



NUCLEAR WASTE SOCIÉTÉ DE GESTION
MANAGEMENT DES DÉCHETS
ORGANIZATION NUCLÉAIRES

February 21, 2012

Township of Nipigon
52 Front St
Box 160
Nipigon, ON P0T 2J0

Attn: Mr. Lindsay Mannila, CAO

Re: Adaptive Phased Management Initial Screening – The Township of Nipigon

Dear Mr. Mannila,

Further to the Municipality of Nipigon'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 Nipigon 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 Nipigon from further consideration in the NWMO site selection process. The initial screening suggests that the Nipigon 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 Nipigon 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, Nipigon 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,

A handwritten signature in blue ink that reads "Kathryn Shaver". The signature is fluid and cursive, with the first letters of the first and last names being capitalized and prominent.

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

c. Mayor Richard Harvey



February 2012

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

Township of Nipigon, 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 (9000B)

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EXECUTIVE SUMMARY

On November 9, 2011, the Township of Nipigon 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 Nipigon area 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 Township of Nipigon from further consideration in the site selection process. The initial screening focused on the Township of Nipigon and its periphery, which is referred to as the "Nipigon area" in this report. Areas within or in closer proximity to neighbouring townships 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 Township of Nipigon from further consideration in the NWMO site selection process. The initial screening indicates that there are large areas within the Township of Nipigon and its periphery that are potentially suitable for hosting a deep geological repository. The geology of these areas is dominated by metasedimentary rocks that extend to the northwest and north of the township boundaries. There are also several sufficiently large granitic intrusions to the north and northwest of the township that are also potentially suitable. Potential suitability of these areas would need to be further assessed during subsequent site evaluation stages, if the community of Nipigon 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 Nipigon 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 Nipigon remain interested in continuing with the site selection process, more detailed studies would be required to confirm and demonstrate whether the Nipigon 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 economically exploitable resources, and avoiding known hydrogeologic and geologic conditions that would make an area or site unsuitable for hosting a deep geological repository.



SUMMARY REPORT - INITIAL SCREENING - TOWNSHIP OF NIPIGON, ONTARIO



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 Nipigon area, based on readily available information. The intent of this evaluation is not to conduct a detailed analysis of all



SUMMARY REPORT - INITIAL SCREENING - TOWNSHIP OF NIPIGON, ONTARIO

available information or identify specific potentially suitable sites, but rather to identify any obvious conditions that would exclude the Township of Nipigon from being further considered in the site selection process.

The Township of Nipigon is approximately 116 km² in size and is located on the western shore of Lake Superior's Nipigon Bay, approximately 85 km northeast of Thunder Bay, and immediately north of the Township of Red Rock.

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 Nipigon 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 the Township of Nipigon contains limited constraints that would prevent the development of the repository's surface facilities. These would mainly include rugged terrain in the central portion of the township and development along the east portion of the township in the vicinity of the settlement area of Nipigon. Residential and industrial infrastructure occupies a small portion of the township, with developments limited mainly to roadways and the settlement area. The areas to the north and west of the township are largely undeveloped, with limited natural or physical constraints such as major infrastructure or permanent water bodies. The review of available geological information suggests that the Nipigon area contains geological formations with potentially 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 Nipigon area contains sufficient land outside of protected areas, heritage sites, provincial parks and national parks to accommodate the repository's facilities. Two provincial parks (Black Sturgeon River Provincial Park and Ruby Lake Provincial Park) and three conservation reserves (Black Bay Bog Conservation Reserve, Lake Superior Archipelago Conservation Reserve and Nipigon River Conservation Reserve) present within the Nipigon area occupy only small portions of land. Most of the land in the Nipigon area is free of known heritage constraints. Known archaeological and historical sites are small and generally located around the shoreline of Lake Superior, Lake Helen or on the Nipigon River.

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 information did not identify any known groundwater resources at repository depth (typically 500 m) for the Nipigon 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 Nipigon area or anywhere else in Northern Ontario. Water wells in the Nipigon area source water from overburden or shallow bedrock aquifers at depths of up to 159 m, with most wells from 30 to 60 m deep.



Experience in similar geological settings across the Canadian Shield suggests that the potential for deep groundwater resources at repository depths is low throughout the Nipigon 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 Nipigon area contains sufficient land, free of known economically exploitable natural resources, to accommodate the required repository's facilities.

The Nipigon area has a generally low potential for oil and gas resources and economic minerals. There are currently no producing mines in the Nipigon area. A few mineral occurrences have been identified in the area but their economical potential has not been proven. Active mining claims, 10 km to the west of the Township of Nipigon, are targeting copper and nickel within the shallow Hele Intrusion.

Commercial potential exists in the Nipigon area for aggregate and peat extraction. However, the risk that these resources pose for future human intrusion is negligible, as development of these non-metallic resources would be 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 Nipigon 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 Nipigon 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 Nipigon area contains areas with no obvious geological and hydrogeological conditions that would fail the containment and isolation requirements.

There are several geological units in the Nipigon area with favourable geological characteristics, and sufficient lateral extent, away from mapped faults, that are potentially suitable for hosting a deep geological repository. The Nipigon area is largely (about 90%) underlain by metasedimentary rocks (gneisses and migmatites) that are potentially suitable for hosting a deep geological repository. The Nipigon area also contains a number of granitic intrusions to the north and northwest of the township that are potentially suitable. Potential suitability of these geological units would need to be further assessed during 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 Nipigon 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 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 Nipigon 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 Nipigon area.

The Township of Nipigon 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. The geology of the Nipigon 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 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 under Screening Criterion 3 and 4 above, which concluded that the potential for deep groundwater resources at repository depths and known economically exploitable natural resources is low in the Nipigon 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 Nipigon area. However, available information from geologically similar settings suggests that crystalline rock formations within the Canadian Shield 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 Nipigon area did not indicate any obvious conditions which would make the rock mass unusually 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, if 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 Nipigon area against five initial screening criteria using readily available information. The initial screening focused on the Township of Nipigon and its periphery, which are referred to as the “Nipigon area”. Areas within or in closer proximity to neighbouring townships 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 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 Nipigon from further consideration in the NWMO site selection process. The initial screening indicates that there are large areas within the Township of Nipigon and its periphery that are potentially suitable for hosting a deep geological repository. The geology of these areas is dominated by metasedimentary rocks that extend to the northwest and north of the township boundaries. There are also several sufficiently large granitic intrusions to the north and northwest of the township that are also potentially suitable. 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 Nipigon 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 Nipigon 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 Nipigon 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., 2012. Initial Screening for Siting a Deep Geologic Repository for Canada's Used Nuclear Fuel – Township of Nipigon, Ontario. Golder Report Number 10-1152-0110 (9000).

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.

Charles Mitz, M.Eng., P.Geol.
Senior Geoscientist
CWM/GWS/wlm

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

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Africa	+ 27 11 254 4800
Asia	+ 86 21 6258 5522
Australasia	+ 61 3 8862 3500
Europe	+ 356 21 42 30 20
North America	+ 1 800 275 3281
South America	+ 55 21 3095 9500

solutions@golder.com
www.golder.com

Golder Associates Ltd.
2390 Argentia Road
Mississauga, Ontario, L5N 5Z7
Canada
T: +1 (905) 567 4444

