



NUCLEAR WASTE
MANAGEMENT
ORGANIZATION

SOCIÉTÉ DE GESTION
DES DÉCHETS
NUCLÉAIRES

June 9, 2011

Township of Schreiber
204 Alberta Street
P.O. Box 40
Schreiber, ON P0T 2S0

Attn: Mr. Jon Hall, Clerk/Administrator

Re: Adaptive Phased Management Initial Screening – The Corporation of the Township of Schreiber

Dear Mr. Hall,

Further to the Township of Schreiber'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 Township of Schreiber 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 Township of Schreiber from further consideration in the NWMO site selection process. The initial screening suggests that the Schreiber area contains portions of lands 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 Township of Schreiber 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, Schreiber as a whole community would need to clearly demonstrate that it is willing to host the repository in order for this project to proceed.

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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 Don McArthur



April 2011

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

Township of Schreiber, Ontario

Submitted to:

Nuclear Waste Management Organization
22 St. Clair Avenue East, 6th Floor
Toronto, Ontario
M4T 2S3

REPORT



A world of
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Report Number: 10-1152-0110 (5000B)

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EXECUTIVE SUMMARY

On September 28, 2010, the Township of Schreiber 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 Golder Associates Ltd., to evaluate the potential suitability of the Schreiber area against five screening criteria using readily available information (Golder, 2011). The purpose of the initial screening is to identify whether there are any obvious conditions that would exclude the Township of Schreiber from being further considered in the site selection process. The initial screening focused on the Township of Schreiber and its periphery, which are referred to as the "Schreiber area" in this report.

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 Township of Schreiber from being further considered in the NWMO site selection process. The initial screening indicates that the Schreiber area contains portions of lands that are potentially suitable for hosting a deep geological repository. Potential suitability of these areas would need to be further assessed during subsequent site evaluation stages, if the community of Schreiber remains interested in continuing with the site selection process.

It is important to note that the intent of this initial screening is not to confirm the suitability of the Schreiber area 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 Schreiber remain interested in continuing with the site selection process, more detailed studies would be required to confirm and demonstrate whether the Schreiber area 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.



1.0 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 and social, economic and cultural factors as identified through dialogue with Canadians and 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. These are: Initial Screenings (Step 2) to evaluate the potential suitability of the community against a list of initial screening criteria; Feasibility Studies (Step 3) to determine if candidate sites within the proposed areas may be potentially suitable for developing a safe used nuclear fuel repository; and Detailed Site Evaluations (Step 4), at one or more selected sites, to confirm suitability based on detailed site evaluation criteria. It is up to the communities to decide whether they wish to continue to participate in each step of the process.

2.0 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 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.

3.0 INITIAL SCREENING ASSESSMENT

This section provides a summary evaluation of each of the five initial screening criteria for the Schreiber area, based on readily available information. 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 Township of Schreiber from being further considered in the site selection process.

The Township of Schreiber is approximately 40 km² in size. The Township is located along the north shore of Lake Superior and lies approximately 150 km east of Thunder Bay.

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 shows that the Schreiber area contains sufficient land to accommodate the repository surface 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 developed areas and large water bodies occupy only a small portion of the Schreiber area. Lands at the periphery of the Township of Schreiber are accessible and contain areas that are potentially suitable for the establishment of surface and underground facilities. However, the availability of potentially suitable lands within the boundaries of the Township to support the construction of the repository's surface facilities could be constrained by topography. The feasibility and practicality of developing the repository facilities within the Township would need to be further assessed during subsequent site evaluation stages, if the community remains interested in continuing with the site selection process. The review of available geological information also suggests that the Schreiber area contains a number of geological formations with potentially sufficient volumes of rock at depth to accommodate the repository's underground facilities.

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 Schreiber area contains sufficient land outside of protected areas, heritage sites, provincial parks and national parks to accommodate the repository's facilities.

Four protected areas are found in the Schreiber area, all bordering Lake Superior. These protected areas occupy a small portion of the land in the Schreiber area. In addition, all the shoreline and water of Lake Superior in the Schreiber area is part of the Lake Superior National Marine Conservation Area. Most of the land in the Schreiber area is free of known heritage constraints. Known archaeological sites are small and generally concentrated around the shoreline of Lake Superior, with two of these sites lying within the Township at Worthington Bay. There are no National Historic Sites in the Schreiber area.

The absence of locally protected areas 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 information did not identify any known groundwater resources at repository depth (typically 500 m) for the Schreiber area. The Ontario Ministry of the Environment Water Well Records indicates that no potable water supply wells are known to exploit aquifers at typical repository depths in the Schreiber area



or anywhere else in Northern Ontario. Water wells in the Schreiber area source water from overburden or shallow bedrock aquifers at depths of up to 65 m.

Experience in similar geological settings across the Canadian Shield suggests that the potential for deep groundwater resources at repository depths is low throughout the Schreiber area. Active groundwater flow is generally confined to localized shallow fractured systems, in the upper 300 m. At greater depth, permeability tends to decrease as fractures become less common and interconnected. Groundwater at such depths is also generally saline. 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 Schreiber area contains sufficient land, free of known economically exploitable natural resources, to accommodate the required repository's facilities.

The Schreiber area has a generally low potential for oil and gas resources. There are currently no operating mines within the Schreiber area, although mineral exploration and mining have occurred in the area in the past. The potential for economically exploitable natural resources in the Schreiber area is associated with specific geological units such as the metavolcanic rocks of greenstone belts. The natural resource potential of the large granitic batholiths in the area is limited, except in localized areas along their margins.

Extraction of sand and gravel and quarrying of stone has occurred in the Schreiber area in the past and continues today. However, the risk that these resources pose for future human intrusion and breaching of the repository is negligible, as quarrying operations are typically limited to very 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 safety factors outlined in Section 6 of the Site Selection Document.

Based on the review of available geological and hydrogeological information, the Schreiber area comprises portions of land 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 Township of Schreiber from further consideration. They would be gradually assessed in more detail as the site evaluation process progresses and more site specific data is 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 Schreiber area contains areas with no obvious geological and hydrogeological conditions that would fail the containment and isolation requirements.

The Township of Schreiber is situated within the Wawa Subprovince of the Superior Province of the Canadian Shield. The rocks of the Schreiber area are composed primarily of Archean greenstone belts and granitic intrusions (plutons and batholiths). There are a number of geological formations in the Schreiber area that might be considered as potential host rocks for a repository. Examples of these formations include the granitic Whitesand Lake Batholith and Crossman Lake Batholith at the periphery of the Township. Within the boundaries of the Township, the potential suitability is limited to a small area underlain by the granitic Gwynne Mountain Pluton. The metavolcanic rocks of the greenstone belt that dominate the geology of the Township of Schreiber are likely unsuitable due to their heterogeneity, spatial variability and their potential for natural resources.

The potentially suitable granitic intrusions are cross cut by a number of inferred major faults. Smaller scale faults have also been inferred in the Schreiber area. The extent to which these faults extend to depth, their frequency of occurrence, and their potential impact on a repository would need to be further assessed through subsequent site evaluation stages, if the community remains interested in continuing with the site selection process.

From a hydrogeological point of view, the review of readily available information did not reveal the existence of deep fracture systems or deep aquifers in the Schreiber area. The presence of active deep groundwater flow systems in crystalline rocks is controlled by the frequency and interconnectivity of fractures at depth. Experience from other areas in the Canadian Shield, particularly for granitic intrusions, indicates that active groundwater flow tends to be generally limited to shallow fractured systems, typically less than 300 m. In deeper rock, fractures are less common and less likely to be interconnected, leading to very slow groundwater movement.

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 Schreiber area. 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 Schreiber area.

The Township of Schreiber is located in the Superior Province of the Canadian Shield, where large portions of land have remained tectonically stable for the last 2.5 billion years. There is also no evidence to suggest that the faults and shear zones identified in the Schreiber area have been tectonically active within the past billion years. The geology of the Schreiber area is typical of many areas of the Canadian Shield, 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 the Canadian Shield suggest



that deep crystalline formations, particularly the plutonic intrusions, have remained largely unaffected by past perturbations such as glaciation.

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. This factor has already been addressed in previous sections, which concluded that the potential for deep groundwater resources at repository depths and known economically exploitable natural resources is low throughout the granitic intrusive rocks in the Schreiber area.

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 Schreiber area. However, available information from geologically similar settings suggests that crystalline rock formations within the Canadian Shield, particularly within plutonic intrusions, generally possess geomechanical characteristics that are good to very good and amenable to the type of excavation activities involved in the development of a deep geological repository for used nuclear fuel.

In terms of predictability of the geological formations and amenability to site characterization activities, the review of the bedrock and Quaternary geology for the Schreiber area did not indicate any obvious conditions which would make the granitic intrusions difficult to characterize, although such conditions may exist in localized areas.

The degree to which factors such as geologic variability and overburden thickness might affect the characterization and data interpretation activities would require further assessment during subsequent site evaluation phases, provided the community remains interested in continuing in the site selection process.

4.0 INITIAL SCREENING FINDINGS

This report presents the results of an initial screening to assess the potential suitability of the Schreiber area against five initial screening criteria using readily-available information. The initial screening focused on the Township of Schreiber and its periphery, which are referred to as the “Schreiber area”. 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 natural resources and avoiding known hydrogeologic and geologic conditions that would make an area or site unsuitable for hosting a deep geological repository.

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 Township of Schreiber from further consideration in the NWMO site selection process.



The initial screening indicates that the Schreiber area contains portions of lands with geological formations that are potentially suitable for hosting a deep geological repository. Examples of these formations include the Whitesand Lake and Crossman Lake granitic Batholiths at the periphery of the Township. Within the Township, the potential suitability is limited to a small area underlain by the granitic Gwynne Mountain Pluton. Potential suitability of these areas would need to be further assessed during subsequent site evaluation stages, if the community remains interested in continuing with the site selection process.

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 Schreiber area, but rather to identify whether there are any obvious conditions that would exclude it from further consideration in the site selection process. Should the community of Schreiber 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 Schreiber area 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.

5.0 REFERENCES

Golder Associates Ltd., 2011. Initial Screening for Siting a Deep Geologic Repository for Canada's Used Nuclear Fuel – Township of Schreiber, Ontario. Golder Report Number 10-1152-0110 (5000).

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



6.0 REPORT SIGNATURE PAGE

GOLDER ASSOCIATES LTD.

Handwritten signature of Charles Mitz in black ink.

Charles Mitz, M.Eng., P.Geol.
Senior Geoscientist

CWM/GWS/wlm

Handwritten signature of George Schneider in black ink.

George Schneider, M.Sc., P.Geol.
Principal

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