



NUCLEAR WASTE MANAGEMENT ORGANIZATION SOCIÉTÉ DE GESTION DES DÉCHETS NUCLÉAIRES

August 09, 2012

Municipality of South Bruce
P.O. Box 540
21 Gordon St. E.
Teeswater, ON N0G 2S0

Attn: Ms. Sharon Chambers, CAO

Re: Adaptive Phased Management Initial Screening – The Municipality of South Bruce

Dear Ms. Chambers,

Further to the Municipality of South Bruce's request to Learn More about the Adaptive Phased Management program and request for an initial screening, I am pleased to attach a report outlining the findings from the initial screening, as described in the Process for Selecting a Site for Canada's Deep Geological Repository for Used Nuclear Fuel (May, 2010). As you know, the purpose of the initial screening in Step 2 of the process is to determine whether, based on readily-available information and five screening criteria, there are any obvious conditions that would exclude the Municipality of South Bruce from further consideration in the site selection process.

As the report indicates, the review of readily available information and the application of the five initial screening criteria did not identify any obvious conditions that would exclude the Municipality of South Bruce from further consideration in the NWMO site selection process. The initial screening suggests that the Municipality comprises geological formations that are potentially suitable for hosting a deep geological repository for Canada's used nuclear fuel. It is important to note that this initial screening has not confirmed the suitability of your community. Should your community choose to continue to explore its potential interest in the project, your area would be the subject of progressively more detailed assessments against both technical and social factors. Several years of studies would be required to confirm whether a site within your area could be demonstrated to safely contain and isolate used nuclear fuel.

The process for identifying an informed and willing host community for a deep geological repository for the long-term management of Canada's used nuclear fuel is designed to ensure, above all, that the site which is selected is safe and secure for people and the environment, now and in the future. The NWMO expects that the selection of a preferred site would take between seven to ten years. It is important that any community which decides to host this project base its decisions on an understanding of the best scientific and social research available and its own aspirations. Should the Municipality of South Bruce continue to be interested in exploring the project, over this period there would be ongoing engagement of your community, surrounding communities and others who may be affected. By the end of this process, South Bruce as a whole community would need to clearly demonstrate that it is willing to host the repository in order for this project to proceed.

Tel 416.934.9814
Fax 416.934.9526
Toll Free 1.866.249.6966

22 St. Clair Avenue East 6th Floor
Toronto Ontario Canada M4T 2S3
www.nwmo.ca

The next evaluation step would be to conduct a feasibility study as described in Step 3 of the site selection process. This feasibility study would focus on areas selected in collaboration with the community. As your community considers whether it is interested in advancing to the feasibility study phase, the NWMO encourages you to continue community discussion and further learning about the project. Support programs are available to assist your community to reflect on its long-term vision and whether this project is consistent with achieving that vision. Programs and resources are also available to engage your community residents in learning more about this project and becoming involved. We would be very pleased to provide further information about these programs.

Once again, I thank you for taking the time to learn about Canada's plan for the safe, secure management of Canada's used nuclear fuel.

Sincerely,



Kathryn Shaver,
Vice President, APM Public Engagement and Site Selection

c. Mayor Bill Goetz

**SUMMARY REPORT
INITIAL SCREENING FOR SITING A DEEP GEOLOGICAL
REPOSITORY FOR CANADA'S USED NUCLEAR FUEL**

The Corporation of the Municipality of South Bruce

**SUMMARY REPORT
INITIAL SCREENING FOR SITING A DEEP GEOLOGICAL
REPOSITORY FOR CANADA'S USED NUCLEAR FUEL**

**The Corporation of the Municipality of
South Bruce**

Prepared by:

AECOM

300 – 300 Town Centre Boulevard 905 477 8400 tel
Markham, ON, Canada L3R 5Z6 905 477 1456 fax
www.aecom.com

Project Number:

60247068-2a

Date:

August, 2012

AECOM Signatures



Report Prepared By:

Robin Frizzell, M.Sc., P.Geo
Senior Geoscientist



Report Reviewed By:

Robert E.J. Leech, P.Geo.
Practice Lead, Environment

Executive Summary

On, March 27, 2012, the Corporation of the Municipality of South Bruce expressed interest in learning more about the Nuclear Waste Management Organization (NWMO) site selection process to find an informed and willing community to host a deep geological repository for Canada's used nuclear fuel (NWMO, 2010). This report summarizes the findings of an initial screening, conducted by AECOM (2012), to evaluate the potential suitability of the Municipality of South Bruce against five screening criteria using readily available information. The purpose of the initial screening is to identify whether there are any obvious conditions that would exclude the Municipality of South Bruce from further consideration in the site selection process. The initial screening focused on the areas within the boundaries of the Municipality of South Bruce. Areas within neighbouring municipalities were not included in the initial screening.

The review of readily available information and the application of the five initial screening criteria did not identify any obvious conditions that would exclude the Municipality of South Bruce from being further considered in the NWMO site selection process. The initial screening indicates that there are geological formations within the boundaries of the Municipality that are potentially suitable for safely hosting a deep geological repository. Potentially suitable host formations include the Upper Ordovician shale and limestone units that comprise the geology of the Municipality at typical repository depths.

It is important to note that the intent of this initial screening is not to confirm the suitability of the Municipality of South Bruce to host a deep geological repository, but rather to provide early feedback on whether there are known reasons to exclude it from further consideration. Should the community of South Bruce remain interested in continuing with the site selection process, more detailed studies would be required to confirm and demonstrate whether the Municipality of South Bruce contains sites that can safely contain and isolate used nuclear fuel. The process for identifying an informed and willing host community for a deep geological repository for Canada's used nuclear fuel is designed to ensure, above all, that the site which is selected is safe and secure for people and the environment, now and in the future.

The five initial screening criteria are defined in the site selection process document (NWMO, 2010) and relate to: having sufficient space to accommodate surface and underground facilities, being outside protected areas and heritage features, absence of known groundwater resources at repository depth, absence of known natural resources and avoiding known hydrogeologic and geologic conditions that would make an area or site unsuitable for hosting a deep geological repository.

1. Introduction

In May 2010, the NWMO published and initiated a nine-step site selection process to find an informed and willing community to host a deep geological repository for Canada's used nuclear fuel (NWMO, 2010). The site selection process is designed to address a broad range of technical, social, economic and cultural factors as identified through dialogue with Canadians including Aboriginal peoples, and draws from experiences and lessons learned from past work and processes developed in Canada to site facilities for the management of other hazardous material. It also draws from similar projects in other countries pursuing the development of deep geological repositories for used nuclear fuel. The suitability of potential candidate sites will ultimately be assessed against a number of site evaluation factors, both technical and social in nature.

The site evaluation process includes three main phases over a period of several years, with each step designed to evaluate the site in progressively greater detail upon request of the community. The three site evaluation phases include: Initial Screenings to evaluate the potential suitability of the community against a list of initial screening criteria, using readily available information (Step 2); Feasibility Studies to determine if candidate sites within the proposed areas are potentially suitable for developing a safe deep geological repository for used nuclear fuel (Step 3); and Detailed Site Evaluations, at one or more selected sites, to confirm suitability based on detailed site evaluation criteria (Step 4). It is up to the communities to decide whether they wish to continue to participate in each step of the process.

2. Objective of the Initial Screening

The overall objective of the initial screening is to evaluate proposed geographic areas against a list of screening criteria using readily available information. Initial screening criteria (NWMO, 2010) require that:

1. The site must have enough available land of sufficient size to accommodate the surface and underground facilities.
2. This available land must be outside of protected areas, heritage sites, provincial parks and national parks.
3. This available land must not contain known groundwater resources at the repository depth, so that the repository site is unlikely to be disturbed by future generations.
4. This available land must not contain economically exploitable natural resources as known today, so that the repository site is unlikely to be disturbed by future generations.
5. This available land must not be located in areas with known geological and hydrogeological characteristics that would prevent the site from being safe, considering the safety factors outlined in Section 6 of the Site Selection Document (NWMO, 2010).

For cases where readily available information is limited and where assessment of some of the criteria is not possible at the initial screening stage, the area would be advanced to the feasibility study stage for more detailed evaluation, if the community remains interested in participating in the siting process.

3. Initial Screening Assessment

This section provides a summary evaluation of each of the five initial screening criteria for the Municipality of South Bruce, based on readily available information (AECOM, 2012). The intent of this evaluation is not to conduct a detailed analysis of all available information or identify specific potentially suitable sites, but rather to identify any obvious conditions that would exclude the Municipality of South Bruce from being further considered in the site selection process.

The Municipality of South Bruce is approximately 488 km² in size and is located within Bruce County in southern Ontario, between Owen Sound and Goderich.

Screening Criterion 1: The site must have enough available land of sufficient size to accommodate the surface and underground facilities.

The review of readily available information indicates that the Municipality of South Bruce contains sufficient land to accommodate the repository's surface and underground facilities. Surface facilities will require a land parcel of about 1 km by 1 km (100 ha) in size, although some additional space may be required to satisfy regulatory requirements. The underground footprint of the repository is about 1.5 km by 2.5 km (375 ha) at a typical depth of about 500 m.

Review of available mapping and satellite imagery shows that the Municipality of South Bruce contains limited constraints that would prevent the development of the repository's surface facilities. Only a small portion of the Municipality is covered by localized residential and industrial/commercial infrastructure. These are mainly associated with the villages of Teeswater and Mildmay in the west and east-central areas of the Municipality and the former hamlet of Formosa in the north-central area of the municipality. The remainder of the Municipality of South Bruce is largely agricultural land with development limited to roadways and settlement areas. The review of available geological information suggests that the Municipality of South Bruce contains geological formations with sufficient volumes of rock at depth to accommodate the repository underground facilities (see Screening Criterion 5).

Screening Criterion 2: Available land must be outside of protected areas, heritage sites, provincial parks and national parks.

The review of readily available information shows that the Municipality of South Bruce contains sufficient land outside of protected areas, heritage sites, provincial parks and national parks to accommodate the repository's facilities. There are no provincial or national parks within the Municipality of South Bruce. Protected areas include the Saugeen Conservation Reserve in the southeast portion of the Municipality (1.5 km²), and Provincially Significant Wetlands such as the Greenock Swamp, the Teeswater Wetland Complex and the Otter Creek Wetland, which account for approximately 6 % (29 km²) of the area of the Municipality. Most of the land in the Municipality of South Bruce is free of known heritage constraints. There is only one known archeological site within the Municipality and there are no listed National Historic Sites in the Municipality of South Bruce.

The absence of locally protected areas or heritage sites would need to be confirmed in discussion with the community and Aboriginal peoples in the area during subsequent site evaluation stages, if the community remains interested in continuing with the site selection process.

Screening Criterion 3: Available land must not contain known groundwater resources at the repository depth, so that the repository site is unlikely to be disturbed by future generations.

The review of available hydrogeological information did not identify any known groundwater resources at repository depth beneath the Municipality of South Bruce. The Ministry of the Environment Water Well Records indicates that no potable water supply wells are known to exploit aquifers at typical repository depths (approximately 500 m) within the Municipality of South Bruce or the surrounding areas. All water wells known in the Municipality of South Bruce obtain water from overburden or shallow bedrock sources at depths ranging from 3 to 128 m.

The potential for groundwater resources at the typical repository depth beneath the Municipality of South Bruce is very low. Experience from other areas in southern Ontario and the detailed site characterization work recently completed at the nearby Bruce nuclear site for OPG's proposed DGR for low and intermediate level radioactive waste has shown that there is no active deep groundwater system at typical repository depths. The active groundwater system is shallow and limited to the upper approximately 200 m.

The absence of groundwater resources at repository depth would need to be confirmed during subsequent site evaluation stages, if the community remains interested in continuing with the site selection process.

Screening Criterion 4: Available land must not contain economically exploitable natural resources as known today, so that the repository site is unlikely to be disturbed by future generations.

Based on the review of available information, the Municipality of South Bruce contains sufficient land, free of known economically exploitable natural resources, to accommodate the required repository's facilities.

The review of available information indicates that there are no known oil and gas pools within the Municipality of South Bruce. Four historic exploration wells drilled within the Municipality for hydrocarbon exploration resulted in dry holes with no production. There are currently no operating mines within the Municipality. There is no record of metallic mineral production in the past, and no exploration potential for metallic minerals has been identified within the Municipality of South Bruce. Known non-metallic mineral resources in the region include bedrock-derived crushed stone, natural surficial sand and gravel resources, salt and building stone. Current licensed non-metallic mineral extraction in the Municipality of South Bruce is limited to shallow sand and gravel resources. The risk that these resources pose for future human intrusion is negligible, as quarrying operations would be limited to shallow depths.

Screening Criterion 5: Available land must not be located in areas with known geological and hydrogeological characteristics that would prevent the site from being safe, considering the outlined safety factors in Section 6 of the Site Selection Document.

Based on the review of available geological and hydrogeological information, the Municipality of South Bruce comprises large areas of lands that do not contain obvious known geological and hydrogeological conditions that would make the area unsuitable for hosting a deep geological repository.

The safety-related geoscientific factors outlined in Section 6 of the Site Selection Document (NWMO, 2010) relate to: safe containment and isolation of used nuclear fuel; long-term resilience to future geological processes and climate change; safe construction, operation and closure of the repository; isolation from future human activities; and

amenability to site characterization and data interpretation activities. At this early stage of the site evaluation process, where limited data at repository depth exist, these factors are assessed using readily available information, with the objective of identifying any obvious unfavourable hydrogeological and geological conditions that would exclude the Municipality of South Bruce from further consideration. The safety factors would be gradually assessed in more detail as the site evaluation process progresses and more site specific data are collected during subsequent evaluation phases, provided the community remains interested in continuing in the site selection process.

Safe Containment and Isolation

The geological and hydrogeological conditions of a suitable site should promote long-term containment and isolation of used nuclear fuel and retard the movement of any potentially released radioactive material. This requires that the repository be located at a sufficient depth, typically around 500 m, in a sufficient rock volume with characteristics that limit groundwater movement.

The review of readily available information indicates that the Municipality of South Bruce contains areas with no obvious geological and hydrogeological conditions that would fail the containment and isolation requirements. The geology of the Municipality of South Bruce at typical repository depth is dominated by the Upper Ordovician shale and limestone units. These formations exist at a sufficient depth and in sufficient volumes to host a deep geological repository. They are also expected to have hydrogeological characteristics that would limit groundwater movement. Experience from other areas in southern Ontario indicates that the deep groundwater regime within the Upper Ordovician shale and limestone units in southern Ontario is diffusion dominated and isolated from the shallow groundwater system. Additional geoscientific characteristics that may have an impact on the containment and isolation functions of a deep geological repository for used nuclear fuel beneath the Municipality of South Bruce, such as the mineralogy of the rock, the geochemical composition of the groundwater and rock porewater, and the thermal and geomechanical properties of the rock would need to be further assessed during subsequent site evaluation stages, provided the community remains interested in continuing with the site selection process.

Long-Term Stability

A suitable site for hosting a repository is a site that would remain stable over the very long-term in a manner that will ensure that the performance of the repository will not be substantially altered by future geological and climate change processes, such as earthquakes or glaciation. A full assessment of this geoscientific factor requires detailed site specific data that would be typically collected and analyzed through detailed field investigations. At this early stage of the site evaluation process, the long-term stability factor is evaluated by assessing whether there is any evidence that would raise concerns about the long-term hydrogeological and geological stability of the Municipality of South Bruce.

The review did not reveal any obvious geological or hydrogeological conditions that would clearly fail to meet the long-term stability requirement for a potential repository within the Municipality of South Bruce. The Municipality is underlain by the Precambrian crystalline basement of the Grenville Province, which has remained tectonically stable since approximately 970 million years ago. The geology of the Municipality of South Bruce is typical of many areas of southern Ontario, which has been subjected to numerous glacial cycles during the last million years. Glaciation is a significant past perturbation that could occur in the future. However, findings from studies conducted in other areas of southern Ontario suggest that the deep subsurface Paleozoic sedimentary formations have remained largely unaffected by past perturbations such as glaciations. These findings would need to be further assessed during subsequent site evaluation stages, provided the community remains interested in continuing with the site selection process.

Potential for Human Intrusion

The site should not be located in areas where the containment and isolation functions of the repository are likely to be disrupted by future human activities such as exploration or mining. Therefore, the repository should not be located within rock formations containing exploitable groundwater resources (aquifers) at repository depth and economically exploitable natural resources and other valuable commodities as known today. This factor has already been addressed under screening criterion 3 and 4 above, which suggests that the potential for deep groundwater resources and exploitable natural resources at repository depth is low in the Municipality of South Bruce.

Amenability to Construction and Site Characterization

The characteristics of a suitable site should be favourable for the safe construction, operation, closure and long-term performance of the repository. This requires that the strength of the host rock and in situ stress at repository depth are such that the repository could be safely excavated, operated and closed without unacceptable rock instabilities; and that the soil cover depth over the host rock should not adversely impact repository construction and site investigation activities. Similarly, the host rock geometry and structure should be predictable and amenable to site characterization and interpretation activities.

From a constructability perspective, limited site specific information is available on the local rock strength characteristics and in situ stresses for the Municipality of South Bruce. However, available information from other locations in southern Ontario suggests that the Upper Ordovician shale and limestone units have favourable geomechanical characteristics and are amenable to the type of excavation activities involved with the development of a deep geological repository for used nuclear fuel.

In terms of predictability of the geologic formations and amenability to site characterization activities, the review of available information on the bedrock geology for the Municipality of South Bruce did not reveal any conditions that would make the rock mass unusually difficult to characterize. The Upper Ordovician shale and limestone units are expected to have a simple geometry with limited structural complexities that would make them difficult to characterize.

4. Initial Screening Findings

This summary report presents the results of an initial screening to assess the potential suitability of the Municipality of South Bruce against five initial screening criteria using readily available information. The initial screening focused on the areas within the boundaries of the Municipality of South Bruce. Areas within neighbouring municipalities were not included in the initial screening. As outlined in NWMO's site selection process (NWMO, 2010), the five initial screening criteria relate to: having sufficient space to accommodate surface facilities, being outside protected areas and heritage sites, absence of known groundwater resources at repository depth, absence of known economically exploitable natural resources and avoiding known hydrogeologic and geologic conditions that would make an area or site unsuitable for hosting a deep geological repository. The initial screening focused on the areas within the boundaries of the Municipality of South Bruce. Areas within neighbouring municipalities were not included in the initial screening.

The review of readily available information and the application of the five initial screening criteria did not identify any obvious conditions that would exclude the Municipality of South Bruce from being further considered in the NWMO site selection process. The initial screening indicates that there are geological formations within the boundaries of the Municipality that are potentially suitable for safely hosting a deep geological repository. Potentially suitable host formations include the Upper Ordovician shale and limestone units that comprise the geology of the Municipality at typical repository depths.

It is important to note that at this early stage of the site evaluation process, the intent of the initial screening was not to confirm the suitability of the Municipality of South Bruce, but rather to identify whether there are any obvious conditions that would exclude it from the site selection process. Should the Municipality of South Bruce remain interested in continuing with the site selection process, several years of progressively more detailed studies would be required to confirm and demonstrate whether the Municipality of South Bruce contains sites that can safely contain and isolate used nuclear fuel.

The process for identifying an informed and willing host community for a deep geological repository for Canada's used nuclear fuel is designed to ensure, above all, that the site which is selected is safe and secure for people and the environment, now and in the future.

5. References

AECOM, 2012:

Initial Screening for Siting a Deep Geological Repository for Canada's Used Nuclear Fuel – Municipality of South Bruce, Ontario. AECOM Report Number 60247068-2

NWMO, 2010:

Moving Forward Together: Process for Selecting a Site for Canada's Deep Geological Repository for Used Nuclear Fuel, Nuclear Waste Management Organization, May 2010. (Available at www.nwmo.ca)