



NUCLEAR WASTE MANAGEMENT ORGANIZATION SOCIÉTÉ DE GESTION DES DÉCHETS NUCLÉAIRES

March 4, 2011

Chief Ralph Paul
English River First Nation
Box 30,
Patuanak, SK S0M 2H0

Re: Adaptive Phased Management Initial Screening – English River First Nation

Dear Chief Paul,

Further to your 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 English River First Nation 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 English River First Nation from further consideration in the NWMO site selection process. The initial screening indicates that there are a number of English River First Nation reserve areas that are potentially suitable for hosting a deep geological repository for Canada's used nuclear fuel. 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 to confirm the suitability of your community. 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 English River First Nation 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, English River First Nation as a whole community would need to clearly demonstrate that it is willing to host the repository in order for this project to proceed.

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

Copy: Bernie Eaglechild, Councillor



February 2011

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

English River First Nation, Saskatchewan

Submitted to:

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



A world of
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Report Number: 10-1152-0110 (4000B)

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EXECUTIVE SUMMARY

On September 13, 2010, the English River First Nation 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 thirteen English River First Nation reserve areas 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 English River First Nation from further consideration in the site selection process. 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.

For the purpose of the screening, the thirteen reserves were grouped into three distinct regions based on the similarity of their geology: the three reserves within the sedimentary rocks of the Athabasca Basin (Region 1); the seven reserves within the Canadian Shield (Region 2); and the three reserves within the sedimentary rocks of the Western Canada Sedimentary Basin (Region 3). The surface area within the boundaries of some of the English River reserves would not be sufficient to accommodate the repository surface facilities. Therefore, as per discussions between NWMO and the Band Council, the initial screening was conducted to also assess whether there are areas at the periphery of the reserves that would meet the initial screening criteria. In this report, the lands within the English River First Nation reserves and their periphery are also referred to as the "the reserve areas".

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 English River First Nation from being further considered in the NWMO site selection process. There are a number of English River First Nation reserve areas that are potentially suitable for hosting a deep geological repository. These include the seven reserve areas located on the Canadian Shield (Region 2). All the English River First Nation reserves areas located within the sedimentary rocks of the Athabasca basins (Region 1) and the Western Canada Sedimentary Basin (Region 3) were excluded from further consideration as they do not meet some of the screening criteria.

It is important to note that the intent of the initial screening is not to confirm the suitability of the proposed reserve areas, but rather to provide early feedback on whether there are known reasons to exclude the English River First Nation from further consideration. Should the English River First Nation remain interested in continuing with the site selection process, more detailed studies would be required to confirm and demonstrate whether the English River First Nation reserve areas contain 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.



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 these steps in 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 English River First Nation reserve areas, 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 English River First Nation reserve areas from further consideration in the site selection process.

The English River First Nation reserve areas are located across central and northern Saskatchewan and cover a large territory. For the purposes of this screening, they have been grouped into three distinct regions based on similar geological settings. Three reserve areas are located within the Athabasca Basin (Region 1) in northern Saskatchewan, along the west and northeast shores of Cree Lake. Seven reserve areas are located within the Canadian Shield (Region 2) in north central Saskatchewan, between the margins of the Athabasca Basin to the north, and the Western Canada Sedimentary Basin to the south. Finally, three reserve areas are located on the northern margin of the Western Canada Sedimentary Basin (Region 3) in central Saskatchewan, near the communities of Patuanak, Ile-a-la-Crosse, and Beauval.

Given the large geographic extent covered by the thirteen English River First Nation reserves, the screening was first conducted on a regional basis to assess whether there are any unsuitable conditions that would exclude any of the three geological regions into which the reserve areas had been grouped.

3.1 Areas Not Meeting Screening Criteria

Based on the regional screening, the reserve areas within the Athabasca Basin (Region 1) and the Western Canada Sedimentary Basin (Region 3) do not meet all the screening criteria and have, therefore, been excluded from further consideration.

The reserve areas within the Athabasca Basin include the Cable Cree Lake, the Cree Lake and the Barkwell Bay Indian Reserves. All three reserves do not meet the screening criteria related to the presence of groundwater resources at repository depth (Criterion 3); the presence of known economically exploitable resources (criterion 4); and the presence of known unfavourable geological and hydrogeological characteristics that make the reserve areas unsuitable for hosting a deep geological repository (Criterion 5).

The reserves areas located within the Western Canada Sedimentary Basin include the Wapachewunak, the Ile-a-la-Crosse and the La Plonge Indian Reserves. They all fail to meet the screening criteria related the presence of known unfavourable geological and hydrogeological characteristics that make them unsuitable for hosting a deep geological repository (Criterion 5).

3.2 Areas Meeting Screening Criteria

All seven reserve areas located within the Canadian Shield (Region 2) meet the screening criteria. They include the Haultain Lake, the Flatstone Lake, the Porter Lake Island, the Dipper Rapids, the Primeau Lake, the Knee Lake, and the Elak Dase Indian Reserves.

A brief summary of the assessment of these reserve areas against each of the initial is provided below.

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 English River First Nation reserve areas within the Canadian Shield (Region 2) contain sufficient land to accommodate the repository 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 available mapping and satellite imagery shows that despite the presence of major lakes and permanent water bodies, the areas at the periphery of all the English River First Nation reserves within the Canadian Shield (Region 2) have no obvious constraints that would prevent the development of the repository surface facilities. The English River First Nation reserve areas are largely undeveloped, with no major infrastructure present.

Although topographic relief is variable across the Canadian Shield in Region 2, there are no obvious topographic features that would prevent construction and site characterization activities. Also, as discussed later, the review of available geological information suggests that the English River First Nation reserve areas contain a number of geological formations with potentially sufficient volumes of rock at depth to accommodate the repository underground facilities.

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

The review of publicly available information shows that the English River First Nation reserve areas within the Canadian Shield (Region 2) contain sufficient land outside protected areas, heritage sites, provincial parks and national parks to accommodate the repository's facilities.

The nearest protected area is the Gordon Lake Recreation Site which is located approximately 10 km east of the Elak Dase reserve area. This recreational site is small and covers less than 4 km². Several heritage sites were identified near the Elak Dase reserve area. These sites are also small and generally concentrated along the Churchill River and along Provincial Road 914 to the east of the Elak Dase reserve area. There are no known wildlife or nature reserves in the 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 in the areas covered by the English River First Nation reserve areas in the Canadian Shield. The Saskatchewan Watershed Authority Water Well Records database has no records of any water wells within the reserve areas.

The geology in the English River First Nation reserve areas at typical repository depth (approximately 500 m) within Region 2 is dominated by the crystalline bedrock from the Canadian Shield. Experience from other areas in the Canadian Shield has shown that 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. The absence of groundwater resources at repository depth would, however, 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 English River First Nation reserve areas within the Canadian Shield (Region 2) contain sufficient areas, free of known economically exploitable natural resources, to accommodate the required repository's facilities.

The English River First Nation reserve areas in the Canadian Shield (Region 2) have a generally low potential for oil and gas resources and economic minerals. There are no currently operating or past producing mines within the English River First Nation reserve areas. There are several metallic mineral occurrences within the area such as gold, copper and iron. However, none of these are known to be economically exploitable. Uranium exploration activities are present less than 1 km to the east of the Haultain Lake reserve area, but to date, no economically viable uranium deposits have been discovered in this 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.

Based on the review of available geological and hydrogeological information, the English River First Nation reserve areas within the Canadian Shield (Region 2) comprise areas of land that do not contain obvious known geological and hydrogeological conditions that would make the reserve areas 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 English River First Nation reserve areas within the Canadian Shield (Region 2) from further consideration. These factors would be gradually assessed in more detail as the site evaluation process progresses and more site specific data is collected during subsequent site 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 isolation and containment 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, around 500 m, in a sufficient rock volume with characteristics that limit groundwater movement. The review of readily available information indicates that there are geological units within and in the seven English River First Nation reserve areas within the Canadian Shield (Region 2) that are expected to have geological and hydrogeological conditions that can potentially meet the containment and isolation requirements.

The geology of the English River First Nation reserve areas within the Canadian Shield (Region 2) is generally dominated by felsic gneiss, with the presence of narrow bands of metasedimentary rocks. Given their granitic



composition, and their lateral extent and depth, the extensive felsic gneiss rocks might be considered as potential host rock for a deep geological repository. While the metasedimentary rock bands may fulfill the safe isolation and containment function, it is uncertain whether they have sufficient volume to host a deep geological repository.

Very few faults have been mapped in the English River First Nation reserve areas in Region 2. This is consistent with the general faulting pattern mapped at the regional scale where faulting has been inferred on a frequency of 10 km to 20 km in a predominantly northwest (and secondary northeast) direction. Sufficient volumes of rock to potentially host the repository exist between these faults. There is no readily available information regarding faulting between the inferred faults or fracturing of the rock at depth. This would need to be further assessed in subsequent site evaluation stages.

From a hydrogeologic perspective, the review of readily available information did not reveal the existence of known deep fracture systems or deep aquifers in the crystalline rock within the English River First Nation reserve areas in Region 2. Crystalline rocks, such as those found in the area, generally have hydraulic properties that would limit groundwater flow except where extensive fracturing is present. The presence of active deep groundwater flow systems in crystalline formations is controlled by the frequency and interconnectivity of fractures at depth. Experience from other areas in the Canadian Shield indicate that active groundwater flow tends to be generally limited to shallow fractured systems, typically less than 300 m depth.

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 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 hydrogeological and geological long-term stability of the English River First Nation reserve areas within the Canadian Shield (Region 2). The review of readily available information did not reveal any obvious characteristics that would suggest this.

English River First Nation reserve areas in Region 2 are located in the Hearne Province of the Canadian Shield, where large portions of land have remained tectonically stable for the last 1.8 billion years. No earthquakes have been recorded near any of the English River First Nation reserve areas from 1985 through 2010 and there is no evidence of historical earthquakes prior 1985. There is no evidence that the inferred faults in the area have been significantly active in the last 1.8 billion years.

The geology of the English River First Nation reserve areas within Region 2 is typical of many areas of the Canadian Shield, which has been subjected to numerous glacial cycles during the last million years. This is a significant past perturbation that could occur in the future. However, findings from studies conducted in the Canadian Shield suggest that deep crystalline formations, particularly plutonic intrusions, have remained largely unaffected by past perturbations such as glaciations.

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 in the English River First Nation reserve areas in Region 2.

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 English River First Nation reserve areas in the Canadian Shield (Region 2). However, there is abundant information at other locations of the Canadian Shield that could provide insight into what should be expected for the English River First Nation reserve areas in Region 2 in general. Available information suggests that crystalline rock formations within the Shield, such as the felsic gneiss, 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 readily available information on the bedrock geology and Quaternary geology for the English River First Nation reserve areas in Region 2 indicate that conditions which could make the rock mass more difficult to characterize and predict may be present in localized areas. For example, there is no readily available information on the thickness of Quaternary deposits. Low lying areas in the English River First Nation reserve areas can be covered with muskeg. The degree to which these factors might affect the characterization and data interpretation activities in localized areas would require further assessment during subsequent stages of 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 thirteen English River First Nation reserve areas against five initial screening criteria using readily available information. The purpose of the initial screening is to identify any obvious conditions that would exclude the English River First Nation from further consideration in the site selection process. As outlined in the NWMO 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 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.

The surface area within the boundaries of some of the English River First Nation reserves would not be sufficient to accommodate the repository surface facilities. Therefore, as per discussions between NWMO and the Band Council, the initial screening was conducted to also assess whether there are areas at the periphery of the reserves that would satisfy the initial screening criteria. The lands within the English River First Nation reserves and their periphery are referred to as the “the reserve areas”.



SUMMARY REPORT - INITIAL SCREENING - ENGLISH RIVER FIRST NATION, SASKATCHEWAN

For the purpose of the screening, the thirteen reserves of the English River First Nation were grouped into three distinct geological regions (Figure 3.2): the Athabasca Basin (Region 1), the Canadian Shield (Region 2), and the Western Canada Sedimentary Basin (Region 3).

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 English River First Nation from being further considered in the NWMO site selection process. There are a number of English River First Nation reserve areas that are potentially suitable for hosting a deep geological repository. These include the seven reserve areas located on the Canadian Shield (Region 2). The English River First Nation reserves areas located within the sedimentary rocks of the Athabasca basins (Region 1) and the Western Canada Sedimentary Basin (Region 3) were excluded from further consideration as they do not meet some of the screening criteria.

Reserve Areas Not Meeting Screening Criteria

The reserve areas within the Athabasca Basin (Region 1) include the Cable Cree Lake, the Cree Lake and the Barkwell Bay Indian Reserves. All three reserves do not meet the screening criteria related to the presence of known groundwater resources at repository depth; the presence of known economically exploitable resources; and the presence of known unfavourable geological and hydrogeological characteristics that make the reserve areas unsuitable for hosting a deep geological repository.

The reserves areas located within the Western Canada Sedimentary Basin (Region 3) include the Wapachewunak, the Ile-a-la-Crosse and the La Plonge Indian Reserves. They all fail to meet the screening criteria related to the presence of known unfavourable geological and hydrogeological characteristics that make them unsuitable for hosting a deep geological repository.

Reserve Areas Meeting Screening Criteria

All seven reserve areas located within the Canadian Shield (Region 2) contain areas that are potentially suitable for hosting a deep geological repository. They include the Haultain Lake, the Flatstone Lake, the Porter Lake Island, the Dipper Rapids, the Primeau Lake, the Knee Lake, and the Elak Dase Indian Reserves.

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 reserve areas, but rather to identify whether there are any obvious conditions that would exclude the English River First Nation from further consideration in the site selection process. Should the English River First Nation remain interested in continuing with the site selection process, more detailed studies would be required to confirm and demonstrate whether the English River First Nation reserve areas contain 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 – English River First Nation, Saskatchewan. Golder Report Number 10-1152-0110 (4000)
- 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

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