



2024 Technical Peer Review Summary Report

Geoscience Study Work

Municipality of South Bruce

23 August 2024

Executive Summary

The Nuclear Waste Management Organization (NWMO) has been engaged in a multi-year, community driven process to identify a site where Canada's used nuclear fuel can be safely contained. The site selection process involves nine steps (NWMO 2010), with the process currently at Step 3 (Phase 2). The NWMO is now in its final screening process, and the two remaining siting areas currently being assessed under Step 3, Phase 2, are the South Bruce Site located in the Municipality of South Bruce (MSB) and the Revell Site located near the Township of Ignace. The NWMO plans to complete all preliminary assessment work and to select one community/area to host the Adaptive Phased Management (APM) Project (Project) by the end of 2024.

The multi-year geoscience study work and associated technical documents produced by the NWMO and reviewed by the Peer Review Team (PRT) provides the community with a good description of the scope of work that has been undertaken and contributes to developing an understanding of the geologic and hydrogeologic setting of the Project site. The geoscience study work is being carried out to characterize and assess the ability of the geologic and hydrogeologic setting to safely contain and isolate the used nuclear fuel. The NWMO has identified the factors required for the assessment as follows:

- The depth of the host rock formation
- The volume and expanse of the host rock at the depth of the repository
- The mineralogy of the rock
- The hydrogeologic regime within the host rock
- The geochemical composition of the groundwater at the depth of the repository
- The ability of the host rock to withstand natural stresses

The current peer reviews and their findings described in this report is a follow up to the peer reviews conducted in 2021 and 2022 on initial background reports produced by the NWMO. The 2021 and 2022 background reports provided an understanding of site location, conceptual deep geological repository (DGR) and related facility design, and a high level description of the regional geologic/hydrogeologic setting.

The NWMO has continued with the geoscience study work throughout 2022, 2023, and 2024. This work has included the following:

- Drafting reports on the Site preparation for drilling activities related to deep boreholes SB_BH01 and SB_BH02
- Reporting related to SB_BH01 and SB_BH02 including geology and core logging, hydraulic testing, geophysical borehole logging, groundwater geochemistry, bedrock porewater geochemistry, mineralogy, and petrographic analysis testing of deep bedrock stratigraphic units
- Installing six shallow overburden and shallow bedrock nested monitoring wells within the South Bruce Site area, including reporting on monitoring well installation, and reporting on 2022 calendar year continuous groundwater elevation monitoring and quarterly groundwater geochemistry in the overburden and shallow bedrock
- Preparing reports on the local and regional geology
- Assessing the potential presence for petroleum resources within the regional area geology
- Conducting seismic investigations to determine the size, shape, and extent of a shallow buried bedrock valley in the Study Area, and to determine the depth to bedrock units, identify potential fault or fracture zones within the bedrock, and characterize physical properties of the bedrock units
- Undertaking passive microseismic vibration monitoring
- Carrying out initial noise, vibration, and dust baseline monitoring

Peer reviews conducted to date have included the review of work plans, observations of field work, and review of reports made available to GHD. Overall, the geoscience study work completed and reported to date provides

additional data that augments the development of the Conceptual Site Model (CSM) and contributes to supporting the NWMO confidence in safety conclusion that the DGR could be constructed at this site. It is the PRT's view that the information acquired through the geoscience studies will aid the MSB in building confidence in safety and making an informed decision about whether the APM Project is suitable for their community, and if they are willing to consider hosting it, and under what circumstances and terms.

It is the view of the PRT that the geoscience study work and the associated documents are technical in nature and the factual data collected to date demonstrates progress towards satisfying Guiding Principle #2. It is too early in the program to demonstrate progress in satisfying Guiding Principle #7 as site specific designs for the construction and operation of the DGR have not been developed. Notwithstanding this, the PRT has identified that it is still in the process of receiving all geoscience study results and important data gaps as described in this Report are expected to be addressed as the geoscience study work continues. As this is a multi-year program, it is understood by GHD that peer review of the geoscience study work will continue as the work is carried out and the reporting is made available.

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Acronyms

APM	Adaptive Phased Management
CNSC	Canadian Nuclear Safety Commission
CWB	Community well-being
GHD	GHD Limited
MSB	Municipality of South Bruce
NWMO	Nuclear Waste Management Organization
PRT	Peer Review Team
SME	Subject Matter Expert

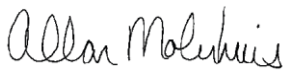
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Respectfully submitted by:



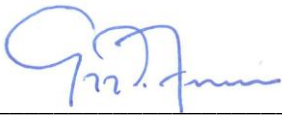
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1. Introduction

Background

This report documents the technical peer reviews undertaken of the various Geoscience study reports and observation of field activities carried out by the Nuclear Waste Management Organization (NWMO) and their consultants during the 2022 to 2024 period. The NWMO has been engaged in a multiyear, community driven process to identify a site where Canada's used nuclear fuel can be safely contained. The site selection process involves nine steps (NWMO 2010), with the process currently at Step 3 (Phase 2). Step 3 is defined by two phases of preliminary assessments for each interested community. Phase 1 involved primarily desktop studies documenting the current socioeconomic conditions in the communities and then considering what might be the possible implications of the Adaptive Phased Management (APM) Project (Project) on community wellbeing (CWB) for each community and the wider area. For interested communities that successfully completed the initial screening in Phase 1, Phase 2 (the current phase) involves additional work to support conducting a preliminary assessment of potential suitability and narrowing the number of communities that have expressed an interest in partnering with the NWMO.

The NWMO is now in its final screening process, and the two remaining siting areas currently being assessed under Step 3, Phase 2, are the South Bruce Site located in the Municipality of South Bruce (MSB) and the Revell Site located in Township of Ignace, and their surrounding areas. The NWMO plans to complete all preliminary assessment work and to select one community/area to host the APM Project by end of 2024 which then marks the beginning of the fourth step of APM implementation. The NWMO plans to trigger the regulatory approvals phase of the APM Project once the site has been selected. Federal approval under the Impact Assessment Act and licensing by the Canadian Nuclear Safety Commission (CNSC) under the Nuclear Safety and Control Act will be required. Meeting federal regulatory standards is imperative to achieve approval, and to withstand intense public and regulatory scrutiny.

Building on previous work, engagements completed to-date, and the MSB's 36 Guiding Principles, the NWMO and the MSB are working together to prepare a suite of studies which will be shared broadly with the community. A significant area of study is the NWMO's geoscience work to characterize the geologic and hydrogeologic setting surrounding the South Bruce Site.

The information acquired through the NWMO's geoscience studies and corresponding peer reviews is expected to aid the MSB in building confidence in safety and make an informed decision about whether the APM Project is suitable for their community, and if they are willing to consider hosting it and under what circumstances and terms.

Geoscience Studies

The NWMO's geoscience study work is being carried out to characterize and assess the ability of the South Bruce Site's geologic and hydrogeologic setting to safely contain and isolate the used nuclear fuel. Factors required for the geological and hydrogeological characterization and assessment include the following:

- The depth of the host rock formation
- The volume and expanse of the host rock at the depth of the repository
- The mineralogy of the rock
- The hydrogeologic regime within the host rock
- The geochemical composition of the groundwater at the depth of the repository
- The ability of the host rock to withstand natural stresses

Based on the information obtained from the geoscience study work, and other technical studies such as engineering, transportation and safety assessment, completed to date, the NWMO has stated in the March 2022 Confidence in Safety Report that it is "confident that a deep geological repository could be constructed at the South Bruce Site in a manner that would provide safe long-term management for Canada's used nuclear fuel."

The March 2022 Confidence in Safety Report (updated in December 2023) identified that additional characterization of the site is required not only for advancing the characterization of bedrock setting but also to develop a thorough quantitative understanding of the Site. The NWMO advises that the quantitative understanding includes the following:

- The characteristics of the geological setting that provide containment and isolation
- The long term stability of the geological setting
- The low risk of future human intrusion into the repository
- The site is amenable to characterization
- The robustness of the multiple barrier system
- The repository can be constructed, operated, and closed safely
- The used fuel can be safely transported to the site
- The facility performance will meet regulatory criteria for safety and environmental protection

The NWMO's geoscience study field activities have been carried out, and related data reports have been prepared by the NWMO and their consultants and agencies:

- Geofirma Engineering Inc.
- Nanometrics
- Cambium Consulting and Engineering
- Geologic Survey of Canada
- KGS Group

Laboratory testing was carried out by the University of Ottawa, SGS Natural Resources (a member of SGS Group), and the British Geological Survey.

Peer Review Team

The MSB has retained GHD to complete a peer review of the geoscience work developed and carried out by the NWMO and their consultants. The Peer Review Team (PRT) for the geoscience related documents and field observation activities include the following Subject Matter Experts (SMEs) from GHD:

- Allan Molenhuis, B.Sc., P.Geo. – Senior Geologist/Hydrogeologist
- Brad Trytten, B.Sc., M.S., P.Geo. – Senior Geologist/Hydrogeologist
- Joe Rothfischer, M.Eng., P.Eng. – Senior Engineer/Geophysicist
- Greg Ferraro, B.E.Sc., P.Eng. – Senior Civil/Environmental Engineer

The SMEs, in combination with the GHD Leadership Team (Greg Ferraro, Jennifer Son, and Amy Douglas), make up the PRT. The peer review has been undertaken in general accordance with the Peer Review Protocol process established jointly by the MSB and the NWMO. Deviations from the Peer Review Protocol that were used for the geoscience studies are discussed in Section 2.

Peer Review Status

The current peer reviews and their findings described in this Report is a follow up to the peer reviews conducted in 2021 and 2022 on initial background reports produced by the NWMO. The 2021 and 2022 background reports provided an understanding of Site location, conceptual DGR and related facility design, and a high level description of the regional geologic/hydrogeologic setting.

The NWMO has continued with the geoscience study work throughout 2022, 2023, and 2024, providing factual reports on the following aspects of the geoscience study work:

- Reporting on the Site preparation for drilling activities, investigations related to the boreholes and the drill core and stratigraphy, and decommissioning of the drilling sites SB_BH01 and SB_BH02 including:

- Installation of conductor casing, surface casing, and the intermediate and production casings (all installed to isolate the overburden and potable groundwater zone from the non-potable groundwater zone and provide stable drilling conditions)
- Geologic coring reports for each of SB_BH01 and SB_BH02 describing in detail the Paleozoic and Precambrian bedrock encountered
- Organic Geochemistry and Clay Mineralogy study for SB_BH01 and SB_BH02, including whole rock mineral composition testing
- Hydraulic testing (hydraulic conductivity testing) of the lower hydraulic conductivity sections of the bedrock using specialized equipment designed for low hydraulic conductivity testing in SB_BH01 and SB_BH02. Additional testing of the higher conductivity testing was also completed.
- Installation of a multilevel monitoring well (Westbay MP-55 system) within SB_BH01 for long-term hydrogeologic monitoring
- Installation of temporary removable seals in SB_BH02
- Opportunistic groundwater sampling for SB_BH01 and SB_BH02
- Porewater and Petrographic analyses for SB_BH01 and SB_BH02
- Mineralogical and geochemical analysis of bedrock cores for SB_BH01 and SB_BH02
- Geophysical well logging for SB_BH01 and SB_BH02
- Borehole Data Integration reports for SB_BH01 and SB_BH02
- Construction noise, vibration and air quality studies associated with drilling SB_BH01 and SB_BH02
- Reporting on shallow overburden and shallow bedrock monitoring wells installed within the South Bruce Site area, including monitoring well installation, and calendar year 2022 continuous groundwater elevation monitoring and quarterly groundwater geochemistry
- Reporting on the local and regional geology, including a 3D seismic reflection study of the Study Area bedrock, and the investigation of a shallow bedrock paleochannel
- Assessing the potential presence for petroleum resources within the regional area geology
- Undertaking passive microseismic vibration monitoring
- Carrying out initial noise, vibration, and dust baseline monitoring prior to drilling at SB_BH01 and SB_BH02
- Monitoring of air quality, noise, and vibration during an early stage of the drilling programs for SB_BH01 and SB_BH02

Section 2 of this report elaborates on the Peer Review Protocol process followed including the steps specifically followed and discussions held with the NWMO and their consultants.

As described in **Section 3**, the PRT considered several relevant technical documents and information prepared by the NWMO in the peer review of the geoscience study documentation to aid in their understanding, focus the peer review, and develop peer review findings.

A high level overview of the PRT findings/observations are summarized in **Section 4**. This is followed by how the technical geoscience reports and associated documents informs the applicable Guiding Principles. Lastly, the conclusions from the peer review are provided.

It is understood by GHD that peer review of the geoscience study work will continue as the work is carried out and the reporting is made available to GHD by the NWMO. It is the PRT's understanding that the information contained within these factual reports and the interpretation of that information will be compiled into a Descriptive Geoscientific Site Model report.

2. Peer Review Protocol

2.1 Objectives and Overview of the Peer Review Protocol Process

The technical peer review of the various geoscience reports, work plans, and field observations was undertaken in general accordance with the Peer Review Protocol established jointly by the MSB and the NWMO. The Peer Review Protocol had the following established objectives:

1. To provide the community of the MSB with an independent review by qualified SMEs
2. To complete a peer review of the NWMO's assessment of potential impacts and proposed benefits of locating the APM Project in the MSB in comparison to existing conditions
3. To review how the potential impacts and proposed benefits adhere to the 36 Guiding Principles that will guide the MSB's assessment of willingness to host the APM Project

With these objectives in mind, the Peer Review was conducted in a collaborative manner between the NWMO team and the MSB/GHD team while maintaining independence during the process. **Appendix A** includes the Peer Review Protocol established in June 2021 and **Figure 2.1** summarizes the process followed.

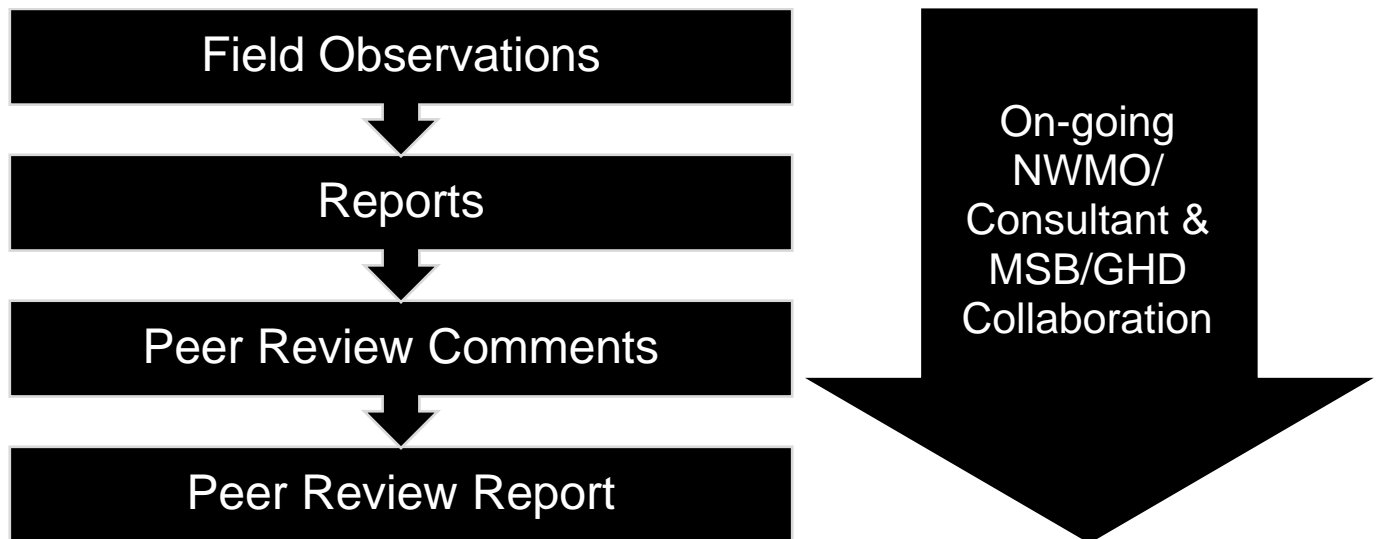


Figure 2.1 The Peer Review Protocol Process

The peer review process, as it relates to the geoscience program, was modified given that the work program was defined by the NWMO and already in progress prior to the PRT's involvement. As shown in **Figure 2.1**, the PRT completed field observations during the drilling and instrumentation of SB_BH01 and SB_BH02 and peer review of technical reports. No work plans were reviewed as part of this peer review process.

2.2 Key Activities Associated with the Peer Review of the Geoscience Studies and Reports

With the preceding process in mind, the Peer Review carried out by the PRT, included field observations and technical reports prepared by the NWMO and its consultants. As part of the peer review process, the PRT reviewed various components of the of the geoscience site characterization program to understand the following:

- Are there any significant concerns, issues, and/or omissions in the documentation?
- What are the PRT's initial observations/impressions on the quality of the documentation?

- Are the baseline findings interpreted and presented in a clear and understandable manner?
- Does the documentation reflect the most current information?
- Does the information contribute to developing the CSM and building Confidence in Safety?

A description of the activities conducted as part of the peer review process of the field observations and reports made available to GHD are provided as follows.

Field Observations

- Observe field data collection activities as part of the geoscience studies.
- Hold on-going discussions as required with the NWMO team and provide input where appropriate and to get an understanding of the work that was being conducted.

Reports

- Review draft reports made available by the NWMO to understand the data and information obtained and the assessment of such data in the context of the peer review process.

Peer Review Comments

- Develop a preliminary list of comments including initial impressions, observations, and any potential issues and/or concerns with the work plans, field observations, and reports based on the peer review of documents and information described in **Section 3**.
- Provide comments on the various documents to the NWMO team for their understanding of the PRT's initial impressions, observations, and any potential issues and/or concerns.

Peer Review Report

- Prepare the draft 2024 Technical Peer Review Summary Report and submit to the MSB for review.

3. Key Documentation and Information Reviewed

Various geoscience study reports made available to GHD were reviewed by the PRT following the Peer Review Protocol. **Table 3.1** lists the key background documents and information considered by the PRT in the review of the geoscience study reports during 2022 through 2024. **Table 3.2** lists the key documents and information considered by the PRT in the review of the geoscience work.

Table 3.1 Background Reports Reviewed to Support the Peer Review Process

Document Name/Information	Author/Source/Date	Description/Application
Preliminary Radon Assessment for a Used Fuel Deep Geological Repository (NWMO-TR-2019-09)	NWMO (December 2020)	This report provides an initial assessment of the radon gas hazard during construction and operation of the DGR for both a crystalline and sedimentary rock setting. The report states the initial assessment has determined minimal risk to workers at the DGR facility and the excavated rock management area (ERMA).
Implementing Adaptive Phased Management 2021 to 2025	NWMO (March 2021)	Reviewed to understand the Project planning timelines. The PRT provided comments (November 18, 2021) for the NWMO's consideration and response (January 27, 2022).

Document Name/Information	Author/Source/Date	Description/Application
Deep Geological Repository Conceptual Design Report – Crystalline / Sedimentary Rock (APM-REP-00440-0211-R000)	NWMO (September 2021)	All members of the PRT reviewed the Executive Summary to obtain an understanding of the below ground facility. Subsequently, additional sections of the Report were reviewed, by certain members of the PRT as appropriate, to obtain a greater level of understanding specific to their areas of study (e.g., Facility Design and Operation, Aggregate Resources Study, Local Traffic Effects Study, Waste Management, etc.). The PRT provided comments (November 18, 2021) for the NWMO's consideration and response (January 27, 2022).
Confidence In Safety – South Bruce Site	NWMO (March 2022, updated December 2023)	This report summarizes the NWMO's safety analyses and the suitability of the South Bruce Site as of early 2022. The report concludes the South Bruce Site would be suitable from a technical perspective and was prepared to support public discussion around site selection. The report summarizes the characteristics of the geological setting and conceptually how this setting is protective of the environment.
Draft Report: Nuclear Waste Management Organization Adaptive Phased Management Project – South Bruce Site, Biophysical Conceptual Site Model Update and Screening Level Change Assessment	CanNorth, Geosyntec, IEC and Zajdlik (November 2022)	This report examines, at a high level, how the Project may affect the environment, and identifying technologies and systems that are commonly used to manage those changes. It also provides a description of the existing conditions in the natural environment. The change assessment simply acknowledges when there may be a change to the environment because of the Project, it does not identify whether that change is important or significant. Additionally, this screening level change assessment focuses on the Project activities and not potential cumulative considerations of other activities in the area.
Preliminary Radiological Safety Study – South Bruce	NWMO (August 2023)	This report summarizes how safety would be ensured and how radiological effects to members of the public would be minimized so that they stay below well relevant regulatory criteria and do not cause any undue health effects. The report is based on information available up to December 2022. The report focuses on the operations phase and the post-closure phase because these are the main phases that involve radioactivity. The report concludes that ensuring safety relies mainly on proper siting, design, implementation of emplacement processes and monitoring; and lists the ways in which the Project will ensure safety during both the operation and post-closure phases.
Final Draft Report: Nuclear Waste Management Organization Adaptive Phased Management Project – Saugeen Ojibway Nation-South Bruce Area, Environmental Media Baseline Program – Year 1 Baseline Report	CanNorth, Geosyntec, SVCA (August 2023)	This report outlines the collection of data from the SON-South Bruce area under the EMBP that started in September 2021 and was primarily completed by the SVCA. The report describes how during Year 1 of the program, data were collected on surface water quality and surface water flow (hydrology).

Table 3.2 Key Documents and Information Included in the Peer Review of the Geoscience Study Work

Document Name/Information	Author/Source/Date	Description/Application
<p>Phase 2 Initial Borehole Drilling and Testing Program for SB_BH01 (13 reports total):</p> <ul style="list-style-type: none"> – WP01A: Site Construction Report for SB_BH01, Geofirma, Sep. 23, 2022 (APM-REP-01332-0314) – WP01B: Site Commissioning Report for SB_BH01, Geofirma, Feb. 09, 2022 (APM-REP-01332-0315) – WP02: Data Report for Borehole Drilling and Coring at SB_BH01, Geofirma, Nov. 30, 2022 (APM-REP-01332-0316) – WP03 Data Report: Geological and Geotechnical Core Logging, Photography, and Sampling for SB_BH01, Geofirma, Sep. 15, 2022 (APM-REP-01332-0330) – WP04C Data Report: Porewater Extraction and Analyses, and Petrographic Analysis for SB_BH01, Geofirma, Dec. 18, 2023 (APM-REP-01332-0319) – WP04G Data Report: Organic Geochemistry and Clay Mineralogy for SB_BH01, Geofirma, Jun. 19, 2023 (APM-REP-01332-0321) – WP05: Data Report for Geophysical Well Logging and Interpretation for SB_BH01, Geofirma, Jan. 12, 2024 (APM-REP-01332-0322) – WP06: Hydraulic Testing Summary Report for SB_BH01, Geofirma, Jul. 05, 2023 (APM-REP-01332-0323) – WP07Data Report: Opportunistic Groundwater Sampling and Testing for SB_BH01, Geofirma, Nov. 23, 2023 (APM-REP-01332-0324) – WP09: Data Report for Westbay WP55 Multi-Level Monitoring System Installation at SB_BH01, Geofirma, Jul. 04, 2023 (APM-REP-01332-0325) – WP10 – Geological Integration Report for Borehole SB_BH01, NWMO, Oct. 2022 (APM-REP-01332-0326) – WP01: Site Decommissioning Report for SB_BH01, Geofirma, May 12, 2023 (APM-REP-01332-0424) – Phase 2 Initial Borehole Drilling and Testing, South Bruce. WP04D Data Report: Mineralogical and Geochemical Analysis of Core for SB_BH01. Revision: 1 (Final), Geofirma, May 29, 2024 (APM-REP-01332-0320) 	<p>Geofirma (February 9, 2022, to May 29, 2024) NWMO (October 2022)</p>	<p>These reports include a description of the following:</p> <ul style="list-style-type: none"> – BH01 drill site construction (access road, drill pad) and site commissioning (infrastructure, fencing, office trailers, washroom facilities, utilities). – The drilling process and installation of four nested steel casings cemented in place to stabilize portions of the borehole and isolate the deep non-potable groundwater from potable shallow bedrock and overburden groundwater. – The process for logging the bedrock drill cores and the stratigraphic units and geologic structures encountered. – The process for porewater extraction, analysis, and analytical results from porewater extraction, and X-ray diffraction petrography for major expected minerals from selected bedrock core samples. – Documentation of organic geochemistry and clay mineralogy. – Description of borehole geophysical logging procedures and instruments, and preliminary interpretation of borehole geophysical logging results. – Hydraulic conductivity testing of low permeability zones within the deep bedrock. – The description of the procedures used to collect groundwater samples from permeable locations, and analytical results for drill water source, drill water used, groundwater analytical results, and QA/QC. – Installation of a multi-level groundwater monitoring system (Westbay system) For long term groundwater monitoring. – A summary and description of the bedrock encountered in the corehole, including stratigraphy, lithology, rock alteration/weathering, hydrocarbon occurrences, and geophysical characteristics. – Drill site decommissioning, including soil sampling for potential impacts and presentation of soil sample results. – A summary of the mineralogy (bulk mineral mass, grain size), and geochemistry (major element oxides and major elements, organic and inorganic carbon, sulphur), clay speciation, petrography and fluid inclusion study of fracture infills.

Document Name/Information	Author/Source/Date	Description/Application
<p>Phase 2 Initial Borehole Drilling and Testing Program for SB_BH02 (14 reports total):</p> <ul style="list-style-type: none"> – WP01A: Site Construction Report for SB_BH02, Geofirma, Nov. 07, 2022 (APM-REP-01332-0327) – WP01B: Site Commissioning Report for SB_BH02, Geofirma, Aug. 15, 2022 (APM-REP-01332-0328) – WP02: Data Report for Borehole Drilling and Coring at SB_BH02, Geofirma, Feb. 01, 2023 (APM-REP-01332-0329) – WP03 Data Report: Geological and Geotechnical Core Logging, Photography, and Sampling for SB_BH02, Geofirma, Nov. 09, 2022 (APM-REP-01332-0335) – WP04C Data Report: Porewater Extraction and Analyses, and Petrographic Analysis for SB_BH02, Geofirma, Jan. 11, 2024 (APM-REP-01332-0332) – WP04G Data Report: Organic Geochemistry and Clay Mineralogy for SB_BH02, Geofirma, Nov. 1, 2023 (APM-REP-01332-0334) – WP06: Hydraulic Testing Summary Report for SB_BH02, Geofirma, Oct. 31, 2023 (APM-REP-01332-0336) – WP07Data Report: Opportunistic Groundwater Sampling and Testing for SB_BH02, Geofirma, Jan. 5, 2024 (APM-REP-01332-0337) – WP08 Data Report, Temporary Well Sealing for SB_BH02, Geofirma, June 29, 2023 (APM-REP-01332-0338) – WP10 – Integration Report for Borehole SB_BH02, NWMO, May 2023 (APM-REP-01332-0339) – WP01: Site Decommissioning Report for SB_BH02, Geofirma, May 12, 2023 (APM-REP-01332-0425) – WP13: Technical Report for Monitoring well (SB_MW01) Installation at SB_BH02, Geofirma, Feb. 01, 2022 (APM-REP-01332-0313) – Phase 2 Initial Borehole Drilling and Testing, South Bruce. WP05: Data Report for Geophysical Well Logging and Interpretation for SB_BH02. Revision: 0 (Final), Geofirma, Feb. 7, 2024 (APM-REP-01332-0317) – Phase 2 Initial Borehole Drilling and Testing, South Bruce. WP04D Data Report: Mineralogical and Geochemical Analysis of Core for SB_BH02. Revision: 1 (Final), Geofirma, May 29, 2024 (APM-REP-01332-0333) 	<p>Geofirma (February 1, 2022, to May 29, 2024)</p>	<p>These reports include a description of the following:</p> <ul style="list-style-type: none"> – BH02 drill site construction (access road, drill pad) and site commissioning (infrastructure, fencing, office trailers, washroom facilities, utilities). – The drilling process and installation of four nested steel casings cemented in place to stabilize portions of the borehole and isolate the deep non-potable groundwater from potable shallow bedrock and overburden groundwater. – The process for logging the bedrock drill cores and the stratigraphic units and geologic structures encountered. – The process for porewater extraction, analysis, and analytical results from porewater extraction, and X-ray diffraction petrography for major expected minerals from selected bedrock core samples. – Documentation of organic geochemistry and clay mineralogy. – Hydraulic conductivity testing of low permeability zones within the deep bedrock. – The description of the procedures used to collect groundwater samples from permeable locations, and analytical results for drill water source, drill water used, groundwater analytical results, and QA/QC. – The temporary well sealing via five removable packers. – A summary and description of the bedrock encountered in the corehole, including stratigraphy, lithology, rock alteration/weathering, hydrocarbon occurrences, and geophysical characteristics. – Drill site decommissioning, including soil sampling for potential impacts and presentation of soil sample results. – The installation of a shallow overburden/bedrock well nest near SB_BH02 for potable groundwater monitoring purposes during the SB_BH02 drilling program. – Description of borehole geophysical logging procedures and instruments, and preliminary interpretation of borehole geophysical logging results. – A summary of the mineralogy (bulk mineral mass, grain size), and geochemistry (major element oxides and major elements, organic and inorganic carbon, sulphur), clay speciation, petrography and fluid inclusion study of fracture infills.

Document Name/Information	Author/Source/Date	Description/Application
<p>Shallow Groundwater Monitoring Network (4 reports total):</p> <ul style="list-style-type: none"> – Project Data Report for Shallow Groundwater Monitoring Well Network Installation, Geofirma, Jul. 05, 2023 (APM-REP-01332-0360) – Project Demobilization Report for Groundwater Monitoring Well Network Installation, Mar. 07, 2023 (APM-REP-01332-0361) – Groundwater Monitoring of Shallow Well Networks – South Bruce Pressure Data Annual Report 2022. Final Rev 2, KGS Group, May 9, 2024 (APM-REP-01332-0419) – Groundwater Monitoring of Shallow Well Network – South Bruce Chemistry Data Annual Report 2022. Final Rev 1, KGS Group, Apr. 29, 2024 (APM-REP-01332-0450) 	<p>Geofirma (March 7 and July 5, 2023)</p> <p>KGS Group (April 2024 and May 9, 2024)</p>	<p>The first two reports describe the drilling and installation of six shallow overburden/shallow bedrock well nests in the study area, well development and hydraulic testing, installation of pressure transducers for groundwater level recording, and site demobilization and site cleanup activities. The installation of these study area monitoring wells was completed in a manner to reduce impacts to local agricultural fields, and following well completion, the disturbed areas were restored.</p> <p>The latter two reports describe for the overburden and shallow bedrock, the quarterly groundwater elevation monitoring program and results, and the quarterly groundwater chemistry monitoring program and results, respectively, for calendar year 2022.</p>
<p>Phase 2 Initial Borehole Drilling and Testing Program for SB_BH01 and SB_BH02 (combined investigation) (2 reports total):</p> <ul style="list-style-type: none"> – WP01: Construction Noise and Vibration Study for SB_BH01 and SB_BH02 Sites, Geofirma, Nov. 27, 2023 (APM-REP-01332-0426) – WP01: Air Quality Study for SB_BH01 and SB_BH02, Geofirma, Nov. 27, 2023 (APM-REP-01332-0427) 	<p>Geofirma (November 27, 2023)</p>	<p>The first report describes the assessment of noise and vibration associated with the cable tool rig and the core drill rig. The assessment was conducted during a portion of one day, with modelling used to extrapolate potential noise and vibration at receptors.</p> <p>The second report describes the air quality modelling associated with emissions from powered equipment at the Site.</p> <p>Both reports apply to both SB_BH01 and SB_BH02.</p>
<p>Regional Geology (5 reports total):</p> <ul style="list-style-type: none"> – 3D Geological Model for South Bruce, Model Version 1.0, NWMO, Nov. 2022 (APM-REP-01332-0379) – South Bruce Area Microseismic Monitoring Project Annual Event Summary Report (Nov 2021 – Dec 2022), Nanometrics, Jan. 24, 2023 (APM-REP-01332-0381) – A Petroleum Resource Assessment of the Huron Domain Area, Southern Ontario, NWMO, Dec. 2019 (NWMO-TR-2019-20) – Data Report for 2D Seismic Paleochannel Characterization, South Bruce, Ontario. Revision: 1 (Final), Geofirma, Mar. 22, 2024 (APM-REP-01332-0388) – 3D Seismic Data Acquisition & Processing Report, South Bruce, Ontario. Revision: 1 (Final), Geofirma, May 28, 2024 (APM-REP-01332-0454) 	<p>NWMO (December 2019, November 2022)</p> <p>Nanometrics (January 24, 2023)</p> <p>Geofirma (March 22 and May 28, 2024)</p>	<p>These reports include a description of the following:</p> <ul style="list-style-type: none"> – The assessment of the potential for exploitable petroleum resources in and near the study area. – The assessment of the passive seismicity (microseismic study) of the study area. – A summary describing the 3D geological model for the South Bruce and Surrounding Region including data sources, stratigraphic information, and comparison/deviation from the preexisting regional geologic model – Seismic investigation of a previously identified shallow bedrock paleochannel within the study area, including methodology (3 parallel seismic lines), data processing, and resultant depth to top of bedrock contours developed using the depth from ground surface to bedrock based on MECP water well records and the interpreted seismic data. – The 3D seismic investigation project was designed to determine the depth to bedrock units (or other lithological contrasts within the bedrock units),

Document Name/Information	Author/Source/Date	Description/Application
		identify potential fault or fracture zones, and characterize physical properties of the bedrock units. This report describes the design, data acquisition, and data processing efforts associated with the 3D seismic investigation project. The data interpretation will be reported separately.
Dust, Noise, and Vibration Background Study for SB_BH01 and SB_BH02 sites in South Bruce, Cambium, Jan. 13, 2021 (APM-REP-01332-0428)	Cambium (January 13, 2021)	This report presents a summary of dust, noise, and vibration background monitoring conducted at each of the two deep boreholes (SB_BH01 and SB_BH02) over a one-day period.

The PRT understands that additional geoscience work was completed during the 2022-2024 period and that this additional reporting has not yet been made available for peer review. This additional geoscience work and reporting is understood to include, at a minimum, the following:

- Laboratory-based geomechanical and thermal testing of drill core
- 3-dimensional seismic reflection study of the stratigraphic layering throughout the study area
- 2023 microseismic monitoring report
- 2023 overburden and shallow bedrock groundwater elevation and geochemistry reports

4. Peer Review Findings and Resolution

4.1 Comments on the 2022-2024 Geoscience Study Work

The PRT provided preliminary comments on the various NWMO geoscience study documents reviewed in memorandum form. **Table 4.1** lists the documents made available to GHD and their status as of July 25, 2024, along with a high level overview of the peer review findings/observations. Additional detail on the specific technical comments on each report can be found in the peer review comment memoranda provided in **Appendix B**.

It is the PRT’s view and the PRT agrees with NWMO that an important area of study and key to understanding the geologic and hydrogeologic setting is the hydraulic conductivity, piezometric heads and potential hydraulic connectivity within and in between the various Paleozoic formations between the proposed DGR and the potable groundwater zone in the overburden and shallow bedrock. The PRT understands that a comprehensive data integration report will be prepared. In the data integration report, NWMO has indicated that integration and interpretation of results will be provided. This information, compiled within a Descriptive Geoscientific Site Model (DGSM) will form a key component of the overall Conceptual Site Model (CSM) for the Site. The timing for the receiving the DGSM is unknown and thus the PRT’s full understanding of the geologic and hydrogeologic setting is incomplete at this time.

To date, the PRT has not received all of the data reports for the geosphere work, and the DGSM has not yet been completed. These components will still need to be reviewed by the PRT to inform the overall confidence in safety of the DGR.

Overall, the geoscience study work completed and reported to date provides additional data that augments the CSM and contributes additional data to support the NWMO confidence in safety conclusion that the DGR could be constructed at the South Bruce Site in a manner that would provide safe long-term management for Canada’s used nuclear fuel.

The PRT notes that inconsistencies of descriptions of the mineralogy and geochemistry between factual reports and data integration reports may result and will require full explanation in the data integration reports. It is also understood that the integration report and/or other future work plans will address modelling of the fluid chemistry within the geologic formations.

Table 4.1 Peer Review Memoranda issued throughout the Geoscience Study Work

Document Title	Author/Source/Date	PRT's General Findings / Observations
<p>Phase 2 Initial Borehole Drilling and Testing Program for SB_BH01 (13 reports total):</p> <ul style="list-style-type: none"> – WP01A: Site Construction Report for SB_BH01, Geofirma, Sept. 23, 2022 (APM-REP-01332-0314) – WP01B: Site Commissioning Report for SB_BH01, Geofirma, Feb. 09, 2022 (APM-REP-01332-0315) – WP02: Data Report for Borehole Drilling and Coring at SB_BH01, Geofirma, Nov. 30, 2022 (APM-REP-01332-0316) – WP03 Data Report: Geological and Geotechnical Core Logging, Photography, and Sampling for SB_BH01, Geofirma, Sept. 15, 2022 (APM-REP-01332-0330) – WP04C Data Report: Porewater Extraction and Analyses, and Petrographic Analysis for SB_BH01, Geofirma, Dec. 18, 2023 (APM-REP-01332-0319) – Phase 2 Initial Borehole Drilling and Testing, South Bruce. WP04D Data Report: Mineralogical and Geochemical Analysis of Core for SB_BH01. Revision: 1 (Final), Geofirma, May 29, 2024 (APM-REP-01332-0320) – WP04G Data Report: Organic Geochemistry and Clay Mineralogy for SB_BH01, Geofirma, Jun. 19, 2023 (APM-REP-01332-0321) – WP05: Data Report for Geophysical Well Logging and Interpretation for SB_BH01, Geofirma, Jan. 12, 2024 (APM-REP-01332-0322) – WP06: Hydraulic Testing Summary Report for SB_BH01, Geofirma, Jul. 05, 2023 (APM-REP-01332-0323) – WP07Data Report: Opportunistic Groundwater Sampling and Testing for SB_BH01, Geofirma, Nov. 23, 2023 (APM-REP-01332-0324) – WP09: Data Report for Westbay WP55 Multi-Level Monitoring System Installation at SB_BH01, Geofirma, Jul. 04, 2023 (APM-REP-01332-0325) – WP10 – Geological Integration Report for Borehole SB_BH01, NWMO, Oct. 2022 (APM-REP-01332-0326) – WP01: Site Decommissioning Report for SB_BH01, Geofirma, May 12, 2023 (APM-REP-01332-0424) 	<p>Geofirma (February 9, 2022, to May 29, 2024) NWMO (October 2022)</p>	<p>The geoscience study work completed and reported on to date for the installation and testing of deep borehole SB_BH01 indicates the following:</p> <ul style="list-style-type: none"> – The site was prepared with support infrastructure installed for the duration of the SB_BH01 drilling and testing program. – The deep borehole core logging provides additional stratigraphic information to support and refine the existing geologic CSM. – The deep borehole core logging provides information on the presence of joints, fractures and faults. The presence of faults in the Guelph Formation with visible (though limited) displacement may be related to reactivation of deeper structures. Further work will need to be completed to understand the extent of the displacement. – The porewater analysis provided information related to porewater quality, including the presence of radiohalides. The petrographic analysis identified the main mineralogical constituents. – The rock matrix mineralogy and pore fabric analysis provided a summary of the characteristics of the stratigraphic units based on thin section analysis. The geochemical analysis provided major elements and major element oxides percentages, and total organic and inorganic carbon and total sulphur percentages. Additionally, petrography and fluid inclusion studies were completed on carbonate fracture infills to provide a better understanding of burial history and the presence of hydrothermal fluids. – The organic geochemistry provided a summary of organic carbon and hydrocarbon presence, along with clay mineralogy. – The borehole geophysical logging provided interpretations of bedrock lithology and structure, and indications of vertical flow within the bedrock corehole. – The hydraulic conductivity testing of deep very low permeability layers provides data to support the CSM and indicates that the proposed DGR is isolated from the overlying deep nonpotable groundwater and shallow bedrock and overburden potable groundwater resources by thick layers of essentially impervious shale and dolostone. Additional testing of the higher conductivity testing was also completed. – The opportunistic groundwater sampling provided groundwater samples and analytical results, including selected radionuclides, for selected permeable intervals in the bedrock. – The installation of the Westbay WP55 system allows for future monitoring of hydraulic pressures to further evaluate the connectivity of the deep groundwater conditions and provide additional data to confirm and augment the CSM.

Document Title	Author/Source/Date	PRT's General Findings / Observations
		<ul style="list-style-type: none"> – The site decommissioning indicated that the site was restored to appropriate conditions for future use without the presence of documented impacts. <p>It is the PRT's view that the additional testing and reporting for SB_BH01 referred to in the Work Plans and not yet provided to the PRT constitutes a data gap with respect to building the PRT's confidence in safety. It is the PRT's view that additional work is required related to the potential presence of faults in the bedrock.</p> <p>The PRT also notes that further testing and assessment for characterization of the groundwater and porewater is important to be carried out including further evaluation of porewater samples for contamination by drilling fluids. This testing will be used in assessing the source and age of the porewater.</p>
<p>Phase 2 Initial Borehole Drilling and Testing Program for SB_BH02 (14 reports total):</p> <ul style="list-style-type: none"> – WP01A: Site Construction Report for SB_BH02, Geofirma, Nov. 07, 2022 (APM-REP-01332-0327) – WP01B: Site Commissioning Report for SB_BH02, Geofirma, Aug. 15, 2022 (APM-REP-01332-0328) – WP02: Data Report for Borehole Drilling and Coring at SB_BH02, Geofirma, Feb. 01, 2023 (APM-REP-01332-0329) – WP03 Data Report: Geological and Geotechnical Core Logging, Photography, and Sampling for SB_BH02, Geofirma, Nov. 09, 202 (APM-REP-01332-0335) – WP04C Data Report: Porewater Extraction and Analyses, and Petrographic Analysis for SB_BH02, Geofirma, Jan. 11, 2024 (APM-REP-01332-0332) – Phase 2 Initial Borehole Drilling and Testing, South Bruce. WP04D Data Report: Mineralogical and Geochemical Analysis of Core for SB_BH02. Revision: 1 (Final), Geofirma, May 29, 2024 (APM-REP-01332-0333) – WP04G Data Report: Organic Geochemistry and Clay Mineralogy for SB_BH02, Geofirma, Nov. 1, 2023 (APM-REP-01332-0334) – Phase 2 Initial Borehole Drilling and Testing, South Bruce. WP05: Data Report for Geophysical Well Logging and Interpretation for SB_BH02. Revision: 0 (Final), Geofirma, Feb. 7, 2024 (APM-REP-01332-0317) – WP06: Hydraulic Testing Summary Report for SB_BH02, Geofirma, Oct. 31, 2023 (APM-REP-01332-0336) – WP07Data Report: Opportunistic Groundwater Sampling and Testing for SB_BH02, Geofirma, Jan. 5, 2024 (APM-REP-01332-0337) 	<p>Geofirma (February 1, 2022, to May 29, 2024)</p>	<p>The geoscience study work completed and reported on to date for the installation and testing of deep borehole SB_BH02 indicate the following:</p> <ul style="list-style-type: none"> – The site was prepared with support infrastructure installed for the duration of the SB_BH02 drilling and testing program. – The deep borehole core logging provides additional stratigraphic information to support and refine the existing geologic CSM. – The deep borehole core logging provides information on the presence of joints, fractures and faults. The presence of faults in the formations overlying the Salina Formation, with visible (though limited) displacement may be related to dissolution of the Salina or reactivation of deeper structures and therefore may be laterally and vertically extensive. – The porewater analysis provided information related to porewater quality, including the presence of radiohalides. The petrographic analysis identified the main mineralogical constituents. – The rock matrix mineralogy and pore fabric analysis provided a summary of the characteristics of the stratigraphic units based on thin section analysis. The geochemical analysis provided major elements and major element oxides percentages, and total organic and inorganic carbon and total sulphur percentages. Additionally, petrography and fluid inclusion studies were completed on carbonate fracture infills to provide a better understanding of burial history and the presence of hydrothermal fluids. – The organic geochemistry provided a summary of organic carbon and hydrocarbon presence, along with clay mineralogy. – The borehole geophysical logging provided interpretations of bedrock lithology and structure, and potential indications of vertical flow within the bedrock corehole. – The hydraulic conductivity testing of deep very low permeability layers provides data to support the CSM and indicates that the proposed DGR is

Document Title	Author/Source/Date	PRT's General Findings / Observations
<ul style="list-style-type: none"> – WP08 Data Report, Temporary Well Sealing for SB_BH02, Geofirma, June 29, 2023 (APM-REP-01332-0338) – WP10 – Integration Report for Borehole SB_BH02, NWMO, May 2023 (APM-REP-01332-0339) – WP01: Site Decommissioning Report for SB_BH02, Geofirma, May 12, 2023 (APM-REP-01332-0425) – WP13: Technical Report for Monitoring well (SB_MW01) Installation at SB_BH02, Geofirma, Feb. 01, 2022 (APM-REP-01332-0313) 		<p>isolated from the overlying deep non-potable groundwater and shallow bedrock and overburden potable groundwater resources by thick layers of essentially impervious shale and dolostone. Additional testing of the higher conductivity testing was also completed.</p> <ul style="list-style-type: none"> – The opportunistic groundwater sampling provided groundwater samples and analytical results, including selected radionuclides, for selected permeable intervals in the bedrock. – The installation of the five packers used to temporarily seal SB_BH02 isolate zones of differing water quality and water pressures and allow for the future installation of monitoring equipment. – The site decommissioning indicated that the site was restored to appropriate conditions for future use without the presence of documented impacts. – The installation of a shallow overburden and shallow bedrock well nest near SB_BH02 was completed to allow for monitoring of potential impacts to the local area and contributes to the CSM. <p>It is the PRT's view that the additional testing and reporting for SB_BH02 referred to in Work Plans and not yet provided to the PRT constitutes a data gap with respect to building the PRT's confidence in safety. It is the PRT's view that additional work is required to further investigate and demonstrate the characteristics of the bedrock.</p> <p>The PRT also notes that further testing and assessment for characterization of the groundwater and porewater is important to be carried out including further evaluation of porewater samples for contamination by drilling fluids. This testing will be used in assessing the source and age of the porewater.</p>
<p>Shallow Groundwater Monitoring Network (4 reports total):</p> <ul style="list-style-type: none"> – Project Data Report for Shallow Groundwater Monitoring Well Network Installation, Geofirma, July 05, 2023 (APM-REP-01332-0360) – Project Demobilization Report for Groundwater Monitoring Well Network Installation, Mar. 07, 2023 (APM-REP-01332-0361) – Groundwater Monitoring of Shallow Well Networks – South Bruce Pressure Data Annual Report 2022. Final Rev 2, KGS Group, May 9, 2024 (APM-REP-01332-0419) – Groundwater Monitoring of Shallow Well Network – South Bruce Chemistry Data Annual Report 2022. Final Rev 1, KGS Group, Apr. 29, 2024 (APM-REP-01332-0450) 	<p>Geofirma (March 7 and July 5, 2023) KGS Group (April 2024 and May 9, 2024)</p>	<p>These study area geoscience reports provide information related to the overburden and shallow bedrock stratigraphy and hydrogeologic conditions and augment the shallow portion of the geologic and hydrogeologic setting to build the CSM for the study area.</p> <p>The groundwater elevation (pressure) monitoring indicates similar groundwater elevations in shallow overburden and shallow bedrock at many locations. Vertical gradients are upward from shallow bedrock to overburden and/or downward from overburden to shallow bedrock. This indicates potential vertical groundwater flow. Overall, the overburden and shallow bedrock groundwater monitoring network presents a general groundwater flow pattern to the north, with flow apparently converging on the Teeswater River. However, it is the PRT's view that additional monitoring locations are required to better understand the shallow bedrock and overburden flow directions, seasonal changes in groundwater elevations, and potential vertical gradient reversals.</p> <p>The shallow groundwater geochemical monitoring shows that there is a significant amount of variation in</p>

Document Title	Author/Source/Date	PRT's General Findings / Observations
		<p>geochemical conditions between wells at the same well nest and between well nests. Some water quality results (e.g., chloride, nitrate) indicate potential anthropogenic impacts.</p> <p>The PRT is of the view and the PRT agrees with the NWMO that routine water quality testing of the shallow overburden and shallow bedrock monitoring wells are required to augment the regional water quality assessment that relies in part on the participation of local residents and access to their water supply wells.</p>
<p>Phase 2 Initial Borehole Drilling and Testing Program for SB_BH01 and SB_BH02 (combined investigation) (2 reports total):</p> <ul style="list-style-type: none"> – WP01: Construction Noise and Vibration Study for SB_BH01 and SB_BH02 Sites, Geofirma, Nov. 27, 2023 (APM-REP-01332-0426) – WP01: Air Quality Study for SB_BH01 and SB_BH02, Geofirma, Nov. 27, 2023 (APM-REP-01332-0427) 	<p>Geofirma (November 27, 2023)</p>	<p>The PRT noted that these assessments were completed during one day. As noted by NWMO, these assessments were not intended to be comprehensive, but intended to capture major activities.</p>
<p>Regional Geology (5 reports total):</p> <ul style="list-style-type: none"> – 3D Geological Model for South Bruce, Model Version 1.0, NWMO, Nov. 2022 (APM-REP-01332-0379) – South Bruce Area Microseismic Monitoring Project Annual Event Summary Report (Nov 2021 – Dec 2022), Nanometrics, Jan. 24, 2023 (APM-REP-01332-0381) – A Petroleum Resource Assessment of the Huron Domain Area, Southern Ontario, NWMO, Dec. 2019 (NWMO-TR-2019-20) – Data Report for 2D Seismic Paleochannel Characterization, South Bruce, Ontario. Revision: 1 (Final), Geofirma, Mar. 22, 2024 (APM-REP-01332-0388) – 3D Seismic Data Acquisition & Processing Report, South Bruce, Ontario. Revision: 1 (Final), Geofirma, May 28, 2024 (APM-REP-01332-0454) 	<p>NWMO (December 2019, November 2022) Nanometrics (January 24, 2023) Geofirma (March 22 and May 28, 2024)</p>	<p>These regional geoscience reports provide additional understanding related to the regional geoscience regime. These reports indicate the following:</p> <ul style="list-style-type: none"> – The 3D geologic model for the regional study area is generally consistent with the stratigraphic information from the two deep boreholes but will require revision based on updated stratigraphic information to be consistent with the findings from the deep boreholes. – The microseismicity study provides additional confidence in the regional geologic understanding that the site is located in a seismically quiescent and stable geologic setting. The microseismic study did not review historical seismic data for the area. However, that information review was outside of the scope of work and would be completed as part of regional studies and permitting requirements, including for the existing Bruce Nuclear Power Station. – Petroleum Resources – Paleochannel – Seismic data acquisition
<p>Dust, Noise, and Vibration Background Study for SB_BH01 and SB_BH02 sites in South Bruce, Cambium, Jan. 13, 2021 (APM-REP-01332-0428) (1 report total received to date)</p>	<p>Cambium (January 13, 2021)</p>	<p>The intent of the dust, noise, and vibration background study was to complete in one day a “snapshot” of conditions rather than a background encompassing variable weather conditions and seasonal variations.</p>

It is expected peer review of the geoscience study work will continue to be carried out once additional reporting becomes available from the NWMO.

4.2 Municipality of South Bruce’s Guiding Principles

The geoscience documents inform select principles of the 36 Guiding Principles established by the MSB. The Municipality published a Project Visioning report based on community workshops held in December 2019 and January 2020 that identified areas of community concern and opportunities. Based on the Project Visioning report and further public consultation, the MSB passed a Council resolution endorsing the 36 Guiding Principles that will guide their

assessment of willingness to host the APM Project. In light of their importance to the MSB, the principles have been individually linked to each of the studies as appropriate to ensure that they were fully considered or accounted for in completing the work (**Appendix C**).

Two of the 36 Guiding Principles are linked to the implementation and findings of the geoscience studies (Guiding Principles #2 and #7). **Table 4.2** lists the MSB’s Guiding Principles #2 and #7 and how the results of the geoscience studies inform these principles.

Table 4.2 The MSB Guiding Principles Associated with the Geoscience Study Work

Principle # and Description	Consideration of the Principle in the Geoscience Study Work
<p>2. The NWMO must demonstrate to the satisfaction of the Municipality that sufficient measures will be in place to ensure the natural environment will be protected, including the community’s precious waters, land and air, throughout the Project’s lifespan of construction, operation and into the distant future.</p>	<p>The scope of work related to the geoscience studies informs Guiding Principle #2 by collecting technical data to characterize and assess the ability of the South Bruce Site’s geologic and hydrogeologic setting to safely contain and isolate the used nuclear fuel. The geoscience study work contributes to characterizing the deep and shallow geologic and hydrogeologic setting for the Project site.</p> <p>As this program is multi-year program, it is the PRT’s understanding that the geoscience work will continue with corresponding peer reviews conducted.</p> <p>Once integrated with the results of the Environmental Media Baseline Program a comprehensive CSM can be prepared. The CSM will be used for preparing and advancing the detailed change effects assessment.</p> <p>This work will allow for identifying any mitigative actions required to address the requirements of Guiding Principle #2.</p>
<p>7. The NWMO must commit to preparing construction management and operation plans that detail the measures the NWMO will implement to mitigate the impacts of construction and operation of the Project.</p>	<p>As outlined in the Confidence in Safety report, the geoscience study work will inform Guiding Principle # 7 by identifying the characteristics of the regional geologic and hydrogeologic setting and the targeted depth and geologic strata for the repository. The geologic and hydrogeologic characteristics will be used to build the comprehensive CSM and DGSM.</p> <p>The characteristics of the geologic setting will be assessed to confirm the presence of the required natural barriers and will feed into the site-specific detail design for the repository construction and operational mitigations.</p> <p>The characteristics of the excavated rock and deep groundwater to be removed during the construction and operation phases must be determined to mitigate impacts to the environmental and human receptors.</p> <p>The geoscience study work will also be used to understand the characteristics and sensitivities of hydrogeologic conditions in the vicinity of the DGR, to mitigate the potential for groundwater interference and integrate with the environmental water management programs.</p>

4.3 Conclusions of the Peer Review

The current peer reviews and their findings described in this report are a follow up to that conducted in 2021 and 2022 on initial background reports prepared by the NWMO. The 2021 and 2022 background reports provided an understanding of site location, conceptual DGR and related facility design, and a high level description of the regional geologic/hydrogeologic setting.

The NWMO has continued with the geoscience study work throughout 2022, 2023, and 2024 as follows:

- Preparation of descriptive reports on the Site preparation for drilling activities related to deep boreholes SB_BH01 and SB_BH02 and decommissioning of the drilling sites
- Technical reporting related to SB_BH01 and SB_BH02 including:
 - Installation of conductor casing, surface casing, and the intermediate and production casings (all installed to isolate the overburden and potable groundwater zone from the non-potable groundwater zone and provide stable drilling conditions)
 - Geologic coring reports for each of SB_BH01 and SB_BH02 describing in detail the Paleozoic and Precambrian bedrock encountered
 - Summary and description of the bedrock encountered, including stratigraphy and lithology, alteration and weathering, hydrocarbon occurrences, and geophysical characteristics for SB_BH01 and SB_BH02

- Organic Geochemistry and Clay Mineralogy study for SB_BH01 and SB_BH02
- Hydraulic Testing (hydraulic conductivity testing) of the lower hydraulic conductivity sections of the bedrock using specialized equipment designed for low hydraulic conductivity testing in SB_BH01 and SB_BH02
- Porewater sampling and results, and X-ray diffraction petrographic analyses for major minerals for SB_BH01 and SB_BH02
- Opportunistic groundwater sampling results from permeable zones including analytical results for drill water for comparison, for SB_BH01 and SB_BH02
- Borehole geophysical logging of bedrock lithology and structure, and potential indications of vertical flow within the bedrock corehole
- Rock matrix mineralogy and pore fabric analysis for stratigraphic unit characterization, major elements and oxides percentages, and total organic and inorganic carbon and total sulphur percentages, petrography and fluid inclusion studies were completed on carbonate fracture infills to provide a better understanding of burial history
- Installation of a multilevel monitoring well (Westbay MP-55 system) within SB_BH01 for long-term hydrogeologic monitoring
- Installation of temporary removable seals in SB_BH02
- Site decommissioning reports including soil sample results for SB_BH01 and SB_BH02
- Installation and reporting on shallow overburden and shallow bedrock monitoring wells within the South Bruce Site area
 - Summary of the installation of nested monitoring wells (overburden and three nested shallow bedrock wells)
 - Groundwater elevation (pressure) monitoring, determination of vertical and horizontal groundwater flow directions in overburden and shallow bedrock, and calculation of vertical gradients
 - Overburden and shallow bedrock groundwater geochemical monitoring for general chemistry, metals, nutrients, and selected isotopes
- Preparation of descriptive technical reports on the local and regional geology
- Assessment of potential presence for petroleum resources within the regional area geology
- Seismic monitoring
- Initial noise, vibration, and dust baseline monitoring

The multi-year geoscience study work completed and reported on to date currently provides the community with a good description of what characterization work has been completed. Overall, the factual geoscience study reports are well written and technically understandable.

The geoscience study reports provide information and test data on many aspects and features of the geosphere. The information and data contributes to developing an understanding of the geologic and hydrogeologic setting of the Project site. The reports (plus the reports yet to be provided) provide sufficient information to allow for the NWMO to proceed with developing an integrated Descriptive Geoscientific Site Model for the geologic and hydrogeologic setting for the DGR. The DGSM will provide the visual and technically descriptive geologic and hydrogeologic characterization.

The PRT is of the view that the reports provide sufficient information and data to support the NWMO's confidence in safety conclusion provided in their March 22, 2022 (updated in December 2023) Confidence in Safety Report. The PRT understands that not all the reporting on the geoscience work completed during the 2022-2024 period has been made available for peer review. The additional testing, data integration and assessment and reporting referred to in the Work Plans and identified from the initial work carried out constitutes important information gaps in characterizing the shallow and deep geologic and hydrogeologic settings for the DGR site. It is expected that the important information gaps will be addressed as the geoscience study work continues and additional reporting becomes available for peer review.

The PRT notes that important area of study and key to understanding the geologic and hydrogeologic setting is the hydraulic conductivity, piezometric heads and potential hydraulic connectivity within and in between the various

Paleozoic formations between the proposed DGR and the potable groundwater zone in the overburden and shallow bedrock. In particular, the PRT recognizes that additional testing and data collection related to the shallow overburden and shallow bedrock aquifers (groundwater elevations, flow directions, vertical gradients, geochemistry, etc.), as well as the integrity of deep bedrock (additional deep bedrock drilling and characterization) will occur should the Site be selected for the DGR.

The current geoscience study work and the associated reporting is technical in nature and factual data collected to date demonstrates progress towards satisfying Guiding Principle #2. It is too early in the program to demonstrate progress in satisfying Guiding Principle #7 as site specific designs for the construction and operation of the DGR have not been developed. As this is a multi-year program, review of the additional collected data will ensure that the characterization of the geologic and hydrogeologic setting is complete to make informed decisions and assess the changes resulting from the Project.

5. References

Nuclear Waste Management Organization (NWMO). 2010. Moving Forward Together: Process for Selecting a Site for Canada's Deep Geological Repository for Used Nuclear Fuel. May 2010.

Appendices

Appendix A

Peer Review Protocol

South Bruce Consultants Peer Review Protocol

Protocol for Peer Review Process

1. The scope of the peer review is variable for each NWMO study (Study). The scope and objective of each Study is variable. The Study may include development of information, data and documents in the form of a:

- Statement of Work
- Work plan
- Baseline conditions
- Modeling/prediction/forecast of future conditions
- An assessment of impact/benefits

Not all NWMO studies will include each of the above listed elements. While a collaborative peer review approach is to be used, it is important to maintain independence during the peer review process.

2. Develop an initial understanding of NWMO inputs to conducting the Study including timing, availability and sources of information.
3. Meet with NWMO and their consultants to
 - compile a list of information/documents that will need to be reviewed as part of the Peer Review
 - compile a list of parties/agencies providing information for use in preparing the Study
 - identify additional information/sources that may be pertinent to the Study
4. Undertake an initial review of the information/documents assembled and developed for the Study
 - Peer review of the SoW will include information and data pertaining to some or all of the following elements:
 - i.) Statement of Work (SoW)
 - ii.) Work plan
 - iii.) Baseline conditions
 - Provide questions/comments to NWMO on the available information/documents and ensure they have been adequately addressed with the community in mind.
5. Conduct peer review of the Study findings as they are developed which may include the following:
 - i.) Project design(s)
 - ii.) Modeling of future conditions
 - iii.) Impact assessment approach
 - iv.) Impact assessment findings
 - v.) Analysis of reliability
 - If warranted, work with NWMO and their consultants to conduct a site visit
6. Meet with NWMO and their consultants to:
 - Seek clarifications of the information/documents reviewed
 - Ensure a full understanding of the assessment approach and findings
 - Present the preliminary peer review findings (concurrences and concerns)



- Provide questions/comments and peer review findings and ensure they have been adequately addressed with the community in mind.
- 7. Review NWMO draft reports
 - Complete a detailed review of the draft reports
 - Identify omissions and/or inconsistencies if they occur with SOW and Work Plan
- 8. Prepare draft Peer Review Report for submission to South Bruce for comments.
 - Include a summary of peer review observations, findings, and comments
- 9. South Bruce will review with RedBrick for communications to public
- 10. Finalize and present the Peer Review Report to South Bruce and NWMO
- 11. Each consultant will need to provide a presentation of the findings of the peer reviews to the CLC.

Table of Contents for Peer Review Report

1. Introduction
 - a. State the purpose of the Peer Review Report (Report)
 - b. Provide capsule summary of the proposed Project
 - c. Identify the NWMO Study that is being peer reviewed
 - d. Identify the NWMO Statement of Work for completing the Study (i.e., SOW from EOI or update)
 - e. Identify participants involved in conducting the Study
 - f. Identify the time period the Study work and Peer Review was carried out
2. Peer Review Objectives and Process
 - a. State objectives for conducting the Peer Review which include
 - i. To provide the community of SB with independent review by qualified subject matter experts
 - ii. To complete a peer review of the NWMO Assessment of potential impacts and proposed benefits in comparison to existing conditions
 - iii. To review how the potential impacts and proposed benefits adhere to the 36 principles that will guide the assessment of willingness to host the Project.
 - b. Describe the Peer Review Process Undertaken
 - i. Describe the Peer Review process that was carried out.
 - ii. List activities completed (e.g., site visits, work plan review, data review, report review, meetings, etc.)
3. Documentation and Information Reviewed
 - a. List NWMO study specific information reviewed which may include:
 - i. Scope of work
 - ii. Detailed work plan
 - iii. Baseline Conditions
 - iv. Assessment Approach
 - v. Assessment Findings
 - b. List parties/agencies involved in providing information into the study
 - c. List all documents/meetings/data/additional information and include a short summary of each
4. Peer Review Findings and Resolution
 - a. Baseline Conditions Report (concurrences and concerns and resolution)

- b. Impact Assessment (IA) Report
 - i. IA approach (concurrences and concerns and resolution)
 - ii. IA findings (concurrences and concerns and resolution)
 - c. Conclusions of peer review
 - d. Adherence to the 36 principles which are pertinent to the study
5. Summary

Appendix B

Peer Review Comment Memorandums

Geoscience Memoranda Issued by GHD

Document Title	Reference Memo Number
3D Geological Model for South Bruce, Model Version 1.0, NWMO, November 2022 (APM-REP-01332-0379)	MEM-49
3D Seismic Data Acquisition & Processing Report, South Bruce, Ontario. Revision: 1 (Final), Geofirma, May 28, 2024 (APM REP 01332-0454)	MEM-74
A Petroleum Resource Assessment of the Huron Domain Area, Southern Ontario, NWMO, December 2019 (NWMO-TR-2019-20)	MEM-49
Data Report for 2D Seismic Paleochannel Characterization, South Bruce, Ontario. Revision: 1 (Final), Geofirma, March 22, 2024 (APM-REP-01332-0388)	MEM-74
Dust, Noise, and Vibration Background Study for SB_BH01 and SB_BH02 sites in South Bruce, Cambium, January 13, 2021 (APM-REP-01332-0428)	MEM-59
Groundwater Monitoring of Shallow Well Network – South Bruce Chemistry Data Annual Report 2022. Final Rev 1, KGS Group, April 29, 2024 (APM-REP-01332-0450)	MEM-74
Groundwater Monitoring of Shallow Well Networks – South Bruce Pressure Data Annual Report 2022. Final Rev 2, KGS Group, May 9, 2024 (APM-REP-01332-0419)	MEM-74
Phase 2 Initial Borehole Drilling and Testing, South Bruce. Air Quality Study for SB_BH01 and SB_BH02 Sites Revision: 1 (Final), Geofirma, November 27, 2023 (APM-REP-01332-0427)	MEM-72
Phase 2 Initial Borehole Drilling and Testing, South Bruce. Construction Noise and Vibration Study for SB_BH01 and SB_BH02 Sites Revision: 1 (Final), Geofirma, November 27, 2023 (APM-REP-01332-0426)	MEM-72
Phase 2 Initial Borehole Drilling and Testing, South Bruce. WP01: Site Decommissioning Report for SB_BH01 Revision: 0 (Final), Geofirma, May 12, 2023 (APM-REP-01332-0424)	MEM-72
Phase 2 Initial Borehole Drilling and Testing, South Bruce. WP01: Site Decommissioning Report for SB_BH02 Revision: 0 (Final), Geofirma, May 12, 2023 (APM-REP-01332-0425)	MEM-72
Phase 2 Initial Borehole Drilling and Testing, South Bruce. WP04C Data Report – Porewater Extraction and Analysis and Petrographic Analysis for SB_BH01 Revision: 0 (Final), Geofirma, December 18, 2023 (APM-REP-01332-0319)	MEM-72
Phase 2 Initial Borehole Drilling and Testing, South Bruce. WP04C Data Report – Porewater Extraction and Analysis and Petrographic Analysis for SB_BH02 Revision: 0 (Final), Geofirma, January 11, 2024 (APM-REP-01332-0332)	MEM-72
Phase 2 Initial Borehole Drilling and Testing, South Bruce. WP04D Data Report: Mineralogical and Geochemical Analysis of Core for SB_BH01. Revision: 1 (Final), Geofirma, May 29, 2024 (APM-REP-01332-0320)	MEM-74
Phase 2 Initial Borehole Drilling and Testing, South Bruce. WP04D Data Report: Mineralogical and Geochemical Analysis of Core for SB_BH02. Revision: 1 (Final), Geofirma, May 29, 2024 (APM-REP-01332-0333)	MEM-74
Phase 2 Initial Borehole Drilling and Testing, South Bruce. WP04G Data Report – Organic Geochemistry and Whole Rock and Clay Mineralogy for SB_BH02 Revision: 2, Geofirma, November 1, 2023 (APM-REP-01332-0334)	MEM-72
Phase 2 Initial Borehole Drilling and Testing, South Bruce. WP05 Data Report – Geophysical Well Logging and Interpretation for SB_BH01 Revision: 0 (Final), Geofirma, January 12, 2024 (APM-REP-01332-0322)	MEM-72
Phase 2 Initial Borehole Drilling and Testing, South Bruce. WP05: Data Report for Geophysical Well Logging and Interpretation for SB_BH02. Revision: 0 (Final), Geofirma, February 7, 2024 (APM-REP-01332-0317)	MEM-74

Document Title	Reference Memo Number
Phase 2 Initial Borehole Drilling and Testing, South Bruce. WP06 Data Report – Hydraulic Testing for SB_BH02 Revision: 1 (Final), Geofirma, October 31, 2023 (APM-REP-01332-0336)	MEM-72
Phase 2 Initial Borehole Drilling and Testing, South Bruce. WP07 Data Report – Opportunistic Groundwater Sampling and Testing for SB_BH01 Revision: 1 (FINAL), Geofirma, November 23, 2023 (APM-REP-01332-0324)	MEM-72
Phase 2 Initial Borehole Drilling and Testing, South Bruce. WP07 Data Report – Opportunistic Groundwater Sampling and Testing for SB_BH02 Revision: 0 (Final), Geofirma, January 5, 2024 (APM-REP-01332-0337)	MEM-72
Phase 2 Initial Borehole Drilling and Testing, South Bruce. WP10 Data Report – Single Borehole Data Integration for SB_BH02 Revision: 0, NWMO, May 2023 (APM-REP-01332-0339)	MEM-72
Project Data Report for Shallow Groundwater Monitoring Well Network Installation, Geofirma, July 05, 2023 (APM-REP-01332-0360)	MEM-59
Project Demobilization Report for Groundwater Monitoring Well Network Installation, March 07, 2023 (APM-REP-01332-0361)	MEM-49
South Bruce Area Microseismic Monitoring Project Annual Event Summary Report (November 2021 – December 2022), Nanometrics, Jan 24, 2023 (APM-REP-01332-0381)	MEM-49
WP01A: Site Construction Report for SB_BH01, Geofirma, September 23, 2022 (APM-REP-01332-0314)	MEM-41
WP01A: Site Construction Report for SB_BH02, Geofirma, November 07, 2022 (APM-REP-01332-0327)	MEM-41
WP01B: Site Commissioning Report for SB_BH01, Geofirma, February 09, 2022 (APM-REP-01332-0315)	MEM-41
WP01B: Site Commissioning Report for SB_BH02, Geofirma, August 15, 2022 (APM-REP-01332-0328)	MEM-41
WP02: Data Report for Borehole Drilling and Coring at SB_BH01, Geofirma, November 30, 2022 (APM-REP-01332-0316)	MEM-41
WP02: Data Report for Borehole Drilling and Coring at SB_BH02, Geofirma, February 01, 2023 (APM-REP-01332-0329)	MEM-49
WP03 Data Report: Geological and Geotechnical Core Logging, Photography, and Sampling for SB_BH01, Geofirma, September 15, 2022 (APM-REP-01332-0330)	MEM-41
WP03 Data Report: Geological and Geotechnical Core Logging, Photography, and Sampling for SB_BH02, Geofirma, November 09, 202 (APM-REP-01332-0335)	MEM-41
WP04G Data Report: Organic Geochemistry and Clay Mineralogy for SB_BH01, Geofirma, June 19, 2023 (APM-REP-01332-0321)	MEM-59
WP06: Hydraulic Testing Summary Report for SB_BH01, Geofirma, July 05, 2023 (APM-REP-01332-0323)	MEM-59
WP08 Data Report, Temporary Well Sealing for SB_BH02, Geofirma, June 29, 2023 (APM-REP-01332-0338)	MEM-59
WP09: Data Report for Westbay WP55 Multi-Level Monitoring System Installation at SB_BH01, Geofirma, July 04, 2023 (APM-REP-01332-0325)	MEM-59
WP10 – Geological Integration Report for Borehole SB_BH01, NWMO, October 2022 (APM-REP-01332-0326)	MEM-49
WP13: Technical Report for Monitoring well (SB_MW01) Installation at SB_BH02, Geofirma, February 01, 2022 (APM-REP-01332-0313)	MEM-49

Memorandum

20 January 2023 – updated 12 February 2024

To	Dave Rushton/Steve Travale, Municipality of South Bruce		
Copy to	Sarah Hirschorn/Jeff Marshall/Michael Pahor/Geoff Crann, NWMO		
From	Brad Trytten, Allan Molenhuis, Greg Ferraro and Jennifer Son/AD/mma	Tel	+1 519 884 0510
Subject	Geoscience Reports – Peer Review Comments	Project no.	11224152-MEM-41

1. Introduction

This memo provides the Municipality of South Bruce (South Bruce) peer review team’s comments on seven reports prepared by Geofirma Engineering (Geofirma). The reports were received and made available for peer review on December 8, 2022. The peer review comments are provided for South Bruce’s consideration and internal circulation as per the South Bruce Nuclear Exploration Project peer review protocol process. GHD Limited (GHD) will submit the memo to the Nuclear Waste Management Organization (NWMO) and their consultants.

This memo includes the results of the peer review on the following reports.

Borehole 1:

- WP01A Site Construction Report for SB_BH01 (APM-REP-01332-0314) (September 23, 2022)
- WP01B Site Commissioning Report for SB_BH01 (APM-REP-01332-0315) (February 9, 2022)
- WP02 Data Report – Borehole Drilling and Coring SB_BH01_R0 (APM-REP-01332-0316) (November 30, 2022)
- WP03 Geological and Core Logging Report for SB_BH01 (APM-REP-01332-0330) (September 15, 2022)

Borehole 2:

- WP01A Site Construction Report for SB_BH02 (APM-REP-01332-0327) (November 7, 2022)
- WP01B Site Commissioning Report for SB_BH02 (APM-REP-01332-0328) (August 15, 2022)
- WP03 Geological and Core Logging Report for SB_BH02 (APM-REP-01332-0335) (November 9, 2022)

2. Peer review approach

The peer review of the Reports was carried out by GHD’s Peer Review Team (PRT). 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, the PRT for the reports reviewed included Subject Matter

Experts (SMEs) Brad Trytten and Allan Molenhuis and GHD Lead Consultants Jennifer Son and Greg Ferraro. The peer reviews were conducted having the following questions in mind:

- Are there any significant concerns, issues, and/or omissions in the documentation?
- What are the PRT's initial observations/impressions on the quality of the documentation?
- Are the baseline findings interpreted and presented in a clear and understandable manner?
- Does the documentation reflect the most current information?
- Does the information contribute to developing the Conceptual Site Model (CSM)?

3. Peer review comments

The PRT has provided below a brief summary of each report followed by comments listed in a comment disposition table. The comment disposition tables list GHD's initial peer review comments on the individual reports reviewed. The comments are intended to provide South Bruce a better understanding of the geoscience study work, how the work was carried out, and how the study work contributes to characterizing the geologic and hydrogeologic setting for the Project site. The comments are provided to the NWMO for their consideration in advancing the geoscience study work. NWMO provided responses to the comments on November 20, 2023.

As the reports have been received for peer review on an intermittent basis and provide technical data on individual components of the geoscience study program, the PRT has not commented on the sufficiency of the geoscience program as a whole in characterizing the geologic and hydrogeologic setting for the Project site.

Based on completion of the peer review, the PRT noted that the reports were, overall, well written. In general, the comments provided below identify minor inconsistencies in the reports and sections that may benefit from additional discussion where details are missing or not fully discussed.

3.1 WP01A Site Construction Report for SB_BH01

The PRT understands the objective of this report is to present a description of the Site preparation and construction activities related to preparing the area for the drilling of SB_BH01.

Overall, the PRT found the report to be of good quality with little concerns in regard to the quality of the report or the factual statements and data presented within. Comments are provided in **Table 1**. Comment 2 is provided to request clarity with respect to handling of potentially impacted soils and spill pads. Comment 3 is provided to request clarity due to conflicting statements between the report and field supervisors, and to ensure accuracy within the report.

Table 1 Comment Disposition Table - WP01A Site Construction Report for SB_BH01 (APM-REP-01332-0314) (September 23, 2022)

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
1	Section 1.0	WP01 was not available to review. The PRT cannot compare to see if work package was followed. Although the description in this report is good (with the exception of comment 2).	Noted, no action.	Noted.
2	Section 2.10	<i>“All hydrocarbon sheens and impacted soils were immediately remediated by Geofirma personnel using absorbent pads and hand tools.”</i> Were the impacted soils removed for off-Site disposal? Please expand on the remediation.	During the field program all impacted material was retained and disposed of off site at a licenced facility. Pre work sampling was undertaken across the sites to establish baseline. Post demobilisation sampling was undertaken across the sites and all samples were below the Table 2 Residential/Parkland/Institutional Property Use standards (Soil, ground water and sediment standards for use under Part XV.1 of the Environmental Protection Act).	Comment satisfactorily addressed.
3	Section 2.8	<i>“The 1.8 m diameter drilling cellar was installed to approximately 2 m bgs. The bottom was filled with compacted granular material.”</i> GHD were under the impression from discussions with Site staff that the drilling cellar was floored with concrete to retain any spilled fluids and prevent loss to the subsurface. Please clarify the construction and handling of any spilled fluids in the drilling cellar.	The base of the cellar was lined with concrete prior to commencing coring. Fluids which accumulated in the cellar were pumped into holding tanks and the disposed of offsite with other liquid waste by licenced contractor.	Comment satisfactorily addressed.

3.2 WP01B Site Commissioning Report for SB_BH01

The PRT understands the objective of this report is to present a description of the Site preparation activities related to Site layout (equipment, trailers, washrooms, supplies) and the handling and storage of fuel and chemicals, and the management of solid and liquid waste for the drilling of SB_BH01.

Overall, the PRT found the report to be of good quality with no concerns in regard to the quality of the report or the factual statements and data presented within. Comments are provided in **Table 2**. The PRT notes that third-party inspections were conducted by GHD on behalf of the PRT and by First Nations.

Table 2 Comment Disposition Table - WP01B Site Commissioning Report for SB_BH01 (APM-REP-01332-0315) (February 9, 2022)

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
1	Section 6.0	<p>No concerns/comments (GHD was unable to compare the report against WP01).</p> <p>Could add that GHD completed several third-party site inspections and that work was overseen by First Nations and did not find any deficiencies (none by GHD, none from First Nations that GHD are aware of).</p> <p>Note that GHD's third-party inspections were completed after Site commissioning was completed and drilling had commenced.</p>	No action.	Noted.

3.3 WP02 Data Report – Borehole Drilling and Coring for SB_BH01

The PRT understands the objective of this report is to describe the activities associated with the drilling, coring, and casing for borehole SB_BH01. Overall, the PRT found the report to be of good quality with few concerns in regard to the quality of the report or the factual statements and data presented within.

The PRT provides the following comments (**Table 3**) on the report that request clarity and to ensure accuracy within the report. Several of the comments are related to potentially improving the understanding of the report by the public or non-technical reviewers. The PRT notes that the report is focused on the entire borehole, however, the shallow bedrock sequence where the potable groundwater is found could have used additional information clarity.

Comment 13 is related to the source of significant fracturing and the requirement for additional cementing in the interval 75 to 123 m bgs, approximately 55 m below the top of bedrock. The PRT also notes that there is a fault documented in the drill core in the Guelph Formation (Silurian age) directly underlying the Salina Formation. The lack of description and analysis suggests that the source of the faulting/fracturing may not be fully understood and therefore may be related to larger scale features.

Comment 15 was provided to request clarity in the drill rig reference datum. Comments 20 and 21 related to Opportunistic Groundwater sampling, and clarifying how zones were chosen for the collection of groundwater samples.

Table 3 Comment Disposition Table - WP02 Data Report – Borehole Drilling and Coring SB_BH01_R0 (APM-REP-01332-0316) (November 30, 2022)

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
1	Section 1.1, paragraph 5	“SB-BH01 drill sites” Drill site?	Correct, the “s” was a typo.	Comment satisfactorily addressed.
2	Section 1.2	Although mention Paleozoic sequence and Precambrian basement, these should potentially include ages, and for the Paleozoic era, the specific Periods and age ranges for the bedrock encountered at the Site.	Noted. N/A. This type of information will be included in the descriptive geoscientific site model.	Noted. The PRT is unaware of timing and scope of the geoscientific site model.
3	Section 2.2.1, paragraph 1 and 2	Was the air monitoring equipment replaced daily at a minimum? To be consistent with Section 2.3 which states daily. Does the major adverse air quality event described in Paragraph 2 correspond to the air monitoring table in Appendix F? I don’t see a TWA that corresponds with the text. Define OGW.	Air monitoring systems were calibrated daily, in accordance with Section 2.3. The major adverse air quality event was the event recorded at 23:45 on 22-July 2021. The air monitoring system alerted the workers and work was stopped until the air quality was remediated. OGW = Opportunistic Ground Water (defined in Section 3).	Comment satisfactorily addressed.
4	Section 2.2.2	With reference to the noise survey, are the results of the survey significant?	The results of the survey are intended to define a boundary where hearing protection is necessary. As a result of the study, a hearing protection required zone was placed around the drill rig. Noise levels at the office trailers were below recommended decibel limits defined in O. Reg 381/15.	Comment satisfactorily addressed.
5	Section 3.1	Paragraph 2. Although the installation of the drilling cellar is described in the WP01A Site Construction Report, please add a sentence about sealing of the cellar (if it was sealed), see comment on WP01A Site Construction Report. It is our understanding that the bottom of the drilling cellar was sealed with concrete to prevent loss of fluids to the subsurface.	This is addressed in the report for WP01A (which is the related document for the construction).	Comment satisfactorily addressed.

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
6	Section 3.1.1	Although not required, a description of the cable tool drilling method may be useful to the reviewers not familiar with cable tool drilling. This might include a description of the method, the drilling bits used, the cuttings removal system (dart bailer), which are shown in pictures in Figure 3. I note that there is no caption describing the photos for Figure 3.	Noted. No action.	Noted.
7	Figure 8	Although scaled for the length of the entire borehole, a more detailed figure of the upper 200 m may be useful to the reviewers to better show protection of the water supply aquifers in the area, and include the zones where freshwater is normally found. Define "OGW" in the figure to show it is the opportunistic groundwater sample collection point. Note Cambrian Sandstone is not shown on Figure 8.	Noted. No action. These comments will be considered as we develop our integrated site understanding documents.	Noted. The PRT has identified the integration of the data reports has yet to be addressed.
8	Section 3.3	First paragraph says conductor casing was not cemented in place. How was the overburden sealed from the bedrock? In the second paragraph it says the casings were fully cemented between the casing and the borehole wall or between any two casings. Please clarify.	Conductor casing was driven/spun into bedrock, therefore did not require cementing. This is best practice if bedrock is competent, such as was this case here. All other casings were cemented. This is addressed in the BH02-WP02 report.	Comment satisfactorily addressed.
9	Section 3.3.2	Define the purpose of the MNR Class 1 Examiner. Why was an MNR Class 1 Examiner needed since there was no requirement for a OGSR permit?	Although no OGSR permit was required, NWMO utilized a MNR Class 1 Examiner to ensure that NWMO was following best practices used by companies requiring OGSR permits.	Comment satisfactorily addressed.

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
10	Section 3.3.3	Did Geofirma monitor the surrounding shallow bedrock wells to observe potential influences from cement plug #1? It's unlikely that there would be much influence. Many water supply wells in the area are completed within the shallow bedrock. It would be a good addition to state that there were no negative influences related to the significant loss of cement.	The monitoring well was monitored throughout the duration of drilling and no negative impacts due to cementing were evident.	Comment satisfactorily addressed.
11	Section 3.3.3	Second paragraph indicates no returns to surface were observed during injection, but last sentence indicates two grout samples were taken of grout returned to surface. Please clarify.	There was no return during the injection however, during displacement with freshwater after injection returns were achieved and samples taken at this point.	Comment satisfactorily addressed. Would be beneficial to be clarified in the text.
12	Section 3.3.4	The MRNF Class 1 Examiner is named here, but not previously. Should names be used, and if so, the names should be included for each cementing operation, and the persons affiliation (e.g., Mike Dorland is an independent consultant).	The name will be removed from the future reports (one occurrence was missed).	Comment satisfactorily addressed.
13	Section 3.3.5 and 3.3.6	The interval cemented was described as significantly fractured. Can this be elaborated on, as fractures may be related to the specific formation or an indication of large-scale structures that may interconnect formations. This is especially important due to the large amount of cement used.	It is common for bedrock close to surface to be fractured due to unloading of stress when bedrock above this is eroded. In Canada, this is especially common due to recent de-glaciation of the area as the KM's thick ice sheet retreated. Further discussion on this will be included in the descriptive geoscientific site model report.	This amount of fracturing is unlikely to be related to unloading of stress. It is much more likely to be related to solution collapse or other large-scale structures. The PRT understands assessment and interpretation will be provided in the geoscientific site model report.
14	Section 3.4.1	May want to describe that all repairs were completed in areas with containment. No oils, grease, PHC, etc. were released to the environment.	Noted. No action.	Noted.
15	Section 3.4.3	The drill rig foot clamp as fixed reference datum was also described in Section 2.1.1 as depths below drill rig Kelly Bushing (BKB).	Noted. No action.	Noted. The drill rig foot clamp and Kelly Bushing may be different reference points depending on the style of drill rig.

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
16	Section 3.4.4	Describe the Teeswater Concrete settling pond. Is it approved for use in accepting these types of materials?	Teeswater Concrete is approved to handle disposal of groundwater and have an environmental compliance approval.	Comment satisfactorily addressed.
17	Section 3.6.1	<p><i>“Local Elevation Benchmark #1 as the top of nail in hydro pole behind the house as shown in Figure #”.</i></p> <p><i>“Local Elevation Benchmark #2 as the top of nail on the southwest corner of the existing building (shed) as shown in Figure #.”</i></p> <p>The report does not include a figure that shows the benchmarks.</p>	Noted. Reference to figures will be removed in the next reports.	Noted.
18	Section 3.6.2	Depth of borehole was estimated with cm accuracy by counting rods. It's not going to be significant but was borehole depth adjusted for the deviation from 90 degrees? Reported borehole depth may need to have some uncertainty. Or describe the correction. The maximum reported inclination variation of 1.9 degrees results in a significant depth change over distances of hundreds of metres.	NWMO conducts post-drilling corrections to depths. All depths are calculated as true metres below ground surface (mBGS) using the survey data. This will account for any deviation.	Comment satisfactorily addressed.
19	Section 3.4	Paragraph 4, can a number be provided for <i>“only a couple of samples”</i> .	It will be addressed in the next reports.	Noted.

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
20	Section 4.3, final paragraph	<p>Agreed, the loss of circulation means that fluid loss cannot be a reliable trigger. This may be a good point to describe other triggers used to identify OGW samples. Table 8 in Section 5.0 relies heavily on the loss of drilling fluid as justification for OGW. This is somewhat inconsistent with the statement in Section 4.3.</p> <p>Also raises concerns on how representative OGW samples might be. Need to rely on fluorescein percentages. Will this be discussed in the OGW report? Is this a good spot to reference that report.</p>	Once an OGW is identified, the zone is packered off to isolate it from the rest of the borehole. This allows the zone to be effectively purged. Fluorescein is an industry standard for ensuring representative groundwater samples are captured. Isotopic ratios are also used to ensure that the water retrieved during sampling represents groundwater and not drill water (which has a known, unique isotopic signature).	Comment satisfactorily addressed.
21	Section 5.0	Section needs more description on how zones were chosen to target for OGW sampling. Needs a description of why other zones were not chosen. The section should speak to the absence of groundwater flow zones particularly around the host formation (Cobourg).	Noted. This report is the factual data report but will be considered in future. The justifications for the OGW sampling are provided in the table 8.	Noted.
22	Appendix C	The depths and orientation data could be used to calculate vertical depth BGS, rather than just showing depth down the corehole.	Noted.	Noted.
23	General Comment	Several spelling/grammar mistakes. Common changes of tense from past tense to present tense when describing work completed. Some of these tense changes appear related to using text from work plans or other sources.	Noted.	Noted.

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
24	General Comment	The report appears focused on the deep bedrock geology; however, the public is going to also be focused on the shallow bedrock and overburden where potable/fresh water is found/taken from. More focus should be given to the shallow bedrock interval.	Noted. This is a factual data report for WP02 in the deep borehole. The shallow bedrock is described in detail in the WP03 reports. We have also completed installation of shallow groundwater monitoring wells and are monitoring these on an on-going basis. This will be used to complement the deep borehole data.	Noted. The PRT understands the assessment of the shallow groundwater zone and corresponding monitoring data will be provided in future reports.

3.4 WP03 Geological and Core Logging Report for SB_BH01

The PRT understands the objective of this report is to describe the activities associated core description, photography, and a summary of the geologic logging for SB_BH01. Overall, the PRT found the report to be of good quality with few concerns in regard to the quality of the report or the factual statements and data presented within.

The PRT provides the following comments (**Table 4**) on the report that request clarity and to ensure accuracy within the report. Several of the comments are related to potentially improving the understanding of the report by the public or non-technical reviewers.

Comments 13 and 15 are related to the interpretation of the presence of a fault within the geologic sequence in the lower part of the Guelph Formation. The use of the term “brittle deformation structures” alludes to the potential for movement along faults that would potentially cross-cut formations.

Table 4 Comment Disposition Table - WP03 Geological and Core Logging Report for SB_BH01 (APM-REP-01332-0330) (September 15, 2022)

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
1	Section 1.1, paragraph 3	Similar to WP02 (see Table 3), uncertainty (+/-) may need to be added to the borehole depths in this report.	Noted. No action.	Noted.
2	Section 1.3 and Section 2.2	Data was also used to log the presence of salts and/or evaporite layers	Noted. No action.	Noted.
3	Section 3.0	It would be a good addition to add a measure of uncertainty to the depths and totals in this section as well	Noted. No action.	Noted.

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
4	Section 3.1.1	Rock types – a thin ash layer in the Coboconk Fm was mentioned. Is this a rock unit or non-consolidated such as a bentonite or meta-bentonite? Please describe its characteristics. Perhaps describe it as volcanic ash.	This is described in our borehole logging data. It was a volcanic ash layer common to the Coboconk Formation.	Noted.
5	Section 3.1.1	The Salina Group is mentioned as being often brecciated with moderate porosity. This appears to tie into at least some of the cement plugs needed for drilling, and cross-referencing would be useful. Is there a discussion on the source of the brecciation? Is it dissolution/expansion of anhydrite to gypsum, dissolution of salts (halite, sylvite, etc) or is it related to activation of faults? The presence of salts is not mentioned, though the Salina is known to contain evaporites.	There are numerous publications which discuss the Geology of Southern Ontario, including: <i>Armstrong, D.K. and Carter T.R., 2006. An Updated Guide to the Subsurface Paleozoic Stratigraphy of Southern Ontario. Open File Report 6191. Ontario Geological Survey</i> The WP03 report is a factual data report that represents observations in the field and is not intended to include interpretations of the Geology.	Comment satisfactorily addressed.
6	Section 3.1.1	There is no mention of Cambrian Sandstones, but these are referred to in the Drilling report (WP02, Section 3.2.2).	Cambrian Sandstones were not present in this borehole, therefore they are not mentioned in the WP03 report. This was an error in WP02 report.	Comment satisfactorily addressed.
7	Section 3.1.2	Saussuritization – just want to confirm that it is the interpretation that this occurred by the defined process (e.g., hydrothermal alteration), rather than weathering at or near the surface which can also degrade feldspars to a clay-like components. Was there any weathering associated with the uppermost bedrock unit (Lucas Fm)? It might have been evident in cable tool cuttings.	We did not find any definitive evidence of weathering. The Saussuritization is interpreted as hydrothermal alteration within the Precambrian bedrock.	Comment satisfactorily addressed.

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
8	Section 3.1.3	Visible oil may imply recoverable oil to some reviewers. Perhaps describe the presence of visible oil in more detail. There is always a potential for later independent investigations of oil shows to result in drilling to investigate oil shows.	Noted. For clarify, the WP03 report is a factual data report that represents observations in the field and is not intended to include interpretations of the Geology. Interpretations on the economic viability of the geology at the site are not handled as part of this report, but will be discussed in other reports.	Comment satisfactorily addressed.
9	Section 3.1.4	Table 5 and paragraph above it. The table shows thicknesses of strata based on age, with no mention of Cambrian or Precambrian strata. In addition, the paragraph describes the Ordovician shales and Ordovician limestones but makes no mention of overlying Silurian mixed limestone, dolostone and shales, and Devonian limestones. Adding these descriptions would tie it back to Figure 4. The paragraph below Table 5 indicates the Cambrian was not encountered, but WP02 indicates Cambrian was encountered.	There was an error in the WP02 report in section 3.3.4 where Cambrian sandstone is mentioned once – Cambrian was not present and should not have been mentioned there.	Noted.
10	Section 3.1.4.4	Bass Islands unconformity – was there any erosion/weathering associated with this unconformity? An unconformity should potentially be described in more detail as it is a potential significant water-bearing zone.	Yes, there is signs of paleo -erosion of the bass island formation at the contact, however, the contact does not appear to be a large water bearing zone.	Comment satisfactorily addressed.
11	Section 3.1.4.29	The off-gassing of methane alone should be odourless, it is the related hydrocarbons and other gases that provide the hydrocarbon odour, and possibly sour gas odour common with hydrocarbon degassing (plus many other gases usually associated with hydrocarbons). Perhaps just call it degassing of hydrocarbon and related gases.	Noted, no action.	Noted.

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
12	Section 3.1.4.31	Related to the comment for Section 3.1.1, use consistent terms related to the volcanic ash layer, now it is called a clay marker bed.	It is "a thin clay (volcanic ash) marker bed".	Comment satisfactorily addressed, though the PRT notes inconsistent terminology is still being used.
13	Section 3.2.1	<i>"brittle deformation structures"</i> sound like folds and faults. Perhaps refer to these as joints and fractures. In addition, although a summary of logged structures is presented in Figure 6, how they related to the rock type should be described. I note that the Cabot Head, Queenston and Georgian Bay formations (all predominantly shale) have very few joints identified, which indicates a potential for a very good aquitard.	Brittle deformation structures is the correct geological term when referring to joints. This distinguishes them from ductile structures which would indicate movement and a higher degree of strain (like shearing and faulting).	The PRT is not in full agreement. Brittle deformation includes folds, faults, joints, and fractures. Ductile deformation includes shear zones. Stress unloading is a common method of forming joints and fractures, and is a subset of brittle deformation structures. Note further work is required.
14	Section 3.2.3	The percentage of broken structures by depth and "across" Ordovician limestones is mentioned. Add a mention for the shales.	Noted, no action.	Noted.
15	Section 3.2.4, second paragraph	Additional description of why this zone has been interpreted as a fault structure would be beneficial. The presence of faults (potentially regional structures) is a tremendously important point for this project. Is there any way to determine off-set along the fault? There should be cross-referencing to the interpreted seismic reflection study for additional information or add that information to this report. Describing the presence of a fault is very important to the suitability of the Site. It would strengthen the report to include statements on whether or not there were evidence of faults in the target zone.	The zone was described as a fault due to deformation seen in the rock formation. However, these two features are considered small-scale features with the zones only being 20-26cm wide. There are no marker beds to identify offset, however they both show less than 10cm of aperture. Faults of this scale are common place in geology and they do not suggest any larger scale features which would impact the stability of the site.	The PRT is not in full agreement. Faults with visible limited displacement (small scale deformation) still may be laterally extensive and are commonly related to reactivation of deeper structures. Note further work is required.
16	Section 4	Fourth bullet – degassing of methane, perhaps it should say hydrocarbon and related gases.	Noted, no action.	Noted.

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
17	Appendix B	Suggest that Logged Structures column angle have a note that it is degrees from the core axis not degrees from horizontal. I recognize that the core logging manual indicates angle from core axis (which is also not from vertical due to borehole deviation), but many people would view it as angle from horizontal. A stereonet of fracture orientations could be useful to interpretation.	Noted, no action.	Noted.

3.5 WP01A Site Construction Report for SB_BH02

The PRT understands the objective of this report is to present a description of the Site preparation and construction activities related to preparing the area for the drilling of SB_BH02.

Overall, the PRT found the report to be of good quality with little concerns in regard to the quality of the report or the factual statements and data presented within. Comments are provided in **Table 5**. Comment 2 is provided to request clarity with respect to handling of potentially impacted soils and spill pads.

Table 5 Comment Disposition Table - WP01A Site Construction Report for SB_BH02 (APM-REP-01332-0327) (November 7, 2022)

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
1	Section 1.3.2	<p><i>“The drill pad will remain in Geofirma custody until the end of drilling and testing activities.”</i></p> <p>Hasn't drilling/testing been completed?</p>	<p>Sites have been returned to NWMO C/C and C after completion of field program.</p> <p>At the time of writing of this report, the drilling and testing work was still on going.</p>	Comment satisfactorily addressed.
2	Section 2.9	<p><i>“All hydrocarbon sheens and impacted soils were immediately remediated by Geofirma personnel using absorbent pads and hand tools.”</i></p> <p>Were the impacted soils removed for off-Site disposal? Please expand on the remediation.</p>	<p>During the field program all impacted material was retained and disposed of off site at a licenced facility.</p> <p>Pre work sampling was undertaken across the sites to establish baseline.</p> <p>Post demobilisation sampling was undertaken across the sites and all samples were below the Table 2 Residential/Parkland/Institutional Property Use standards (Soil, ground water and sediment standards for use under Part XV.1 of the Environmental Protection Act).</p>	Comment satisfactorily addressed.
3		<p>Same comment regarding the <i>“drilling cellar”</i> sealing.</p>	<p>See response above.</p>	Comment satisfactorily addressed.

3.6 WP01B Site Commissioning Report for SB_BH02

The PRT understands the objective of this report is to present a description of the Site preparation activities related to Site layout (e.g., equipment, trailers, washrooms, supplies), the handling and storage of fuel and chemicals, and the management of solid and liquid waste for the drilling of SB_BH02. Comments are provided in **Table 6**. The PRT notes that the work plan was unavailable for review.

Table 6 Comment Disposition Table - WP01B Site Commissioning Report for SB_BH02 (APM-REP-01332-0328) (August 15, 2022)

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
1	Section 1.3.2	There is an inconsistency between WP01A and WP01B. WP01A states care and control was transferred to Geofirma for four days on November 17, 2020	Noted.	Noted.
2	Section 1.3.2	<i>“The drill pad will remain in Geofirma custody until the end of drilling and testing activities.”</i> Hasn't drilling/testing been completed?	Sites have been returned to NWMO C/C and C after completion of field program. At the time of writing of this report, the drilling and testing work was still on going.	Comment satisfactorily addressed.
3	General comment	WP01 was not available to review. The PRT cannot compare to see if work package was followed.	Noted.	Noted.

3.7 WP03 Geological and Core Logging Report for SB_BH02

The PRT understands the objective of this report is to describe the activities associated core description, photography, and a summary of the geologic logging for SB_BH02. Overall, the PRT found the report to be of good quality with few concerns in regard to the quality of the report or the factual statements and data presented within.

The PRT provides the following comments (**Table 7**) on the report that request clarity and to ensure accuracy within the report. Several of the comments are related to potentially improving the understanding of the report by the public or non-technical reviewers.

Comments 3 and 6 are related to the interpretation of the presence of several faults within the geologic sequence in the Bass Islands, Bois Blanc, and Amherstburg Formations.

Table 7 Comment Disposition Table - WP03 Geological and Core Logging Report for SB_BH02 (APM-REP-01332-0335) (November 9, 2022)

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
1	Section 3	Uncertainty (+/-) may need to be added to the borehole depths in this report.	Noted, no action.	Noted.
2	Section 1.3 and Section 2.2	Data was also used to log the presence of salts and/or evaporite layers	Noted, no action.	Noted.
3	Section 3.2.4, second paragraph	Again, the presences of faults is tremendously important to this project. It would strengthen the report to include statements on whether or not there were evidence of faults in the target zone.	See comment above for BH01 report. All faults in BH02 were observed in the shallow bedrock <180m deep. The faults observed in BH02 were minor as was the case in BH01, with the largest having a width of approx. 11cm. No apparent aperture was observed on any of these faults. One fault showed an offset of <1cm.	The PRT is not in full agreement. Fault width/aperture is not a measure of fault lateral and vertical dimensions. Note further work is required.
4	Various	Most of the comments from SB-BH01 review will apply here and are not repeated.	Noted, no action.	Noted.
5		Was there any Cambrian sandstone present? (it was referred to as being present at SB_BH01 [WP02]). Was there any weathering at the top of the Lucas (it might have been identified in cuttings from cable tool drilling)	No Cambrian present. The Lucas has been weathered significantly in this area and, as a result, only 50m of the Lucas was present, while the Lucas can be up to 90m thick.	The PRT notes that the NWMO comment regarding WP03 Geological and Core Logging Report for SB_BH01 for weathering of the Lucas Formation indicated no weathering was noted. At SB_BH02, NWMO indicates that the Lucas has been weathered significantly. Given the small distance between the two investigation sites, the descriptions appear inconsistent.

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
6	Section 3.2.1	<p>The presence of 5 faults in the upper Silurian and Devonian sequence is of potential concern, and needs further discussion and cross-referencing to that area of discussion. Although these very small displacement faults may be related to solution and collapse of underlying Salina Formation bedrock, the potential for multi-formation cross-cutting faults to be present exists and needs to be considered.</p>	<p>The faults observed in BH02 are all very minor features, with a maximum width of approximately 11cm. None of these faults displayed an apparent aperture and only one fault showed signs of displacement (<1cm). Small scale faults like this are very common and do not suggest that there are any large scale features in the area. Thus, we do not believe that these faults would have an impact on the stability of the host-rock. Furthermore, all of these faults are isolated to the shallow bedrock (<180m).</p>	<p>As noted for NWMO responses to other PRT comments regarding faults, fault thickness and apparent displacement are not always good indicators of the lateral and vertical extent of the structure. The PRT notes that further work is required.</p>
7	Appendix B	<p>The Bass Islands appears to have a significant number of fractures/joints. Additional discussion is warranted.</p> <p>Bass Islands unconformity – was there any erosion/weathering associated with this unconformity? An unconformity should potentially be described in more detail as it is a potential significant water-bearing zone.</p>	<p>There are minor signs of a paleo-erosional unconformity, however the contact is intact and does not have any fracturing present.</p> <p>The intention of this report is to state observation and not to interpret the geology. Interpretations of the geology will be conducted by the NWMO at a later point.</p>	<p>Comment satisfactorily addressed.</p>



Memorandum

05 December 2023 – updated 12 February 2024

To	Dave Rushton/Steven Travale, Municipality of South Bruce		
Copy to	Sarah Hirschorn/Jeff Marshall/Michael Pahor/Geoff Crann, NWMO		
From	Brad Trytten, Allan Molenhuis, Greg Ferraro and Jennifer Son/AD/mma	Tel	+1 519 884 0510
Subject	March 2023 Geoscience Reports – Peer Review Comments	Project no.	11224152-MEM-49

1. Introduction

This memo provides the Municipality of South Bruce (South Bruce) peer review team's (PRT) comments on seven factual reports prepared by Geofirma Engineering (Geofirma), Nanometrics, and Nuclear Waste Management Organization (NWMO) for South Bruce's 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 and their consultants (Geofirma/Nanometrics) by GHD Limited (GHD) as per the peer review protocol process.

The following reports were reviewed as part of the peer review process:

- 3D Geological Model for South Bruce and Surrounding Region: Model Version 1.0 (APM-REP-01332-0379) (NWMO; November 2022)
- A Petroleum Resources Assessment of the Huron Domain Area, Southern Ontario (NWMO-TR-2019-20) (NWMO; December 2019; revised August 2021)
- Groundwater Monitoring Well Network Installation in the South Bruce Area, Project Demobilization Report for Groundwater Monitoring Well Network Installation (APM-REP-01332-0361) (Geofirma; March 7, 2023)
- Phase 2 Initial Borehole Drilling and Testing, South Bruce Area, WP10 Geological Integration Report for Borehole SB_BH01 (APM-REP-01332-0326) (NWMO; October 2022)
- Phase 2 Initial Borehole Drilling and Testing, South Bruce, WP02 Data Report for Borehole Drilling and Coring at SB_BH02 (AMP-REP_01332-0329) (Geofirma; February 1, 2023)
- Phase 2 Initial Borehole Drilling and Testing, South Bruce, WP13 Technical Report for Monitoring Well (SB_MW01) Installation at SB_BH02 (APM-REP-01332-0313) (Geofirma; February 1, 2022)
- South Bruce Area Microseismic Monitoring Project, Annual Event Summary Report (November 2021 – December 2022) (APM-REP-01332-0381) (Nanometrics; January 24, 2023)

2. Peer review approach

The PRT's review of the Reports was carried out by GHD (Subject Matter Expert [SME] and Lead Consultant). 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, the PRT for the reports reviewed included Subject Matter Experts (SMEs) Brad Trytten and Allan Molenhuis and GHD Lead Consultants Jennifer Son and Greg Ferraro. The peer reviews were conducted having the following questions in mind:

- Are there any significant concerns, issues, and/or omissions in the documentation?
- What are our initial observations/impressions on the quality of the documentation?
- Are the baseline findings interpreted and presented in a clear and understandable manner?
- Does the documentation reflect the most current information?
- Does the information contribute to developing the Conceptual Site Model (CSM)?

3. Peer review comments

The PRT has provided a brief statement on the objective of each the reports reviewed followed by review comments. Comments have been listed in a comment disposition table to provide South Bruce a better understanding of the geoscience study work, how the work was carried out, and how the study work contributes to characterizing the geologic and hydrogeologic setting for the Project site. The comments are also provided to the NWMO for their consideration in advancing the geoscience study work.

The PRT understands that the geoscience work being carried out by the NWMO will be used to determine and build the confidence in safety and evaluate the Project Site as a potential host for the deep geologic repository (DGR). The PRT understands that the factual geoscience reports will be provided to the public. We note that there are a number of reports yet to be received and/or reviewed that will provide additional pertinent information in characterizing the geophysical setting and building the confidence in safety.

The PRT provides the following general comments following our review of the seven factual reports listed above:

- It would help the general public understand the contents of these reports if each report included a list of terminology (terms and abbreviations). The terminology would include brief descriptions of key geoscience concepts. This would be similar to Section 2.1.1 in report APM-REP-01332-0326 where lithographic terminology is described. Description of terminology would be particularly useful in understanding the Petroleum Assessment and Microseismic Monitoring reports.
- One of the key aspects to the understanding of the Project Site's physical setting is gaining knowledge on the hydraulic conductivity of the various Paleozoic formations, along with the piezometric heads.

3.1 3D Geological Model for South Bruce and Surrounding Region Report

The PRT understands the objective of this report is to present a site-scale 3D geologic model for South Bruce and surrounding region which can be used as a tool to evaluate the Project Site as a potential host for the deep geologic repository. The South Bruce 3D geologic model will form the basis for developing the conceptual site model for the Project Site.

Overall, the PRT found the report to be of good quality with little concerns in regard to the quality of the report or the factual statements and data presented within. Comments are presented in **Table 1**. Comments 1 and 2 are generally minor but would improve the quality of the report. Comment 3 is provided to add clarity and to ensure accuracy within the report.

Table 1 Comment Disposition Table - 3D Geological Model for South Bruce and Surrounding Region: Model Version 1.0 (APM-REP-01332-0379) (NWMO; November 2022)

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
1	Section 4.1	Control wells – not well defined. Perhaps list as control points, ghost points, or define as imaginary boreholes with stratigraphy contacts assigned based on the GSC model.	Noted. In future reports, NWMO will provide a better definition of what control wells are.	Noted. Future reports should clarify what control wells are.
2	Figure 16	Use of an odd map scale (1:108585) is difficult to use or understand. The use of a km based bar scale as in other maps is much more useful for understanding.	Noted. In future, NWMO will consider using a more standardized scale or provide a scale bar.	Noted.
3	Section 4.5.5	It is unclear whether the regional unconformity referred to that causes the thickness of Devonian formations to be different is between the OPG-DGR area and the Site (27.1 m), or between SB_BH01 and SB_BH02 (40.9 m).	The regional unconformity referred to in this section is inferred to occur at the base of the Quaternary overburden across Southern Ontario. The unconformity leads to local variation in formation thicknesses in the entire region and can result in differences from modelled thicknesses.	The PRT is not in full agreement. The NWMO response did not clarify whether the regional unconformity was between SB_BH01 and SB_BH02 or between OPG-DGR area and the Site, or both.

3.2 A Petroleum Resources Assessment of the Huron Domain Area, Southern Ontario Report

The PRT understands the objective of this report is to present an assessment of oil and gas resources in the region based on available data. Overall, the PRT found the report to be technically sound and of good quality but found that the report lacked focus on the study area. Comments are provided in **Table 2**.

Table 2 Comment Disposition Table - A Petroleum Resources Assessment of the Huron Domain Area, Southern Ontario (NWMO-TR-2019-20) (NWMO; December 2019; revised August 2021)

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
1	General	Although the authors conclude limited potential for future oil and gas plays in the Study Area, this conclusion could perhaps be more strongly worded/described in relation to the proposed NWMO facility.	Noted. We believe the current wording provides a balance of acknowledging the presence of minor amounts of hydrocarbons, while highlighting that it would not be economically feasible to extract.	Comment satisfactorily addressed; however, the PRT believes that stronger wording between “minor amounts of hydrocarbons” and the potential for future oil and gas plays would benefit a future report.
2	General	The assessment uses a number of published data sets/reports. Will this be updated to reflect data collected at SB_BH01 and SB_BH02?	This report was prepared using the available data at the time of publication. NWMO does not plan on revising this report.	Noted.

3.3 Groundwater Monitoring Well Network Installation in the South Bruce Area, Project Demobilization Report for Groundwater Monitoring Well Network Installation

The PRT understands the objective of this report is to describe drilling, installation, and testing of the monitoring well network surrounding the deep boreholes. No test results were provided in this report. Overall, the PRT found the report to be of good quality with little concerns in regard to the quality of the report or the factual statements and data presented within. Comments are provided in **Table 3**. Comment 1, below, is provided to improve clarity and understanding for the reader. Comments 2 and 3 are made in regards to missing or potentially erroneous information and should be addressed by NWMO.

Table 3 Comment Disposition Table - Groundwater Monitoring Well Network Installation in the South Bruce Area, Project Demobilization Report for Groundwater Monitoring Well Network Installation (APM-REP-01332-0361) (Geofirma; March 7, 2023)

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
1	Figure 1	It would be beneficial to identify the outline of the proposed Site, and the location of the two deep bedrock boreholes to provide geographic reference to the locations of the monitoring wells shown on the figure	Noted. Adding an outline of the proposed site will be taken into account for future reports. As this project was a separate study to the deep borehole drilling project, the information from the deep boreholes was not included.	Noted. As these wells were installed as part of the overall NWMO Site investigation for the proposed DGR, showing the outline of the property for the DGR would be beneficial.
2	Appendix A	Photographs of well completions is missing the well completion for SB_MW09.	Noted. The report will be revised to include photographs of the well completion of SB_MW09.	Comment satisfactorily addressed.
3	Section 2.3	A reference to SB_MW01 is made in this section but this well nest is not shown on the figures, not included in the photos and isn't discussed elsewhere. Please describe MW01 or if the numbering started at MW02. Similar comment about SB_MW08. Was there an MW08?	SB_MW01 is a monitoring well that was installed as part of the deep borehole drilling and testing project. Therefore, it was not included in the scope of this report. SB_MW08 was a potential well site that was not chosen to be drilled.	Noted. Recommend current report clarify SB_MW01 and SB_MW08.

3.4 Phase 2 Initial Borehole Drilling and Testing, South Bruce Area, WP10 Geological Integration Report for Borehole SB_BH01

The PRT understands the objective of this report is to evaluate relevant core logging observations and the geophysical well log to provide an analysis of the stratigraphic formation intersected in SB_BH01. Overall, the PRT found the report to be of good quality. Comments are provided in **Table 4**. Comment 1, below, is provided to correct a minor error. The PRT recognizes that the report is meant to be factual presentation of the stratigraphy in SB_BH01; however, Comment 2 is suggested to provide some additional context for and clarity in the report.

Table 4 Comment Disposition Table - Phase 2 Initial Borehole Drilling and Testing, South Bruce Area, WP10 Geological Integration Report for Borehole SB_BH01 (APM-REP-01332-0326) (NWMO; October 2022)

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
1	Figure 3	Y-axis scale should be in metres, not kilometres.	Noted. NWMO will consider this for future reports.	Noted. Recommend current report be corrected.
2	Section 4.2	The uncertainty related to the local presence/absence of Cambrian Sandstones and the related potential for overpressure and artesian flow is stated. However, the potential impact on the proposed DGR is not described. Whether the presence of Cambrian Sandstone and related overpressures could present a concern for the proposed DGR should be mentioned.	This is out of scope of this single borehole report. This will be discussed in other NWMO reports.	Noted. A simple comment that the uncertainty will be addressed during additional Site investigation activities, if the proposed DGR undergoes additional testing would clarify the current report.

3.5 Phase 2 Initial Borehole Drilling and Testing, South Bruce, WP02 Data Report for Borehole Drilling and Coring at SB_BH02

The PRT understands the objective of this report is to describe the activities associated with the drilling, coring, and casing for borehole SB_BH02. GHD has previously provided a number of comments while reviewing reporting on SB_BH01 (see GHD’s Memo-41 dated 20-January 2023). Many of the comments made in Memo-41 should be referenced as they apply to this report and would improve clarity. The PRT provides the following comments (Table 5) on the report.

Table 5 Comment Disposition Table - Phase 2 Initial Borehole Drilling and Testing, South Bruce, WP02 Data Report for Borehole Drilling and Coring at SB_BH02 (AMP-REP-01332-0329) (Geofirma; February 1, 2023)

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
1	Figure 2	The figure shows coring continued until March 22, 2022, but doesn’t show the final geophysics and OGW. For clarity, this should be added. The figure is missing the hydraulic testing as well.	This report focuses on the sequence of activities during Drilling and Coring activities and does not include borehole testing (geophysics & hydraulic testing), which happened after the completion of drilling and coring activities. The two events shown for geophysical logging were 1) for the first 200m before installation of the production casing and 2) running an ATV log as part of borehole troubleshooting. Both of these happened while drilling activities were on-	Comment satisfactorily addressed.

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
			going and are therefore part of the scope of this report. The location of OGW's are provided in the figure.	
2	Figure 8	It would be beneficial breaking this into two figures, one for the 0 depth to Salina Unit F, and one for the complete sequence. That way, additional details related to cementing the casings and the way the casings are nested can be presented. Also define OGW.	The figure is intended to provide an overview of the entire casing program for the borehole. NWMO will consider creating additional figures that are focused on the upper bedrock formations in future reports. Section 5 provides information on what OGW's represent. This is further elaborated on in the WP07 report.	Noted.

3.6 Phase 2 Initial Borehole Drilling and Testing, South Bruce, WP13 Technical Report for Monitoring Well (SB_MW01) Installation at SB_BH02

The PRT understands the objective of this report is to provide a detailed summary of the field activities and results from the well installation and sampling program associated with monitoring well nest SB_MW01/02. The PRT provides the following comments (Table 6) to improve the accuracy and clarity of the report.

Table 6 Comment Disposition Table - Phase 2 Initial Borehole Drilling and Testing, South Bruce, WP13 Technical Report for Monitoring Well (SB_MW01) Installation at SB_BH02 (APM-REP-01332-0313) (Geofirma; February 1, 2022)

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
1	Title Page	Title Page indicates report is for a single well installation (SB_MW01) at the SB_BH-2 location. Table of contents and text indicate two monitoring wells installed in a well nest. It would be beneficial for the title to reflect that it is a well nest.	SB_MW01 refers to a single well site (comprised of an overburden and a bedrock well). This is the approach NWMO applied to all monitoring wells. An explanation of this is provided in the body of the report.	Comment satisfactorily addressed.
2	Section 1.2	Section should specify that the objective is monitoring shallow groundwater quality. Presuming the focus is on shallow bedrock	The objective is stated in the first bullet point. The aim is to monitor any potential impact on groundwater level and quality. This includes,	Comment satisfactorily addressed.

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
		and overburden where residents source their water.	but is not limited to, monitoring any potential impact on the local residents' wells.	
3	Section 3.3.2	Detections of BTEX should be very uncommon in this setting. Could the detections of BTEX be related to gasoline powered equipment used for well purging and/or sampling?	This factual report does not include speculation on the source of the results. It is important to note that all gasoline powered equipment for the well purging and sampling was operated (and refueled) in secondary containment, and no releases to the ground as part of this work occurred.	Noted. The PRT advises that detections of BTEX are common from the exhaust of gasoline powered equipment, if the engine location was close to the sampling location, regardless of where the engines were operated and refueled.
4	Appendix B	It would be beneficial to add a date to the water levels shown on the logs to avoid potential confusion in the future.	The date of the water level is the same as the date of completion, which is indicated on the image.	Comment satisfactorily addressed. The PRT notes that water levels collected at the time of drilling are not representative of static conditions.
5	Appendix B	The sample intervals do not correspond with the bottoms of the well log graphics (e.g., the bottom of MW01-1 shows a transition from till to sand but no sample was collected). Please confirm.	No sample was recovered from this interval (plugged split spoon) but drilling indicators showed that lithology changed from sand to till at this depth.	Comment satisfactorily addressed.
6	Appendix B	The borehole/well completion diagram for MW01-1 indicates the "borehole was terminated at a total depth of 7.92 m BGS", however, the graphic for the borehole log, soil descriptions, and the presence of bentonite fill beneath the screened interval all indicate a termination depth of 12.6 m BGS.	Noted. The report has been revised accordingly.	Comment satisfactorily addressed.
7	Appendix D, Table D1.2	The AO for iron (300 ug/L) was exceeded for sample SB_MW01-02 (490 ug/L) and exceeded the listed AO for manganese as well. Several of the MAC and/or AO criteria may be incorrect, including for manganese.	The report has been revised to include the most recent MAC and AO values reported in O.Reg 163/09. Exceedances of both MAC and AO values have been identified in the revised report.	Comment satisfactorily addressed.
8	Appendix D, Table D1.3	ODWS MAC exist for Alachlor, Atrazine, Bromoxynil and many other Semi-Volatile Organics.	The report has been revised to include the most recent MAC and AO values reported in O.Reg 163/09.	Comment satisfactorily addressed.
9	Appendix D, Table D1.4	Benzene criteria appears incorrect.	The report has been revised to include the most recent MAC and AO values reported in O.Reg 163/09.	Comment satisfactorily addressed.

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
10	Appendix D, Table D1.5	PCBs have an associated ODWS MAC criterion. Azinphos-methyl also has a MAC criterion.	The report has been revised to include the most recent MAC and AO values reported in O.Reg 163/09.	Comment satisfactorily addressed.

3.7 South Bruce Area Microseismic Monitoring Project, Annual Event Summary Report

The PRT understands the objective of this report is to describe the installation of a network of seismic sensors and continuous earthquake monitoring activity with the region surrounding the South Bruce site. The PRT found many of the in-text figures included in this report could be improved for clarity. Inclusion of legends and less detailed UTM coordinates on maps would improve clarity on many of the figures. The following comments (**Table 7**) are made to improve the quality of the report and ensure accuracy and clarity with sufficient detail to support the interpretation of the data.

Table 7 Comment Disposition Table - South Bruce Area Microseismic Monitoring Project, Annual Event Summary Report (November 2021 – December 2022) (APM-REP-01332-0381) (Nanometrics; January 24, 2023)

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
1	Section 4	This section notes that the majority of seismic events are false positives with upticks due to high wind. This argument would be strengthened with a plot of wind or weather events versus number of seismic events.	Noted. This will be included in the next annual report.	Noted.
2	Figure 5	Orange shaded box described in figure caption is difficult to see. The red square is also difficult to see given that the orange shaded box is over top of the red square. The figure is missing a legend, scale, and north arrow.	Legend, scale and north arrow will be added in the next annual report.	Noted. The PRT notes that the current version of the report could readily be revised for clarity.
3	Section 5	Suggested that velocity model be compared to stratigraphic model.	This is a coarse velocity model with much lower resolution of the stratigraphic model, and thus, a comparison is not feasible.	Noted.
4	Figure 7	Note that the cluster of events to the northeast of the AOI is associated with multiple quarry blasts, not a singular quarry blast and suggest renaming the figure for clarity.	Noted. This will be considered for the next annual report.	Noted.
5	Figure 7 and Table 4	Table 4 shows 12 events related to quarry blasting. The local magnitude ranges from	These events are confirmed anthropogenic (human induced, not natural) events.	Noted. The PRT notes that Figure 7 should have an additional legend symbol and show

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
		<p>0.98 to 1.9. Figure 7 shows four events with a local magnitude of 1.0 to <1.5.</p> <p>The ML in Figure 7 does not go high enough to cover the MLs reported.</p> <p>The report would benefit from a zoomed in Figure 7 that focuses on the area to the northeast and clearly shows the blasts and magnitude.</p>	<p>Zooming in on these events would emphasize the importance of these event, which is not the intended focus of the report.</p>	<p>the location of events with a local magnitude of >1.5 since four of these events are listed in the table.</p>
6	Section 7	<p>A sentence to correlate the CHIS data with data collected by Nanometrics is needed.</p>	<p>Comparing all the events between Nanometric and CHIS database it out of scope of this project/report. The reason CHIS is referenced in section 7, is to identify the anthropogenic blasts as these are reported on in the CHIS database and can thus be treated as such within this report.</p>	<p>Comment satisfactorily addressed.</p>
7	Figure 10	<p>The northing and eastings scale would speak more clearly to uncertainty with distance if the Site was set to 0,0 m similar to Figure 11.</p>	<p>This will be implemented in the next annual report.</p>	<p>Noted.</p>
8	References	<p>Many references are related to northern Ontario. References that may be a carry over from the Ignace area should be removed.</p>	<p>This will be implemented in the next annual report.</p>	<p>Noted. Comment satisfactorily addressed.</p>



Memorandum

05 December 2023 – updated 12 February 2024, updated March 1, 2024

To	Dave Rushton/Steven Travale, Municipality of South Bruce		
Copy to	Sarah Hirschorn/Jeff Marshall/Michael Pahor/Geoff Crann, NWMO		
From	Brad Trytten, Allan Molenhuis, Jennifer Son and Greg Ferraro/AD/mma	Tel	+1 519 884 0510
Subject	July 2023 Geoscience Reports – Peer Review Comments	Project no.	11224152-MEM-59

1. Introduction

This memo provides the Municipality of South Bruce (South Bruce) peer review team's (PRT) comments on seven reports prepared by Geofirma Engineering (Geofirma), Cambium Consulting & Engineering (Cambium), and Nuclear Waste Management Organization (NWMO). The seven reports were received and made available for peer review on July 24, 2023.

The peer review comments are provided for South Bruce's consideration and internal circulation. As per the South Bruce Nuclear Exploration Project peer review protocol process, the memo will be submitted to the NWMO and their consultants (Geofirma/Cambium) by GHD Limited (GHD). This memo includes the results of the peer review on the following reports:

- Phase 2 Initial Borehole Drilling and Testing, South Bruce, WP04G Data Report: Organic Geochemistry and Clay Mineralogy for SB_BH01 Revision: 2 (APM-REP-01332-0321) (Geofirma; June 19, 2023)
- Phase 2 Initial Borehole Drilling and Testing, South Bruce, WP06: Hydraulic Testing Summary Report for SB_BH01, Revision: 0 (Final) (APM-REP-01332-0323) (Geofirma; July 5, 2023)
- Phase 2 Initial Borehole Drilling and Testing, South Bruce, WP09: Data Report for Westbay MP55 Multi-Level Groundwater Monitoring System Installation at SB_BH01, Revision: 0 (Final) (APM-REP-01332-0325) (Geofirma; July 4, 2023)
- Phase 2 Initial Borehole Drilling and Testing, South Bruce, WP08 Data Report: Temporary Well Sealing for SB_BH02, Revision: 0 (Final) (APM-REP-01332-0338) (Geofirma; June 20, 2023)
- Shallow Groundwater Monitoring Well Network Installation at the South Bruce Site, Project Data Report for Shallow Groundwater Monitoring Well Network Installation Revision: 3 (Final) (APM-REP-01332-0360) (Geofirma; July 5, 2023)
- Phase 2 Initial Borehole Drilling and Testing, South Bruce, Dust, Noise, and Vibration Background Study for SB_BH01 and SB_BH02 sites, in South Bruce, Revision: 0 (APM-REP-01332-0428) (Cambium; January 13, 2021)

2. Peer review approach

The peer review of the Reports was carried out by GHD's Peer Review Team (PRT). 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, the PRT for the reports reviewed included Subject Matter Experts (SMEs) Brad Trytten and Allan Molenhuis and GHD Lead Consultants Jennifer Son and Greg Ferraro. The peer reviews were conducted having the following questions in mind:

- Are there any significant concerns, issues, and/or omissions in the documentation?
- What are the PRT's initial observations/impressions on the quality of the documentation?
- Are the baseline findings interpreted and presented in a clear and understandable manner?
- Does the documentation reflect the most current information?
- Does the information contribute to developing the Conceptual Site Model (CSM)?

3. Peer review comments

The PRT has provided below a brief summary of each report followed by comments listed in a comment disposition table. The comment disposition table lists the PRT's initial peer review comments on the individual reports reviewed. The comments are intended to provide South Bruce a better understanding of the geoscience study work, how the work was carried out, and how the study work contributes to characterizing the geologic and hydrogeologic setting for the Project site. The comments are also provided to the NWMO for their consideration in advancing the geoscience study work.

As the reports have been received for peer review on an intermittent basis and provide technical data on individual components of the geoscience study program, the PRT has not commented on the sufficiency of the geoscience program as a whole in characterizing the geologic and hydrogeologic setting for the Project site. In general, the comments provided below identify minor inconsistencies in the reports and sections that may benefit from additional discussion where details are missing or not fully discussed. The PRT also identified potential deficiencies in field procedures related to the installation of certain monitoring wells. These potential deficiencies may have resulted in non-representative hydrogeologic data. Discussions with NWMO have indicated that the deficiencies were related to information presentation rather than field procedures as described in **Section 3.5**.

GHD understands that these factual reports will be provided to the public. It would help the general public to better understand the contents of these reports if each report included a list of terminology (terms and abbreviations). The terminology should include brief descriptions of key geoscience concepts. This would be similar to Section 2.1.1 in report APM-REP-01332-0326 where lithographic terminology is described.

Key to the understanding of the geologic and hydrogeologic setting is the understanding of the hydraulic conductivity of the various Paleozoic formations between the DGR and the shallow potable groundwater aquifers, along with the piezometric heads for these formations. It is understood that there are a number of technical reports not yet made available for peer review that provide important data including:

- Geophysical well logging
- Hydraulic Testing for SB_BH02
- Opportunistic Groundwater Sampling Results
- Laboratory geomechanical and thermal testing
- Porewater extraction and analysis and petrographic analysis
- Organic geochemistry and mineralogy for SB_BH02

Outstanding information pertaining to building the 3D Geoscientific Model includes at this this time:

- The 3D seismic reflection report
- Descriptive Geoscientific Site Model (DGSM) report

3.1 Phase 2 Initial Borehole Drilling and Testing, South Bruce, WP04G Data Report: Organic Geochemistry and Clay Mineralogy for SB_BH01

The objective of this report is to present the total organic carbon (TOC) content, the thermal maturity of the oil and gas-related organic carbon content, and the clay mineralogy of selected bedrock samples.

Overall, the PRT found the report to be of good quality with little concerns in regard to the quality of the report or the factual statements and data presented within. Comments below (**Table 1**) are generally minor but would improve the quality of the report.

Table 1 Comment Disposition Table – Phase 2 Initial Borehole Drilling and Testing, South Bruce, WP04G Data Report: Organic Geochemistry and Clay Mineralogy for SB_BH01 Revision: 2 (APM-REP-01332-0321) (Geofirma; June 19, 2023)

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
1	Section 2.3	Minor comment – sentence above Table 1 “S1 defines the acronyms...” I think the acronym “S1” refers to and should be replaced by the words Table 2.	Noted. The report will be update accordingly.	Comment satisfactorily addressed.
2	Section 3.1	The results of the TOC and Rock-Eval Pyrolysis are provided. However, additional context and explanation would be useful to relate these results to producing oil and gas bearing strata in southwestern Ontario. It is noted that a brief summary describing the maturity and TOC content and probability of oil production is presented in Section 5 Conclusions.	This will be considered for future reports on organic geochemistry.	Noted.
3	Section 3.1	It would be helpful to indicate the depth interval of the proposed DGR and how that relates to the testing completed.	This is a factual report on the full stratigraphy present at SB_BH01 and thus, an emphasis is not placed on the repository depth. The results of this report will be incorporated into the integrated understanding of the site.	Comment satisfactorily addressed.
4	Section 3.1.1	Hydrogen Index ratios indicate the derivation of organic matter (terrestrial vs marine) is described. But the data provided for SB_BH01 has no indication of the source matter. The kerogen type is not an indication necessarily of the source matter. These discussions could use additional explanation.	This will be considered for future reports on organic geochemistry.	Noted.
5	Figures 3, 4, 5, 6, 7	The sample ID reference placed with the symbol correlates poorly to the legend, which is based on the geologic formation. The legend should include the sample number for completeness.	There are several sample ID's that may correspond to one formation; hence, they cannot be added to the legend. Improving the correlation between Sample ID and formation will be considered for future reports on organic geochemistry.	Noted.
6	Tables 7	The sample ID and depth could readily be correlated to formation name	Sample ID's, depths and formations are correlated in Table 3.	Comment satisfactorily addressed.

3.2 Phase 2 Initial Borehole Drilling and Testing, South Bruce, WP06: Hydraulic Testing Summary Report for SB_BH01

The objective of this report is to present the hydraulic testing program and results, and initial estimation of formation pressures in very low hydraulic conductivity bedrock that is very slow to respond to hydraulic testing and reaching pressure equilibrium. Comments are provided in **Table 2**.

Overall, the PRT found the report to be technically sound and of very good quality.

Table 2 Comment Disposition Table - Phase 2 Initial Borehole Drilling and Testing, South Bruce, WP06: Hydraulic Testing Summary Report for SB_BH01, Revision: 0 (Final) (APM-REP-01332-0323) (Geofirma; July 5, 2023)

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
1	General	The WP06: Hydraulic Testing Summary Report for SB_BH01 opens with a file name in the pdf of "Ground and Surface Water Monitoring Program Report", even though the report name and contents are the Hydraulic Testing Summary Report	The files metadata has been updated.	Comment satisfactorily addressed.
2	General	X-Y-Z scatter plots may be visually inverted by some people. In some instances, it appears that the image is the inside of a 3D box, then the image changes or other figures appear to show the underside of a transparent 3D box. Perhaps using coloured axes would aid in a better plot. Consider using a 2D plot, where possible. As well, cluttered 3D figures are not informative, e.g., Figures 4.6, 4.7, 4.8, 4.9.	The plots are a derivative of the software used to analyze the results. If options to change the color of axis are provided, NWMO will investigate if this improves visualization. In this instance, a 3D plot is required to display the relationship between three variables. The 3D plots used in figure 4.6-4.9 are useful to see clustering of data or lack thereof. This is best practice used for visualizing hydraulic conductivity datasets.	Noted. The PRT notes that the 3D plot does not meet the objective described.
3	Tables 7.1 to 7.7	These tables could use a depth interval or depth midpoint in the table to relate the results to the depth of the test interval.	This will be considered for future reports on hydraulic testing results.	Noted.

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
4	Tables 7.1 to 7.7	Footnotes explaining anomalous results would be informative. For example, formation pressure in the lower Cobourg and Sherman Fall may be related to actual under pressure or very slow to equilibrate formation pressures. Another example would be skin thickness for the Gasport/Lions Head/Fossil Hill which is much greater than the other tested intervals, or the skin factor for the Guelph, which is orders of magnitude different than the remainder of the tested intervals.	This report is intended to be a factual data report and interpretation of these results is outside of the scope of this report. The results of this report will be incorporated into the integrated understanding of the site, where further interpretation will take place.	Noted. The PRT has not seen this integration of data in any other report reviewed to date.
5	Figure 7.1	This might be the most important figure of this report. It shows the formation hydraulic conductivity, specific storage and adjusted formation pressure. Showing the depth interval of the proposed repository would be useful. A description of what formation under-pressure represents would be very useful. Formation under-pressure strongly relates to the limited ability of water to flow through the rocks, and deserves additional explanation in the context of the proposed DGR.	These reports are designed to show the overall assessment of all formations present in the SB_BH01 borehole. The results of this report will be incorporated into the integrated understanding of the site, where further interpretation will take place.	Noted. The PRT has not seen this integration of data in any other report reviewed to date.

3.3 Phase 2 Initial Borehole Drilling and Testing, South Bruce, WP09: Data Report for Westbay MP55 Multi-Level Groundwater Monitoring System Installation at SB_BH01

The objective of this report is to describe the installation of the Westbay MP55 multi-level monitoring system in SB_BH01. The Westbay system will be used to monitor in-situ groundwater pressures, and potentially to collect groundwater samples from monitored intervals.

Overall, the PRT found the report to be of good quality with little concerns in regards to the quality of the report or the factual statements and data presented within. The comments provided (**Table 3**) would improve the clarity of the information presented.

Table 3 Phase 2 Initial Borehole Drilling and Testing, South Bruce, WP09: Data Report for Westbay MP55 Multi-Level Groundwater Monitoring System Installation at SB_BH01, Revision: 0 (Final) (APM-REP-01332-0325) (Geofirma; July 4, 2023)

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
1	General	The WP09: Data Report for Westbay MP55 Multi-Level Groundwater Monitoring Installation at SB_BH01 opens with a file name in the pdf of "Ground and Surface Water Monitoring Program Report", even though the report name and contents are the Westbay installation.	The files metadata has been updated.	Comment satisfactorily addressed.
2	Figure 3	The pressure profile comparison would be more relevant and better understood if a stratigraphic column and hydrostatic pressure line were included to show what units are under- or over-pressured. In addition, an explanation for the decline in pressures from post-inflation would be useful, particularly as there is a vertical change in pressure profiles at approximately 500 mBGS (base of Queenston shale) and 740 m BGS (approximate Sherman Fall/Kirkfield formation contact).	Noted. This will be considered for future reports on borehole instrumentation.	Noted.
3	General	Variable numbers of monitoring locations are mentioned in Section 1.3, Table 1, Section 3.1. Perhaps more clarity could be provided describing the number of pressure monitoring ports, sample ports, etc. There are apparently 36 measurement ports, including 4 pumping ports and 20 pressure transducers, although Figure 3 shows 36 pressure measurements. It is unclear what the remaining measurement ports are to be used for or how measurements will be collected at these ports.	There are a total of 36 measurement ports. During and post installation, measurements were completed at all 36 measurement ports. A string on 20 transducers was subsequently added to the system, which allows for pressure measurements at 20 out of the 36 ports. Therefore, 16 measurement ports are not actively being used to conduct pressure measurements.	Comment satisfactorily addressed.

3.4 Phase 2 Initial Borehole Drilling and Testing, South Bruce, WP08 Data Report: Temporary Well Sealing for SB_BH02

The objective of this report is to describe the temporary borehole sealing method for SB_BH02. It is noted that this report presented the borehole geophysical logs from WP05 (not yet available to the PRT) and the formation pressures from the Hydraulic Testing program (reviewed by the PRT during this review period). Comments are provided in **Table 4**.

Overall, the PRT found the report to be of good quality.

Table 4 Comment Disposition Table - Phase 2 Initial Borehole Drilling and Testing, South Bruce, WP08 Data Report: Temporary Well Sealing for SB_BH02, Revision: 0 (Final) (APM-REP-01332-0338) (Geofirma; June 20, 2023)

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
1	General	A description of how the bridge plug and four packers are to be removed would have aided technical understanding.	This will be considered in future reports. The type of bridge plug and packers used would require a drill rig and overshot tool to release the plug and packers.	Noted.

3.5 Shallow Groundwater Monitoring Well Network Installation at the South Bruce Site, Project Data Report for Shallow Groundwater Monitoring Well Network Installation

The objective of this report is to describe the activities associated with the installation of a shallow overburden and shallow bedrock groundwater monitoring network (six locations) in the vicinity of the South Bruce Site. Comments are provided in **Table 5**.

Overall, the PRT found the report to be of good quality. During the initial review, the PRT identified concerns with drilling procedure and monitoring well construction as they were presented in the report. As initially shown the overburden drilling and installation methodology of certain monitoring wells may have resulted in cross-connection of shallow and deep overburden and shallow bedrock aquifer units due to inadequate sealing and segregation of the overburden stratigraphic intervals. Discussions with the NWMO regarding this concern led the NWMO to conduct further internal investigations of field procedures and corresponding documentation. The PRT was informed that the NWMO confirmed the overburden monitoring well installation procedures and provided corrected the stratigraphic logs to accurately present monitoring well construction, addressing the initial concerns raised by the PRT.

Table 5 Comment Disposition Table - Shallow Groundwater Monitoring Well Network Installation at the South Bruce Site, Project Data Report for Shallow Groundwater Monitoring Well Network Installation Revision: 3 (Final) (APM-REP-01332-0360) (Geofirma; July 5, 2023)

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
1	Figure 2	<p>It is noted that the well installation at SB_MW02_BR_R was less than optimal with a sand pack extending from 55 to 41.4 m BGS, and potentially interconnected to as deep as 68 m BGS. No discussion is presented whether the potentially long monitoring interval may result in hydraulic cross-connection within the bedrock aquifer.</p>	<p>The monitoring well has collapsed material from 56m to the bottom of the well. Therefore, cross connection is unlikely. Additionally, this report focused on the installation of the monitoring well. To understand impact on cross-connection of aquifers, data will need to be collected over a time period appropriate for this. The long-term monitoring of these wells is a study currently being undertaken by NWMO.</p> <p>NWMO additional comments:</p> <p>All of the completion/borehole logs in Appendix B are being reviewed and corrected as required before the revised report is finalized and accepted by the NWMO.</p> <p>For this well (SB_MW02_BR_R), the sand pack and collapsed material below the sand pack occur within the same formation (Amherstburg).</p> <p>Initial monitoring of hydraulic heads within SB_MW02 show a head difference between the deep bedrock interval and the intermediate interval at this cluster, suggesting that the well has not provided communication between the Bois Blanc and Amherstburg formations.</p>	<p>Noted. The PRT is of the view that any potential for cross-connection should be corrected at the time of the learning of the potential.</p> <p>The PRT understands the potential for cross-connection.</p>

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
2	Section 3.2.1	Description of borehole geophysics findings (e.g., caliper enlargements, fluid anomalies) could use a mention of the bedrock stratigraphic unit that the anomaly occurs within.	The borehole geophysical results are reported on in section 3.3. Section 3.2. focus on information gathered during borehole drilling and logging, prior to the collection of geophysical data.	Noted.
3	Section 2.4.1/Appendix B	Overburden borehole logs show slough or sand pack to bedrock; however, Section 2.4.1 indicates the borehole was backfilled with bentonite and well sand to the bottom of the well screen. The text in Section 2.4.1 indicates that the overburden wells are probably isolated from the bedrock contact water-bearing zone, however the stratigraphic logs indicate a probable hydraulic interconnection between the overburden monitoring well and the bedrock contact water-bearing zone. This should be clarified, and if required, the stratigraphic logs corrected.	<p>There was an error in Section 2.4.1. For all the overburden wells, once the borehole was drilled to depth, the augers were pulled up to the monitoring well installation depth. Most boreholes did not remain open below the augers as they were pulled. Based on ground conditions, native soil sloughed in as the augers were pulled. If a minor amount of material was needed to reach the target install depth, the borehole was backfilled with well sand only and no bentonite was used. As such, the logs are correct and the report will be reissued to correct the wording in Section 2.4.1.</p> <p>NWMO additional comments:</p> <p>Upon investigation, the text in Section 2.4.1 was correct as originally written. The NWMO, their contractor (and their subcontracted driller) went back to original notes and confirmed that bentonite was installed in the base of the wells, and that the logs in Appendix B of the report were incorrect. The overburden borehole logs in Appendix B will be corrected, before the revised report is finalized and accepted by the NWMO.</p>	<p>Noted. The PRT advises that allowing the overburden material to collapse into the borehole below the monitored interval indicates that there is a strong possibility of interconnection of the water-bearing zone at the top of bedrock and the monitored interval in the overburden monitoring well. Best practices typically include sealing the interval below the bottom of the monitoring well with bentonite gravel or pellets to prevent such condition from occurring.</p> <p>The PRT held discussions with NWMO regarding this issue. The NWMO agreed that this was a potential issue and further investigated. As a result the NWMO identified the use of bentonite borehole sealing material in the interval below the well screen. NWMO then presented updated stratigraphic logs to the PRT that depicted the well completions using bentonite borehole sealant. The PRT was satisfied with this response and update to the stratigraphic logs. NWMO identified that the report would be updated with corrected stratigraphic logs prior to release to the public.</p>
4	Appendix B	SB_MW02 and SB_MW02_BR_R_B bedrock stratigraphic logs. The SB_MW02 well nest stratigraphic log should reference the replacement SB_MW02_BR_R_B stratigraphic log as there is a substantial thickness of sand pack and collapse material in the replacement well. Similarly, the stratigraphic log for SB_MW06_BR should reference SB_MW09_BR-B and indicate the decommissioned well.	<p>Noted. This will be included in the updated revision of the report.</p> <p>NWMO additional comments:</p> <p>Given the errors identified by the PRT, all of the stratigraphic logs in Appendix B are all being reviewed to ensure accuracy, and clarity in conveying information. The revised report, including Appendix B, will be reviewed prior to acceptance and release.</p>	Noted.

3.6 Phase 2 Initial Borehole Drilling and Testing, South Bruce, Dust, Noise, and Vibration Background Study for SB_BH01 and SB_BH02 sites, in South Bruce

The objective of this report is to describe the baseline noise levels and vibration levels, and baseline airborne dust levels in this rural setting within the region surrounding the South Bruce site. Comments are provided in **Table 6**.

The PRT noted that these portions of a single day measurements do not reflect expected overall background conditions throughout the year; however, do provide a general indication of background levels during a very quiet, calm day.

Table 6 *Comment Disposition Table - Phase 2 Initial Borehole Drilling and Testing, South Bruce, Dust, Noise, and Vibration Background Study for SB_BH01 and SB_BH02 sites, in South Bruce, Revision: 0 (APM-REP-01332-0428) (Cambium; January 13, 2021)*

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
1	General	As these measurements were conducted at two sites for portions of a single day, these measurements constitute a snapshot of conditions rather than a background study encompassing variable weather conditions and seasonal variations. It is the PRTs view that additional monitoring be conducted to coincide with seasonal conditions including agricultural activities (planting, harvesting), aggregate extraction within the community and other seasonal/climatic conditions.	Noted and agreed that the intent of this study was to capture a snapshot values versus a comprehensive long-term background study.	Noted.



Memorandum

10 April 2024 – Updated 10 May 2024

To	Dave Rushton/Steven Travale, Municipality of South Bruce		
Copy to	Sarah Hirschorn/Jeff Marshall/Michael Pahor/Geoff Crann, NWMO		
From	Brad Trytten, Allan Molenhuis, Jennifer Son and Greg Ferraro/AD/mma	Tel	+1 519 884 0510
Subject	February 2024 Geoscience Reports – Peer Review Comments	Project no.	11224152-MEM-72

1. Introduction

This memo provides the Municipality of South Bruce (South Bruce) peer review team's (PRT) comments on 12 reports prepared by Geofirma Engineering (Geofirma), Cambium Consulting & Engineering (Cambium), and Nuclear Waste Management Organization (NWMO). The 12 reports were received and made available for peer review on February 21, 2024.

The peer review comments are provided for South Bruce's consideration and internal circulation. As per the South Bruce Nuclear Exploration Project peer review protocol process, the memo will be submitted to the NWMO and their consultants (Geofirma) by GHD Limited (GHD). This memo includes the results of the peer review on the following reports:

- Phase 2 Initial Borehole Drilling and Testing, South Bruce. WP04C Data Report – Porewater Extraction and Analysis and Petrographic Analysis for SB_BH01 Revision: 0 (Final) (APM-REP-01332-0319) (Geofirma; December 18, 2023)
- Phase 2 Initial Borehole Drilling and Testing, South Bruce. WP04C Data Report – Porewater Extraction and Analysis and Petrographic Analysis for SB_BH02 Revision: 0 (Final) (APM-REP-01332-0332) (Geofirma; January 11, 2024)
- Phase 2 Initial Borehole Drilling and Testing, South Bruce. WP04G Data Report – Organic Geochemistry and Whole Rock and Clay Mineralogy for SB_BH02 Revision: 2 (APM-REP-01332-0334) (Geofirma; November 1, 2023)
- Phase 2 Initial Borehole Drilling and Testing, South Bruce. WP05 Data Report – Geophysical Well Logging and Interpretation for SB_BH01 Revision: 0 (Final) (xAPM-REP-01332-0322) (Geofirma; January 12, 2024)
- Phase 2 Initial Borehole Drilling and Testing, South Bruce. WP06 Data Report – Hydraulic Testing for SB_BH02 Revision: 1 (Final) (APM-REP-01332-0336) (Geofirma; October 31, 2023)
- Phase 2 Initial Borehole Drilling and Testing, South Bruce. WP07 Data Report – Opportunistic Groundwater Sampling and Testing for SB_BH01 Revision: 1 (FINAL) (APM-REP-01332-0324) (Geofirma; November 23, 2023)
- Phase 2 Initial Borehole Drilling and Testing, South Bruce. WP07 Data Report – Opportunistic Groundwater Sampling and Testing for SB_BH02 Revision: 0 (Final) (APM-REP-01332-0337) (Geofirma; January 5, 2024)

- Phase 2 Initial Borehole Drilling and Testing, South Bruce. WP10 Data Report – Single Borehole Data Integration for SB_BH02 Revision: 0 (APM-REP-01332-0339) (NWMO; May 2023)
- Phase 2 Initial Borehole Drilling and Testing, South Bruce. Construction Noise and Vibration Study for SB_BH01 and SB_BH02 Sites Revision: 1 (Final) (APM-REP-01332-0426) (Geofirma; November 27, 2023)
- Phase 2 Initial Borehole Drilling and Testing, South Bruce. Air Quality Study for SB_BH01 and SB_BH02 Sites Revision: 1 (Final) (APM-REP-01332-0427) (Geofirma; November 27, 2023)
- Phase 2 Initial Borehole Drilling and Testing, South Bruce. WP01: Site Decommissioning Report for SB_BH01 Revision: 0 (Final) (APM-REP-01332-0424) (Geofirma; May 12, 2023)
- Phase 2 Initial Borehole Drilling and Testing, South Bruce. WP01: Site Decommissioning Report for SB_BH02 Revision: 0 (Final) (APM-REP-01332-0425) (Geofirma; May 12, 2023)

2. Peer review approach

The peer review of the Reports was carried out by GHD's Peer Review Team (PRT). 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, the PRT for the reports reviewed included Subject Matter Experts (SMEs) Brad Trytten and Allan Molenhuis and GHD Lead Consultants Jennifer Son and Greg Ferraro. The peer reviews were conducted having the following questions in mind:

- Are there any significant concerns, issues, and/or omissions in the documentation?
- What are the PRT's initial observations/impressions on the quality of the documentation?
- Are the baseline findings interpreted and presented in a clear and understandable manner?
- Does the documentation reflect the most current information?
- Does the information contribute to developing the Conceptual Site Model (CSM)?

3. Peer review comments

The PRT has provided below a brief summary of each report followed by comments listed in a comment disposition table. The comment disposition table lists the PRT's initial peer review comments on the individual reports reviewed. The comments are intended to provide South Bruce a better understanding of the geoscience study work, how the work was carried out, and how the study work contributes to characterizing the geologic and hydrogeologic setting for the Project site. The comments are also provided to the NWMO for their consideration in advancing the geoscience study work.

As the reports have been received for peer review on an intermittent basis and provide technical data on individual components of the geoscience study program, the PRT has not commented on the sufficiency of the geoscience program as a whole in characterizing the geologic and hydrogeologic setting for the Project site. In general, the comments provided below identify minor inconsistencies in the reports and sections that may benefit from additional discussion where details are missing or not fully discussed.

GHD understands that these factual reports will be provided to the public. It would help the general public to better understand the contents of these reports if each report included a list of terminology (terms and abbreviations). The terminology should include brief descriptions of key geoscience concepts.

It is understood that there are a number of technical reports not yet made available for peer review that provide important data including:

- Geophysical well logging for SB_BH02 (summarized in the Single Borehole Integration Report)
- 3D Seismic Investigation – Data Acquisition and Processing
- 3D Seismic Investigation – Interpretation and Inversion
- Groundwater Monitoring of Shallow Well Network – Pressure Data 2022
- Groundwater Monitoring of Shallow Well Network – Pressure Data 2023
- Groundwater Monitoring of Shallow Well Network – Chemistry Data Annual Report 2023 (no report was submitted to the PRT for 2022)
- Mineralogical and Geochemical Analysis of Core for SB_BH01 and SB_BH02
- Laboratory Geomechanical and Thermal Testing of Core for SB_BH01 and SB_BH02
- Repeat sampling at MWCP 7047231
- Microseismic Annual Report

3.1 Phase 2 Initial Borehole Drilling and Testing, South Bruce WP04C Data Report – Porewater Extraction and Analysis and Petrographic Analysis for SB_BH01

The objective of this report is to describe the sampling methods and analysis carried out on selected bedrock samples for porewater and petrographic analysis. The results of the porewater and petrographic analysis are presented with a description of variations with depth, but without interpretation. The results will be used to assess the age of the porewater and whether the porewater has been exposed to surface waters. The PRT understands that interpretation of the data will be provided in a data integration report.

Overall, the PRT found the report to be of good quality with little concerns in regard to the quality of the report or the factual statements and data presented within. Comments made below (**Table 1**) are to improve the quality of the report and obtain clarifications on certain technical components of the studies. The PRT understands that this is a technical report, however, providing context would aid the reviewer.

Table 1 Comment Disposition Table – Phase 2 Initial Borehole Drilling and Testing, South Bruce. WP04C Data Report – Porewater Extraction and Analysis and Petrographic Analysis for SB_BH01 Revision: 0 (Final) (APM-REP-01332-0319) (Geofirma; December 18, 2023)

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
1	3.1.1	Concentration units in grams per litre may be unfamiliar to reviewers. This unit is not defined in the text. In the context of drinking water, it would be useful to express the concentrations in units of milligrams per litre, and/or mention the ODWS standard for TDS in drinking water (500 mg/L or 0.5 g/L).	Acknowledged. We will consider this for future reports.	Noted.
2	Section 3.1.3	Discussions of radiohalides should include mention of half-lives, as these are important considerations for the total radiohalides and radiohalide/stable isotope ratios. The half-lives may also relate to the slight decreasing trends seen for Chlorine-36/total Chlorine and for Iodine-129.	Acknowledged. Interpretation of the radiohalide results, beyond assessing the data for indicators of contamination/ artefacts, was outside of the scope of this factual data report, but assessment of the data to develop the site conceptual understanding is within the scope of future interpretation work and reporting.	Noted. The PRT believes that discussion of half-lives is important to the concept of radiohalide concentrations.

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
3	Figure 8	The lower Salina/Guelph $^{36}\text{Cl}/\text{Cl}$ anomaly appears to indicate the presence of water with higher concentrations of ^{36}Cl . Given the relatively short half-life of 301,300 years, it appears to indicate the presence of fresher water compared to the water sampled from above and below.	Acknowledged. This is recognized in the context of a reef structure encountered in SB_BH01 (which was not encountered in SB_BH02). Interpretation of the radiohalide results, beyond assessing the data for indicators of contamination / artefacts, was outside of the scope of this factual data report, but assessment of the data, and relationships to features such as the reef structure in the Guelph Formation, in order to develop the site conceptual understanding is within the scope of future interpretation work and reporting.	Noted.
4	Appendix A, Appendix B	There is no table associating sample IDs with stratigraphic unit. Tables of results should have associated stratigraphic units shown.	Sample ID's and stratigraphic intervals are described in the WP3 report. Figures throughout this report (e.g., Figures 3-5 and 8-11) show the sample locations in association with the stratigraphic units. We will consider if a table should be included in the Appendix or Chapter 2 of such reports in the future, to identify the samples, formations and type of data measured.	Noted.
5	Figure 6	The PW008 sample from 0 to 250 m bgs appears isotopically depleted. Since the first sample was collected at 78 m bgs, the sample depth range should indicate 78-250 m.	The text in Section 3.1.2 describes the depleted signature of PW008, and similar observations (attributed to gypsum hydration) made during site characterization works at the Bruce Nuclear Site. The legend in Figure 6 was intended to cover the full length of the borehole, with all samples "binned" into one of the 4 depth ranges. The exact sample depths for the samples shown in Figure 6 are given in Appendix A.	Noted. The PRT believes that the "binned" interval should reflect the actual interval where the sample was collected.

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
6	Figure 8	Porewater Iodine-129 concentrations in the upper stratigraphic units (Bois Blanc, Salina, Guelph) are lower than but similar to the drilling water results. What potential effects of drilling water is there on the porewater sample results?	Acknowledged. The interpretation of the porewater chemistry is outside of the scope of this report and will be undertaken as part of data interpretation and integration reporting. As part of data interpretation and integration activities, potential mixing end-members, including drilling water, will be evaluated.	Noted.
7	3.13	Why was tritium not analysed for as it would be an indicator of drilling water impact?	Tritium is analysed in groundwater samples, which follows best practice. Due to the volume of water required for the analyses, it is not possible to analyse tritium in the extracted porewater.	Comment satisfactorily addressed.
8	Table of Contents	List of acronyms and elemental abbreviations should be defined up front in the report. Some elemental abbreviations are defined in the text and some are not.	Agreed. This will be considered in future reports.	Noted.
9	Section 2.1	Define what noble gases are being targeted in the analysis	This is described in section 2.2.4 of the report.	Comment satisfactorily addressed.
10	Section 3.1.1	The results of the analysis have not been corrected for mineral dissolution. Are the TDS results reliable? Should discuss.	The values presented assumed a 1 kg to 1 L relationship for the fluids, and thus do not include density corrections. The fluid chemistry has not been modelled in this report, as that was outside of the scope of the factual data report. The results presented for TDS were intended as a proxy for the salinity trends with depth in the respective boreholes, but do not present corrected TDS values (as noted). Correction of the TDS will be undertaken as part of ongoing interpretation and analysis.	Noted.

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
11	Figure 3	Paper absorption for TDS as profiled mimics paper absorption for CL. As TDS is a calculated value the mathematical relationship between CL and TDS should be described. Figure 3 (and other Figures) column heading for TDS can be mis-leading. Why was PA results used to calculate TDS vs VD?	<p>The trend of CL data closely mimics TDS as CL is the dominant dissolved anion in these samples. The TDS derived from both PA and VDE are shown for comparison purposes and to provide a simple representation of trends in salinity with depth (as noted in the response to comment 10 above, the chemical data is not yet modelled).</p> <p>The TDS presented is a calculated sum from the final, accepted laboratory data only, with the caveat noted above regarding geochemical modelling not yet having been completed.</p> <p>Future site characterization activities, if the South Bruce Site is selected, will utilize the VDE methodology, with the PA method considered as a supporting / complementary analysis.</p>	Comment satisfactorily addressed.
12	Section 3.1.2	Clarify why a porewater sample containing hydrocarbon labelled as being contaminated? Is the hydrocarbon naturally occurring or an artifact of the extraction/analytical process?	All hydrocarbons should have been removed through the vacuum distillation process. However, very minor amounts of hydrocarbon were still observed in the sample after distillation which could impact the stable isotope water results. Therefore, "contamination" is not referring to the source of the hydrocarbon, but rather that the stable isotope water results could be impacted ("contaminated") by the presence of hydrocarbons retained in the sample after vacuum distillation.	Comment satisfactorily addressed. The PRT believes a clarification in the report would be beneficial.
13	Section 3.1.4	Why is there is a general increase in NG levels with depth? A brief explanation regarding ratios with depth would be helpful.	The interpretation of noble gas data, including the increasing trend of NG levels with depth will be undertaken as part of future data interpretation reporting.	Noted.

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
14	Conclusion	Should there be a concluding explanation on the scattering of analytical data in the instances above, within and below the Cobourg formation?	The data scatter at the South Bruce Site is consistent with the scatter seen in similar data sets from the Bruce Nuclear Site. Modelling of the fluid chemistry was outside of the scope of the factual data report, but this will be done as a part of another work program, which will also assess the observed variability.	Noted. The future modelling of the fluid chemistry is significant to the characterization of the formation.
15	General	It appears extraction methods (VE and PA) produce similar results depending on parameter, rock formation, density and mineralogy. Should the preferred method and reliability of the data from each formation and method be further investigated prior to integration?	Commenting on NWMO's future use/method development is outside the scope of this data report. However, the use of VDE is a demonstrated method and was used in the characterization of the Bruce Nuclear Site porewaters. The intent is that VDE will continue to be used in future porewater characterization works if the South Bruce Site is selected. The utilization of the PA method as a complementary analysis also will be considered.	Comment satisfactorily addressed.

3.2 Phase 2 Initial Borehole Drilling and Testing, South Bruce. WP04C Data Report –Porewater Extraction and Analysis and Petrographic Analysis for SB_BH02

The objective of this report is to describe the sampling methods and analysis carried out on selected bedrock samples for porewater and petrographic analysis. The results of the porewater and petrographic analysis are presented with a description of variations with depth, but without interpretation. The results will be used to assess the age of the porewater and whether the porewater has been exposed to surface waters. The PRT understands that interpretation of the data will be provided in a data integration report.

Overall, the PRT found the report to be of good quality with little concerns in regard to the quality of the report or the factual statements and data presented within. Comments below (**Table 2**) are generally minor but would improve the quality of the report. The PRT notes that the comments provided above in Table 1 for the SB_BH01 report also apply to this report and have not been repeated.

Table 2 Comment Disposition Table - Phase 2 Initial Borehole Drilling and Testing, South Bruce. WP04C Data Report – Porewater Extraction and Analysis and Petrographic Analysis for SB_BH02 Revision: 0 (Final) (APM-REP-01332-0332) (Geofirma; January 11, 2024)

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
1	Figure 6	The samples from 0 to 350 m depth appear isotopically depleted. Since the first sample was collected at 210 m bgs, the sample depth range should indicate 210-350 m, which is entirely within the Salina.	The legend in Figure 6 was intended to cover the full length of the borehole, with all samples “binned” into one of the 4 depth ranges. The exact sample depths for the samples shown in figure 6 are given in Appendix A.	Noted. The PRT believes that the “binned” interval should reflect the actual interval where the sample was collected.

3.3 Phase 2 Initial Borehole Drilling and Testing, South Bruce WP04G Data Report – Organic Geochemistry and Whole Rock and Clay Mineralogy for SB_BH02

The objective of this report is to present the total organic carbon (TOC) content, the thermal maturity of the oil and gas-related organic carbon content, and the clay mineralogy of selected bedrock samples.

Overall, the PRT found the report to be of good quality with little concerns in regard to the quality of the report or the factual statements and data presented within. The comments provided (**Table 3**) would improve the clarity of the information presented. Additional clarifications are noted for the conclusion. The PRT previously provided comments on the similar report for SB_BH01 and will not repeat those specific comments. The PRT understands that interpretation of the data will be provided in a data integration report.

Table 3 Comment Disposition Table - Phase 2 Initial Borehole Drilling and Testing, South Bruce. WP04G Data Report – Organic Geochemistry and Whole Rock and Clay Mineralogy for SB_BH02 Revision: 2 (APM-REP-01332-0334) (Geofirma; November 1, 2023)

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
1	Figures 3, 4, 5, 6, 7	The use of the same colour and symbol for multiple samples makes discerning the samples difficult. Different symbols using the same colour for grouped samples is suggested.	Understood. This will be considered for future reports.	Noted.
2	Table 4, 5	Why was OG016 collected after WP03?	After completion of drilling, NWMO assessed the entirety of the borehole and took the opportunity to select additional samples for analysis, such as OG016. This approach was part of the sampling plan	Comment satisfactorily addressed.

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
3	Figure 3,5	Results for OG016?	Results from OG016 are included in the figures (labelled light blue square). The sample falls outside of the inset box, in the upper right corner in both figures.	Comment satisfactorily addressed. The PRT believes that clarification of the figure in the report would be beneficial.
4	5 Conclusions	Clarification of conclusions re: hydrocarbon migration.	As noted in the conclusion section of the report, migration of hydrocarbons into the Salina A1 Carbonate is presented as a likely interpretation. This conclusion is based on the presence of relatively low TOC in the Salina A1 (Figure 2 in the report) suggesting it is not a local source of hydrocarbon, and also based on a standard Oil and Gas discrimination diagram, Production Index vs Tmax (shown in Figure 6 of the report).	Comment satisfactorily addressed.

3.4 Phase 2 Initial Borehole Drilling and Testing, South Bruce WP05 Data Report – Geophysical Well Logging and Interpretation for SB_BH01

The objective of this report is to document the procedures and present the data and preliminary interpretation from borehole geophysical logging of SB_BH01. This information was to be used to better define lithology, stratigraphic contact, rock properties, oriented structures, hydrogeological characteristics, and borehole orientation. Comments are provided in **Table 4**.

Overall, the PRT found the report to be of good quality. The explanation of data processing and correction was useful to the PRT. The detailed explanation of factors affecting the data quality and interpretation was also useful to the PRT. In addition, the inclusion of Section 4 Preliminary Interpretations was useful to the PRT.

Table 4 Comment Disposition Table - Phase 2 Initial Borehole Drilling and Testing, South Bruce. WP05 Data Report – Geophysical Well Logging and Interpretation for SB_BH01 Revision: 0 (Final) (xAPM-REP-01332-0322) (Geofirma; January 12, 2024)

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
1	General Comment	“minerology” is actually spelled “mineralogy”.	Agreed. Typo will be corrected if the report is reissued.	Comment satisfactorily addressed.
2	General Comment	A table listing the logging apparatus and the geophysical data / formation characteristics information to be obtained from each apparatus would be helpful.	Noted. This will be considered for future reporting.	Noted.

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
3	Section 2.1	Phase 2 geophysical logging completed in three stages, prior to October 11, 2021, April 8, 2022, and June 2 to 4, 2022. This timeline indicates an open hole was present from prior to October 11, 2021, to June 15, 2022 (beginning of Westbay Installation). What effect does leaving an open borehole with differing hydraulic heads have on the future water quality samples?	All water samples planned to be collected from SB_BH01 were collected opportunistically during drilling. No future water sampling is planned from this borehole.	Comment satisfactorily addressed.
4	Section 3.2	Did flushing of the borehole with brine and fresh water (September 25-26, 2021) affect the borehole geophysics or subsequent groundwater monitoring?	Flushing of the borehole helped to improve the visibility within the borehole for optical televiewer. Overall, the results from the geophysical logging were good and negative impacts due to flushing were negligible. The flushing did not have any significant impacts on groundwater monitoring.	Comment satisfactorily addressed.
5	Section 3.3.3	5 th bullet. Micrite is microcrystalline calcite. The bullet is inexact in description. Dark colored micrite commonly contains a significant fraction of sedimentary clay particles. Light colored micrite commonly contains little sedimentary clay particles.	Noted, and this will be clarified in the report if the report is reissued.	Noted.
6	Section 3.2	This is the first mention in reports of a blockage at 620 m bgs in SB_BH01. It was not documented in the WP02 report.	Due to the fissile nature of the shales within the borehole, it was common for blockages to occur. These blockages were removed by drilling over the blocked zone. This process is described in Section 3.1.2. of the WP02 report	Comment satisfactorily addressed.

3.5 Phase 2 Initial Borehole Drilling and Testing, South Bruce WP06 Data Report – Hydraulic Testing for SB_BH02

The objective of this report is to present the hydraulic testing program and results, and initial estimation of formation pressure in very low hydraulic conductivity bedrock. Comments are provided in **Table 5**. The PRT has provided comments previously on the Hydraulic Testing Report for SB_BH01 and has not repeated the SB_BH01 comments here for SB_BH02.

Overall, the PRT found the report to be of good quality.

Table 5 Comment Disposition Table - Phase 2 Initial Borehole Drilling and Testing, South Bruce. WP06 Data Report – Hydraulic Testing for SB_BH02 Revision: 1 (Final) (APM-REP-01332-0336) (Geofirma; October 31, 2023)

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
1	Table 7.5 Skin Thickness	<p>The PRT understands that this is a calculated parameter from the testing program, but formation skin from drilling should not extend up to 100 metres from the borehole wall. The PRT requests the data be reviewed and an explanation provided for anomalous well skin thicknesses. The large well skin thickness values appear associated with higher hydraulic conductivity and may be a mathematical artifact.</p>	<p>In general, for the low hydraulic conductivity intervals, the parameter listed as skin thickness does represent the modelled thickness of the skin. For the particular examples noted by the PRT, where the hydraulic conductivity is higher and slug tests were performed, the value presented as formation skin thickness is not actually representing a skin in the typical sense. For these tests, modelling of the formation pressure responses identified minor heterogeneities within the test volume. Minor differences between the drill fluid and formation fluid composition and density could cause similar effects. These tests could be more accurately described as composite radial formation models, and to best capture this, the formation skin thickness was expanded to represent the minor variation of hydraulic conductivity.</p> <p>For these particular slug tests, up to 100 m was used as a formation skin thickness to best define a formation with composite response.</p> <p>We agree that presenting skin thicknesses of up to 100 m as a “formation skin” thickness in this context seems anomalous and in the reporting of future work we will add additional explanation of this approach to the text to clarify.</p>	<p>Noted. This will be an important future consideration as the term well skin normally refers to the near borehole wall area affected by well drilling and well development.</p>

3.6 Phase 2 Initial Borehole Drilling and Testing, South Bruce WP07 Data Report – Opportunistic Groundwater Sampling and Testing for SB_BH01

The objective of this report is to describe the activities associated with the collection of groundwater samples from permeable intervals, and to present the analytical results. Comments are provided in **Table 6**.

Table 6 Comment Disposition Table - Phase 2 Initial Borehole Drilling and Testing, South Bruce. WP07 Data Report – Opportunistic Groundwater Sampling and Testing for SB_BH01 Revision: 1 (FINAL) (APM-REP-01332-0324) (Geofirma; November 23, 2023)

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
1	Table 7	Iodine-129 concentrations may be affected by the water source and drill water concentrations (approximately 10 ⁷ atms/kg). At 1 to 3% drill water in the OGW, what effect does the drill water have on the OGW concentration.	The interpretation of the chemistry is outside of the scope of this report and will be undertaken as part of data interpretation and integration reporting. As part of data interpretation and integration activities, potential mixing end-members, including drilling water, will be evaluated.	Noted.
2	Table 7	The presence of tritium in all OGW, especially the deep OGW (in brine water isolated from fresh water) is unexpected given the short half-life of tritium (12.3 years). What effect does the drill water presence have on the OGW sample results (especially the deep OGW) and should suspect results like tritium be qualified? The same comment would apply for Carbon-14 (half-life of 5,730 years). Do these results indicate the presence of recent groundwater in the OGW samples collected from the Amherstburg/Bois Blanc/Bass Islands? Do these results indicate the presence of fresh water in the Salina, Guelph, and Precambrian? The PRT notes that Table 7 Tritium results appear to be uncorrected for drill water contamination (Appendix C).	The source of tritium is either due to drill water impact or, for the Precambrian sample combination of drill water and groundwater due to packer by-pass (see section 3.4.3 for more details). OGW results were reported uncorrected for drill water in the text and corrected in the appendix. While interpretation of the results are outside the scope of data report, the results do not indicate presence of fresh water in the deep groundwater, but rather reflect impact of drill fluid/packer by-pass.	Comment satisfactorily addressed. The PRT is unclear as to why there are inconsistencies in reporting results.

3.7 Phase 2 Initial Borehole Drilling and Testing, South Bruce WP07 Data Report –Opportunistic Groundwater Sampling and Testing for SB_BH02

The objective of this report is to describe the activities associated with the collection of groundwater samples from permeable intervals, and to present the analytical results. Comments are provided in **Table 7**. The PRT notes that the comments provided above also apply to this report and have not been repeated.

Table 7 Comment Disposition Table - Phase 2 Initial Borehole Drilling and Testing, South Bruce. WP07 Data Report – Opportunistic Groundwater Sampling and Testing for SB_BH02 Revision: 0 (Final) (APM-REP-01332-0337) (Geofirma; January 5, 2024)

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
1	Figure 2	The PRT notes there is more variability in the DW samples and less variability in the WS samples compared to SB_BH01.	Noted. Drill water samples are influenced by the groundwater encountered as well as rock that is encountered and is considered to be quite variable. Slight variability in water source samples are expected.	Comment satisfactorily addressed.

3.8 Phase 2 Initial Borehole Drilling and Testing, South Bruce WP10 Data Report – Single Borehole Data Integration for SB_BH02

The PRT understands the objective of this report is to evaluate relevant core logging observations and the geophysical well log to provide an analysis of the stratigraphic formation intersected in SB_BH01. Overall, the PRT found the report to be of good quality. Comments are provided in **Table 8**. The PRT provided comments on the Single Borehole Data Integration Report for SB_BH01 and those comments have not repeated.

Table 8 Comment Disposition Table - Phase 2 Initial Borehole Drilling and Testing, South Bruce. WP10 Data Report – Single Borehole Data Integration for SB_BH02 Revision: 0 (APM-REP-01332-0339) (NWMO; May 2023)

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
1	Section 3.2.1.4 Cobourg Formation (lower member)	The comment regarding crude oil seeping from hairline fractures is important. Will the presence of crude oil within the portion of the Cobourg Formation proposed to be utilized for the DGR affect construction, operation, or longevity of the DGR components?	This is beyond the scope of this report and will be covered in engineering and safety assessment technical reports. For avoidance of doubt, none of the data collected to date, including the observation of crude oil seeping from the hairline fracture would suggest that the site is unsuitable to safely host a deep geological repository.	Comment satisfactorily addressed.

3.9 Phase 2 Initial Borehole Drilling and Testing, South Bruce Construction Noise and Vibration Study for SB_BH01 and SB_BH02 Sites

The objective of this report is to describe the expected noise levels from the operation of the cable tool drill rig, core drill rig, and the power generator/air compressor. The PRT understands that the noise assessment and vibration assessment was completed during a single Site visit on September 15, 2021. During this period, cable tool drilling was being completed at SB_BH01 and core drilling was being completed at SB_BH01. Comments are provided in **Table 9**.

Table 9 Comment Disposition Table - Phase 2 Initial Borehole Drilling and Testing, South Bruce. Construction Noise and Vibration Study for SB_BH01 and SB_BH02 Sites
Revision: 1 (Final) (APM-REP-01332-0426) (Geofirma; November 27, 2023)

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
1	General	The PRT notes that the assessment was completed during one day and may not reflect the noise generated during non-routine activities (retrieval of stuck drill rods, cementing of casing, hammering on stuck/frozen equipment). The vibration assessment did not include the vibration associated with the 3D seismic study that utilized vibroseis truck to induce sound waves into the subsurface.	Noted and agreed that this study was to not intend to be comprehensive long-term study of all site characterization activities, the focus was on capturing the major activities during drilling activities.	Comment satisfactorily addressed.
2	Section 6	It is unclear how much the Noise Impact Assessment relied on actual noise measurements taken at the drill sites versus calculations based on manufacturers' specifications.	Field measurements were taken on the 15th September at SB_BH01, during coring/casing, and SB_BH02 during cable drilling to set casing. For items not in use during the site visit manufacturers specifications were used. Table 1 details the data sources used (all but a SB_BH01 generator/compressor were measurement based).	Comment satisfactorily addressed.

3.10 Phase 2 Initial Borehole Drilling and Testing, South Bruce Air Quality Study for SB_BH01 and SB_BH02 Sites

The objective of this report is to describe the background air quality and significant sources of emission from Site equipment, including predicted impacts on surrounding lands surrounding the South Bruce site. The PRT understands it is based on modelling emissions at Points of Impingement. It is the PRTs understanding that the report did not utilize actual equipment-specific measurements. Comments are provided in **Table 10**.

Table 10 Comment Disposition Table - Phase 2 Initial Borehole Drilling and Testing, South Bruce. Air Quality Study for SB_BH01 and SB_BH02 Sites Revision: 1 (Final) (APM-REP-01332-0427) (Geofirma; November 27, 2023)

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
1	General	The PRT notes that the report assumes that the core drilling rig and diesel generator modeled for the assessment are assumed to operate at normal efficiency. The PRT notes that no actual exhaust stack testing was completed to ensure compliance at POI.	Conservative assumptions have been applied, such that the maximum emission rates listed in Table 2, are likely an overestimate of the actual emission quantities, see Section 4.4 of the report.	Comment satisfactorily addressed.

3.11 Phase 2 Initial Borehole Drilling and Testing, South Bruce WP01: Site Decommissioning Report for SB_BH01

The objective of this report is to describe the decommissioning of the site facilities, including final soil sampling results. Comments are provided in **Table 11**.

Table 11 Comment Disposition Table - Phase 2 Initial Borehole Drilling and Testing, South Bruce. WP01: Site Decommissioning Report for SB_BH01 Revision: 0 (Final) (APM-REP-01332-0424) (Geofirma; May 12, 2023)

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
1	General	The PRT notes that a minor amount of surface staining was noted around the drilling rig rod racks. The staining was mentioned to NWMO oversight staff who indicated it was rust staining and not PHC. The PRT notes the report did not discuss any evidence of staining or impact.	Correct, minor rust staining was observed on the granular pad. No additional action required for rust staining.	Comment satisfactorily addressed.

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
2	Sampling Locations	The PRT notes that the sampling locations selected were not located immediately adjacent to or beneath storage tanks/spill containment, and that the sample locations in the northwest parking area (Area 1) were not located beneath where any vehicles parked. The rationale for selecting subsampling locations in area is unclear and appears to miss potential areas of impact.	Soil samples were collected on the drill pad and one additional area to the south of the drill pad. The sample locations were selected to provide spatial coverage across the drill pad and in areas where activities of potential environmental concern took place. A composite sample comprised of soil mixed from three discrete sampling locations was submitted for analysis from each area, so a total of 21 sub samples were collected to form seven composite samples. Regarding parking sample location SB_BH01_SS_01C is located where vehicles were routinely parked. It's note that no vehicle is shown at that the time of the image captured in Figure 3.	Comment satisfactorily addressed.

3.12 Phase 2 Initial Borehole Drilling and Testing, South Bruce WP01: Site Decommissioning Report for SB_BH02

The objective of this report is to describe the decommissioning of the site facilities, including final soil sampling results. Comments are provided in **Table 12**. The PRT notes that the comments provided above also apply to this report and have not been repeated.

Table 12 Comment Disposition Table - Phase 2 Initial Borehole Drilling and Testing, South Bruce. WP01: Site Decommissioning Report for SB_BH02 Revision: 0 (Final) (APM-REP-01332-0425) (Geofirma; May 12, 2023)

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
1	General	The PRT notes that minor F3 and F4 PHC impacts were noted for sample locations SS22-03 and SS22-04, well below applicable criteria.	Agreed, as shown in Table B.1.	Comment satisfactorily addressed.



Memorandum

10 July 2024 – updated 30 July 2024

To	Dave Rushton/Steven Travale, Municipality of South Bruce		
Copy to	Sarah Hirschorn/Jeff Marshall/Michael Pahor/Geoff Crann, NWMO		
From	Brad Trytten, Allan Molenhuis, Jennifer Son and Greg Ferraro/AD/mma	Tel	+1 519 884 0510
Subject	June 2024 Geoscience Reports – Peer Review Comments	Project no.	11224152-MEM-74

1. Introduction

This memo provides the Municipality of South Bruce (South Bruce) peer review team’s (PRT) comments on seven reports prepared by Geofirma Engineering Ltd. (Geofirma), KGS Group (KGS), and the Nuclear Waste Management Organization (NWMO). The seven reports were received and made available for peer review on June 3, 2024.

The peer review comments are provided for South Bruce’s consideration and internal circulation. As per the South Bruce Nuclear Exploration Project peer review protocol process, the memo will be submitted to the NWMO and their consultants (Geofirma and KGS) by GHD Limited (GHD). This memo includes the results of the peer review on the following reports:

- Phase 2 Initial Borehole Drilling and Testing, South Bruce. WP05: Data Report for Geophysical Well Logging and Interpretation for SB_BH02. Revision: 0 (Final) (APM-REP-01332-0317) (Geofirma; February 7, 2024)
- Phase 2 Initial Borehole Drilling and Testing, South Bruce. WP04D Data Report: Mineralogical and Geochemical Analysis of Core for SB_BH01. Revision: 1 (Final) (APM-REP-01332-0320) (Geofirma; May 29, 2024)
- Phase 2 Initial Borehole Drilling and Testing, South Bruce. WP04D Data Report: Mineralogical and Geochemical Analysis of Core for SB_BH02. Revision: 1 (Final) (APM-REP-01332-0333) (Geofirma; May 29, 2024)
- Data Report for 2D Seismic Paleochannel Characterization, South Bruce, Ontario. Revision: 1 (Final) (APM-REP-01332-0388) (Geofirma; March 22, 2024)
- Groundwater Monitoring of Shallow Well Networks – South Bruce Pressure Data Annual Report 2022. Final Rev 2 (APM-REP-01332-0419) (KGS; May 9, 2024)
- Groundwater Monitoring of Shallow Well Network – South Bruce Chemistry Data Annual Report 2022. Final Rev 1 (APM-REP-01332-0450) (KGS; April 29, 2024)
- 3D Seismic Data Acquisition & Processing Report, South Bruce, Ontario. Revision: 1 (Final) (APM-REP-01332-0454) (Geofirma; May 28, 2024)

2. Peer review approach

The peer review of the Reports was carried out by GHD's Peer Review Team (PRT). The peer review process was completed in alignment with the peer review protocol that was developed to support a collaborative approach between the NWMO and South Bruce while maintaining independence during the process. In accordance with the peer review protocol process, the PRT for the reports reviewed included Subject Matter Experts (SMEs) Brad Trytten and Allan Molenhuis and GHD Lead Consultants Jennifer Son and Greg Ferraro. The peer reviews were conducted having the following questions in mind:

- Are there any significant concerns, issues, and/or omissions in the documentation?
- What are the PRT's initial observations/impressions on the quality of the documentation?
- Are the baseline findings interpreted and presented in a clear and understandable manner?
- Does the documentation reflect the most current information?
- Does the information contribute to developing the Conceptual Site Model (CSM)?

3. Peer review comments

The PRT has provided below a brief summary of each report followed by comments listed in a comment disposition table. The comment disposition table lists the PRT's initial peer review comments on the individual reports reviewed. The comments are intended to provide South Bruce a better understanding of the geoscience study work, how the work was carried out, and contributes to characterizing the geologic and hydrogeologic setting for the Project site. The comments are also provided to the NWMO for their consideration in advancing the geoscience study work.

As the reports have been received for peer review on an intermittent basis and provide technical data on individual components of the geoscience study program, the PRT has not commented on the sufficiency of the geoscience program as a whole in characterizing the geologic and hydrogeologic setting for the Project site. In general, the comments provided below identify where clarifications are required and any inconsistencies with data or other information provided.

GHD understands that these factual reports will be provided to the public. It would help the general public to better understand the contents of these reports if each report included a list of terminology (terms and abbreviations). The terminology should include brief descriptions of key geoscience concepts. It would also help the general public to better understand the results presented in these reports, if the described samples or features included the Formation name, rock type, and depth interval. This is of particular importance for rock samples where characteristics are being described but not in context of the bedrock sequence and rock types.

It is the PRT's understanding that the information contained within these factual reports and the interpretation of that information will be compiled into a Descriptive Geoscientific Site Model report.

It is understood that there are a number of technical reports not yet made available for peer review that provide important data including:

- 3D Seismic Investigation – Interpretation and Inversion
- Groundwater Monitoring of Shallow Well Network – Pressure Data 2023
- Groundwater Monitoring of Shallow Well Network – Chemistry Data Annual Report 2023
- Laboratory Geomechanical and Thermal Testing of Core for SB_BH01 and SB_BH02
- Microseismic Annual Report

3.1 Phase 2 Initial Borehole Drilling and Testing, South Bruce. WP05: Data Report for Geophysical Well Logging and Interpretation for SB_BH02

The objective of this report is to document the procedures and present the data and preliminary interpretation from borehole geophysical logging of SB_BH02. This information was to be used to better define lithology, stratigraphic contact, rock properties, oriented structures, hydrogeological characteristics, and borehole orientation. Comments are provided in **Table 1**.

Table 1 Comment Disposition Table – Phase 2 Initial Borehole Drilling and Testing, South Bruce. WP05: Data Report for Geophysical Well Logging and Interpretation for SB_BH02. Revision: 0 (Final) (APM-REP-01332-0317) (Geofirma; February 7, 2024)

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
1	General	Six comments provided on the SB_BH01 report (APM-REP-01332-0322) will generally apply to this report (GHD Memo 72, May 10, 2024). Any comments presented for SB_BH02 should be considered for SB_BH01, if appropriate.	Noted.	Comment satisfactorily addressed.
2	Section 2.5	Were all depth measurements adjusted relative to ground surface?	Yes, all measurements are relative to ground surface.	Comment satisfactorily addressed.
3	Section 3.3.13.1	The ALT QL40 probe is actually the SFM (not the SMF as listed). This probe is listed as an impeller flowmeter. It is unclear whether the probe included stacking of other tools as listed in Section 3.3.13.1 (normal resistivity, spontaneous potential, single point resistance, gamma) which were also listed as collected with an E-Log tool. Please clarify.	It was only stacked with the natural gamma probe. There is a typo in the sentence and the items included in the parentheses were not stacked with the impeller flowmeter (i.e. normal resistivity, spontaneous potential and single point resistance).	Comment satisfactorily addressed.

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
4	Section 4.2.2 Figure 12 and Figure 13	<p>It is noted that 475 features dip in a mean direction of 295.20 degrees, 28 dip in a mean direction of 323.51 degrees, and 5 dip in a mean direction of 93.50 degrees. The majority of dip directions may be more accurately described as WNW (within 30 degrees north of west) rather than NNW (within 30 degrees west of north). The mean dip of 297.87 degrees is not considered overly meaningful when a mean is taken from approximately opposing directions (e.g., 93.50 degrees and 295.20 degrees).</p> <p>These are different populations of features and may be better referred by stratigraphic unit/age/depth in the borehole. Since most boundaries are shallow dipping, perhaps binning by orientation in a rose diagram may be more informative.</p>	Noted, will be considered for future reports and future interpretation of the data.	<p>Comment satisfactorily addressed.</p> <p>Interpretation of the orientations of these features, along with the stratigraphic location will be important to understanding the nature of the populations of these features.</p>
5	Section 4.4.2 Figure 14 and Figure 15	The discontinuity type could readily be incorporated into the legend for additional clarity. Similar to the above comment, perhaps binning in increments in a rose diagram, and binning by the dip magnitude in a graphical format may be more readily understood and identify populations of features.	Noted, will be considered for future reports.	Comment satisfactorily addressed.
6	Section 4.4	The first order hydraulic subdivision interpretations are greatly appreciated. These could benefit from mentioning the stratigraphic unit(s) these occur in.	Noted, will be considered for future reports.	Comment satisfactorily addressed.

3.2 Phase 2 Initial Borehole Drilling and Testing, South Bruce. WP04D Data Report: Mineralogical and Geochemical Analysis of Core for SB_BH01

The objective of this report is to describe the sampling methods and analysis carried out on selected bedrock samples for mineralogical and petrographic analysis of SB_BH01. The results of the mineralogical and petrographic analysis are presented with a description of variations with depth. Comments are provided in **Table 2**.

Table 2 Comment Disposition Table - Phase 2 Initial Borehole Drilling and Testing, South Bruce. WP04D Data Report: Mineralogical and Geochemical Analysis of Core for SB_BH01. Revision: 1 (Final) (APM-REP-01332-0320) (Geofirma; May 29, 2024)

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
1	Section 2	Please describe the pertinence and intended use of the thin section assessments (photomicrographs) conducted by SGS, and the carbonate petrography, fluid inclusion microthermometry, and stable isotope analysis conducted by the British Geological Survey.	There are multiple intended uses. For instance, BGS work on fluid inclusion microthermometry may be used to inform burial history of studied formations. Thin section petrography is part of the basic geological characterization. Thin section petrography also provides information about mineralogy, textures, grain size and porosity which may be used in other studies in the future (such as sorption or transport modelling studies).	Comment satisfactorily addressed.
2	Section 2.1 Figure 4	The rock sample crushing described initial crushing to 2 mm. Then a portion was pulverized to 44 µm. All pulverized material was checked to see if it passed 75 µm. The PRT notes that the material should passed 75 µm the have as it was pulverized to 44 µm. The caption for Figure 4 indicates samples pulverized to 75 µm and 300 µm. The figure caption is interpreted as being inconsistent with the methodology described within the text. Please clarify the methodology and sample sizes utilized.	Noted and agreed, future reports will ensure consistency between methods stated and other information presented.	Comment satisfactorily addressed.

3.3 Phase 2 Initial Borehole Drilling and Testing, South Bruce. WP04D Data Report: Mineralogical and Geochemical Analysis of Core for SB_BH02

The objective of this report is to describe the sampling methods and analysis carried out on selected bedrock samples for mineralogical and petrographic analysis of SB_BH02. The results of the mineralogical and petrographic analysis are presented with a description of variations with depth. Comments are provided in **Table 3**.

Table 3 Comment Disposition Table - Phase 2 Initial Borehole Drilling and Testing, South Bruce. WP04D Data Report: Mineralogical and Geochemical Analysis of Core for SB_BH02. Revision: 1 (Final) (APM-REP-01332-0333) (Geofirma: May 29, 2024)

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
1		Comments from SB_BH01 will generally apply to this report.	Noted.	Comment satisfactorily addressed.
2	Table 2	It appears that no samples from the Queenston through the Coboconk were submitted to BGS for specialized analysis, although other samples from shallower bedrock and deeper bedrock units were submitted to BGS. Please confirm, and if not submitted to BGS please indicate why the stratigraphic units pertinent to this project were not included in the analyses by BGS.	Fracture infill in these shales do not contain viable samples for fluid inclusion studies. Following fluid inclusion study of BH01, BGS team noted the characteristics of prospective samples that can provide good fluid inclusion samples. Such prospective sampling intervals were not identified in these formations.	Noted.
3	Appendix A	The text is listed as Revision 1 (Final) however the British Geological Survey Report is listed as Draft for Approval -V4 (starting on page 962/1106). Please clarify if the appendices are also considered Revision 1 Final.	The BGS report is final, and the draft wording was erroneously left on the final report.	Comment satisfactorily addressed.

3.4 Data Report for 2D Seismic Paleochannel Characterization, South Bruce, Ontario

The objective of this report is to document the collection procedures and data analysis and interpretation from the 2D seismic reflection study. This information was to be used to better define paleochannel characteristics such as depth to bedrock, lithologic soil boundaries, and shear wave velocities. Comments are provided in **Table 4**.

Table 4 Comment Disposition Table - Data Report for 2D Seismic Paleochannel Characterization, South Bruce, Ontario. Revision: 1 (Final) (APM-REP-01332-0388) (Geofirma; March 22, 2024)

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
1	Figure 17	The bedrock structure contour map interpreted using borehole information appears to contain significantly interpreted and extrapolated contours for the widely spaced data points used to generate the contours. Please clarify how the contours were generated.	<p>We agree that the report is unclear on the steps taken. The detailed steps are described below:</p> <ul style="list-style-type: none"> - The process was started with a gridded bedrock depth from well tops (Table 6) in mBGS to create a point file. - This point file was processed using the IDW tool to convert the points into a raster called SB_Tops_BedrockDepthGrid_m. This gave a raster of the bedrock depth in meters (30 meter grid). - The SB_Tops_BedrockDepthGrid_m was subtracted from the 2008 DEM (best resolution at 10 meter grid over the whole area) to produce the SB_Tops_BedrockDepthGrid_mASL raster (30m grid) showing bedrock tops in mASL. 	<p>Noted. However, the process used to produce Figure 17 imposed much of the ground surface DEM irregularities onto the bedrock surface, resulting in top of bedrock contours that appear more reflective of the ground surface topography than the actual top of bedrock topography.</p> <p>This can be seen on Figure 17.</p>
2	Figure 22	<p>The top of bedrock map is expressed as depth below ground surface. The intent is listed as to understand approximate depth and extent of the buried bedrock valley.</p> <p>This figure should be produced as bedrock structure contour elevations (metres above sea level) to aid the understanding of the size, shape, and extent of this buried bedrock valley.</p>	Noted, will be considered for future reports.	Noted. The PRT is of the view that a bedrock structure contour map will be required for the interpretation of the size, shape, and extent of the buried bedrock valley and the DGR and ERMA facility designs.

3.5 Groundwater Monitoring of Shallow Well Networks – South Bruce Pressure Data Annual Report 2022

The objective of this report is to present the hydraulic data recording program and results for the overburden and shallow bedrock nested monitoring wells. Information obtained from these results will help define shallow groundwater characteristics. Comments are provided in **Table 5**.

Table 5 Comment Disposition Table - Groundwater Monitoring of Shallow Well Networks – South Bruce Pressure Data Annual Report 2022. Final Rev 2 (APM-REP-01332-0419) (KGS; May 9, 2024)

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
1	Section 3.3.5	<p>SB_MW03 wells are sealed with Margo-plugs that seal the well to halt flowing artesian conditions. The Solinst Levelogger transducers are placed below the Margo plug. As a result, during sealed conditions, the Solinst Leveloggers record total artesian pressure only, with no atmospheric pressure component being recorded.</p> <p>The PRT believes that compensating the SB_MW03 data loggers for atmospheric pressure may not be correct.</p>	<p>The NWMO understands the PRT's position on this. However, KGS looked at this data and compared barometric correction vs non-correction and determined that barometric correction provided more accurate representation of formation pressures.</p>	Noted.
2	Figure B2 and other Appendix B figures	<p>The PRT notes that the groundwater elevation for SB_MW01 for Q3 was not posted on Figure B2. It is listed in Table 2.</p> <p>The PRT also notes that the groundwater elevations posted on Figure B2 are identical to Figure B1 for locations SB_MW02, SB_MW03, SB_MW04, SB_MW06, and SB_MW07, which indicates that the Figure B2 groundwater elevation contours may be incorrect.</p> <p>The PRT also notes that many groundwater elevations posted on these figures do not correspond to the data posted in Table 2.</p>	<p>Figure B2 represents contours for the Amherstburg formation. SB_MW01 is installed in the Lucas formation and terminates prior to the Amherstburg formation therefore the contour is not included in Figure B2. The location of the well is still shown for reference.</p> <p>The labels of groundwater elevations are incorrect in Figure B2, however, the contours are correct. This will be corrected and the report reissued.</p> <p>All other figures and labels for the hydrographs are correct.</p>	Comment satisfactorily addressed.

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
3		<p>The PRT notes that the change from downward to neutral and upward vertical gradients (Appendix B) will be pertinent to selecting the location of the ERMA and surface facility with respect to environmental protection and monitoring.</p> <p>The areas of upward and downward vertical gradients should be further studied as part of selecting the surface facility and location of the ERMA.</p>	Noted.	Comment satisfactorily addressed.

3.6 Groundwater Monitoring of Shallow Well Network – South Bruce Chemistry Data Annual Report 2022

The objective of this report is to describe the activities associated with the collection of groundwater samples from the overburden and shallow bedrock nested monitoring wells, and to present the analytical results. These results describe the physiochemical properties of the groundwater such as concentrations of dissolved metals, nutrients, and major ions. Comments are provided in **Table 6**.

Table 6 Comment Disposition Table - Groundwater Monitoring of Shallow Well Network – South Bruce Chemistry Data Annual Report 2022. Final Rev 1 (APM-REP-01332-0450) (KGS; April 29, 2024)

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
1	Section 3.4.4	<p>The PRT notes that sampling groundwater with Waterra inertial foot valves and polyethylene tubing, and with bailers while collecting detailed field parameter measurements and high-quality samples with minimal sediment/turbidity is very difficult.</p> <p>While acknowledging that the 2 -year sampling program through 2024 is nearly complete, the PRT strongly recommends low flow sampling methodology be employed in the future to collect groundwater samples and reduce water quality issues related to high turbidity in groundwater samples. Low flow sampling is considered a best practice for groundwater sampling.</p>	Noted. The June 2024 sampling event utilized methodology as described in the report and low flow sampling is also being trialed to assess suitability for sampling.	Comment satisfactorily addressed.
2	Table 2 Summary of Laboratory Parameters	The laboratory analytical parameters should be listed by which parameters are field filtered, and which are submitted unfiltered, and include the sample preservation technique.	Noted, this will be considered for future reports. The approach was consistent with the test plan methodology.	Comment satisfactorily addressed.
3	Table 4, associated field parameter measurements, associated analytical results	The 3 nested bedrock standpipes and one overburden standpipe are not listed with associated well depths or corresponding stratigraphic logs. Please include this information in order to associate relevant results with stratigraphy and with depth below/above stratigraphic contacts.	Noted, this will be considered for future reports.	Comment satisfactorily addressed.

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
4	Table 4	<p>Please explain why well groups SB_MW01, SB_MW02, SB_MW03, SB_MW04, SB_MW05 were not sampled in July 2022.</p> <p>The PRT understands that location SB_MW06 was not accessible during December 2022 due to drilling activities at SB_MW06.</p>	<p>The quarterly sampling plan for these wells involved sampling all intervals at two well locations each quarter. The selection of wells to sample each quarter is mainly based on the need to balance the number of samples collected from each well and access conditions. Consequently, SB_MW06 and SB_MW09 were sampled during the July 2022 event. Additionally, NWMO has opportunistically sampled more wells in certain quarters to expand the dataset.</p>	<p>Comment satisfactorily addressed.</p>
5	Section 4.2.2.1, Table 6	<p>Dissolved oxygen is observed to be elevated primarily in overburden wells. The PRT notes that this is likely related to purging and sampling with a bailer (Table 5) and monitoring field parameters after discharging from the bailer, rather than continuous flow from the aquifer.</p> <p>In these cases, low purging rate with Waterra footvalves and polyethylene tubing may be more appropriate, or as described above, low-flow sampling.</p>	<p>Noted. Method improvements (including low flow purging) are being considered in 2024 Q3 field visits and beyond.</p>	<p>Comment satisfactorily addressed.</p>
6	Figure 4 (and other similar figures)	<p>The use of Durov plots to present the major ion results for comparison purposes is useful.</p> <p>It would be helpful if each well nest was shown with a different colour and a different symbol for each well in that well nest for clarity.</p>	<p>Noted, will be considered for future reports.</p>	<p>Comment satisfactorily addressed.</p>

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
7	Section 4.3.1.1 Quarterly and Annual Isotope Analysis	Are groundwater samples collected for isotope analysis affected by the collection methodology, including aerating samples collected via bailer? Are other environmental isotopes affected by the elevated turbidity (and presence of solids, such as SB_MW05_OB_INT) in the groundwater samples? Please provide an explanation of any data quality effects caused by aerating samples for isotope analysis or elevated turbidity.	<p>Bailers were not used on this project (acknowledging that that the use of bailers was erroneously included in the report). This will be corrected, and the report reissued.</p> <p>The wells were sampled using Waterra tubing and foot valve. This minimized contact with the atmosphere. Sample bottles for isotopes (18O and 2H) were filled with no headspace, so exchange with atmosphere is minimized. At these temperatures with these techniques the potential for isotope exchange is minor.</p> <p>Generally speaking, C14 and tritium analyses may be affected by aeration if samples in question were withdrawn from isolated intervals and contaminated with air. But note that this is not the case here. Additionally C14 and tritium results in this report were not obtained with required testing methodology and are all below detection limit. Gross alpha and beta activity may be affected by turbidity of the sample.</p> <p>No other environmental isotope measurements (in this study) are expected to be affected by elevated turbidity</p> <p>Future work will consider using low-flow methodologies to reduce the chance of aeration impacts on samples.</p>	Comment satisfactorily addressed.
8	Table 7	How will the water type data inform the decision-making process? Does this information indicate the degree of hydraulic connectivity between the overburden and shallow bedrock aquifers, and between the three intervals monitored at each bedrock well group.	This information reflects baseline conditions at the site. It is likely that there is a strong hydraulic conductivity between the overburden and shallow bedrock aquifers, but detailed study of transport processes is beyond the scope of this report and project.	Comment satisfactorily addressed.
9	Section 4.3.1, paragraph below Table 8	What do you interpret to be the source of nitrate to be for the deep bedrock well samples (SB_MW07_BR-A), and what is the method of contaminant transport to enable the nitrate to reach those depths?	Speculation on the source of the nitrates will be removed from the report as it goes beyond the scope of this report.	Comment satisfactorily addressed.

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
10	Figure 11, Appendix A	The PRT notes that the conductivity of SB_MW01_BR_GW001 (2.1 µS/cm) does not correspond to the analytical results (Appendix C) or Table 6 (Field Chemistry Parameter Summary). Please clarify the source and validity of this result.	Thank you for pointing this out. There appears to be an error. EC value should be higher similar to the rest of the samples on this plot – 488uS/cm. This will be corrected, and the report reissued.	Comment satisfactorily addressed.
11	Appendix C Laboratory Results table	These tables of results should include the field-measured parameters to allow comparison to analytical results. This is of particular importance for turbidity, as turbid samples may affect unfiltered groundwater quality results.	Noted, will be considered for future reports.	Comment satisfactorily addressed.

3.7 3D Seismic Data Acquisition & Processing Report, South Bruce, Ontario

The objective of this report is to document the collection procedures and data analysis from the 3D seismic reflection study. This information was to be used to define subsurface geological conditions such as characterizing seismic reflections and petrophysical properties. 3D seismic interpretations of this data are described in a separate report. Comments are provided in **Table 7**.

Table 7 Comment Disposition Table - 3D Seismic Data Acquisition & Processing Report, South Bruce, Ontario. Revision: 1 (Final) (APM-REP-01332-0454) (Geofirma; May 28, 2024)

Comment Number	Report Section Reference	Comments from Peer Review	How and Where Comments are Addressed (NWMO to complete)	Peer Review Responses to NWMO Comments (GHD to complete after previous column completed by NWMO)
1	General	Many technical concepts are not explained sufficiently for lay-person review. The PRT has no comments on the technical portion of this report.	Noted, will be considered for future reports	Comment satisfactorily addressed.

Appendix C

36 Guiding Principles

South Bruce Guiding Principles for NWMO's Site Selection Process

The Nuclear Waste Management Organization (NWMO) is seeking an informed and willing host for a deep geologic repository (DGR) to safely store Canada's used nuclear fuel, and a Centre for Expertise. To guide its work, South Bruce held a comprehensive visioning process in 2019 and 2020 to get input on what people cared about most in relation to the Project. The process, in addition to other community input and feedback resulted in the creation of 36 Guiding Principles which focus on safety for people and the environment, ensuring the Project brings meaningful benefits to the community, and ensuring the municipality has a voice in decision-making.

The principles were adopted by Council resolution and they have guided municipal activities and engagement related to the Project. South Bruce is seeking NWMO commitments on how it would meet or address these 36 expectations and aspirations for the Project. This is a key step in determining whether the Project is right for the community and will help people make an informed decision when a public referendum is held to measure willingness to be a host community.

Safety and the Natural Environment



1. The NWMO must demonstrate to the satisfaction of the Municipality that the Project will be subject to the highest standards of safety across its lifespan of construction, operation and into the distant future.
2. The NWMO must demonstrate to the satisfaction of the Municipality that sufficient measures will be in place to ensure the natural environment will be protected, including the community's precious waters, land and air, throughout the Project's lifespan of construction, operation and into the distant future.
3. The NWMO must demonstrate to the satisfaction of the Municipality that used nuclear fuel can be safely and securely transported to the repository site.
4. The NWMO will ensure that the repository site will not host any nuclear waste generated by other countries.
5. The NWMO must commit to implementing the Project in a manner consistent with the unique natural and agricultural character of the community of South Bruce.
6. The NWMO will minimize the footprint of the repository's surface facilities to the extent it is possible to do so and ensure that public access to the Teeswater River is maintained, subject to meeting regulatory requirements for the repository.
7. The NWMO must commit to preparing construction management and operation plans that detail the measures the NWMO will implement to mitigate the impacts of construction and operation of the Project.

People, Community and Culture

8. The NWMO must demonstrate to the satisfaction of the Municipality that it has built broad support for the Project within the community of South Bruce.
9. The Municipality will, in collaboration with community members, develop and establish an open and transparent process that will allow the community to express its level of willingness to host the Project.
10. The NWMO will identify the potential for any positive and negative socio-economic impacts of the Project on South Bruce and surrounding communities and what community benefits it will contribute to mitigate any potential risks.
11. The NWMO, in consultation with the Municipality, will establish a property value protection program to compensate property owners in the event that property values are adversely affected by the NWMO's site selection process and the development, construction and/or operation of the Project.
12. The NWMO, in consultation with the Municipality, will establish a program to mitigate losses to business owners in the event that their business is adversely affected by the NWMO's site selection process and the development, construction and/or operation of the Project.
13. The NWMO, in partnership with the Municipality, will develop a strategy and fund a program to promote the agriculture of South Bruce and the surrounding communities.
14. The NWMO, in partnership with the Municipality, will develop a strategy and fund a program to promote tourism in South Bruce and the surrounding communities.
15. The NWMO, in partnership with the Municipality, will commit to implement programs to engage with and provide opportunities for youth in the community, including investments in education and the provision of scholarships, bursaries and other incentives for youth to remain in or return to the community.
16. The NWMO will implement the Project in a manner that promotes diversity, equality and inclusion.
17. The Municipality recognizes the important historic and contemporary roles Indigenous peoples have and continue to play in the stewardship of the lands we all call home and will, in the spirit of Reconciliation, work with the NWMO and local Indigenous peoples to build mutually respectful relationships regarding the Project.
18. The NWMO will commit to relocate the working location of a majority of its employees to South Bruce as soon as it is reasonably practicable to do so after the completion of the site selection process.
19. The NWMO will, in consultation with the Municipality, establish a Centre of Expertise at a location within South Bruce to be developed in conjunction with the Project.

Economics and Finance

20. The NWMO, in consultation with the Municipality, will commit to implementing a local employment and training strategy with the objective of ensuring that the majority of employees for the Project are located within South Bruce and surrounding communities.
21. The NWMO, in consultation with the Municipality, will commit to implementing a business opportunities strategy that will provide opportunities for qualified local businesses to secure agreements that support the Project and that requires the NWMO to take all reasonable steps to create opportunities for qualified local businesses to benefit from the Project.
22. The NWMO will commit to implementing a procurement strategy for the Project that gives preference to the selection of suppliers who can demonstrate economic benefit to South Bruce and surrounding communities.
23. The NWMO will enter into an agreement with the Municipality providing for community benefit payments to the Municipality.

Capacity Building

24. The NWMO will cover the costs incurred by the Municipality in assessing community well-being and willingness to host the Project.
25. The NWMO will fund the engagement of subject matter experts by the Municipality to undertake peer reviews of Project reports and independent assessments of the Project's potential impacts on and benefits for the community as determined necessary by the Municipality.

26. The NWMO agrees to cover the costs of the Municipality's preparation for and participation in the Project's regulatory approval processes, including the Canadian Nuclear Safety Commission's licencing process and the assessment of the Project under the Impact Assessment Act (or other similar legislation), that are not otherwise covered by available participant funding.
27. The NWMO will fund the Municipality's preparation of a housing plan to ensure that the residents of South Bruce have access to a sufficient supply of safe, secure, affordable and well-maintained homes.

Services and Infrastructure

28. The NWMO will prepare a review of the existing emergency services in South Bruce and provide appropriate funding for any additional emergency services required to host the Project in South Bruce.
29. The NWMO will prepare an infrastructure strategy that addresses any municipal infrastructure requirements for the Project and will commit to providing appropriate funding for any required upgrades to municipal infrastructure required to host the Project in South Bruce.
30. The NWMO will prepare a review of the existing and projected capacity of South Bruce's road network and will commit to providing appropriate funding for any required upgrades to the road network.
31. The NWMO will enter into a road use agreement with the Municipality that identifies approved transportation routes during construction and operation of the Project and ensures proper funding for maintenance and repair of municipal roads and bridges used for the Project.

Services and Infrastructure (continued)

32. The NWMO, in consultation with the Municipality and other local and regional partners, will prepare a strategy to ensure there are sufficient community services and amenities, including health, child-care, educational and recreational facilities, to accommodate the expected population growth associated with hosting the Project in South Bruce.
33. The NWMO will comply with the Municipal Official Plan and zoning by-law and seek amendments to the Official Plan and zoning by-law as necessary to implement the Project.

Regional Benefits

36. The NWMO must demonstrate to the satisfaction of the Municipality that the Project will benefit the broader region outside of the community of South Bruce, including local Indigenous communities.

Governance and Community Engagement

34. The NWMO will provide the Municipality with an ongoing and active role in the governance of the Project during the construction and operation phases of the Project.
35. The NWMO will continue to engage with community members and key stakeholders to gather input on community vision, expectations and principles, including concerns, related to the Project.



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Reach out anytime with your questions, comments, concerns, or if you are seeking more information. We would be happy to hear from you!

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