nwmo
NUCLEAR WASTE MANAGEMENT ORGANIZATION
SOCIÉTÉ DE GESTION DES DÉCHETS NUCLÉAIRES

May 5, 2011

The Corporation of the Township of Ear Falls
P.O. Box 309
Ear Falls, ON P0V 1T0

Attn: Mayor and Members of Council

Re: Council Resolution 256 – Request for Information/Request for Screening

Dear Mayor Kahoot and Council,

Further to Council'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 Ear Falls 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 Ear Falls from further consideration in the NWMO site selection process. The initial screening suggests that there are areas within the boundaries and at the periphery of the Township of Ear Falls 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 Ear Falls 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, Ear Falls 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

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

April 2011

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

Township of Ear Falls, Ontario

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

REPORT

A world of capabilities delivered locally

Report Number: 10-1152-0110 (1000B)

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EXECUTIVE SUMMARY

On August 26, 2010, the Township of Ear Falls 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. (Golder), to evaluate the potential suitability of the Ear Falls 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 Ear Falls from further consideration in the site selection process. As per discussions between the NWMO and the Township Council, the initial screening focused on the Township of Ear Falls and its periphery, which are referred to as the "Ear Falls 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 Ear Falls from being further considered in the NWMO site selection process. The initial screening indicates that there are areas within the Township and at the periphery of the Township of Ear Falls 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 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 Ear Falls 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 Ear Falls remain interested in continuing with the site selection process, more detailed assessments would be required to confirm and demonstrate whether the Ear Falls 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 Ear Falls 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 Ear Falls from being further considered in the site selection process.

The Township of Ear Falls is situated in the District of Kenora in northwestern Ontario, at the northwestern end of Lac Seul, covering an area of about 350 km^2. It is located about 100 km northwest of Vermillion Bay, and 65 km southeast of Red Lake.

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 Ear Falls area contains 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.

Review of available mapping and satellite imagery shows that the Ear Falls area contains land with limited natural or physical constraints that would prevent the development of the repository surface facilities. Despite the presence of major lakes and permanent water bodies, there are large portions of land in excess of the surface area needed for the development of the facilities associated with a deep geological repository. The Ear Falls area is largely forested, with developments limited mainly to roadways and the settlement area itself. Land surface elevation varies from approximately 350 to 400 metres above sea level (masl) in the Ear Falls area, but no obvious topographic features that would prevent construction or site characterization activities have been identified. Also, the review of available information suggests that the Ear Falls area contains 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 readily available information shows that the Ear Falls area contains sufficient land outside of protected areas, heritage sites, provincial parks and national parks to accommodate the repository's facilities.

There are three known protected areas that partly lie within the Township of Ear Falls: The Pakwash Provincial Park, located 20 km north of the settlement area on Pakwash Lake; the Bruce Lake Conservation Reserve about 25 km north of the settlement area east of Bruce Lake; and the Lac Seul Island Conservation reserve in Lac Seul. There is another park, the West English River Provincial Park, at the periphery of the Township of Ear Falls. These protected areas occupy a small portion of land in the Ear Falls area.

Limited known heritage constraints were identified in the Ear Falls area. Known archaeological sites are small and generally concentrated on the shores and islands of Lac Seul and along the Chukuni River. There are no national historic sites in the Ear Falls 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 Ear Falls area. The Ontario Ministry of Environment Water Well Records indicates that no potable water supply wells are known to exploit aquifers at typical repository depths in the Ear Falls area or anywhere else in northern Ontario. Water wells in the Ear Falls area source water from overburden or shallow bedrock aquifers at depths ranging from 4 to 134 m, with most wells between 30 to 40 m deep.

Experience from other areas in the Canadian Shield suggests that the potential for groundwater resources at repository depths is low throughout the Ear Falls 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, 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 Ear Falls area contains sufficient land, free of known economically exploitable natural resources, to accommodate the required repository's facilities.

The Ear Falls area has a generally low potential for oil and gas resources and economic minerals. There are currently no operating mines within the Township of Ear Falls. Mineral production to date has been limited to the Griffith Iron Mine in the northern sector of the Township, which operated between 1968 and 1986. Localized occurrences of rare metals exist within the Township, but no economically viable deposits have been identified. There are also ongoing gold exploration activities in the Township of Ear Falls, but the gold potential in the area remains unproven.

Mining activities at the periphery of the Township of Ear Falls, primarily for gold and base metals, are mainly concentrated away from the Township in the Red Lake area. Potential for iron has been identified at specific locations within the periphery of the Township, but the economic viability of these occurrences has not been proven. No record of non-metallic mineral resources exploitation was found within the Ear Falls area. Commercial potential for peat exists in some low-lying areas, but no peat extraction has occurred in the Township or its periphery.

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 Ear Falls 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 Ear Falls from further consideration. They will be gradually assessed in more detail as the site evaluation process progresses and more site specific data is collected during subsequent site evaluation stages, provided the community remains interested in continuing with 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 Ear Falls area contains areas with no obvious geological and hydrogeological conditions that would fail the containment and isolation requirements.

There are a number of geological formations in the Ear Falls area that might be considered as potential repository host rocks. These include the extensive metasedimentary rocks that dominate the geology of the area and granitic intrusions such as the Wenasaga Lake Batholith, the Bruce Lake Pluton and the Bluffy Lake Batholith. These geological formations appear to have sufficient lateral extent and depth to host the surface and underground repository facilities. Potential suitability of these geological formations would, however, need to be further assessed through subsequent site evaluation stages, if the community remains interested in continuing with the site selection process.

The Township of Ear Falls is transected by the regional Sydney Lake Fault Zone and its splays (the Long Legged Lake Fault Zones). These fault zones have a width of about 1 to 2 km and affect a small portion of the Township and its periphery. The areas along these faults zones are likely not suitable for hosting a repository. Further assessment would be required during subsequent site evaluation phases to investigate the presence of smaller scale faults within the Ear Falls area.

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 Ear Falls 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 (plutons), 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 Ear Falls area. The review did not identify any obvious geological or hydrogeological conditions that would

clearly fail to meet the long-term stability requirement for a potential repository within the Township of Ear Falls and its periphery.

The Township of Ear Falls 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 that the regional fault zones observed within the Ear Falls area have been significantly active in the last 2 billion years. The geology of the Ear Falls 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 isolation from future human activities safety-related factor requires that 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 activities. This factor has already been addressed in previous sections, which concluded that the potential for groundwater resources at repository depths and for known economically exploitable natural resources is low throughout the Ear Falls 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 stress for the Ear Falls area. However, available information from other locations suggests that crystalline rock formations within the Canadian Shield, particularly within plutonic intrusions, generally possess geomechanical characteristics that are amenable to the type of excavation activities involved in the development of 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 surface geology for the Ear Falls area indicate that conditions which could make the rock mass more difficult to characterize and predict may be present in localized areas. For example, the limited information available on overburden thickness shows that Quaternary deposits are typically less than 20 m, but could exceed 40 m in some areas. The degree to which these factors might affect the characterization and data interpretation activities would require further assessment during subsequent site evaluation stages, provided the community remains interested in continuing with the site selection process..

4.0 INITIAL SCREENING FINDINGS

This report presents a summary of the results of an initial screening to assess the potential suitability of the Ear Falls area against five initial screening criteria using readily available information. As per discussions between the NWMO and the Township Council, the initial screening focused on the Township of Ear Falls and its

periphery, which are referred to as the “Ear Falls 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 Ear Falls from further consideration in the NWMO site selection process. The initial screening indicates that there are areas within the boundaries of the Township of Ear Falls that are potentially suitable for hosting a deep geological repository. Examples of these areas include portions of the Wenasaga Lake Batholith and the metasedimentary migmatites that dominate the bedrock geology of the Township. The review has also revealed that there are areas at the periphery of the Township of Ear Falls that are potentially suitable. These include the metasedimentary migmatites, the Wenasaga Lake Batholith, the Bruce Lake Pluton and the Bluffy Lake Batholith. Potential suitability of these areas would need to be further assessed during subsequent site evaluation stages, provided 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 is not to confirm the suitability of the Ear Falls area, but rather to identify whether there are any obvious conditions that would exclude it from the site selection process. Should the community of Ear Falls remain interested in continuing with the site selection process, several years of progressively more detailed assessments will be required to confirm whether the township contains sites that can 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 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. (2011a). Initial Screening for Siting a Deep Geologic Repository for Canada's Used Nuclear Fuel – Township of Ear Falls, Ontario. Golder Report Number 10-1152-0110 (1000). (Available at www.nwmo.ca)

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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