



NUCLEAR WASTE MANAGEMENT ORGANIZATION SOCIÉTÉ DE GESTION DES DÉCHETS NUCLÉAIRES

June 17, 2011

Township of Red Rock
PO Box 447
Red Rock, ON P0T 2P0

Attn: Mr. Kal Pristanski, Chief Administrative Officer/Clerk/Treasurer

Re: Adaptive Phased Management Initial Screening – The Township of Red Rock

Dear Mr. Pristanski,

Further to the Township of Red Rock'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 Red Rock from further consideration in the site selection process. 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 review of readily available information and the application of the five initial screening criteria show that the Red Rock area is unlikely to contain geological formations that would be potentially suitable for hosting a deep geological repository. The various geological formations within the area considered for this screening are either not amenable to site characterization or are unlikely to meet the safe containment and isolation function of a deep geological repository. Therefore, the Township of Red Rock is not considered as a suitable candidate for continuing in the NWMO site selection process.

Should you have any questions about the screening results, please do not hesitate to contact the NWMO through Peter Simmons. We would be pleased to review the report with you.

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

Sincerely,

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

c. Mayor Gary Nelson



June 2011

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

Township of Red Rock, 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 (7000B)

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EXECUTIVE SUMMARY

On February 25, 2011, the Township of Red Rock 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 Red Rock 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 Red Rock from being further considered in the site selection process. The initial screening focused on the Township of Red Rock and its periphery, which are referred to as the "Red Rock 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 show that the Red Rock area is unlikely to contain geological formations that would be potentially suitable for hosting a deep geological repository. The various geological formations within the area considered for this screening are either not amenable to site characterization or are unlikely to meet the containment and isolation function of a deep geological repository. Therefore, the Township of Red Rock is not considered as a suitable candidate for continuing in the NWMO site selection process.

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 Red Rock 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 Red Rock from being further considered in the site selection process.

The Township of Red Rock is approximately 68 km² in size and is located on the western shore of Lake Superior's Nipigon Bay, approximately 80 km northeast of Thunder Bay, and 5 km south of Nipigon.

Screening Criterion 1: The site must have enough available land of sufficient size to accommodate the 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. The review of readily available information shows that the Township of Red Rock contains sufficient land to accommodate the repository's surface and underground facilities. However, as is discussed in Criterion 5 below, the area does not contain geological units that are suitable for hosting a deep geological repository and associated underground facilities.

Review of available mapping and satellite imagery shows that the Township of Red Rock contains few constraints that would prevent the development of the repository's surface facilities. The main constraints include prominent topographic features near the eastern edge of the Black Sturgeon River Fault Zone (western edge of the Township) and the Red Rock Hill in the southeastern part of the Township. Residential and industrial infrastructure occupies a very small portion of the Township, with developments limited mainly to roadways and the settlement area. The areas at the periphery of the Township of Red Rock are also largely undeveloped, with few natural or physical constraints such as major infrastructure or permanent water bodies but land to the north is within or in closer proximity to the neighbouring Township.

While the Township of Red Rock contains sufficient land to potentially accommodate the repository's surface facilities, the Township does not contain geological units that are suitable for hosting a deep geological repository, as discussed in detail in Screening Criterion 5 below.

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

Two provincial parks and one conservation reserve occupy small portions of land within the Red Rock area. The Black Sturgeon River Provincial Park is some 72 km in length and covers 244 km² in area, but only a small portion of the park occurs within the Township boundaries where it forms a 1 to 1.5 km wide band in the western portion of the Township. The Ruby Lake Provincial Park covers an area of 27 km² on the east side of the mouth of the Nipigon River, bordering the extreme northeast of the Township of Red Rock. The Black Bay Bog Conservation Reserve is located approximately 10 km to the south of the Township of Red Rock. There are no registered archaeological sites or national historic sites within the Red Rock area.



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 Red Rock area. The Ontario Ministry of the Environment Water Well Record database shows that all water wells known in the Red Rock area obtain water from overburden or shallow bedrock sources at depths ranging from 1 to 159 m, with most wells between 30 to 60 m deep.

The geology of the Red Rock area at repository depth is dominated by metasedimentary rocks that are part of the crystalline rocks of the Canadian Shield. Experience in similar geological settings across the Canadian Shield suggests that the potential for deep groundwater resources at repository depths is low throughout the Red Rock 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.

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 Red Rock area contains sufficient land, free of known economically exploitable natural resources, to accommodate the required repository's facilities.

The Red Rock area has a generally low potential for oil and gas resources. There are no current or past mining operations in the Red Rock area and the potential for metallic mineral resources remains low and generally associated with localized geological formations in the area, such as the Nipigon intrusives or the Hele intrusion, and not associated with the metasedimentary, or granitic rocks. Commercial potential for peat exists in some low-lying areas, but no peat extraction has occurred in the Red Rock area.

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.

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 to demonstrate that the project could be safely implemented. 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 Red Rock from further consideration.

The review of readily available geological and hydrogeological information identified characteristics suggesting that the Red Rock area is unlikely to contain geological formations that would be potentially suitable for hosting a deep geological repository. The Red Rock area is therefore not considered as a suitable candidate for continuing in the NWMO site selection process. As discussed below, the geology of the Red Rock area would not satisfy the safe containment and isolation and the site characterization and data interpretation safety-related factors



required to demonstrate with confidence that the project could be safely implemented in the Red Rock area. Since these factors are not satisfied, the other safety-related factors are not discussed.

Safe Containment and Isolation and Amenability to Site Characterization

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 characteristics of a suitable site should also be favourable for the safe construction of the repository. This requires that the host rock geometry and structure should be predictable and amenable to site characterization and interpretation activities.

The geology of the Red Rock area is composed of five distinct geologic units. These include the sedimentary rocks of the Sibley Group, the Hele Intrusion, the Nipigon Sills, the granitic intrusions and the metasedimentary rocks of the Quetico Subprovince. Potential suitability of these various geological formations within and at the periphery of the Township is summarized below.

Sedimentary Rocks of the Sibley Group

More than half of the Township is underlain by sedimentary rocks of the Sibley Group, which overlay the metasedimentary rocks that form most of the rock at repository depth in the Red Rock area. The sedimentary rocks of the Sibley Group cover the southern and eastern parts of the Township and extend significantly beyond the boundaries of the Township to the west and northwest along the west side of the Black Sturgeon River Fault Zone. The sedimentary rocks of the Sibley Group are estimated to be approximately 200 m thick in the Red Rock area. An approximately 500 m deep geological repository in these areas would necessarily have to be developed in the underlying metasedimentary rocks. One of the key criteria in assessing the suitability of a site relates to having a host rock that is amenable to site characterization in order to develop a good understanding of the geoscientific characteristics of the site and a robust safety case. Because of the nature of the structural characteristics of these metasedimentary rocks (e.g. fracture geometry and frequency), the presence of the overlying 200 m thick sedimentary rocks would greatly reduce the ability to adequately characterize them at repository depth. Therefore, all the areas within and outside the Township that are covered by the sedimentary rocks of the Sibley Group are excluded from further consideration. These areas include a very large portion of the Township and the surrounding areas to the south, west and northwest of the Township.

The Hele Intrusion and Nipigon Diabase Sills

The Hele Intrusion covers a small portion of the southwest corner of the Township and extends to the west. Similarly to the sedimentary rocks of the Sibley Group, the Hele Intrusion has an estimated maximum thickness of approximately 130 m and does not extend to repository depth. A deep geological repository in this area would necessarily have to be developed in the underlying metasedimentary rocks, which would be difficult to adequately characterize. Therefore, the area of the Hele Intrusion is also excluded from further consideration. The Nipigon Sills in the Red Rock area are mapped in several localized areas at surface. These are approximately 100 m thick layers of intrusive rocks that are generally too thin to be considered potentially suitable.

Granitic Intrusions

There are a number of granitic intrusions in the Red Rock area, with only one located in the northwest of the Township. This granitic intrusion may have a sufficient lateral extent to host a repository within the Township, but its thickness is unknown. A number of faults have been interpreted at surface with an approximate spacing



of 1 to 2 km. While it is unknown if these faults extend to repository depth, their presence and the proximity of the Black Sturgeon River Fault Zone may indicate that these granitic rocks may have experienced substantial brittle deformation, which would not be favourable for containment and isolation. The granitic intrusions located north of the Township are within or in closer proximity to the neighbouring Township, which has not been included in the initial screening.

Metasedimentary Rocks

The metasedimentary rocks cover small portions of northwest corner and north-central part of the Township and extend north into the neighboring Township and west to the Black Sturgeon River Fault Zone. While there is limited information on the degree of homogeneity of these metasedimentary rocks at repository depth, the high degree of metamorphism and partial melting they have experienced in the past would suggest that their physical characteristics could be similar to those of granitic rock.

The metasedimentary rocks in the northwest corner of the Township are marginally sufficient in volume, but their proximity to the Black Sturgeon River Fault Zone may have greatly altered the quality of the rock at depth. They are also partly covered by the Black Sturgeon River Provincial Park. While the remaining metasedimentary rocks in the north-central part of the Township are potentially suitable to host a deep geological repository, they would be difficult to adequately characterize at depth because they are entirely covered by a fairly thick overburden layer.

4.0 INITIAL SCREENING FINDINGS

This report presents the results of an initial screening to assess the potential suitability of the Red Rock area against five initial screening criteria using readily-available information. The initial screening focused on the Township of Red Rock and its periphery, which are referred to as the "Red Rock area". Areas within or in closer proximity of 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 show that the Red Rock area is unlikely to contain geological formations that would be potentially suitable for hosting a deep geological repository. The various geological formations within the area considered for this screening are either not amenable to site characterization or are unlikely to meet the containment and isolation function of a deep geological repository. Therefore, the Township of Red Rock is not considered a suitable candidate for continuing in the NWMO site selection process.

The bedrock geology of the Red Rock area at repository depth is dominated by metasedimentary rocks that could be potentially suitable for hosting a deep geological repository. However, within large areas of the Township and its periphery, these metasedimentary rocks are overlain by a fairly thick sedimentary rock cover (about 200 m) that would make them difficult to characterize.

The remaining small areas within the Township that are underlain by the metasedimentary rocks and not covered by the sedimentary rocks are unlikely to be suitable either because of their proximity the regional Black



Sturgeon River Fault Zone or they are covered by a fairly thick overburden layer that would also make them difficult to characterize at depth. Most of the areas north of the Township boundaries may be potentially suitable for hosting a deep geological repository as they are underlain by the metasedimentary rocks and are free of the sedimentary rock cover. However, these areas are located within or in closer proximity to the neighbouring Township, which was not included in this initial screening.

Other geological units within and outside of the Township, such as the Hele Intrusion and the various localized Nipigon Sills and the granitic intrusions, have been found to be not suitable. This is either because of their insufficient volume or due to the presence of faults that may affect the containment and isolation function of a deep geological repository.

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 Red Rock, Ontario. Golder Report Number 10-1152-0110 (7000).

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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