

Memorandum

9 September 2024

To	Dave Rushton/Steven Travale, Municipality of South Bruce		
Copy to	Jeff Marshall, NWMO		
From	Laura Boksman, Mark Jasper, Brad Trytten, Jennifer Son, and Greg Ferraro/AD/mma	Tel	+1 519 884 0510
Subject	Confidence in Safety – South Bruce Site 2023 Update – Peer Review Comments	Project no.	11224152-MEM-69

1. Introduction

This memo provides the Municipality of South Bruce (South Bruce) peer review team’s (PRT’s) comments on the *Confidence in Safety – South Bruce Site 2023 Update* (Draft Report) prepared by Nuclear Waste Management Organization (NWMO) for your consideration and internal circulation as per the South Bruce Nuclear Exploration Project joint study review flow process. In addition, the memo will be submitted to the NWMO by GHD Limited (GHD) as per the peer review protocol process.

2. Peer review approach

The peer review of the Draft Report was carried out by GHD and Radiation Safety Institute of Canada (RSIC). The peer review process was completed in alignment with the peer review protocol that was developed to support a collaborative approach between NWMO and South Bruce while maintaining independence during the process. In accordance with the peer review protocol process, RSIC and GHD Subject Matter Experts (SME) Laura Boksman, Brad Trytten and Mark Jasper and GHD Lead Consultants Jennifer Son, and Greg Ferraro reviewed the Draft Report having the following questions in mind:

- Are there any significant concerns, issues, and/or omissions with the Draft Report?
- What are our initial observations/impressions on the Draft Report?
- Is the information presented clear and understandable manner?
- Does the Draft Report reflect the most current information available?

3. Peer review comments

The comment disposition table (**Table 1**) lists the PRT’s peer review comments on the Draft Report. A meeting was held on January 10, 2024, with the NWMO to review to the PRT’s initial peer review comments. During the meeting the NWMO provided responses to the initial comments and different aspects of the report were discussed. Based on information obtained and discussions held the peer review comments have been revised

where appropriate. It is understood the peer review comments will be considered by the NWMO as part of finalizing the Report.

In general, the PRT found the Draft Report to be of high quality and presented information in a clear and understandable manner. The Executive Summary provides a technical overview of the safety assessment, the NWMO's conclusions and provides sufficient information to understand how the Safety Assessment was conducted. The Draft Report is technically comprehensive and provides a good framework for building confidence in safety. The Draft Report presents the elements, the criteria, and key considerations made as part of the assessment.

The PRT finds that, in some cases, the interpretations and conclusions made are presented without including a reference to supporting information or rationale. It is recognized the Draft Report has been prepared to outline the NWMO's status in building confidence in safety and has not been prepared as a technical study report. It is the PRT's view that the assessment and conclusions would be strengthened by identifying reference information used in support of the key conclusions. Further, it is noted that not all data gaps and uncertainties identified in the report are included in the proposed future work. Leaving uncertainties unaddressed can create questions on the completeness of the programs being carried out.

The findings of the Safety Assessment are significant of which the PRT is generally aligned. The PRT is of the opinion the report provides a strong contribution to building confidence in safety for the Project.

Table 1 Comment Disposition Table - Confidence in Safety – South Bruce Site 2023 Update

Comment Number	Report Section Reference	Subject Matter Expert	Comments from Peer Review
1	General	Supporting Information (BT, JS)	<p>Technical statements often lack reference to supporting information or area of study the NWMO has undertaken. The PRT suggests that supporting information or study area be included to support key conclusions and opinions. Reference to the technical reports listed in Appendix A where appropriate should be made.</p> <p>The list of references in Appendix A does not cover all the information presented in the report. Therefore, indicating that studies have been conducted (maybe listing key topics) and that information from these studies has been used to inform this report, while the associated reporting is being prepared.</p>
2	Executive Summary	Supporting Information (JS)	<p>It is understood that through ongoing study and project development that there is high confidence that the regional infrastructure can support the construction, operation and closure of the repository; facility performance will meet regulatory criteria for safety and protection of the environment; and preliminary site-based safety assessment indicates that there would be no impacts on human health during normal operations or post-closure; however, there is no context described as how these conclusions were made.</p>
3	Executive Summary (page vii)	Technical Clarification (JS)	<p><i>“More site characterization is required, and is planned should the site be selected. However, the uncertainties that remain are less about the fundamental suitability of the South Bruce Site to safely contain and isolate used nuclear fuel, and more about continuing to develop and document a thorough quantitative understanding of the site.”</i></p> <p>Please provide context as the report does say that there are uncertainties that remain. Suggest indicating all uncertainties will be addressed.</p>
4	Section 3.1, page 16	Supporting Information (BT)	<p>The PRT notes that the 3D seismic survey data report currently under preparation has not been released for review.</p>
5	Section 3.1, page 16 and 17	Geoscience (BT)	<p><i>“The 3D seismic survey was useful for advancing the understanding of the thickness and extent of the Silurian reef (Guelph Formation) encountered in SB_BH01. The thickness of the Guelph Formation reaches approximately 70 m at the apex of the irregularly shaped reef structure that underlies the eastern part of the South Bruce Site (Figure 3.5). Elsewhere across the site the Guelph Formation is uniformly much thinner, including in SB_BH01 where the logged thickness of the Guelph Formation is five metres (Cachunjua et al., 2023).”</i></p> <p>The significance of the reef structure in the Guelph Formation and the potential impact on the constructability/operation of the South Bruce Site should be described further, as the current description suggests potential issues.</p>
6	Section 3.3	Supporting Information (BT)	<p>Reports related to the composition of the rock, groundwater, and porewater have not been provided to the PRT, with the exception of AMP-REP-01332-0321 WP04G Organic Geochemistry and Clay Mineralogy for SB_BH01, and data presented in APM-REP-01332-0326 WP10 Geological Integration Report for SB_BH01.</p> <p>The PRT will complete peer review when made available.</p>
7	Section 3.3, page 20	Geoscience (BT)	<p>Explain how “low porosities” of the Cobourg Formation and the Ordovician shales will contribute to the retardation of radionuclide movement through the rock, given groundwater flow in most bedrock sequences is through interconnected fractures. The PRT understands that the groundwater flow in the unfractured bedrock is diffusion dominated.</p>

Comment Number	Report Section Reference	Subject Matter Expert	Comments from Peer Review
8	Section 3.3, page 21	Supporting Information (JS)	<p><i>“Similar low sulphide concentrations, which would therefore not likely impact the durability of the copper within the engineered barrier system, are expected in the deep subsurface at the South Bruce Site.”</i></p> <p>At what concentration would sulphide have an affect on copper? Has any testing been completed to date by the NWMO or other entities?</p>
9	Section 3.3, pages 20 and 21	Supporting Information (BT)	Please provide references for Bruce nuclear site to support mineralogy, porosity, porewater composition, and age of bedrock.
10	Section 3.3, page 21	Geoscience (BT)	<p><i>“oxidizing conditions are not expected at repository depth at the South Bruce Site.”</i></p> <p>Although oxidizing conditions may not be present in the bedrock at this time, construction and operation of the repository will change the conditions within the repository. Please explain how this may affect the repository and repository materials.</p>
11	Section 3.4, page 22	Geoscience (BT)	<p><i>“The high hydraulic conductivity of the Guelph Formation in SB_BH01 is indicated...”</i></p> <p>This is the first indication of high hydraulic conductivity being present. This should be further explained.</p>
12	Section 3.4, page 22	Geoscience (BT)	Consideration should be given to providing additional description of the Cobourg hydraulic conductivity versus other materials that are familiar to people. The statement that hydraulic conductivity is over 1 million times smaller is not provided in context to potential groundwater or radionuclide transport velocity, which would be a more familiar frame of reference. The alternative may be to indicate time of travel through the Cobourg or the Ordovician limestone and shale.
13	Section 3.4 and Figure 3.8, page 24	Supporting Information (BT)	Are additional parameter concentrations available besides chloride? The PRT has not been provided any opportunistic groundwater sampling or porewater geochemical results.
14	Section 3.4, page 25	Geoscience (BT)	Since only chloride concentrations have been presented, the statement “contain fluids with different major ion chemistry and isotopic composition” is not supported by any data. Isotopic data that is available related to groundwater age would be useful to support this statement. The PRT has not been provided any opportunistic groundwater sampling or porewater geochemical results.
15	Section 3.5, page 26	Geoscience (BT)	High compressive stresses may be characteristic of a thrust fault regime, but the PRT notes that these similar stresses are found throughout southwestern Ontario and the Michigan Basin with no actual fault displacement occurring. Clarification should be provided that the compressive stresses do not indicate the potential for thrust faulting to or uplifting of the bedrock occur. These compressive stresses are more likely to manifest during construction and operation of the repository as small rock failures.
16	Section 3.5, page 28	Technical Clarification (JS)	<p><i>“It is acknowledged that additional thermal testing will be required to confirm that this initial conclusion can be suitably applied to the South Bruce Site.”</i></p> <p>Should it be listed as an area of uncertainty and listed for further testing in the conclusions/executive summary?</p>
17	Section 4, page 29	Geoscience (BT)	<p><i>“The site should not be unacceptably affected by... earthquakes...”</i></p> <p>The PRT notes that in Section 3.5 the report indicates that it is in thrust fault regime, suggesting the potential for faulting to occur. Please clarify.</p>

Comment Number	Report Section Reference	Subject Matter Expert	Comments from Peer Review
18	Section 4.1, page 31	Geoscience (BT)	The Revell site is referred to in the first paragraph. This may be incorrect and should be reviewed for site name and conclusions related to the site name.
19	Section 4.4, page 35	Geoscience (BT)	The report indicates no faults within approximately 5 km of the South Bruce site. In AMP-REP-01332-0326, NWMO indicates that at SB_BH01, two interpreted fault structures were identified near the base of the Guelph Formation.
20	Section 6, page 39	Geoscience (BT, JS)	<i>“While further analysis is required to confirm if the additional geoscientific properties of the sedimentary rocks beneath the South Bruce Site are consistent with their expected character, all indications to date suggest that they will be, especially with respect to the Cobourg and bounding sedimentary layers.”</i> Should it be listed as an area for further testing in conclusions/executive summary?
21	Section 7.1.2, Page 43	Geoscience (BT)	<i>“Bentonite clay greatly slows radionuclide movement in the unlikely event of container failure; reducing the ability for them to reach the surface and biosphere.”</i> The statement that the clay reduces the ability to reach the surface and biosphere implies that the clay is the key barrier material. The bentonite clay also reduces the ability of the radionuclides to reach the repository walls, prior to then migrating through the hundreds of metres of host rock to the surface and biosphere.
22	Section 7.2, page 52	Technical Clarification (JS)	<i>“Asphalt may also be used as third independent sealing material.”</i> Does the NWMO know where the asphalt would be placed during closure activities? If using asphalt under ground, will it have negative environmental effects (for example, depending on the depth it is placed)?
23	Section 7.4, page 61	Geoscience (BT)	Although the Cobourg Formation was determined to be non-PAG at the Bruce nuclear site, other formations may be PAG. In addition, given the saline nature of the groundwater, the excavated bedrock will likely have high salts concentrations that may leach. The testing indicated suggests it is for PAG potential and not salt/leaching potential. The PRT understands that the NWMO will develop engineered controls for the excavated materials and treatment of any water generated from the excavated materials. Please clarify.
24	Section 7.5.1, page 64	Technical Clarification (JS)	<i>“Based on information to date, there is high confidence that the surface area and infrastructure can support the construction, operations, and closure of the repository”.</i> Should this statement be held until a site-specific design is prepared?
25	Section 7.5.4, page 65	Geoscience (BT, JS)	<i>“As noted in Section 3.5, while there are no direct bedrock stress measurements at this time, analysis shows the orientations of the maximum horizontal stresses follow the general trend in southern Ontario.”</i> Are there plans to conduct this testing if South Bruce is selected?
26	Section 8.1.3, page 71	Supporting Information (JS)	<i>“The NWMO has confirmed the technical feasibility of both of these transportation systems; however, the road/rail combination system requires more infrastructure, facilities, and package handling operations”.</i> Can you please provide references that confirm the technical feasibility?

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27	Section 8.2, page 72	Supporting Information (JS)	<p><i>“Based on the information to date, the South Bruce Site location does not present any barriers that prevent effective security and emergency response planning and protocols for the operational phase. For example, in Bruce County, low and immediate level radioactive waste shipments have been occurring for 45 years in support of the Bruce nuclear site operations using such plans.”</i></p> <p>The example provided is for low and intermediate level radioactive waste. What references can be provided for the level and frequency of waste that would be expected to be transported to the potential DGR to show that there would be high confidence that a safe and secure transportation system can be designed and operated?</p>
28	Section 8.2.2 Page 74	Emergency Management (MJ)	<p>The opening paragraph implies that there is a standard approach for responding to incidents and that all levels of government use a comprehensive approach to emergency management. These statements can be misleading to the reader, and we suggest this be revised to describe the varying approaches and capabilities of different levels of government, and in particular municipalities, have in place for prevention, mitigation, preparedness, response, and especially the recovery from an incident involving radiological material.</p> <ul style="list-style-type: none"> – The approach for emergency response and emergency management for each province is different. Legislation and levels of implementation vary. ON, QC, NB, and MB are noted in NWMO’s Transportation System Conceptual Design Report (NWMO 2021b) and Preliminary Transportation Plan (NWMO 2021c). – The approach for emergency response and emergency management for each municipality will be different depending on which province they are in. Legislation, levels of implementation, and capabilities will vary. – Unless there is a licenced nuclear facility in a municipality, they will not have measures in place to mitigate or complete restoration activities for radiological incidents.
29	Section 8.2.2 Page 74	Emergency Management (MJ)	<p>It is understood the NWMO is continuing to develop the transportation system and emergency response planning. The second paragraph indicates that NWMO will develop and provide a Transportation Emergency Response Plan to Canadian regulatory agencies. This may be true for the requirements under the CNSC. The PRT notes that the plan that is required by Transport Canada under Part 7 of the Transportation of Dangerous Goods Regulations (SOR/2021-286) will need to be provided by the entity that offers for transport of the dangerous goods. This will likely be:</p> <ul style="list-style-type: none"> – Ontario Power Generation, – Hydro-Québec, – New Brunswick Power, and/ – Atomic Energy of Canada Ltd. <p>It is suggested that this paragraph be amended to indicate that NWMO will collaborate with these entities to develop and implement all required plans.</p>

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30	Section 8.2.2 Page 74	Emergency Management (MJ)	The bulleted list is presented as “what <u>may</u> be included in the emergency response plan” by the NWMO. A suggested addition to the list would be the requirements of the Emergency Response Assistance Plan (ERAP) for Transport Canada. This would include: <ul style="list-style-type: none"> – Description of the actions to be taken for potential incident scenarios, including who will complete them, and the specialized equipment that will be needed. – Description of technical advice that will be provided to responders over the phone and at the incident scene.
31	Section 8.2.2 Page 74	Emergency Management (MJ)	The final paragraph on this page describes the services provided by CANUTEC. They should include the specialized advisory services needed for dangerous goods like radioactive materials. CANUTEC will either consult with or connect a caller with the technical advisors associated with the applicable Emergency Response Assistance Plan (ERAP). It is suggested that this paragraph be amended to note that technical advice will be provided by CANUTEC with the support of technical advisors from the shipments associated ERAP.
32	Section 13	Emergency Management (MJ)	The report identifies the transportation phase hazards. A comprehensive list of the applicable transportation related regulatory requirements have been included in the NWMO's <i>Deep Geological Repository Transportation System Conceptual Design Report Crystalline / Sedimentary Rock Report</i> (APM-REP-00440-0209-R001). It is recommended that this list be added or summarized in Section 13.
33	Section 14	Emergency Management	The findings of the Emergency Services Study (S17) are not yet included in the uncertainties and future work listed in this section. The Emergency Services Study acknowledges that at this stage, there is insufficient information to provide details on the Project's effects on the local emergency service requirements. Further, the Study acknowledges that the stakeholders including NWMO, MSB, County of Bruce, industry partners, provincial agencies, and federal agencies will all have a role to play in supporting the emergency service elements for the Project. The study also identifies that the required emergency service capabilities and capacity do not currently exist in the region to support the Project but there is sufficient time to conduct required engagement and planning with MSB and neighbouring municipalities to address Project needs prior to construction. Finally, the report indicates that the NWMO recognizes that they will need to conduct further studies to define the supported needs, capabilities, capacities, and the funding instruments that will be needed for each emergency service to functionally support the Project. To build confidence in this area it is suggested that a summary of these findings be added to section 14 in a new Emergency Service subsection and possibly be added to the Executive Summary and Conclusions sections.
34	Section 14, page 92	Supporting Information (JS)	“ <i>Together, the groundwater and porewater chemistry results to date suggest that a hydrogeologically stable environment, with low rates of mass transport, is present at depth beneath the South Bruce Site.</i> ” Please provide references for these interpretations and indications.

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35	Section 14, page 92	Technical Clarification (JS)	“Another site-specific uncertainty relates to the geometry of a sediment-filled valley located along the west side of the South Bruce Site, just west of the Teeswater River. The valley is about 50-m deep and trends southwesterly at surface.” Is this a significant uncertainty? Should this be addressed in the conclusions/executive summary?
36	Section 14, pages 92 and 93	Technical Clarification (BT, JS)	The uncertainties and future work mentioned include several items previously identified by the PRT as data gaps or worth additional investigation. The PRT notes that additional data gaps or items worth additional investigation were described in previous deliverables to the NWMO and the PRT would like clarification on whether those items will be addressed.
37	Appendix A List of Site-Specific Technical Reports	Supporting Information (BT)	The PRT notes that all of the Phase 1 reports were not provided for review. In addition, the following Phase 2 reports listed in Appendix A were not provided to the PRT: <ul style="list-style-type: none"> – APM-REP-01332-0295 WP13 Ongoing Monitoring of Monitoring Wells SB_MW01-01, SB_MW01-02 and MECP1401064 During Drilling of SB_BH01 and SB_BH02 – APM-REP-01332-0339 WP10 – Geological Integration Report for Borehole SB_BH02 (listed as for SB_BH01) – APM-REP-01332-0424 and -0425 WP01 Site Decommissioning Reports for SB_BH01 and SB_BH02
38	Appendix A List of Site-Specific Technical Reports	Geoscience (BT)	The PRT notes that several reports made available to the PRT were not listed in Appendix A including: <ul style="list-style-type: none"> – APM-REP-01332-0315 Site Commissioning Report for SB_BH01 – APM-REP-01332-0327 Site Construction Report for SB_BH02 – APM-REP-01332-0381 South Bruce Microseismic Monitoring Report – NWMO-TR-2019-20 Petroleum Assessment of the Huron Domain Area