for calculating derived release limits for radioactive material in airborne and liquid effluents for normal operation of nuclear facilities* is referenced in Section 2.4.2, as well as in other sections of the EcoRA and other Technical Support Documents. Given the completion / publication dates of CNL's EIS-related documents, it is not clear whether the applicable conclusions and supporting calculations based on CSA N288.1-14 methodology could be affected by recent updates to the standard (i.e., first update in May 2017 and second update in November 2017). **Expectation to Address Comment:** Please clarify whether the derived conclusions and supporting calculations in the EIS documentation (including the EcoRA) could be affected by recent updates to CSA N288.1-14.	
218.	ECCC	Section 2.4.2 EcoRA Screening Also applicable to Section 2.6 Conceptual Site Models (p.2-47 to 2-51)	p.2-19	**Comment:** The EcoRA states that through modeling for a hypothetical pond in the area of the guard house, an estimation of HTO concentration is presented as a potential pathway for deer (ingestion of pond water). The pond is hypothetically defined as having a surface area of 0.5 hectares. However, further consideration of the hypothetical pond is omitted in Table 2.8 for the screening of HTO in the normal decommissioning phase on the basis that the pond is not real. A wetland / pond about 300 m northeast from the site, and larger wetlands about 1 km from the NPD gatehouse, are present in the area and may become contaminated with HTO and other radionuclides. Furthermore, stormwater management ponds are proposed to control contaminants during decommissioning, and these may also become contaminated with HTO and other radionuclides. The EcoRA has not considered the hypothetical pond, the two existing wetlands in the area or the proposed stormwater management ponds as potential pathways to aquatic and terrestrial receptors. None of the conceptual site models include a wetland component with associated biota. These wetland complexes are likely habitat for many	

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				species of wildlife, including amphibians and reptiles. **Expectation to Address Comment:** Please consider factoring the hypothetical pond, the two wetland habitats and the proposed stormwater management ponds into the EcoRA for all relevant receptor species including amphibians and reptiles. Also, please include a wetland component in each of the conceptual site models that assess ecological risk.	
219.	ECCC	Section 2.4.2 EcoRA Screening	p.2-19	**Comment:** Under normal conditions, as grout is pumped into the NPD facility, air from the building will be pushed out as the void volume in the room shrinks. Depending on how rapidly this occurs, there is a potential for dust and other airborne radioactive elements to be released from the NPD facility. The EcoRA states that the grout mixture would likely bind fine particulates, including radioactive particulates, and that localized dust would be bound by the rising grout. The EcoRA further describes how air velocities may be such that dust would not be mobilized out of the subsurface rooms filled with grout. **Expectation to Address Comment:** Please provide a rationale to explain why air velocities are expected to remain below rates that would mobilize dust out of the rooms. Also, please provide an assessment of the likelihood that dust will be captured and bound by grout while it is being pumped into the NPD facility. This assessment should examine the rate of grout pumping and the relationship between displaced air volume and air velocity (which may vary depending on room configurations). Also, explain the physical processes and parameters (e.g., dust particle sizes and densities) that will result in localized dust being captured and bound by the liquid grout. For conservatism, include an additional scenario of contaminated dust release that assumes no binding of dust as a result of grout.	
220.	ECCC	Section 2.4.2 EcoRA Screening, Table 2.14 Tritium Levels near Guardhouse	p.2-29	**Comment:** Under the forest fire scenario, Table 2.14 shows that the HTO concentration in the hypothetical pond and in soil would both exceed the "No Effects Concentration". Table 2.15 shows HTO concentrations that are about an order of magnitude less than the "No Effects Concentration" for both the forest fire and tornado scenarios, which resulted in tritium being screened out for both those scenarios. It is unclear why the HTO concentrations in these two tables are not the same. **Expectation to Address Comment:** Please review and consider revising the screening assessment for HTO under the forest fire and tornado scenarios for the hypothetical pond and in soil. Please update Tables 2.14 and 2.15 as needed, or alternatively, provide a rationale for the inconsistencies between these tables.	
221.	ECCC	Section 2.4.2 EcoRA Screening	p.2-30	**Comment:** Radioactive COPC estimates for a major flood were calculated for the Pt. Stewart site. While the Pt. Stewart site may be appropriate for human health risk dose calculations, it is not appropriate for aquatic life (e.g., fish, waterfowl, aquatic plants). The closest site where aquatic life would be exposed to the maximum radioactive COPC should be factored into the risk assessment. For the project, the maximum exposure site would likely be on the NPD site or at the shoreline adjacent to the NPD site. The Pt. Stewart site is at a significant distance downstream of the NPD site. It is unclear how this distance may have influenced the risk based on the "No Effects Concentration" result for aquatic life.	

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				Expectation to Address Comment: Please update the risk assessment for radiological and non-radiological COPCs taking into consideration the stormwater / runoff at the shoreline near or adjacent to the NPD site before dilution.	
222.	ECCC	Section 2.4.2 EcoRA Screening	p.2-35	**Comment:** The methodology used for evaluating the post-closure phase incorporates eight scenarios that cannot be compared, as they are not equivalent types of scenarios. For example, the "Seismic Event" and "Early Glaciation" scenarios are disruptive event scenarios, whereas scenarios 4 though 7 are variations in the closure methods (i.e., variations in how to design the project). The post-closure scenarios may have been better organized as a matrix, where the closure methods (i.e., Reactor Vault Backfill with Grout, Reactor Vault Backfill with Bentonite, Removal of Calandria, and Barrier Wall) are assessed against each of the site evolution scenarios (i.e., normal evolution, seismic event, early glaciation, etc.). Furthermore, it is unclear how the "Discharge to Shore" scenario should be categorized, because it appears to relate to a major flooding event, but this cannot be confirmed as a result of the lack of information on this scenario in the EIS / EcoRA. **Expectation to Address Comment:** Please provide a revised EcoRA for the post-closure phase that incorporates comparable scenarios such as disruptive event scenarios and different closure methods. Also, provide additional information on the "Discharge to Shore" scenario so that it can be better understood and evaluated.	
223.	ECCC	Section 2.4.2 EcoRA Screening, Table 2.19	p.2-37	**Comment:** For the "Discharge to Shore" scenario, Table 2.19 shows that the shore sediment concentrations for C-14 and Cl-36 were predicted to be 1.00E+7 Bq/kg and 2.00E+06 Bq/kg, respectively. These predictions are greater than the "No Effects Concentrations" which the table lists as 6.08E+03 Bq/kg and 1.52E+05 Bq/kg, respectively. It is therefore not clear why C-14 and Cl-36 were screened out for sediment. **Expectation to Address Comment:** Please clarify whether or not C-14 and Cl-36 have appropriately been screened out of the "Discharge to Shore" scenario. If they were incorrectly screened out, please update the risk assessment based on their inclusion.	
224.	CNSC	Section 3.5.1 Radiological COPCs Also applicable to Appendix C	p.3-8	**Comment:** To calculate the radiological dose to terrestrial and aquatic organisms, a generally accepted approach was used, consistent with Clause 7.3.4 of CSA N.288.6-12, *Environmental risk assessments at class I nuclear facilities and uranium mines and mills*, and included (but was not limited to) the dose equations, radiation weighting factors, and dose coefficients published in scientific literature (e.g., Prohl, 2003, Amiro, 1997). However, it is unclear in Appendix C what assumptions and input parameters were used, as well as associated uncertainties, in the derivation of dose rates to biota. **Expectation to Address Comment**: Please provide a discussion of the assumptions used in dose calculations, including the associated uncertainties in the derivation of dose rates to biota.	
225.	CNSC	Section 5 Risk Characterization, Tables 5.1 and 5.2	p.5-3 to 5-4	**Comment:** In the radiological dose rate assessment of terrestrial and aquatic receptors, the ENEV values of 2.4 mGy/d and 9.6 mGy/d were used, respectively, as per the United Nations Scientific Committee on the Effects of Atomic Radiation Guidance (2008). While these screening values are appropriate for population-level effects, they are not appropriate for SARA-listed species where individual-level effects / protection are	

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				necessary. Therefore, the assessment for protected species may be less than conservative. **Expectation to Address Comment**: Please clarify how using the ENEV values in the radiological dose rate assessment, which are recommended for population-level protection, can provide adequate protection for individual SARA-listed terrestrial and aquatic species.	
226.	ECCC	Appendix A, Ecological Profiles	p.A-1 to A-15	**Comment:** Ecological profiles provide all the dietary and biological characteristics that are used to model ecological risk (radiological and non-radiological) for a particular species. Appendix A of the EcoRA TSD describes many of the species selected as ecological receptors for inclusion in the assessment (e.g., Table 2.4). However, ecological profiles for each of the species, such as aquatic species, have not been provided. **Expectation to Address Comment:** Please provide the ecological profiles for all of the ecological receptors that were modelled. If standard ecological profiles are not available, or if the standard profiles were modified, then please describe the assumptions (with supporting rationale) used for calculating the radiological and non-radiological risks for aquatic species.	
227.	ECCC	Appendix B, Dose Coefficients	p.B-1 to B-33	**Comment:** The dose coefficient tables list extensively both the internal dose and external dose coefficients (DCs) for all of the radionuclides expected to occur at the NPD site. The external DCs reported for C-14 for terrestrial biota show that an external DC was only included for the Bald Eagle. An external DC of "0" for C-14 was reported for all other terrestrial biota. It would be reasonable to consider that all other terrestrial biota would be exposed to beta radiation from C-14 externally, as is assumed for the Bald Eagle. This would be especially true for earthworms and terrestrial plants assessed, whose roots are in the soil. No additional explanation is provided to explain this inconsistent treatment of external DCs for terrestrial biota. **Expectation to Address Comment:** Please provide an external DC for C-14 for all other terrestrial biota that are assessed.	
Greenhouse Gas Emissions Technical Supporting Document					
228.	CNSC	Section 2.1 Scope of Activities Considered in the Analysis, Table 2.1	p.2-1	**Comment:** Section 3.4.2 (Associated Infrastructure) of the Project Description identifies possible temporary infrastructure that will need to be constructed to facilitate decommissioning of the NPD site. These activities include construction of mobile offices, washrooms and the possible construction of a temporary concrete batch mixing plant. These activities were not identified or discussed in the greenhouse gas (GHG) emissions assessment. Full characterization of possible sources of GHG emissions must be included in the assessment. If a particular source is identified to be negligible, then an explanation or justification should be provided. **Expectation to Address Comment:** Please provide an explanation or justification for why these project-related activities were not included in the GHG emissions assessment for the project.	
229.	CNSC	Section 2.2 Indirect GHG Emissions	p.2-2	**Comment:** The default values of the Green Concrete LCA Web Tool were used for transportation inputs and fuel options for pyroprocessing. These values are based on US average values. Section 2.2 did not include a discussion of the uncertainty that may be	

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				introduced by using these default values. Assessing the level of uncertainty for these two inputs is recommended given that transportation to the plant (concrete production) and cement pyroprocessing (cement production) are the two major indirect sources of GHG emissions. **Expectation to Address Comment:** Please provide an explanation of the level of uncertainty that may be introduced by using the default US parameters for transportation inputs and fuel options for pyroprocessing of the Web Tool.	
230.	CNSC	Section 2.3 Direct GHG Emissions	p.2-3	**Comment:** Reference is made to using the methodology outlined in the GHG Protocol for estimating direct GHG emissions. No reference was provided for this document. **Expectation to Address Comment:** Please provide a reference for the GHG Protocol used. Awareness of the methodology used in the assessment is necessary to properly verify the assessment.	
231.	CNSC	Section 2.3 Direct GHG Emissions	p.2-4	**Comment:** Section 2.3 details the assumptions used to estimate direct GHG emissions from the proposed project. However, no justification or explanation is provided for the selection of these values and why they are deemed to be conservative in nature. For example, how was it determined that 19,000 m^3 is a reasonable upper bound of concrete (grout) that will be needed or that the demolition and concrete batching activities will occur for 70 days per year? **Expectation to Address Comment:** Please provide further justification regarding the assumptions used in the direct GHG emissions assessment for the proposed project.	
232.	CNSC	Appendix A**,** A.1 – Output and Input of Indirect GHG Emission Calculation Model	N/A	**Comment:** CNSC staff independently verified the outputs of the Green Concrete LCA Web Tool. CNSC staff used the same input parameters as those provided in section 2.2 of the GHG Emissions Report. CNSC staff verified the outputs of their assessment against the summary table of indirect emissions (Table 2-3). CNSC staff's outputs for concrete production were consistent with those in Table 2-3. However, CNSC staff found discrepancies in the values for cement production (i.e., quarrying and cement pyroprocessing). Additionally, the graphical outputs for cement production were missing from the printouts for the LCA Web Tool. **Expectation to Address Comment:** Please verify the estimated GHG emissions for cement production (i.e., quarrying and cement pyroprocessing) and provide the graphical outputs for cement production for completeness and verification of the outputs obtained.	
233.	ECCC	Appendix A-A.2 – Summary of Direct GHG Emission Calculations Also applicable to the Decommissioning Safety Assessment Technical Supporting Document, Appendix F Air Quality Assessment for the NPD Project, Tables F-4, F-5 and F-6	N/A	**Comment:** CNL provides sample calculations for emissions estimates of air pollutants in Appendix A.2, but not in the Appendix F of the Decommissioning Safety Assessment TSD. Of the air emission estimates for sources that are included, the ones for unpaved roads, crushing and screening and the concrete batch plant do not include details such as sample calculations, assumptions and emissions factors. Also, these calculations, assumptions and emission factors only cover some sources. Air emissions from these sources could result in adverse effects to air quality that may be of concern. In order to verify CNL's statements about air emissions from the proposed project, additional information is requested to understand:	

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				• Each source of air pollution that was included in the emissions calculation • Each reference value used in the calculation • Any limitations or sources of uncertainty (e.g., from assumptions) **Expectation to Address Comment:** Please provide air quality sample calculations in Table F-6 (Appendix F) for unpaved roads, crushing and screening and the concrete batch plant (for total suspended particles, PM10, PM2.5). In addition, identify any assumptions made (e.g., silt content, control or mitigation efficiencies), include references used to calculate emissions, and incorporate all calculations related to air quality in the Appendix F of the Decommissioning Safety Assessment TSD.	
Postclosure Safety Assessment Technical Supporting Document					
234.	CNSC	General	General	**Comment:** CNSC staff's assessment is that CNL has not demonstrated that the proposed safety case is robust, nor has it been well supported by scientific evidence. CNSC staff do not consider the proposed safety case to meet CNSC's expectations as outlined in CNSC's Guide G-320, *Assessing the Long-Term of Radioactive Waste Management*. In alignment with guidance provided in CNSC's Guide G-320 (Section 5.0) and IAEA SSR-5, *Disposal of Radioactive Waste* (Section 1.26 and Requirement 3.0), a safety case consists of a safety assessment, complemented by a set of additional arguments that is used to give reasonable assurance that long-term waste management will be conducted in a manner that protects human health and the environment. In this respect, the flow and organization of information submitted to support the safety case is a crucial element that is necessary to provide reasonable assurance that the long-term management of waste will be adequately implemented. To clarify CNSC staff's expectations, the safety case is considered to comprise of a suite of living documents, which are revised throughout the life of the project, prior to release from institutional control. The set of documents that comprise the safety case could be organized in many ways. An example of a possible organization is shown in Figure 1 (see Appendix 1 to this comment table below), in which the Preliminary Safety Assessment Report (PSAR) contains the arguments that support the safety case, and the supporting documentation provides the detailed assessment and the scientific evidence to support those arguments being made in the PSAR. **Expectation to Address Comment:** Please submit a safety case which meets CNSC staff's expectations, in alignment with CNSC's Guide G-320 and IAEA SSR-5, and take into consideration additional guidance provided in the comment above. CNSC staff should be engaged to provide additional guidance as necessary.	
235.	ECCC	General	N/A	**Comment:** It is suggested that in an intrusion scenario, there would be a large dilution of the radioactive inventory as a result of the volume of uncontaminated material that needs to be removed. It is conceivable that radioactive materials, which are most concentrated at the bottom of the excavation, could be removed with relatively little dilution, once the overlying material has been excavated. **Expectation to Address Comment:** Please revise the intrusion scenario to account for a	

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				situation where there is "no dilution" of radioactive materials.	
236.	ECCC	General	N/A	**Comment:** Limited information is provided on the "worst case" scenarios used for the assessment of risks. An alternative method of assessing the risks of the proposed project would be to identify "worst case" scenarios, describe the conditions necessary for each "worst case" scenario to develop, and to assess the risks posed. **Expectation to Address Comment:** Please update the scenarios to include "worst cases" scenarios, describe conditions necessary for their development, and describe the potential risks associated with these scenarios.	
237.	CNSC	Section 2.0 Assessment Context	p.2-8	**Comment:** What is the timing of the peak dose / maximum impact, as required by CNSC's Regulatory Policy P-290, *Managing Radioactive Waste* (which is quoted on p. 2-8)? The approach is stated to encompass the peak, yet it is not shown, and is not demonstrably linked to the waste inventory. The basis of the assessment timeframe and its link to the radioactive waste source term should be easy to assess (e.g., demonstrated with a figure). All long-term safety scenarios and evaluations depend on this component, which enables an understanding of the selected safety assessment timeframe. **Expectation to address comment:** Please clarify the basis of the assessment timeframe with respect to the source term.	
238.	CNSC	Section 4.0 Scenarios, Calculation Cases, Models and Data Also applicable to Appendix E Conceptual Models and Data	N/A	**Comment:** Although a description of each scenario exists in Section 4, and model parameters are discussed in Appendix E, within the description of scenarios, the primary model parameters (i.e., hydraulic conductivity, degradation rates, wasteform corrosion rates) are not explicitly provided for each scenario other than the NES. Furthermore, it is not always clear how specific Features, Events and Processes (FEPs) have been considered within the scenarios, including the NES, particularly their effect on model parameters (e.g., FEP 1.3.4 Periglacial Effects). **Expectation to Address Comment:** Please clarify the model parameters used for each scenario and demonstrate how the FEPs have been considered by providing a table which outlines the following: • A description of the dominant transport pathways from the source through the engineered and natural barriers, and the exposure pathways to the defined receptors, where these differ from the NES • A description of the release characteristics for each scenario • The model parameters • The FEPs considered, and how each FEP was considered within the scenario (i.e., effect on model parameters)	
239.	CNSC	Section 4.1.7 Sensitivity Calculations	p.4-9 to 4-10	**Comment:** The sensitivity analysis cases investigated are insufficient to bound the potential scenarios that the NPD facility may encounter or bound uncertainty in the input parameters or the conceptual model. The following points should be considered:	

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				• The sensitivity analysis investigating the inventory based on the reported measurement data is of value. However, it does not appear that a bounding reference inventory was considered in the sensitivity analysis that accounts for uncertainty. A bounding inventory should be considered in light of the low number of samples collected and the uncertainty related to the ORIGEN modeling. • Each sensitivity case only considers a single parameter at a time. It is considered best practice to combine sensitivity cases and co-vary multiple input parameters to fully bound potential scenarios. For example, co-variation of several hydraulic parameters investigated in the current sensitivity analysis would provide a more conservative approach than is currently provided. • Only five sensitivity cases are considered in the current safety assessment. Indeed, sensitivity cases that consider other key input parameters are not included. It would be beneficial if a more comprehensive approach to sensitivity analysis was performed that investigated the importance of the numerous assumptions contained in the safety assessment (e.g., the rate of cement degradation, variations in contaminant transport via diffusion and advection, etc.). **Expectation to Address Comment:** Please enhance the sensitivity analyses performed in the post-closure safety assessment to ensure that key parameters are sufficiently investigated and what the effect of parameter co-variance may be.	
240.	CNSC	Section 4.2.2 Waste and Facility Model	p.4-13	**Comment:** Three phases are proposed to represent the degradation of concrete and grout. It is stated that "[s]tage I ends after around 100 flushes of the pore space; Stage II ends after 1000, and Stage III is complete after around 7500 flushes." However, it is not clear how much time would be needed to achieve the number of pore flushes for each stage, and the hydraulic conductivities of the concrete and grout at the end of each stage. **Expectation to Address Comment:** Please specify the time scale corresponding to the number of flushes for each stage, and the hydraulic conductivities of the concrete and grout at the end of each stage.	
241.	CNSC	Section 5.1 Normal Evolution Scenario, Table 5-2	p.5-6	**Comment:** Carbon-14 has a remarkably high sorption coefficient to concrete structures (2 to 5 m^3/kg) for a relatively inert element. As such, resulting doses to the environment are quite low. **Expectation to Address Comment**: Please explain how Carbon-14 is one of the most sorbed elements in this proposed project.	
242.	Health Canada	Section 5.1.3 Doses to Humans	p.5-18 to 5-21	**Comment:** There is no evidence provided to demonstrate that the exposure group profiles are reflective of actual land and resource use by Indigenous people, including assumptions about food consumption rates. **Expectation to Address Comment:** Please clarify whether the exposure profiles are based on site-specific data (e.g., food consumption surveys), and if not, how the assumptions were made.	
243.	ECCC	Section 5.3 Defence-in-Depth Calculation Cases	p.5-33	**Comment:** The assumptions and model inputs for the various models used to develop the "Role of Grout" scenario have not been clearly outlined, which are needed in order to	

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				review the completeness of modeling methodology. **Expectation to Address Comment:** Please identify the inputs, assumptions, limitations and inferences for the various models used to develop the "Role of Grout" scenario.	
244.	CNSC	Section 5.5.3 Well in Contaminated Plume Also applicable to the main EIS, Section 9.8.3 Identification of Residual Effects, p.9-110	p.5-46	**Comment:** "What if" scenarios are considered to be based on extreme assumptions and are not considered to be plausible. Given that wells are used by people living in the same region as the NPD site, more credibility should be given to this scenario. **Expectation to Address Comment:** Please justify classifying the "well in contaminated plume" as a "what if" scenario, or provide more credibility to this case by considering it in the NES.	
245.	Health Canada	Appendix A 5.4 Criteria for Non-Radioactive Contaminants Also applicable to the main EIS, Section 8.3.5 Sediment Quality	p.A-9	**Comment:** Appendix A states: "[p]otential impacts from non-radioactive elements or chemical species are assessed for both all scenarios and calculation cases in environmental media relevant to human health and environmental protection. The relevant environmental quality standard criteria for soil, sediment and water are designed to protect against adverse effects from exposure by food chain..." It is unclear whether this assumption is supported by scientific evidence or how all environmental quality standards apply to the country foods consumption pathway, since not all criteria are designed to be protective of human health. Similarly, Section 8.3.5 (EIS) indicates that sample concentrations in sediment exceeded criteria, but the discussion does not specify whether the criteria are protective of aquatic life or human health. The CCME criteria used in Table 8.3-10 are based on the protection of freshwater aquatic life, while the MOECC Table 1 criteria uses a mix of values based on the protection of aquatic biota and human health. The use of these values for screening may therefore underestimate the risks to human health. In addition, shore sediment values were screened based on MOECC sediment criteria designed to protect aquatic ecosystem health. Health Canada has published supplemental guidance on the evaluation of human exposure to chemicals in sediments. Please refer to Health Canada's *Guidance on Contaminated Sediments*, and *Federal Contaminated Site Risk Assessment in Canada: Supplemental Guidance on Human Health Risk Assessment of Contaminated Sediments: Direct Contact Pathway (2017) for assessing human health risks from exposure to contaminated sediment for direct contact pathways*. The Supplemental Guidance is available upon request. **Expectation to Address Comment:** Please demonstrate that the specific EQS criteria selected for each COPC is suitable for the protection of human health in the manner in which they are used. Alternatively, an appropriate value can be calculated based on site-specific evidence to support the conclusions drawn in the EIS. In addition, provide additional rationale to support the use of EQS criteria in lieu of a detailed HHRA / assessment of uptake into biota. Ensure that all applicable exposure pathways for the human receptors are considered and clearly discussed. It would also be appropriate to consider sediment stability and the hydrological regime of the area in order to identify and evaluate the disturbance and dispersal of contaminated sediment, as this will support assessment of potential health risks.	
246.	ECCC	Appendix B System Description, B 3.4 Uncertainties	p. B-23	**Comment:** Section B 3.4 states: "Measurement data are also not available for Ag-108m, a particularly important radionuclide. Some radionuclides also appear to have been	

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				underestimated when calculated by modelling, most notably tritium and C-14 in concrete and steels." Failure to assess and accurately predict radiological dose from parameters such as Ag-108m, tritium or C-14, could result in adverse effects on the surrounding environment, such as water quality, sediment quality, and impacts on aquatic biota. **Expectation to Address Comment:** Please describe the risks associated with not having measurement data for Ag-108m and the risks associated with underestimating the radionuclides in the models, including for tritium and C-14. Furthermore, please explain how these uncertainties will be addressed.	
247.	CNSC	Appendix C Features, Events and Processes	General	**Comment:** There are several FEPs that were either screened out with insufficient justification or where their impact does not appear to have been fully considered. Here is a list of FEPs with an explanation of what aspect(s) require further clarification: • **FEP # 1.2.12 Hydrological/Hydrogeological Response to Geological Changes:** It does not appear to consider the possibility of an increase in river levels or regional groundwater levels due to climate change. • **FEP # 2.1.1.1 Radionuclide Content:** It is noted that this FEP can be assessed as a sensitivity case, which was done. However, the sensitivity case only assessed the effect of the lower limit of the waste inventory and did not consider the upper limit of waste inventory uncertainty. • **FEP # 2.3.4.7 Complexation [Waste Form]:** The exclusion of complexing from consideration in the NES is insufficiently justified. It is stated that there will not be a source of complexants in the reactor vault. However, this statement does not appear to consider the possibility of carbonate and hydroxide as complexants from water passage through the concrete shield prior to it reaching the reactor vault, where they could then form new species with radionuclides that either retard or enhance mobility. • **FEP # 2.3.4.8 Colloid Formation [Waste Form], FEP # 3.2.4.8 Colloid Formation [Facility] and FEP # 3.3.1.7 Colloid Transport [Facility]:** The exclusion of colloids as a transport mechanism from the NES is insufficiently justified. It is not clear why up and down gradient hydrologic properties or cement will filter colloids, which are known to be highly conservative and can travel through low permeability and porosity materials. • **FEP # 2.4.2 Gas-Mediated Release:** CNL states that, although gas may be generated from a number of processes, "the potential for gas generation is relatively low as the main sources of gas (corroding metals) will produce gas slowly and as such the gas is likely to become dissolved in groundwater gas". Based on this, gas migration has been screened out as a FEP. However, no data (i.e., scientific evidence) has been provided to quantify the rates of gas generation and dissolution in groundwater to support these statements. **Expectations to Address Comment:** Please address the outstanding concerns related the aforementioned FEPs. For FEP # 2.4.2 (Gas-Mediated Release), please provide a quantitative assessment to	

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				support the decision to screen out gas-mediated release as a FEP. This may include calculating the expected rate of gas generation (from waste inventory and corrosion rates) and its dissolution in groundwater.	

248.	CNSC	Appendix C Features, Events and Processes
		
		Also applicable to Appendix D Scenarios and Calculation Cases, p.D-6
			p.C-103	**Comment:** As defined in CNSC's Guide G-320, *Assessing the Long-Term of Radioactive Waste Management*, "[a] normal evolution scenario should be based on reasonable extrapolation of present day site features and receptor lifestyles. It should include expected evolution of the site and degradation of the waste disposal system (gradual or total loss of barrier function) as it ages." The proposed NES is not considered to be in alignment with CNSC's Guide G-320, for the following reasons:
				• **The presence of a shear zone** is presented in the Updated Groundwater Modeling Report. Yet, large-scale discontinuities are screened out of the NES, as CNL claims that the bedrock at the site contains only minor fractures and little weathering. The shear zone, identified at the NPD site, must be considered as an integral component of the NES.
				• **Seismicity:** Seismicity was screened out from the NES as CNL states that the facility is in a region with a low probability of earthquakes that cause structural damage, and seismicity is covered by a DES that considers damage to engineered structures. However, the site lies within a zone of moderate seismic hazard; therefore, the impact of seismicity on the facility should be included in the design and/or assessed in the NES corresponding to the defined safety assessment timeframe (50,000 years), over which the seismic hazard is expected to be higher – and should be included as a FEP.
				  ○ In order to meet the intent of CNSC's Guide G-320, consideration of a design-basis seismic event occurring, and the associated impacts on the performance of the EBS components (e.g., degradation rates, porosity, hydraulic conductivity), its influence on the existing shear zone (i.e., reactivation of the fracture network), and other geological features should form an integral component of the NES.
				• **Performance of the engineered barrier system:** Significant uncertainty exists within the key model parameters (i.e., hydraulic conductivity and degradation rates) of barrier performance (i.e., grout, foundation).
				  ○ It appears that CNL is using a number of material properties associated with porous concrete for the grout (i.e., hydraulic conductivity, diffusion properties, dry bulk density, degradation, and porosity) based on Savage and Stenhouse (2002). It is not clear within the Postclosure Safety Assessment TSD if the type of grout has been selected, and what the hydraulic and mechanical properties of the selected grout are. The parameters used are therefore not well justified for the purpose of the Postclosure Safety Assessment.
				  ○ No evidence could be found to verify / support that the foundation concrete used at the NPD facility holds similar properties to those adopted from Savage and Stenhouse (2002). Furthermore, the values in this report make reference to other studies. It is not clear which studies have been used, and whether the material properties assessed for concrete in those	

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				studies hold in this assessment. Furthermore, information could not be located on the existing state of the building foundation. ○ In the absence of scientific evidence, a level of conservatism in the performance of the EBS, that is commensurate with the level uncertainty, should be applied to the NES and justified. Given the lack of evidence provided on the current specifications of the grout type(s) to be used in the decommissioning of the NPD facility, and lack of characterization of hydraulic and mechanical properties and current integrity of the existing building foundation, it may be more appropriate to assume complete degradation of these barriers over the reference timeframe in the NES, unless additional evidence to support the assumptions used can be provided. • **Geosphere performance:** Geology in the Postclosure Safety Assessment (p. 3-9) is not presented in enough detail for this project (i.e., just over 200 words were used to describe the stability, regional geology, local geology, rock type with no references, no maps, and no geological model). Supporting information in Appendix B is limited: the bedrock geology map provided is for the entire province of Ontario, and a diagram from Wikipedia (Figure 6-3) is provided for tectonic setting. Please note that Wikipedia is not suitable as a lone reference for this information – the scientific literature must be consulted. It is not clear how the expected evolution of the site, in particularly the geosphere, has been accounted for within the NES. CNL should provide supporting evidence to demonstrate that the site geology and its anticipated evolution in the reference timeframe is being considered in the NES, and that geosphere characteristics have been properly documented in supporting material. • The NES should include the existence of a seismically active fault / shear zone at the project site. This also highlights the need for a seismic hazard assessment. By extension, information on the shear zone must be provided in the main EIS and the Postclosure Safety Assessment. **Expectation to Address Comment:** Please reassess the proposed NES and take into consideration the following: **i)** the presence of the shear zone (potential for reactivation over, relationship to seismicity); **ii)** seismicity; **iii)** conservatism within the key model parameters of barrier performance, commensurate with the level of uncertainty that exists with the properties of the final grout formulation and existing integrity of the building foundation; and **iv)** adequate characterization of the current geology and its evolution within the reference timeframe. Please provide a synthesis of the geological environment for the NPD site, including regional geological setting and site-specific characterization. Related components that should support this synthesis include: regional geological history and setting, structural geology and tectonics, petrology, a seismic hazard assessment (that incorporates the geological information and seismic sources), geomorphology, site-specific geology, fracture frequency in shallow bedrock, and bedrock weathering profile. Furthermore, please provide specific data to establish corrosion rates and constrain releases from the source term. This should take into account congruent release and	

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				potential instantaneous release.	
249.	CNSC	Appendix E Conceptual Models and Data, Section E 2.2.4 Biosphere, Figure E-9	p.E-23	**Comment:** Not all pathways described in CSA N288.1-14, *Guidelines for calculating derived release limits for radioactive material in airborne and liquid effluents for normal operation of nuclear facilities* are considered. Figure E-9 should include all relevant pathways shown in Figure 1 of CSA N288.1-14. Specific pathways that were excluded are: atmosphere to soil, forage, animal produce, and plant produce; and surface water to soil, forage, animal produce, and plant produce. **Expectation to Address Comment:** With regards to Figure E-9 and the assessment of doses to humans, please consider all pathways described in CSA N288.1-14. For any pathways excluded, either provide adequate justification for screening out, or include the pathways in dose assessments.	
250.	CNSC	Appendix E Conceptual Models and Data, Section E 3.1 Contaminants of Interest, Table E-5	p.E-33	**Comment:** When screening the radionuclide inventory to reduce the number of radionuclides being considered to those that are relevant for the post-closure phase, C-14 was calculated to result in the highest ingestion dose. It is surprising that C-14 was not identified as one of the major contributors to dose in the dose calculations. **Expectation to Address Comment:** Please provide the maximum estimated dose during the post-closure phase from intakes of C-14 from ingestion of plants and animals.	
251.	CNSC	Appendix E Conceptual Models and Data	p.E-59 to E-60	**Comment:** One major barrier for NPD is the reactor core components. Mean corrosion rates of aluminum, carbon, stainless steel and zircaloy, under aerobic and anaerobic conditions, are provided in Table E-15 (p. E-60) with reported values of 15,300, 0.1, 0.1 and 0.01 µm/year. These corrosion rates were taken directly from the 2010 data report supporting the Ontario Power Generation (OPG) Deep Geologic Repository Project. This report suggests upper bound values of 5 and 1 µm/year under aerobic and anaerobic conditions for carbon and stainless steel. For zirconium alloys, the upper bound corrosion rate reported is 0.05 µm/year. The references reported in this report are at least 8 years old. **Expectation to Address Comment**: Considering the importance of the reactor core components as barrier to radionuclides transport: • Please provide an updated literature review of corrosion rates and describe any research done by CNL to decrease uncertainties regarding corrosion rates. For instance, what is the current corrosion assessment of the reactor core components? • Based on this information, please discuss the need for a corrosion research program that would help reduce uncertainty regarding corrosion. • Please provide justification for relying on 2010 data by presenting a variant scenario with upper bound corrosion rates, and by considering an instant release scenario.	
252.	CNSC	Appendix E Conceptual Models and Data	p.E-59 to E-60	**Comment:** There is no information about the current corrosion rate of the reactor components, nor is there information on rebar corrosion. As this reactor has been at the NDP site for at least 50 years, what is the current corrosion state of the reactor, and how was the rebar corrosion considered for concrete structures?	

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				Expectation to Address Comment: Please provide current corrosion estimates for the different reactor components and concrete structures, and determine the impact of these estimates on the Normal and Disruptive Event Scenarios.	
253.	CNSC	Appendix G Detailed Results, Section G 2.3 Doses to Human Receptors	p.G-30 to G-35	**Comment:** The dose estimates provided for human receptors in Section G 2.3 are broken down by the five radionuclides contributing most to dose. However, in order for CNSC staff to verify these dose estimates, doses should also be broken down by radionuclides and exposure pathways. **Expectation to Address Comment:** Please provide the post-closure dose estimates for receptors broken down by different pathways (e.g., ingestion of soil, ingestion of deer, ingestion of fish, inhalation, groundshine, etc.).	
Stakeholder Engagement Technical Supporting Document					
254.	CNSC	General	General	**Comment:** CNL has provided a summary of public questions and concerns raised about the project during outreach activities. They have also provided a dispositioning table in their supporting documentation in response to those questions. However, there appears to be outstanding questions from the public that have not been answered by CNL, some dating as far back as 2016. The dispositioning table indicates that there is a proposed response that has been prepared, but no indication that it was sent. **Expectation to Address Comment:** The final EIS must demonstrate that all information requests from the public have been responded to and are closed.	
255.	CNSC	General	General	**Comment:** CNL provided copies of media coverage, but there is no analysis of the coverage. **Expectation to Address Comment:** CNSC would like to see more information about the general nature and tone of the articles, and whether media coverage has increased over the life of this project.	
Supplementary Documentation					
Alkaline Plume Modeling Report					
256.	ECCC	Alkaline Plume Modeling Report Also applicable to the Lead Solubility Limits Report, p. 3-2 and 3-6 Also applicable to the Postclosure Safety Assessment Technical Supporting Document, p. 5-2, 5-5, 5-7, 5-38	General	**Comment:** A key premise of the safety case for this project is the ability of the grout-based monolith to retard the release of contaminants (radiological and non-radiological) through the long-term. Failure of this approach to containment could result in adverse effects on the surrounding environment, including on water quality, air quality and biota such as migratory birds. There are many uncertainties that can affect predictions about the long-term evolution of the grouted monolith and the resulting release of radiological and non-radiological contaminants. Some examples are provided below. **Grout Formulation:** The composition of the grout is a critical factor to retardation of the release of contaminants, since it will govern the physical and chemical behaviour, and evolution over time, of the solidified grout.	

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				The final grout formulation proposed for the NPD Closure Project is not clear. Any change in grout formulation will affect its chemical and physical evolution over the time frames of the proposed project. The EIS, TSDs and verbal communications of NPD staff have revealed inconsistencies regarding the grout formulation proposed and the formulation assumed for the various models. The only assumptions about grout composition that can be considered valid for the EA are those based on the actual composition of the grout that is ultimately used at the NPD site. • In the Alkaline Plume Modeling Report, simulations are based on Portland cement. However, the Lead Solubility Limits Report states: "The grout has a very high fly ash (FA) to Portland Cement (PC) ratio". During the November 7, 2017 site visit, NPD site staff said that the actual grout formulation likely would not contain fly ash due to a lack of local availability, and that other ingredients would need to be substituted. • Considering the limitations outlined on page 9 of the Alkaline Plume Modeling Report regarding the chemistry modeling, this document is an analysis of limited chemistry for a concrete formulation that is not being proposed for the monolith and does not factor cracks in concrete, amongst other factors (see below) that may have a bearing on the long-term evolution of the grout-filled monolith. • Since the Lead Solubility Limits Report is based upon a different formulation of grout than the one described in the Alkaline Plume Modeling Report, the modeling results and conclusions may not be relevant for the proposed Project. If page 3-2 does describe the final grout composition, the rationale for not applying this information consistently to the Alkaline Plume Modeling Report is unclear, especially since conclusions from individual reports affect the assumptions made in others. • Page 3-6 of the Lead Solubility Limits Report states: "The solubility of native lead is significantly lower than lead oxide under higher Eh hyperalkaline conditions." The Alkaline Plume Modeling Report does not predict such conditions; therefore, the relevance of this statement is unclear. Furthermore, if the fly ash based grout is used, the alkalinity is greatly reduced. • There is no indication that laboratory testing of the final grout composition has been completed. Testing would provide information about the physical and chemical behaviour of the grout, and how it will interact with groundwater. However, such data may only help to understand short-term behaviour of the grout, and extrapolations of such data on a timescale of tens-of-thousands of years are highly uncertain. **Physical and Chemical Factors That May Affect the Evolution of the Monolith:** Physical and chemical evolution influence each other, and cannot be considered separately. Physical factors listed below will have an effect on the chemical evolution of the monolith and upon groundwater chemistry. • Cracks in the monolith can be induced / enlarged through mechanisms, such as seismic events, tree roots, freeze-thaw cycles, enlargement of cracks via groundwater flow, etc. • Cement constituents being slowly leached will increase porosity, allowing groundwater to flow more easily. Seepage volumes will increase.	

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				• Once the proposed project is completed and the monolith experiences normal evolution over the lengthy time frames described, substantial cracks will develop and enlarge in the grout within the monolith. Cracks will increase the rate and volume of groundwater flow through the monolith to levels greater than those currently modeled. Increased groundwater flows may reduce the alkalinity of the groundwater flowing through the monolith, to levels lower than those currently modeled. The 2-dimensional model does not simulate these cracks in the grout or their effects. Due to the unique and distinct physical and chemical properties of cracked grout and its influence on other substances, a cracked grout scenario is unique and not captured by the grout or ungrouted scenarios presented. Without understanding the potential risks associated with a cracked grout scenario, it is difficult to assess the results and conclusions of the EIS. • Considering the lack of aggregate in the grout blend (as compared to concretes), the grout may be more susceptible to large scale and/or systemic cracking. These cracks would then be more susceptible to widening from water flows, as well as through other mechanisms. • The development of large cracks in the monolith can lead to faster leaching of contaminants relative to the rate of leaching of alkalinity, thereby changing the geochemistry in ways that have not been considered in the modeling. Since flow through large cracks may dominate the overall flow through the monolith, a much different geochemical regime may exist than is currently considered in the modeling. The importance of the development of cracks in the grout has been virtually ignored by the modeling. Chemical factors listed below will have an effect on the physical evolution of the monolith and the quantity of groundwater that will pass through the monolith. • The Postclosure Safety Assessment TSD states (on p. 5-2): “As the pH falls back to neutral elements such as Ni and Zr become much more mobile and so are rapidly released from the Reactor Vault into the Boiler Room and other downstream rooms.” This statement is very important in the context of the assumptions made about modeled alkalinity and pH levels. The modeling of contaminant solubility assumes high pH and alkalinity, largely on the basis of a Portland cement formulation, despite the fact that a lower pH grout is being proposed (final formulation not established). Contaminant mobility may be greater as a result of using a lower pH grout formulation. However, there are other factors that may result in lower pH and lower alkalinity conditions that have not been considered in the modeling / assessment, which raises serious doubts about the current modeling and increases the degree of uncertainty associated with the model outputs, as follows: ○ Assumptions about the amount of alkalinity that will be available from the leaching of the grout may be invalid. Alkalinity might be much lower than assumed as a result of the grout surfaces becoming coated by iron and/or other metals that may precipitate out from the influent groundwater or from corrosion products generated by corrosion reactions within the monolith. Considering the complex geochemistry that will evolve in the monolith over time, there may be other geochemical reactions that may reduce alkalinity, or have other effects upon the solubility of contaminants. The current modeling,	

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				which is based on the geochemistry of the incoming groundwater, is a gross over-simplification of the actual geochemical conditions that will exist within the monolith. ○ Influent groundwater might be more acidic in the future than is currently measured. For example, conifer needles can create acidic groundwater conditions. After the Institutional Controls Period, when human intervention is no longer occurring at the site, a coniferous forest might develop over the site thereby lowering the pH in groundwater at the NPD site. ○ The geochemical modeling is very simplistic and does not reflect the complex geochemistry that will exist in the groundwater flowing through the monolith. In particular, corrosion products will create additional geochemical complexity that does not appear to have been incorporated into any of the models. For example, it is not clear if the geochemistry of corrosion was modeled to determine if it would affect the solubility of lead, or other parameters of concern. It is also not clear if there are any anion-cation exchange reactions and bacteria-induced reactions that could enhance the solubility of lead or other parameters of concern. ○ There may be kinetic constraints on theoretical thermodynamic reactions that prevent or hinder geochemical reactions from going to completion. **Other Considerations** • Bacteria can alter geochemistry and geochemical reactions within the monolith. The assumption that sulphate-reducing bacteria will not be present (see Lead Solubility Limits Report, p. 3-6) is unsupported. Corrosion of metals and cracks in the grout may create conditions that are favourable to such bacteria. The presence of these, and potentially other bacteria, is not described and is a source of uncertainty for the geochemical evolution of the groundwater, and the physical integrity of the grout over the timeframes relevant to the proposed project. • The safety case for radionuclides is premised on a gradual release of radionuclides from the monolith over extended periods of time (in the order of 100,000 years). Miscalculation in the physical and chemical evolution of the monolith could result in earlier and larger releases, which may have more serious effects than currently modeled. • Some of the radionuclide inventory is from contaminated surfaces. Release of these radionuclides will not be controlled by corrosion rates. Any breach of the pipes and calandria (e.g., through development of cracks, corrosion) will allow these radionuclides to be released relatively rapidly (compared to corrosion controlled releases). • Corrosion may occur more quickly due to complex geochemistry that will develop, and/or from increased seepage rates, lower pH, etc. • The extremely long timeframes and lack of comparable existing projects both contribute to additional uncertainty to the modeling. • The EIS (p. 9-60) states that the maximum concentration of lead (0.0046 mg/L) will occur 70,000 years after decommissioning. This estimate appears to be based on the	

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				NES. As noted in other comments, ECCC has raised many questions about the validity of the modeling results. In light of all uncertainties, a more conservative evaluation of an upper bound lead concentration would be to model the lead as if it was uncontained and was being leached by the existing ambient groundwater. Laboratory tests can be undertaken to help develop this upper bound concentration.
				Expectation to Address Comment: It is recommended that CNL carry out the following:
				• Confirm and provide the final grout composition that will be used for the proposed project, along with a rationale
				• Conduct laboratory studies on the final grout composition that will be used to create the monolith in order to obtain data to support the long-term grout degradation modeling
				• Provide a description of the grout degradation processes for each stage and the condition of the grout that defines each end-state
				• Incorporate the following scenarios into the modeling:
				  ○ Cracked grout
				  ○ Rapid grout degradation
				  ○ Breach of pipes and equipment (e.g., via cracking, corrosion, etc.) with subsequent groundwater flows through these followed by interaction with surface-contaminant radionuclides, in addition to corrosion-related radionuclides
				• Acknowledge and describe the influence and uncertainty associated with the presence of sulphate-reducing and other species of bacteria
				• Evaluate scenarios for various rates of corrosion associated with each of the specific materials present, while considering the complex geochemistry that will exist, and indicate which radionuclides are associated with each material
				• Update text to show that risks associated with pH and seepage rate are understood and incorporated
				• Re-run models with consideration to: the final grout composition, cracked grout conditions, presence of bacteria, lower pH and alkalinity, and the additional geochemical complexities incurred by corrosion products in the groundwater. Furthermore, explain how these are included in the models, along with any assumptions, limitations or inferences made and based on these additional simulations, identify the parameters that may vary in the NES, and provide an estimate of the variability for each.
				• Assess radiological risk using improved models. Identify the time periods where radiological risk is highest.
				  ○ Provide a full assessment of all the factors that may affect the solubility of lead and other parameters of concern
				  ○ Describe the uncertainties they raise with respect to the lead solubility modeling	

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				○ Provide a more conservative estimate of the upper boundary for lead concentration that could occur ○ Describe the methodology used to create the estimate, including any laboratory tests and modeling ○ Note any limitations, assumptions or inferences associated with the estimate	
Calculated Radioactive Inventory of NPD					
257.	CNSC	General	General	**Comment:** The ORIGEN code, which was used in 1988 to determine the radionuclide inventory of numerous components of the NPD facility, may not be suitable for estimating the waste inventory proposed by CNL, or may require use of an updated code and updated neutron cross section libraries. Here are a few points to consider: • ORIGEN typically pertains to fuel irradiation or removed fuel elements (Hermann et. al., 1998). It has also been shown that the ORIGEN code reaches a limitation that could result in an underestimate of neutron activation product activities making it inappropriate for use on reactor pressure vessels and shielding (Von Gunten et. al., 1999, Alexander et.al., 2011), which is the application it is being applied to for NPD. CNL should comment on the applicability of ORIGEN to these types of materials. • The ORIGEN code may underestimate the activity of fission products and actinides due to impurities in the materials, unless these impurities are accounted for. In light of this potential source of error, are the results produced by ORIGEN sufficiently conservative and bounding? • As a result of the findings of Van Gunten and others, the ORIGEN code has been updated several times to reduce uncertainties related to the production of fission products. Since 1988, neutron cross sections libraries have also been updated for numerous isotopes. This has been observed to be the primary source of error in the ORIGEN code, yet it does not appear to have been considered in the inventory provided for NPD (Hermann et. al., 1998). Has the inventory used by CNL considered these sources of error and is it sufficiently conservative? • Has CNL considered these potential issues in the use of the ORIGEN code to derive a large proportion of their waste inventory for NPD? **Expectation to Address Comment:** Considering the aforementioned points, CNL should provide a justification for why the ORIGEN code is suitable for estimating the waste inventory for the NPD facility, what the effect of material impurities may be on the waste inventory, and why the version of the code and neutron cross section libraries used are still appropriate. **References:** Hermann, O. W., and R. M. Westfall. *ORIGEN-S: Scale System Module to Calculate Fuel Depletion, Actinide Transmutation, Fission Product Buildup and Decay, and Associated Radiation Source Terms.* 1998.	

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				Von Gunten, A., et al. *Radiological Characterization and Conditioning of Operational Waste from the Reactor Pressure Vessel.* Proceedings KONTEC 99: 306-317. Alexander, W. Russell, and Linda McKinley, eds. *Deep Geological Disposal of Radioactive Waste*. Vol. 9. Elsevier, 2011.	
Characterization Report for the NPD Reactor					
258.	CNSC	General	General	**Comment:** It is critical to the post-closure safety assessment and EIS that the data collected by sampling verify the results of the ORIGEN model. However, CNL has tested a limited number of samples for waste characterization of the NPD reactor components to verify the ORIGEN code results. The number of samples is insufficient to fully bound the potential variability (e.g., Calculated Radioactive Inventory of NPD). In particular, only three samples of steel casing, three of calandria ALCAN outer and inner, one of calandria tube aluminum, and two of the Zircalloy pressure tubes were collected. The results of these samples also show significant variability for some nuclides between Holes 1, 2, and 3. Indeed, it is acknowledged in several places in the document that inconsistencies were observed for various reasons, such as material impurities, that were not accounted for in ORIGEN. Therefore, it is of great importance that sufficient sampling is performed to constrain any shortcomings of the model. **Expectation to Address Comment:** Please justify how the limited number of samples collected is sufficient to verify and conservatively bound the model calculations on inventory. Furthermore, consider the need for further sampling of the NPD reactor components, such as end fittings and shielding, to ensure that the input data to the post-closure safety assessment is sufficiently conservative and bounding.	
259.	CNSC	General	General	**Comment:** The pressure tubes within the reactor core appear to be the main contributor to the total radiological inventory. However, only one sample was taken inside these pressure tubes, while another sample was taken closer to the outside and had understandably lower activity. Consequently, it is not possible to quantify the variability in radionuclide activity inside the pressure tubes, and it is not possible to adequately bound the assessment. CNL did present ORIGEN calculations to provide evidence of the conservativeness of the inventory estimates, but CNSC staff is of the opinion that direct measurements have more weight than model estimates. **Expectation to Address Comment:** Please justify why only one measurement of radionuclides in the pressure tubes is considered adequate to support the pre-closure and post-closure safety assessment for this proposed project.	
260.	CNSC	General	General	**Comment:** CNL drilled 4 holes through the reactor core for radiological and non-radiological characterization purposes. CNL plugged the drill holes with a steel nut and threaded plug. **Expectation to Address Comment:** Please indicate if these these drill holes can have an impact on the post-closure safety assessment.	
261.	CNSC	Section 7.0 Analytical Instruments – Off-site Analysis	p.35	**Comment:** CNL indicates that Ag-108m was measured, but the measurements were not shown in the results section of the report. Yet, Ag-108m is reported in the EIS.	

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				Expectation to Address Comment: Please provide the detailed measurements of Ag-108m in the rector core for activation and fission products.	
262.	CNSC	Section 8.2 NPD Reactor Radionuclides Analysed, Table 37	p.62	**Comment:** Table 37 provides the total activity of alpha, beta and gamma emitting radionuclides in Bq/g. CNL adds up the activities in Bq/g to obtain the total activity estimate in each hole. **Expectation to Address Comment:** Please explain why activities in Bq/g are added up instead of calculating a mean activity and multiplying by the mass of the different reactor component to obtain total activity estimates.	
263.	CNSC	Section 10.4 Verification of the Calandria Tube Inventory	p.69	**Comment:** CNL claims that the ORIGEN code makes conservative overestimates of total radiological activity. However, the calculations are associated with many assumptions. For instance, the calculations assumed a fuel burnup of 2,400 MWd/tonne and a constant power of 86 kW. **Expectation to Address Comment:** Please justify why the fuel burnup and constant power values yield conservative estimate for the radiological inventory.	
Updated Groundwater Modeling Report					
264.	MOECC	General	General	**Comment:** An overlying and significant concern with the numerical groundwater modeling is the inability of the model to match the actual flow rates observed in the tile drains. Matching modeled and existing data is essential to validating any model. Failure on the part of the model to match the drain flow rates indicates that the model is not able to accurately represent the physical conditions of the site, and indicates that the model has not been validated. Based on the issues identified, the predicted discharge concentrations are subject to significant potential error and uncertainty. Additional comments related to the outputs of the groundwater modeling results are not likely warranted until the model has been improved and validated. **Expectation to Address Comment:** Please match the modeled data with the actual flow rates observed in the tile drains in order to validate the groundwater model.	
265.	MOECC	General	General	**Comment:** The presence of tile drains and other underground utilities (as well as backfill materials) that may act as preferential pathways and result in the direct discharge of impacted groundwater to the Ottawa River is particularly concerning. The current assessment has not adequately identified and assessed these preferential pathways. **Expectation to Address Comment:** CNL should strongly consider removing all potential preferential pathways.	
266.	MOECC	General	General	**Comment:** Significant concerns have been identified with respect to the lack of subsurface investigations conducted in support of the proposed project. The level of investigation required to assess subsurface conditions should be commensurate with the complexity of the physical conditions and the complexity and risk associated with the project. However, the conducted investigations are extremely deficient. Adequate subsurface assessment is required to ensure that an accurate conceptual site model is	

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				developed, and to ensure that physical properties are accurately determined. The following deficiencies have been noted in the assessment of subsurface conditions. **Bedrock Unit:** The assessment of the bedrock unit is grossly inadequate. A small number of wells were competed in the bedrock unit and have short screens that have been arbitrarily placed. In assessing fractured rock, it is essential to identify and assess fractures. This testing would include the completion of packer testing and/or the use of alternative suitable methods. **Shear Zone:** The shear zone has been described as a zone of increased fracture density and is an important physical feature to contaminant migration at the site. However, limited investigation of the shear zone has been conducted and its properties and significance are very poorly understood. Additional investigation of the shear zone is required. Appropriate drilling and testing should be conducted to definitively identify the shear zone and its properties. Also, the statement from the Updated Groundwater Monitoring Report that BH16-2A/B intersects the shear zone is speculative. The hydraulic conductivity values measured in these monitoring wells do not support the presence of a shear zone. **Vertical Connections & Gradients:** Limited knowledge exists with respect to the vertical connections which exist between the various hydrogeological units. The vertical connections between the overburden and bedrock units should have been investigated to determine the degree of vertical connection present, and to determine if the bedrock unit is confined. Understanding if the bedrock unit is confined or unconfined is essential to the development of the conceptual physical model. Vertical connections should be investigated by collecting and interpreting groundwater data from suitably completed monitoring wells and other relevant lines of evidence. The continuous collection of groundwater elevations using dedicated data loggers for a suitable period of time is highly recommended to address this issue. **Hydraulic Properties:** Limited assessment of the hydraulic properties of the various hydrogeological units has been conducted and is not sufficient to assess the conditions and variability in the various units. **Expectation to Address Comment:** Please address the above questions and comments.	
267.	CNSC	General Also applicable to the Resaturation Modeling Report and the Postclosure Safety Assessment Technical Supporting Document	General	**Comment:** Several issues were identified with the groundwater model. **Model calibration:** It is well recognized in groundwater modeling that both groundwater head and flux targets should be routinely used during history matching. In the model calibration, the history matching of groundwater head is reasonably good, but the simulated flux in two locations (i.e., flow rate into tile drain and seepage rate into the NPD facility) has significant discrepancy with the actual measurements. The flow rate into the tile drain is around 10 L/s (p. 2-9), while the simulated flow rate is 1.3 L/s for calibration in case 1 and 3.6 L/s for calibration in case 2 (p. 4-3). The seepage rate into the NPD facility is around 10 m^3/year (Resaturation Modeling Report, p. 12), while the simulated groundwater flow rate into the NPD facility is around 1.9 m^3/year (p. 4-6). It is noted that attempt to change the hydraulic conductivities of the stratigraphic units together with the recharge rate has been made in order to match the history flux without much success. The Groundwater Modeling Report (p. 5-1) indicated that a much larger	

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				catchment area may be needed to match the measured tile drain flows, but it is not clear if a larger model domain has been attempted in the modeling exercise. Has a watershed / sub-watershed delineation been conducted to facilitate the selection of the model domain? **Groundwater level measurements:** The measured groundwater level should be provided in a table in the Groundwater Modeling Report. **Overburden:** It is not clear how the depth of the overburden is determined, and what the distribution of overburden depth is around the NPD site. **Recharge:** It is not clearly stated in the Groundwater Modeling Report what the recharge rate is for calibration in case 2. **Shear Zone:** The Groundwater Modeling Report states (on p. 2-10) that " [t]he shear zone is expected to represent a zone with a high density of major fractures." Figure 2-7 shows the suggested shear zone location. The shear zone seems to be a significant structure for groundwater flow and contaminant transport; however, it is not well characterized and not even represented in the base case model. **Weathered bedrock**: The fractured nature of the bedrock is noted in the Groundwater Modeling Report (p. 2-9), as well as in the Postclosure Safety Assessment TSD (p. 4-14). However, the fractured nature of the bedrock is not well characterized. It is not clear if it is considered in the groundwater modeling. **Tile drain:** The tile drain around the building is perforated, except for the section beyond Manhole 2 towards the river (p. 2-5). It is understood that the flow in the tile drain is an open channel flow instead of a pipe flow. The tile drain is represented in the modeling by a zone with high hydraulic conductivity. Is it more appropriate to use a seepage face boundary condition along the section of the perforated tile drain to represent the tile drain? Would it have any impact on the simulated flow rate through the tile drain? **Pipe trench:** It seems that the pipe trench is represented in the groundwater model as a zone with different hydraulic conductivities. However, its properties are not clearly specified. **Thickness of the NPD wall:** The Groundwater Modeling Report (p. 3-7) states that "the thickness of the NPD walls is not accurate. As the focus of the groundwater model is flow into the NPD and rather than flow through the NPD, this dimension was not adhered to in order to keep the model size manageable". With the thickness of the wall different from the actual dimension, should effective hydraulic conductivity values be assigned to the NPD walls in order to simulate the groundwater seepage into the facility? **Expectation to Address Comment:** Address the above questions and comments, with an emphasis on the following: • Further efforts should be pursued to make the history match of both head and flux reasonably well • A justification should be provided for the modeling domain and boundary conditions • A justification should be provided for the exclusion of the shear zone and fractured nature of the bedrock in the base case model	

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268.	ECCC	General
		
		Also applicable to the Postclosure Safety Assessment Technical Supporting Document, p. 4-15
		
		Also applicable to the Resaturation Technical Supporting Document, p. 6
			General	**Comment:** There are issues with the baseline hydrogeological information that subsequently decrease the validity of the hydrogeological model that is based on them, as outlined below.
				
				For page 2-7 and Table 2-1:
				
				• The calibration methodology, statistics, and final calibrated values are not fully provided nor sufficiently explained. Also, it is not clear how Figure 3-3 (Cumulative Distribution of Measured Sand Hydraulic Conductivity, Compared to Calibrated Groundwater Model) was used by CNL to develop a hydraulic conductivity estimate for the on-site sand layer.
				
				• The 1988 values of hydraulic conductivity (K) look uncharacteristically low for those overburden types. The 1988 values appear questionable when compared to the values for the wells sampled in 2017.
				
				• The first paragraph on page 2-7 states that the wells that are screened across both sand and shallow bedrock are assumed to represent the hydraulic conductivity of the sand. This is an invalid assumption that biases the measured K-values to appear less conductive for the sand units. This is evidenced by the reported K-values which appear to be uncharacteristically low and also lower than the 2017 measurements made in sand only (i.e., no bedrock component).
				
				• The model appears to be based on only three K-values for bedrock, which does not make for a robust dataset, especially considering the importance of this model. Furthermore, there is no information as to what depth these K-values were measured at. A more detailed campaign of drilling and testing the bedrock should be undertaken.
				
				For page 2-10:
				
				• Considering the potential importance of the shear zone to understanding groundwater flows into and out of the monolith, reliance upon only one data point for the shear zone also brings into question the robustness of the data supporting the model. Furthermore, the one K-value reported has only been inferred to represent the shear zone. A more detailed campaign of drilling and testing the shear zone should be undertaken.
				  ○ The easterly strike of the shear zone is important because it can channel groundwater towards the Ottawa River.
				  ○ Based on the inferred location, the shear zone underlies more than half of the NPD building.
				
				• It is stated: “The appendix of the Final Hazards Report also refers to a void in hole S-3, a possible seam in hole S-11, and water losses observed in both S-3 and S-11” and “The shear zone is expected to represent a zone with a high density of major fractures.” Due to the lack of a detailed geotechnical and hydrogeological assessment of the shear zone, it is not clear what the importance of these voids and seams may be. It appears that an inference is being made that these are associated with the shear zone.	

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				For page 3-5: • The hydraulic conductivity of the fill material is based upon a single measurement, and the test method has not been described. **For page 3-6:** • It is stated: "Till was not adjusted during calibration as no calibration points exist within the till to provide a strong basis for calibration of this parameter." This statement also points to the fact that the groundwater model is based upon very limited site-specific data. **For page 2-11:** • It is stated: "The difference in hydraulic conductivity measurements in the bedrock (BH16-02A and BH-16-02B) can be explained by the presence of the shear zone. With a shear zone at this suggested location and dip, the shallow hydraulic conductivity measurement is outside the shear zone, and the deep hydraulic conductivity measurement is located within the shear zone." There is a lack of complete and detailed information in the EIS to properly substantiate this conclusion, such as the location and hydrogeological behavior of the shear zone. These are very important observations that warrant further hydrogeological investigation of the shear zone in order to collect representative data. Also, the groundwater model should incorporate the shear zone into the NES, not as a separate sensitivity scenario, because all other disruptive scenarios and/or sensitivity scenarios will be affected by the presence of the shear zone. **Page 4-15 of the Postclosure Safety Assessment TSD** incorrectly implies that all groundwater flow from the monolith will be through overburden. Groundwater can also flow through bedrock, including the shear zone. In addition, hydraulic conductivity and porosity values from the CRL site are assumed to be the same for bedrock and overburden sands at the NPD site. Hydraulic conductivity and porosity values for the fill material are estimated based on published ranges. Considering the importance of the groundwater model as it relates to groundwater flows into and out of the monolith, and for contaminant movement down-gradient of the monolith, a robust data set for hydrogeological parameters is needed to support the groundwater model. This data should be collected on-site, and should include samples at the shear zone. **Page 6 of the Resaturation Modeling Report** states: "The tighter hydraulic conductivity in the shallow bedrock relative to the deep bedrock is unexplained." This rationale does not provide a sufficient level of certainty or site-specific detail required to support subsequent modeling and predictions about long-term performance and risks of the proposed project. Hydraulic conductivities need to be explained in detail for the project site in order to provide a valid basis for the various modeling exercises that are critical to understand the long term performance of the monolith, potential risks, and proposed mitigation. **Expectation to Address Comment:** Please update the baseline data to include: all borehole logs, a description of tests performed to calculate K-values, all hydraulic conductivity data, and the geometric mean K for each hydrogeologic unit. Provide more	

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				accurate hydraulic conductivity values for the overburden, especially for sand units, for example by conducting a more detailed campaign of drilling and testing the overburden. Consider excluding the 1988 K-values from the model dataset unless it can be demonstrated that the measured K-values are valid. In addition, please complete further site assessments to confirm in detail the location of the shear zone. Conduct further hydrogeological investigation of the entire site, including the shear zone, and collect representative data. Summarize this investigation in the EIS along with a rationale for the investigative approach used and any limitations, assumptions or inferences. Update the EIS to describe the assessments completed and provide a more detailed description of the shear zone including location and hydrogeological behaviour. Re-run the normal evolution, disruptive and sensitivity scenarios of the groundwater model to reflect the presence of the shear zone and the hydrogeological data collected. Update and re-run any other models that rely on hydrogeological data. Provide the groundwater model calibration methodology, calibration statistics, and final calibrated values (e.g., hydraulic conductivity, recharge rate, etc.) for all parameters. Given a number of deficiencies with the groundwater flow model and related assumptions and data inputs have been raised, please revise the Resaturation Modeling Report to reflect updates to the groundwater flow model. Furthermore, articulate any limitations, assumptions or inferences made in the groundwater flow model that are relevant to the Resaturation Modeling Report.	
269.	CNSC	Section 2.0 Background Also applicable to the Postclosure Safety Assessment Technical Supporting Document, Appendix C, p.C-104	p.2-1	**Comment:** Releases during the Institutional Controls and Post-Institutional Controls phases are stated to be delayed and gradual, but do not appear to consider the existence of faults / shear zones / fractures that are likely to exist at the NPD site. This is not consistent with the shear zone that is part of CNL's Updated Groundwater Modeling Report. The existence of a shear zone on the NPD site needs proper characterization. This important information is buried within (and perhaps only presented in) this report. Though it is described as a significant feature on the site, its location and dimensions are approximated from a 1966 Canadian General Electric Company Ltd report that was not provided, and is an admittedly incomplete reference. Further references related to the geological investigation are "currently not available". This highlights the necessity for characterization and verification work on the NPD site. On pages 2-1 and 2-10 of the Updated Groundwater Modeling Report, the following key factors are presented, or statements made: • Faulting in the bedrock is "not infrequent" • A shear zone was recorded at the NPD site (though its exact location is not clear) • Diamond drilling (1966 report) indicates that the bedrock is sheared over ~300 feet • The suggested location of the shear zone (in Figure 2-7) implies that it is an important feature at the site The existence of the shear zone is also inconsistent with the FEP selection rationale provided in the Post-Closure Safety Assessment TSD (Appendix C, p. C-104). The FEP analysis screens out the possibility of an undetected fault or fracture zone. This is entirely	

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				at odds with what is described in the Updated Groundwater Modeling Report, a discrepancy that must be rectified. The introduction of the on-site shear zone within the Updated Groundwater Modeling Report raises concerns about CNL's approach and consistency between important submissions that are supposed to both document the baseline site characteristics and model the long-term evolution of the proposed project. **Expectation to Address Comment**: • Characterization work is required at the NPD site, especially to verify the location and characteristics of the shear zone stated to contain numerous fracture sets. • The influence of the shear zone on project-related releases needs to be presented and evaluated. This is the type of information that needs to be presented on the baseline geological environment (e.g., structural geology, site characterization). • Please explain why the shear zone is not considered as part of the "base case" for the updated groundwater model. • The Normal Evolution Scenario (in the Postclosure Safety Assessment TSD) must consider the presence of the shear zone at the site.	
270.	MOECC	Section 2.0 Background	p.2-1	**Comment:** Groundwater springs were previously reported along the northern slope. It is unclear if these springs still exist or if they may reoccur in the future. The presence of groundwater springs would allow contaminated groundwater to short-circuit to the river via overland flow. **Expectation to Address Comment**: Please consider the identified groundwater springs in the existing assessment.	
271.	ECCC	Section 3.2 Model Domain and Discretization Also applicable to the Resaturation Modeling Report, p.4	p.3-2	**Comment:** The topographic resolution of 20 meters is not sufficient resolution to articulate the factors and details of importance to the proposed project. **Expectation to Address Comment:** A higher resolution topographic map should be developed (and included in the Updated Groundwater Modeling Report TSD and Resaturation Modeling Report), based on, and as a component of, an overall comprehensive geotechnical and hydrogeological assessment of the NPD site. In addition, please apply the updated topographic data to the affected models.	
272.	CNSC	Section 3.3. Material Properties, Table 3-1 Also applicable to the Postclosure Safety Analysis Technical Supporting Document	p.3-6	**Comment:** The concrete of the NPD facility has a hydraulic conductivity value of 10^{-10} m/s for the NES (Table 3-1), and 10^{-8} m/s and 10^{-6} m/s when considering the degradation of the NPD facility concrete and grout (p. 4-11). Table 3-1 indicates that the grout and concrete wall have different hydraulic conductivity values. However, the change of hydraulic conductivities over time for both concrete and grout is not clearly specified. The Postclosure Safety Analysis TSD indicates (on p. 5-26) that the hydraulic conductivities of the concrete change from 0.003 m/year to 3 m/year when considering the degradation of the engineered barrier. The hydraulic conductivity value for the degraded concrete in the NES is assumed to be 0.3 m/year. It is not clear if the groundwater modeling results for all these scenarios are presented in the Groundwater Modeling Report.	

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				Expectation to Address Comment: The groundwater modeling results for the scenarios considered in the Postclosure Safety Analysis TSD should be presented in the Groundwater Modeling Report.	
273.	ECCC	Section 3.4 Boundary and Initial Conditions	p.3-6 to 3-8	**Comment:** Page 3-8 states: "In order to prevent flooding, recharge was reduced to 20 mm/year for a till conductivity of $3x10^{-6}$ m/s." This rate of recharge seems rather low for tills that lack a significant clay component (i.e., the tills are described as "silty to sandy tills"). Assuming that the till is indeed Unit 5a (the text does not clarify this), it is important to get a valid recharge rate considering this unit is upgradient of the NPD facility and will dictate how much water flows towards the NPD facility. The calibration of one hydrogeologic unit can have implications for the calibration of other hydrogeologically connected units. Page 3-6 indicates that "till was not adjusted during calibration as no calibration points exist within the till to provide a strong basis for calibration of this parameter." It is possible that the mismatch might be attributable to both the calibration exercise and the lack of site-specific data for the till unit. Without adequate information regarding the calibration methodology and statistics, it is difficult to evaluate whether calibrated values are accurate. It is not clear if other information can be used to verify that the calibrated recharge rates are appropriate. The inability of the groundwater model to match the flow rates in the tile drains may be a result of inappropriately calibrated values; however, this was not considered in the report. More water would enter the tile drains if the till unit had a higher recharge rate. The validity of a calibration exercise that uses a limited dataset is questionable (one can obtain reasonable calibration statistics against the limited dataset, and yet it may still be a poor representation of the actual site hydrogeology). Additional site-specific measurements of hydraulic conductivity would improve the modeling and result in a better match between measured and calibrated values. **Expectation to Address Comment:** It is recommended that CNL carry out the following: • Clarify that the till unit described is the one shown as Unit 5a in Figure 2-1. • Collect additional site-specific measurements of hydraulic conductivity to create a more robust dataset that describes the site in detail. • Calculate a valid recharge rate for till Unit 5a and recalculate other hydrogeologically connected units, where needed. Field investigations could assist in the calculation of a valid recharge rate. • Calibrate the model against a more robust site-specific dataset. • Describe and justify the groundwater model calibration methodology, statistics, and other information used to verify the calibrated recharge rates.	
274.	ECCC	Section 3.4 Boundary and Initial Conditions	p.3-7	**Comment:** Section 3.4 states: "…the thickness of the NPD walls is not accurate. As the focus of the groundwater model is flow into the NPD and rather than flow through the NPD, this dimension was not adhered to in order to keep the model size manageable".	

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				Expectation to Address Comment: Please explain the implications of this simplification in terms of accuracy of effects prediction.	
Resaturation Modeling Report					
275.	ECCC	Section 3.3 Material Properties	p.10	**Comment:** The actual length of the Pressure Relief Duct is not clear. **Expectation to Address Comment:** Please verify the length of the Pressure Relief Duct, and any other relevant structural details, and update both models.	
276.	ECCC	Section 3.4 Boundary and Initial Conditions	p.11	**Comment:** Many factors can affect the long-term physical and geochemical characteristics of the grout monolith. For example, it is unclear whether variable saturation or cycles of saturation-desaturation affect the long-term evolution and performance of the monolith. Failure of this approach to containment for radiological and non-radiological contaminants could result in adverse effects on the surrounding environment, including to water quality, air quality and biota, such as migratory birds. **Expectation to Address Comment:** Please provide a complete list of factors that may affect the long-term performance of the monolith. Furthermore, describe how these factors affect the monolith, and the relative importance of these factors. Indicate whether these factors have or will be incorporated into the modeling, update models where needed, and identify additional mitigation or follow-up measures, as appropriate.	
277.	CNSC	Section 3.4 Boundary and Initial Conditions	p.11	**Comment:** The Resturation Modeling Report states (on p.11) that "[t]he boundary conditions at the sides of the model domain are interpolated from the groundwater flow model with no tile drains". It is not clear if specified flow or specified head boundary conditions were used in the model. A short pressure relief duct was represented in the resaturation model, but not in the groundwater flow model (p.10). What is the impact of the exclusion of the pressure relief duct in the groundwater model? The Resturation Modeling Report also states (on p.41) that "[r]echarge over the building and its engineered cap and cover are simplified to a constant value equivalent to the estimated annual recharge into the sand (220 mm/yr). Once this recharge has percolated through the engineered cap and cover, approximately 1 mm/yr of recharge percolates into the facility for the base case." This statement is confusing, and should be clearly explained. **Expectation to Address Comment:** Please revise accordingly.	
Lead Solubility Limits Report					
278.	ECCC	Section 2 Modelling of Lead Mineral Solubility Also applicable to Section 3.3 Solubility Limit Calculations, p.3-20 and to the Alkaline Plume Modeling Report (p.14)	p.2-1	**Comment:** The Lead Solubility Limits Report and Alkaline Plume Modeling Report appear to assume that alkaline conditions will be the norm, and so the reports are focused on assessing the solubility of lead under those conditions. Acidic conditions are possible, yet there is very limited discussion of such a scenario. Groundwater composition may change over time. For example, there is a high probability that coniferous forest may develop over the site in the post-closure phase and that the pH	

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				of the water may become more acidic as a result of the acidic coniferous needles. The reports fail to consider this as a possibility, and therefore, provide no assessment of alkalinity or lead concentrations that may develop under acidic pH conditions. This possibility, along with other plausible scenarios of early leaching of alkalinity (even more likely with lower pH grout composition) or of alkalinity being suppressed, such as by the coating of grout surfaces with corrosion products, could lead to the development of very different geochemical reactions that may result in higher leachability of lead. **Expectation to Address Comment:** Please revise the Lead Solubility Limits Report and the Alkaline Plume Modeling Report to model scenarios with acidic pH.	
279.	ECCC	Section 3.1 Model Water Compositions	p.3-1	**Comment:** Section 3.1 states*:* "An aqueous speciation calculation using the SpecE8 (Section 2.3) suggests that there is a significant charge imbalance of 11.4 % associated with the MT- 5 -I composition (Table 2-1)". **Expectation to Address Comment:** Please explain the theoretical effect of this calculation or imbalance upon the model and its conclusions of the inability to correct the charge imbalance. Furthermore, discuss the following: • The implications of the charge imbalance with respect to the geochemical modeling, particularly for timescales modelled (e.g., 70,000 years). • The uncertainties that arise from this imbalance • Additional uncertainties that may be incurred if groundwater chemistry changes through time These discussions should also factor the additional complexities arising from corrosion products in groundwater.	
280.	ECCC	Section 3.2 Thermodynamic Stability of Lead Minerals	p. 3-5	**Comment:** Geochemical reactions can be materially affected by temperatures. While the report includes geochemical reactions and rates based on a 25° C prediction, a 15° C difference is common at the project site location (i.e., year-round groundwater temperatures of 8-12° C are likely). This is a substantial temperature variation and requires a correction factor to be applied to the theoretical thermodynamic reactions. Furthermore, thermodynamics can predict what is stable under certain conditions, but they cannot predict whether potential chemical reactions will actually go to completion. Some reactions may require longer timescales than those considered for the proposed project. **Expectation to Address Comment:** Please update the Lead Solubility Limits Report to include temperature correction in the modeling. Furthermore, explain how reaction rates would affect the overall modeling and conclusions made and identify any limitations, assumptions or inferences associated with the modeling and its inputs.	

APPENDIX 1

Figure 1: Example of Safety Case Supporting Documentation and Information Flow