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October 27, 2017	Revision made to Section 5.2 to clarify that the transport package on the mobile exhibit is “certified” as opposed to “licensed.”

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Executive Summary

The Nuclear Waste Management Organization (NWMO) was established in 2002 by Canada's nuclear electricity corporations in accordance with the federal *Nuclear Fuel Waste Act* (*NFWA*). NWMO's mandate was to develop and implement, collaboratively with Canadians, a management approach for the long-term care of Canada's used nuclear fuel that is socially acceptable, technically sound, environmentally responsible, and economically feasible.

The *NFWA* required the NWMO to study approaches for the management of nuclear fuel waste and recommend to the Government of Canada a preferred approach. In 2007, the Government of Canada selected Adaptive Phased Management (APM) as Canada's plan, and directed the NWMO to implement this plan.

APM is both a technical method and a management system. The technical end-point of APM is the centralized containment and isolation of the used nuclear fuel in a deep geological repository (DGR) located at a safe site in an area with an informed and willing host. The plan also involves development of a system to transport used nuclear fuel to the repository site. The management system involves distinct steps, each marked by explicit decision points with opportunities for input by communities and interested citizens. It includes the implementation of an open, inclusive and fair siting process developed collaboratively with Canadians to select a site for the DGR.

NWMO has been making steady progress on the implementation of this approach. Starting from an initial expression of interest to learn more about the project from 22 communities, the NWMO has been conducting a series of progressively more detailed assessments of these alternative areas from both technical and social perspectives. Based on the assessments to date, 15 areas were screened out and 7 areas are presently under more detailed study. The technical assessments have and continue to address factors important to safety. The NWMO has an active engagement program that is working with indigenous and municipal communities in each area to inform them and involve them in the program, and to understand the potential to develop a supportive partnership. The NWMO expects to narrow down the potential host area and select a preferred repository site by 2023.

The funding to implement APM is provided by the nuclear waste owners. The funding formula used to ensure there are sufficient funds to implement APM was approved by the Minister of Natural Resources in 2009, and the NWMO reports annually to the Minister on the status of the trust funds.

At present, the NWMO has not applied for a licence to prepare a site for the repository. Recognizing the long timeframes for siting and the unique nature of a deep geological repository, the NWMO and the Canadian Nuclear Safety Commission (CNSC) have established a special project arrangement for this pre-licensing period. This arrangement provides a mechanism that (a) informs the NWMO on regulatory expectations; (b) informs CNSC on the APM program status; and (c) allows interested communities to invite the CNSC to present on the Canadian regulatory system. The purpose of this Commission Member Document is to inform the Commission on the history, plans and status of the APM program.

1.0 INTRODUCTION

Canada has relied on nuclear power to produce significant amounts of low-carbon electricity since the early 1970s. There are presently about 2.7 million CANDU used fuel bundles in Canada and a small amount of research reactor used fuel. All Canada's used nuclear fuel[1] is safely stored on an interim basis in licensed facilities at or near where it is generated.

The Nuclear Waste Management Organization (NWMO) was established in 2002 by Canada's nuclear electricity corporations in accordance with the federal *Nuclear Fuel Waste Act* (*NFWA*).

The *NFWA* required the NWMO to study approaches for the management of nuclear fuel waste and recommend a preferred approach. In 2007, the Government of Canada selected the Adaptive Phased Management (APM) approach [GoC 2007a].

The technical end-point of APM is the centralized containment and isolation of used nuclear fuel in a deep geological repository located at a safe site in an area with an informed and willing host. The plan also involves development of a transportation system to move used nuclear fuel to the repository site. The approach involves manageable implementation phases, each marked by explicit decision points with opportunities for input by communities and interested citizens. It includes the implementation of an open, inclusive and fair siting process developed collaboratively with Canadians to seek an informed and willing host.

The NWMO is implementing this federally-selected approach. It will be a major national infrastructure project, funded by the nuclear waste owners. We are actively engaged with interested communities in seeking a safe site, drawing on local and Indigenous Knowledge to implement this solution.

A deep geological repository would be regulated by the Canadian Nuclear Safety Commission (CNSC) under the *Nuclear Safety and Control Act* and its associated regulations. The transportation of used nuclear fuel is jointly regulated by the CNSC and Transport Canada.

The purpose of this Commission Member Document is to provide the Commission with:

(a) The history of the project including relevant federal decisions;

(b) An overview of the site selection process and technical program; and

(c) The status and timelines for the project.

[1] The Nuclear Fuel Waste Act (2002) defines nuclear fuel waste as "irradiated fuel bundles removed from a commercial or research fission reactor". In this document, NWMO refers to used nuclear fuel as a more general term.

2.0 HISTORY OF THE CANADIAN PROGRAM

2.1 Early Studies

From the early stage of the nuclear program in Canada, the long-term hazard of nuclear fuel waste was recognized. Interim storage facilities were established, with the expectation that a long-term solution would be implemented.

In 1978, the governments of Canada and Ontario established the Canadian Nuclear Fuel Waste Management Program to study and advance the technology for the storage, transportation and permanent disposal of Canada's nuclear fuel waste. This initiated a significant research and development program in Canada, primarily by Atomic Energy of Canada Limited (AECL) and Ontario Hydro, in parallel with similar efforts internationally.

This was followed, starting in 1989, by an intensive and lengthy period of deliberation by the Nuclear Fuel Waste Management and Disposal Concept Environmental Assessment Panel. Chaired by Blair Seaborn, the Panel's mandate was to conduct an environmental assessment of an AECL concept for deep geological disposal. In 1998, the Panel issued its report. Key Panel conclusions were that [CEAA 1998]:

- *"From a technical perspective, safety of the AECL concept had been on balance adequately demonstrated for a conceptual stage of development, but from a social perspective, it has not.*
- *As it stands, the AECL concept for deep geological disposal has not been demonstrated to have broad public support. The concept in its current form does not have the required level of acceptability to be adopted as Canada's approach for managing nuclear fuel wastes."*

2.2 The Nuclear Fuel Waste Act

The Government of Canada considered the Seaborn Panel Report recommendations, and in response, it passed the *Nuclear Fuel Waste Act* (*NFWA*) of 2002 [NFWA 2002].

The elements of the *NFWA* are being implemented as described below.

2.3 Establishment of the NWMO

The *NFWA* required Canada's nuclear energy corporations to establish a waste management organization [NFWA 2002; Clause 6(1)].

In response, Ontario Power Generation (OPG), New Brunswick Power Corporation (NBP), and Hydro-Québec (HQ) formed the Nuclear Waste Management Organization (NWMO), a not-for-profit corporation. These companies, along with Atomic Energy of Canada Limited (AECL), fund the NWMO's operations.

The NWMO's mandate is to develop and implement collaboratively with Canadians, a management approach for the long-term care of Canada's used nuclear fuel that is socially acceptable, technically sound, environmentally responsible, and economically feasible.

The *NFWA* also required the NWMO to establish an Advisory Council with members covering a range of scientific and technical disciplines, public affairs and social science, and including representatives nominated by local and regional governments and aboriginal organizations [NFWA 2002; Clauses 8(1), 8(2)]. The Advisory Council meets regularly and provides ongoing advice and guidance on NWMO work plans and activities. As required by the Act [NFWA 2002; Clause 18], the Advisory Council provides comments to the federal government as part of the NWMO Triennial Report [NWMO 2017a].

The NWMO operates with an independent board of directors appointed by the nuclear energy companies. It has about 160 full-time staff, with expertise including engagement, Indigenous Knowledge, geoscience, engineering, safety assessment and environmental assessment. Its present headquarters are in Toronto. It has small field offices in seven communities, plus an industrial facility in Oakville for storing and testing prototype equipment under non-nuclear conditions.

2.4 Study of Alternatives

The *NFWA* required the NWMO to study approaches for the management of nuclear fuel waste, and to recommend an approach to the Minister of Natural Resources [NFWA 2002; Clause 12(1)].

As per the Act, and based on a key recommendation of the Seaborn Panel, the NWMO began by conducting a three-year study (2002 to 2005) involving thousands of citizens, specialists and Aboriginal peoples in every province and territory in Canada. The *NFWA* required that at least three specific methods be included in the study: deep geological disposal in the Canadian Shield; storage at nuclear reactor sites; and centralized storage, either above or below ground, anywhere in Canada [NFWA 2002; Clause 12(2)].

Through the three-year study, it became clear that each of these approaches had unique strengths, but also important limitations. This led Canadians involved in the study to look for an approach that would better meet the objectives Canadians said are important – safety, security, protection of the environment, community well-being, fairness, and economic viability. Adaptive Phased Management (APM) is the approach that emerged from the engagement of citizens over the course of the study [NWMO 2005].

Other options also considered as part of the study included reprocessing, followed by recycling or reusing nuclear fuel, with an aim to reduce the volume and toxicity of the high-level waste to be managed. However, there are no plans to reprocess nuclear fuel waste in Canada, and this option was determined not to be technically or economically feasible at this time. The NWMO continues to keep an annual watching brief on the development of these and other alternative technologies as part of its ongoing effort to

incorporate new learning and knowledge, and to anticipate any changes in fuel cycles used in Canada and the types of waste that may need to be managed.

APM is both a technical method and a management system (Figure 1). APM involves the containment and isolation of used nuclear fuel in a deep geological repository in a suitable rock formation. Under APM, used nuclear fuel will be safely and securely contained and isolated from people and the environment in the repository using a multiple-barrier system. The plan builds in the potential for retrieval of the used nuclear fuel for an extended period, until such time as a future society makes a determination on final closure, along with the form and duration of postclosure monitoring.

In having a deep geological repository as its technical end-point, APM embraces the internationally accepted technical approach for the long-term management of used nuclear fuel. As a management plan, it is adaptive, meaning that it is responsive not only to new technologies, but also to the evolving societal expectations and needs of Canadians.

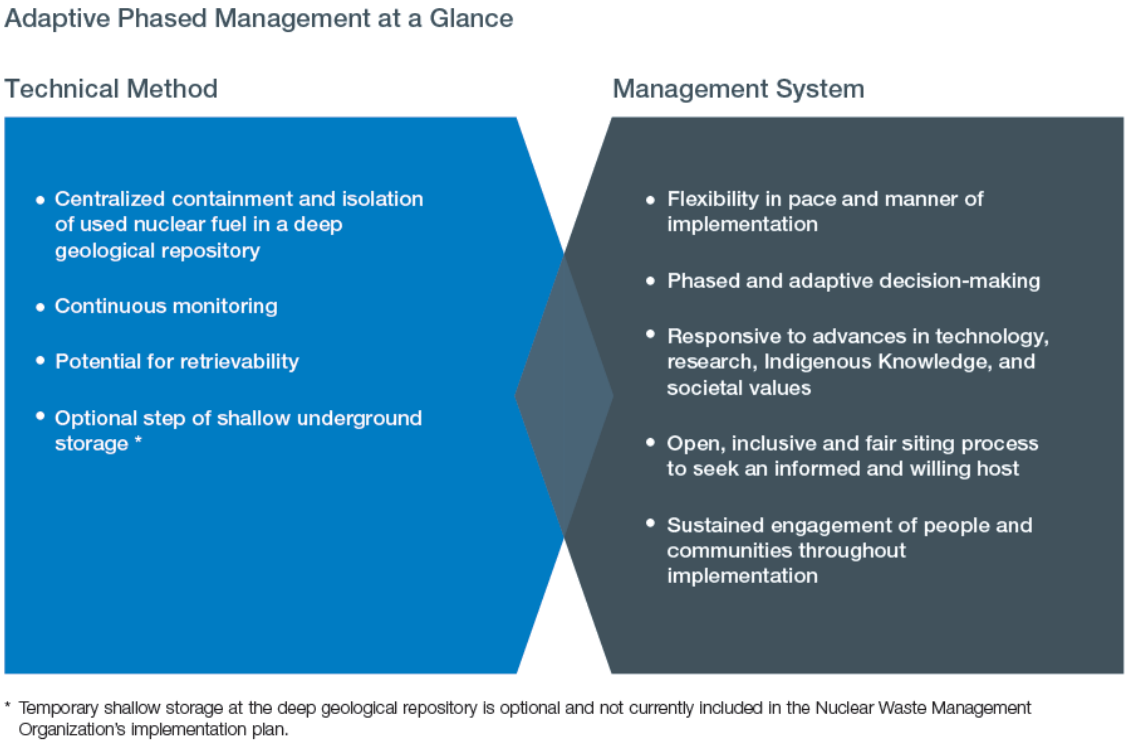

Figure 1: Adaptive Phased Management Summary

2.5 Government Selection of Canada's Plan

The *NFWA* required the NWMO to submit its study to the federal Minister of Natural Resources [NFWA 2002; Clause 12(1)]. The Act further required that "*The Governor in Council, on the recommendation of the Minister, shall select one of the approaches for the management of nuclear fuel waste from among those set out in the study*" [NFWA 2002; Clause 15].

In 2005, the NWMO delivered the study to the federal government, with a preferred approach that emerged from the dialogue with Canadians and from technical study [NWMO 2005]. It safeguards both the public and the environment over the very long time in which used nuclear fuel must be carefully managed, and is also responsive to values and objectives identified by Canadians. It is being implemented using physical sciences, social science and Indigenous Knowledge. The management system involves realistic, manageable phases, each marked by explicit decision points with continuing participation by interested Canadians.

The federal government selected the APM approach in 2007 by Order-in-Council. The decision was made public in the Canada Gazette (June 27, 2007) [GoC 2007a] (see Addendum A). The NWMO was directed to begin implementation of this approach [GoC 2007b] (see Addendum A).

2.6 Reporting to the Federal Government

The *NFWA* specifies that the NWMO is not an agent of the federal government [NFWA 2002; Clause 6(3)]. However it requires the organization to report regularly to the federal government.

In particular, the NWMO is required to issue annual and triennial reports to the Minister of Natural Resources [NFWA 2002; Clauses 16, 18]. The Minister, in turn, must table these reports in each House of Parliament, and issue a public statement regarding each report within 90 days [NFWA 2002; Clause 19].

The Act also required NWMO to propose a funding formula for implementing the selected approach; for the nuclear energy corporations and Atomic Energy of Canada Limited to establish and deposit into trust funds based on this funding formula; and for NWMO to report on the status of the funds in its annual and triennial reports [NFWA 2002; Clauses 9(1), 10(1), 10(2), 16(2), 16(3), 17(1)].

Further, in 2007 the Minister of Natural Resources requested that NWMO provide its plan for a public process to determine a site, prior to the launching of such a process [GoC 2007b] (see Addendum A). And in 2010, The Minister affirmed the expectation that NWMO would report regularly to the government as it advances its federal mandate to implement this national infrastructure project [GoC 2010].

2.7 Financing the Program

The *NFWA* requires the nuclear fuel waste owners to establish trust funds to finance the selected approach [NFWA 2002; Clauses 9(1), 11(2)]. These funds were established in 2002 by OPG, HQ, NBP and AECL. NWMO can only use these funds for activities for which it has received a construction or operating licence [NFWA 2002; Clause 11(3)].

In 2008, as required by the Act [NFWA 2002; Clauses 16(2), 16(3)], the NWMO proposed a funding formula to determine the deposits to be made each year by the waste owners to pay for APM implementation. The proposed formula was approved by the Minister of Natural Resources in 2009 [GoC 2009] (see Addendum A).

The lifecycle costs for implementing APM have been estimated by the NWMO, incorporating input from expert third party consultants and experience from other international programs. These estimates have been benchmarked with those of other national waste management organizations, and are reviewed by our members and other external parties. The cost estimates are formally updated every 5 years, and reported to the Minister of Natural Resources as required by the *NFWA*.

For a projected total of 5.2 million used fuel bundles, the estimated lifecycle cost for an APM deep geological repository is about 23 B$ in as-spent dollars (2015 $) [NWMO 2017a]. The present value of this lifecycle cost is about 9 B$.

The lifecycle costs are addressed in two parts. Costs for the construction, operation and closure of the repository are held in trust funds as defined in the *NFWA*. Costs for repository siting, design, regulatory approvals and site preparation are covered through separate funds and provincial guarantees as part of the financial guarantees required by the CNSC from nuclear facility owners for waste management and decommissioning.

Audited financial statements are included in the NWMO's annual and triennial reports [NWMO 2017a], as well as posted on the NWMO website at www.nwmo.ca/trustfunds.

3.0 SITING PROCESS

3.1 Development of the Siting Process

In 2007, the Minister of Natural Resources directed the NWMO to begin implementation of the APM approach, "*My expectation is that the NWMO will take at least two years to develop a collaborative, community-driven site-selection process and then it will begin consultations with citizens, communities, Aboriginals and other interested parties to find a suitable site located in a willing host community"* [GoC 2007b] (see Addendum A).

In response, the NWMO developed the siting process through public engagement that took place in 2008 and 2009. The proposed process was a community-driven process that was designed to ensure, above all, that the site selected is safe and secure, and has an informed and willing host [NWMO 2010].

In 2010 the Minister accepted the NWMO's proposed process for selecting a site for the project, indicating that "*The process, described in your May 2010 plan, is a reasonable approach for moving forward with the implementation of this project"* [GoC 2010] (see Addendum A).

In this site selection process, the safety and suitability of potential sites in the vicinity of communities which have voluntarily entered into the siting process are evaluated through a series of steps, each with progressively more detailed technical and social assessments [NWMO 2010]. The three main site evaluations steps are:

- Initial Screenings: To determine whether, based on readily-available information and five screening criteria, there were any obvious conditions that would exclude the community from further consideration in the site selection process.

- Preliminary Assessments: Technical, social, economic and cultural assessments of potential to meet detailed project requirements, and conducted in two phases – Desktop Studies for all communities electing to be the focus of a preliminary assessment (Phase 1), and Field Studies for a subset of communities (Phase 2).

- Detailed Site Characterization: Detailed site investigations and economic and cultural assessment at one preferred site to confirm suitability.

To select the preferred location for siting the APM repository, the NWMO will need to have a sufficient degree of confidence that:

- A deep geological repository can be developed with a strong technical safety case at that location. Safety is first and foremost in selecting a site and the NWMO has committed to meet or exceed all applicable regulatory standards and requirements for protecting the health, safety and security of people and the environment;

- A safe, secure and socially acceptable transportation plan can be developed to transport used nuclear fuel to that location; and

- A strong and supportive partnership can be developed with the interested community, First Nation and Métis communities in the area, and surrounding communities.

3.1.1 Technical Safety Criteria

The siting process identifies safety criteria that are consistent with Canadian and international guidance [NWMO 2010]. These technical criteria are listed in Addendum B. They are grouped under the following six safety functions:

- Safe containment and isolation of used nuclear fuel: The characteristics of the rock at the site must be appropriate to ensure long-term containment and isolation of used nuclear fuel from humans, the environment, and surface disturbances caused by human activities and natural events.

- Long-term resilience to future geological processes and climate change: The rock formation at the siting area must be geologically stable and likely to remain stable over the very long term in a manner that will ensure the repository will not be substantially affected by geological and climate change processes such as earthquakes and glacial cycles.

- Isolation of used nuclear fuel from future human activities: Human intrusion such as through future exploration or mining must be unlikely.

- Safe construction, operation and closure of the repository: Conditions at the site must be suitable for the safe construction, operation, and ultimate closure of the repository.

- Amenability to site characterization and data interpretation activities: The geologic conditions at the site must be amenable to being practically studied and described on dimensions that are important for demonstrating long-term safety.

- Safe transportation: The site must have a route that exists or can be created that enables the safe and secure transportation of used nuclear fuel from interim storage sites to the repository site.

3.1.2 Beyond Safety Criteria – Community Well-being

Beyond ensuring safety, the NWMO's commitment to any host community is that its long-term well-being or quality of life will be fostered through its participation in this project.

The NWMO encourages communities to consider this project in the context of their long-term interests and the vision they have for their area. The NWMO understands that well-being can only be defined by the community itself. The NWMO identified a number of factors as minimum criteria to consider in assessing the potential to foster well-being:

- Potential social, economic and cultural effects during the implementation phase of the project;
- Potential for enhancement of the community and the regional long-term sustainability through implementation of the project;
- Potential to avoid ecologically sensitive areas and locally significant features;
- Potential for physical and social infrastructure to adapt to changes resulting from the project; and
- Potential to avoid or minimize effects of the transportation of used nuclear fuel from existing storage facilities to the repository site.

In order to ensure that a broad, inclusive and holistic approach is being taken to assessment in these areas, a 'community well-being' framework was identified to help understand and assess the potential effects of the APM project. This includes exploring the project, understanding how the community may be affected if the project was implemented in the area, and identifying opportunities to leverage the project to achieve other objectives the community considers important. The framework is also used to explore the relative fit of the APM project for the community, and the potential to create the foundation of confidence and support required for the implementation of the project.

The framework is designed to encourage exploration of the project through five different 'lenses': people or human assets, economics or economic assets, built environment or physical assets, society and culture or social assets, natural environment or natural assets.

Ultimately, the potential effect of the project on the well-being of a community needs to be identified and assessed by the community itself. This includes identifying the broad range of factors that need to be considered, the approach to measuring potential effect on well-being and judgements about the magnitude of this effect.

3.2 Status of the Site Selection Process

In 2010, the NWMO published the process for selecting a safe site for the long-term management of used nuclear fuel [NWMO 2010]. This initiated the siting process and the invitation to communities to learn more. This included a broad program to provide information, answer questions, and build awareness among Canadians about APM and the siting process itself.

Twenty-two communities came forward to learn more and explore their suitability for the APM project, as shown in Figure 2. These communities, and the area around them, represented a broad range of potential sites from a technical and social perspective. Three were in Saskatchewan and nineteen were in Ontario. The NWMO suspended the expressions of interest phase in 2012 in order to focus on these communities.

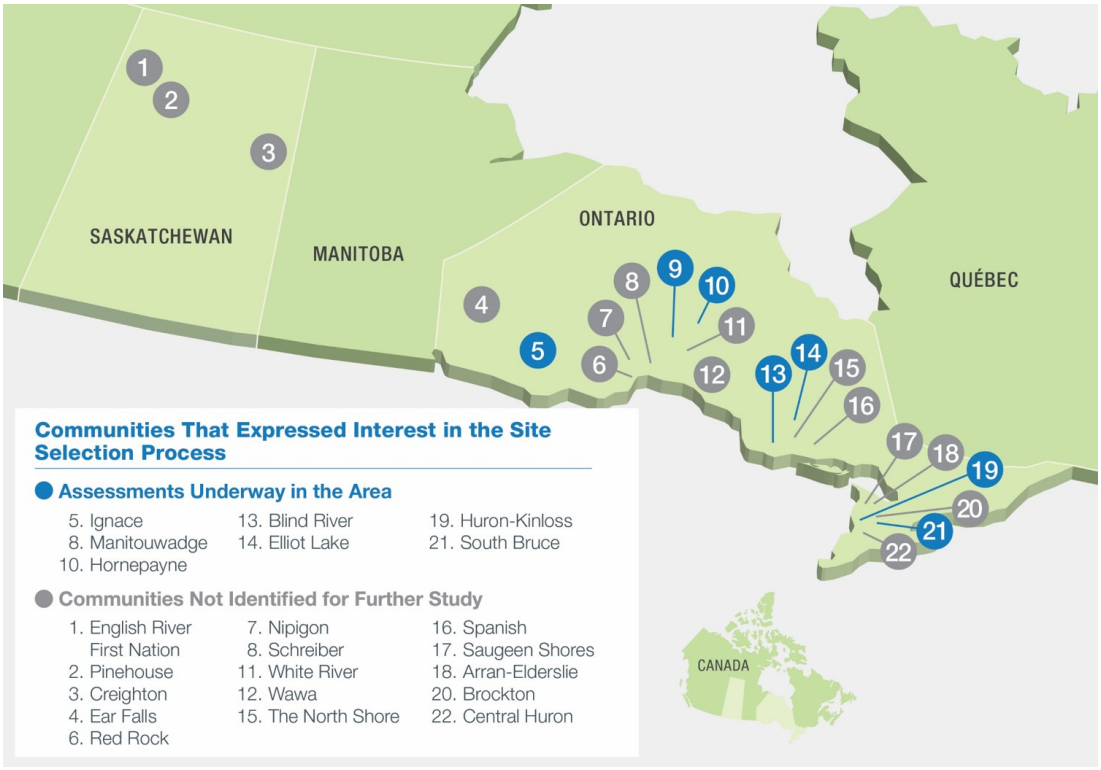

Figure 2: Communities in Site Selection Process as of October 2017

Working together with indigenous and non-indigenous communities in each area, the NWMO has been assessing these areas from the perspective of both technical and social considerations, and is gradually narrowing its focus to areas with strong potential to meet project requirements, using an increasingly intensive program of study and engagement.

As of October 2017, preliminary assessment activities are underway in the areas of 7 communities in Ontario. The remaining 15 communities that had expressed interest in learning about the project, and surrounding areas, are no longer under study.

The status of the overall APM program was summarized in the NWMO Triennial Report submitted to the federal government earlier this year [NWMO 2017a].

3.2.1 Initial Screenings

As communities expressed interest in learning more about the project, the NWMO undertook an initial screening, and began working with each community as they learned about the project and reflected upon their interest in it. Screening reports for the 22 communities are available from NWMO's website (www.nwmo.ca).

The initial screenings identified that 21 of the communities contained geological formations that could be potentially suitable for hosting a deep geological repository. All the 21 communities that successfully completed an initial screening continued to express interest in learning more, and entered into the next step of the site selection process.

3.2.2 Preliminary Assessments

The preliminary assessments follow an integrated approach based on a series of multidisciplinary studies, including geoscientific suitability, engineering, transportation, environment and safety, as well as social, economic and cultural considerations. The ultimate objective of the preliminary assessments are to select one community for detailed site characterization. The preliminary assessments are conducted in two phases consisting of desktop studies followed by field investigations.

The NWMO completed desktop preliminary assessments for all 21 communities. The findings from these desktop studies were discussed with each of the communities, and published on the NWMO website [NWMO 2013a, NWMO 2014a, NWMO 2014b, NWMO 2015a, NWMO 2015b and supporting documents]. Based on desktop studies, 11 communities were assessed to have strong potential to meet the requirements of the project and were carried forward into more detailed preliminary assessments involving fieldwork and deeper engagement.

The narrowing down process is advancing with 7 communities remaining in the process for further study.

3.2.2.1 Initial Geoscientific Fieldwork

Crystalline sites

The geoscientific fieldwork for areas in crystalline rock began with three types of field studies: airborne geophysical survey; direct observations of general geological features; and detailed geological mapping. These studies were conducted by expert consultant teams and reviewed by the Adaptive Phased Management Geoscientific Review Group, a five-person panel of internationally recognized experts.

Airborne geophysical surveys were conducted in locations where earlier desktop assessments suggested there may be areas of land with potential to meet the technical safety requirements for a deep geological repository. Airborne studies were initiated in 2014, with surveys being completed in all remaining crystalline rock communities by early 2017.

Direct observations of general geological features and detailed geological mapping, also known as detailed outcrop mapping, was conducted in each of the remaining crystalline communities. In these studies, geoscientists visited many rock outcrops in each area to examine the structural character of the exposed bedrock, especially the nature and distribution of fractures, as well as physical characteristics of the rock.

The next technical step in the process is to study the rock underground through initial borehole drilling. The location of the boreholes will be informed by the integration of technical studies and input from people in the area, including First Nations and Métis communities. Borehole drilling will commence in late 2017 and will continue over the next several years to support the selection of the preferred site.

Sedimentary sites

During the preliminary assessments, no aerial surveys or geological mapping are planned for the southern Ontario communities, due to the nature of the geology in these areas. In particular, the aerial survey methods are not as useful in sedimentary rocks, and the geology is already reasonably well known (for the preliminary assessment phase) due to its layered structure and past history of geological studies in the area. Once a potential repository area is identified, if any, site-specific field studies will begin, including seismic reflection surveys (to check the local geological structure) and borehole drilling.

3.2.2.2 Initial Environmental Fieldwork

Preliminary environmental field studies have been conducted in each of the remaining crystalline rock siting areas. They help develop an understanding of the general ecology of an area, and are distinct from the formal environmental assessment that will need to be conducted once a preferred site is identified.

Teams of specialists conducted non-obtrusive observations of features such as sizes and types of streams in the area, types of local plants and animals, and fragmentation of existing forest. Where appropriate, they collected small samples of soil or plant life for further characterization.

3.3 Municipal and Indigenous Engagement

The NWMO is advancing the site selection process working collaboratively with municipalities and indigenous communities in siting areas and regions through a comprehensive dialogue and engagement program [NWMO 2017b]. The main goals of the program are to build awareness and understanding of the many components of the project; identify potential repository areas that are acceptable to the communities taking into account social, cultural and spiritual considerations; and explore potential for partnership in the communities.

As the site selection process continues to move forward, the focus of the NWMO's dialogue and engagement program has become increasingly regional, encompassing not only communities that initiated their area's participation in the process, but also the communities around them. The organization has offices in seven communities, with detailed exhibits about the project, transportation, community well-being, and other aspects of Canada's plan.

As part of building strong relationships in and around interested communities, NWMO is delivering its dialogue and engagement program through a wide range of activities. NWMO staff have participated in hundreds of local events, meetings and conversations in each siting area, including monthly meetings of Community Liaison Committees (CLCs) in each siting community; open houses and open office events; participation at local and surrounding area community festivals, fairs, and other local events.

In designing and implementing its engagement program, the NWMO relies on the advice of a number of bodies including the Advisory Council; the Municipal Forum; and the Council of Elders and Youth.

3.3.1 Community Learning and Resources

The NWMO has Learn More Agreements with interested communities and some neighbouring communities to ensure capacity for learning about the long-term management of used nuclear fuel, and to facilitate engagement and reflection on the project. This is supported by a number of funding programs to facilitate learning, capacity building and community well-being.

Typical learning activities include learn more tours and visits to interim storage facilities; engagement with the regulator and independent experts; participation in conferences and forums; monthly meetings of community liaison committees; and a broad range of speakers in communities. Communities have sent representatives to conferences where they can learn about different aspects of managing used nuclear fuel. At these conferences, attendees are able to meet directly with experts in the field, as well as with their counterparts from other communities. In 2016, community representatives attended the Canadian Nuclear Society Conference on Nuclear Waste Management, Decommissioning and Environmental Restoration in Ottawa. The 2012 and 2016 International Conference on Geological Repositories, held in Toronto and Paris respectively, brought together decision-makers from many countries and provided opportunities for community representatives to engage in learning and exchange on an international platform.

3.3.2 Exploring Community Well-Being

The NWMO is committed to implementing Canada's plan for the long-term management of used nuclear fuel in a manner that contributes to the long-term well-being of the area in which the project is located. Every community has its own views on what constitutes well-being. The factors they weigh include, but are not limited to, such things as economic considerations, population growth, and cultural and spiritual values. The NWMO works with communities to understand their well-being as they define it.

Among other things, site assessments are designed to better understand local interactions with the land, environmental and spiritual considerations, specific economic contributions the project would make to area well-being, social and economic pressures that would occur, and what advance planning is required to address these pressures.

3.3.3 Engagement with Indigenous Communities

Inclusion of Indigenous perspectives is an essential element of the NWMO's engagement work. The Aboriginal engagement program is built on the NWMO's Aboriginal Policy [NWMO 2014c] and advice from the Council of Elders and Youth.

Through its Aboriginal policy, the NWMO acknowledges and respects the unique status and rights of Aboriginal peoples and the positive contributions First Nation and Métis

peoples can make to major developments in their treaty area as partners. The NWMO is also following a call to action made by the Truth and Reconciliation Commission of Canada in 2015. The Commission called upon the corporate sector in Canada to provide education for management and staff on the history of indigenous people.

The NWMO activities include a range of engagement activities by our Indigenous Relations team, and cultural awareness training for NWMO staff and contractors. NWMO staff met regularly to discuss the project in more than 50 First Nation and Métis communities between 2014 and 2016 [NWMO 2017b]. Community members were encouraged to attend open houses and talk directly with NWMO staff, as well as with leaders and attendees from other communities in the area. Where invited, NWMO staff also participated in pow-wows, ceremonies, meetings, and other community events.

The NWMO entered into Learn More Agreements with 11 First Nation and Métis communities in siting areas, and 12 organizations at the local (e.g., Tribal Council), regional (treaty group), provincial, and national levels. These agreements provided support to communities and organizations to build internal capacity for learning about the long-term management of used nuclear fuel, and to facilitate learn more activities such as briefings, workshops and tours of waste management facilities. The agreements also provide funding to undertake community well-being and traditional land use studies, contracting for independent expert advice and communications.

3.3.4 Interweaving Indigenous Knowledge with Western Science

In the latter part of 2016, the NWMO became one of the first organizations in North America to implement an Indigenous Knowledge Policy [NWMO 2016a]. The NWMO commits that Indigenous Knowledge will inform decisions in each step of the planning in the decision-making process. It was developed in collaboration with the members of the Council of Elders and Youth, an advisory body that provides counsel on the application of Indigenous Knowledge in the implementation of APM.

Interweaving Indigenous Knowledge is conducted through a wide range of collaborative activities such as multi-year programs to incorporate local traditional knowledge and land use into all areas of assessment, joint development of work plans with First Nation and Metis communities, Community participation in preparing and executing field studies; and ceremonies and offerings led by communities prior to field work.

Plans for the recently completed and upcoming field studies were designed to address the sensitivities and concerns of indigenous people in the area. For example, timing, ecologically sensitive areas and the movement and activities of sensitive species, harvesting, and recreational activities were taken into account in the planning of the airborne surveys. In many cases, the NWMO geological and environmental field mapping activities were conducted with the participation of local guides who were also documenting traditional knowledge. The NWMO was also invited to attend ceremonies before the field work began in some areas.

4.0 TECHNICAL PROGRAM

4.1 Deep Geological Repository

The technical end-point of APM is a deep geological repository. The long-term management of used nuclear fuel relies on separate barriers to safely contain and isolate it over the long term.

The outermost barrier is the natural rock formation enclosing the repository. The remaining barriers are engineered and together known as the engineered barrier system. Each of the barriers provides a unique level of protection. As shown in Figure 3, these engineered barriers include:

- The used fuel bundle, comprising the used fuel and the Zircaloy sheathing, both durable materials;
- The used fuel container, a long-lived container with a steel structure and copper corrosion-resistant outer layer; and
- A clay-based seal around the container.

This approach, multiple passive barriers within a stable geological setting, is internationally recognized as the safest and most responsible method of managing used nuclear fuel [LBNL 2016]. It is the approach adopted by all countries which have defined an end-point for long-lived wastes. Finland, France, Sweden and Switzerland, in particular, are well advanced in their efforts to find a suitable site for a geological repository for their used nuclear fuel.

4.2 Design Concept

The repository will be constructed at a depth of approximately 500 metres, depending upon the specific geology and characteristics of the site. It will consist of a network of placement rooms for the used fuel containers and clay-based sealing systems, as well as a series of access tunnels and shafts to ensure accessibility and monitoring. Figure 3 provides an illustration of the deep geological repository concept. More technical details on the design and safety basis for a repository are provided in NWMO documents available from our website [e.g., NWMO 2016b, NWMO 2012, NWMO 2013b].

Used nuclear fuel will be loaded into specially designed and certified containers at the reactor sites and transported to the repository site. At the site, the used nuclear fuel will be re-packaged into corrosion-resistant containers for placement in the repository. Each container will be encased in a buffer box; this box is made of highly compacted bentonite clay, a stable sealing material. These buffer boxes will be transported underground and placed into one of many placement rooms.

Once each room is filled, the emplacement room will be sealed. After all the used nuclear fuel has been emplaced in the repository and all rooms sealed, the access tunnels and

perimeter tunnels will be left open and maintained to support on-site monitoring and provide an extended period of retrievability. This monitoring period will extend as long as needed to demonstrate the site's long-term safety; closure activities will only begin after sufficient performance data have been collected to support a decision to decommission and close the repository. These activities will also be undertaken in discussion with those in the area.

The NWMO will seek the appropriate regulatory approvals for activities at the site, from site preparation through to closure and postclosure monitoring. Transportation of the used nuclear fuel to the site will also have to meet stringent regulatory requirements.

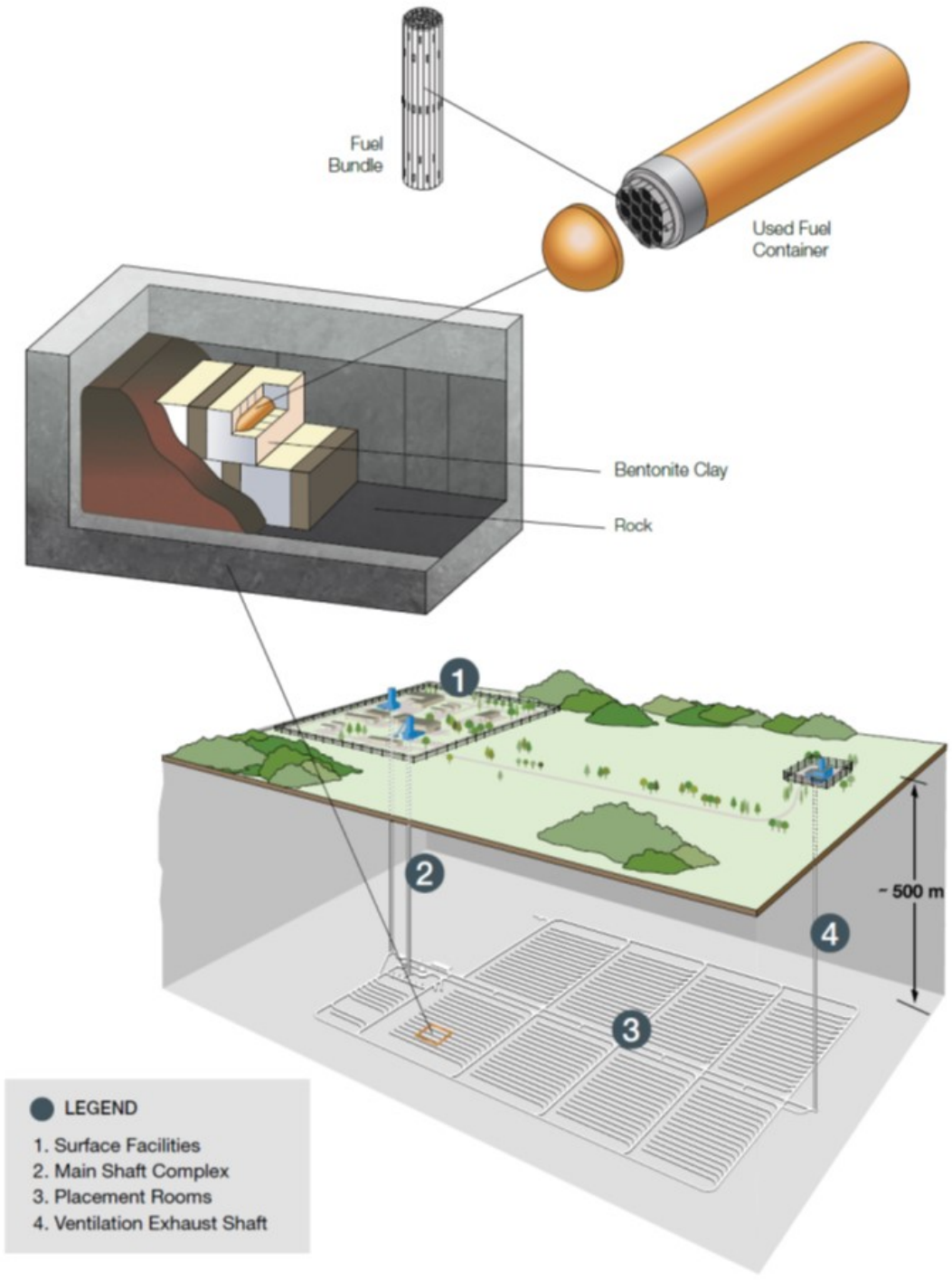

Figure 3: Illustration of NWMO's Deep Geological Repository Concept

4.3 Design Development

The NWMO has developed a reference engineered barrier system design that builds on international concepts that have been widely studied for decades, but is optimized for the characteristics of Canada's used fuel bundles. The NWMO concept in particular takes advantage of current developments in industrial high-quality copper coatings.

A conceptual repository design has also been completed [NWMO 2016b]. This design includes the underground repository layout and surface facilities. The conceptual repository design supports both the update to the lifecycle cost estimate (completed in 2016) and further development of preliminary safety assessments. A potential surface facility layout is illustrated in Figure 4.

Further optimization of various elements of these designs are being carried out. An updated repository layout has been developed within the past few years that provides flexibility in several respects. This design can be more easily adjusted for the geology of crystalline rock. The centralization of the shafts and service facilities also improves operational safety and site security aspects.

With each iteration of the conceptual design, and in concert with site-specific technical data that will start to emerge from the siting program, the NWMO is continuing to develop more details on the design basis.

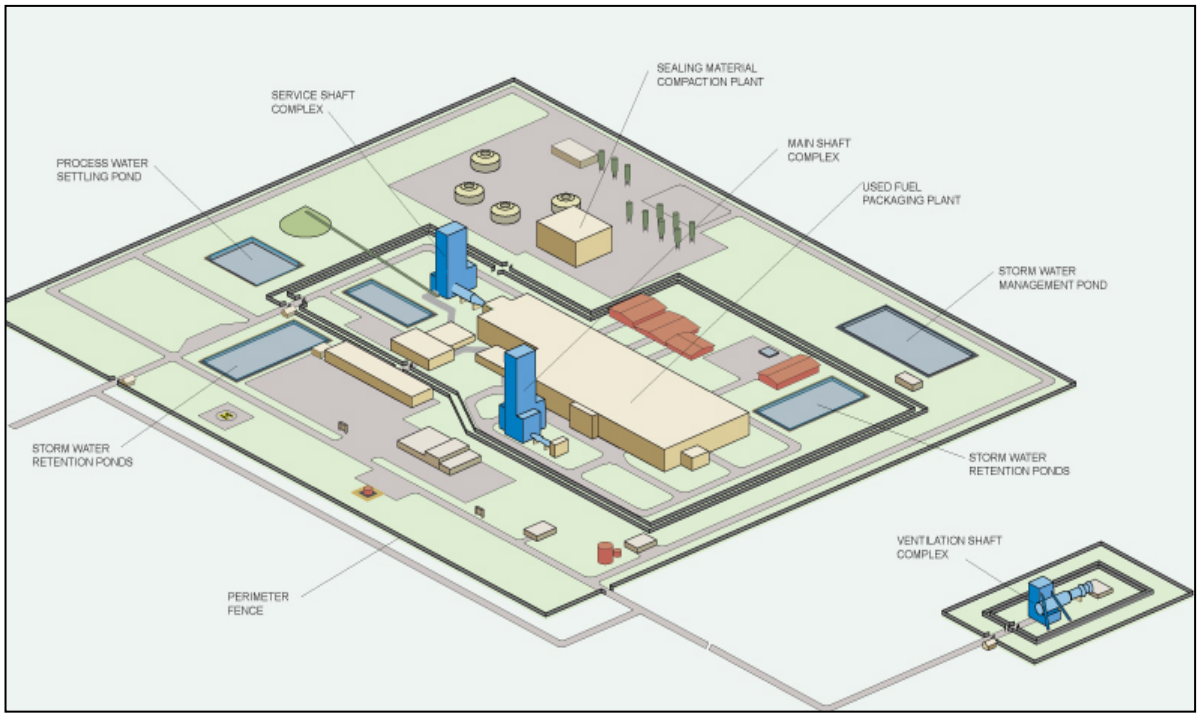

Figure 4: Conceptual Surface Facility Layout

4.4 Proof Testing

The NWMO developed a proof test plan to demonstrate key aspects of the engineered barrier system's safety performance. The plan serves two purposes: (1) to provide evidence that the design meets the requirements of the NWMO's safety case; and (2) to show that the NWMO can successfully and repeatedly manufacture and operate all components of the engineered barrier system. The proof test plan includes work to demonstrate the functionality and operability of the used fuel container, including its ability to withstand repository loads and resist corrosion throughout the life of the repository.

Performance of many of its components is being demonstrated through the fabrication and testing of physical prototypes. Prototypes of full-scale equipment have been fabricated including used fuel containers, bentonite buffer blocks, emplacement components and backfill emplacement equipment.

The NWMO continues to work with industry and academic partners to improve specific technologies, including the hybrid laser arc welding used to seal the used fuel container, and the electrodeposition and cold spray technologies used to apply the corrosion-resistant copper coating to these containers. The NWMO has also advanced the development of non-destructive examination techniques to inspect the fabricated containers, and the equipment required to support the used fuel container production trials.

4.5 Safety Assessment

The objective of the repository safety assessment program is to evaluate the operational and long-term safety of any candidate repository site and design in order to assess and improve the safety of the proposed facility, in part through comparison with Canadian and international standards.

The NWMO is continuously developing its ability to assess the safety of potential sites. In part, this is accomplished through illustrative safety assessments for conceptual designs and hypothetical sites. The NWMO is currently working on updating the previous conceptual safety case studies [NWMO 2012, NWMO 2013b] to incorporate the current engineered barrier system reference design in a hypothetical crystalline rock and a sedimentary setting. The NWMO also has work underway on operational safety, to support the parallel work on developing the facility design for the operating period.

4.6 Technical Research and Collaboration

The NWMO supports a core research program addressing topics in geoscience, materials, and safety assessment. The key objective is to advance the understanding of the safety case in both crystalline and sedimentary settings. This work is summarized in the NWMO Annual Technical Reports [NWMO 2016c].

Research partnerships with universities play an important role in ensuring the NWMO's technical work is scientifically rigorous, and in maintaining a supply of knowledgeable new young people. In 2017, the NWMO is supporting studies at 17 universities.

Some of this university research is co-funded by grants from the Natural Sciences and Engineering Research Council of Canada. These include, for example, an Industrial Research Chair in Radiation-Induced Corrosion at Western University; a Hydrogeochemistry Centre of Excellence in the University of Ottawa's Advanced Research Complex; and an Industrial Research Chair in High-Temperature Aqueous Chemistry at the University of Guelph.

The NWMO also works with other radioactive waste management organizations, often through co-operative activities arranged through the OECD Nuclear Energy Agency or the International Atomic Energy Agency. The NWMO has co-operation agreements with its counterparts in Sweden, Finland, France, Switzerland, Japan, the United Kingdom, and South Korea. This co-operation allows the NWMO to contribute to and benefit from other countries' experience in repository design and safety case development for various host rock formations. These agreements also support joint research projects at underground research laboratories in other countries.

The NWMO and its contractors regularly publish research results. In 2016, the NWMO's research program published 14 NWMO technical reports, submitted 11 papers for journal publication and submitted 17 abstracts for presentation at national and international conferences focused on environmental radioactivity and radioactive waste management These Technical Reports are available at www.nwmo.ca/reports.

5.0 TRANSPORTATION

Canada's plan for the long-term management of used nuclear fuel will require the used nuclear fuel to be transported from where it is currently being stored to the repository site. Although the site has not been selected, work is underway to ensure that used nuclear fuel will be transported in a way that is safe, secure and socially acceptable.

Two complementary programs support this work: a technical program that addresses all aspects of technical safety and security, and an engagement program that helps communities and other interested people learn more about the transportation of used nuclear fuel and encourages their involvement in planning.

5.1 Technical Program

Used nuclear fuel transportation packages are designed and tested to ensure protection of the public and environment during normal operations, as well as during severe accident conditions. Before a transportation package can be used in Canada, the CNSC must certify the design as meeting its regulatory requirements, which incorporate international safety standards published by the International Atomic Energy Agency. The requirements include successfully passing tests designed to demonstrate the package's ability to withstand severe impact, fire and immersion in water.

There are two existing transportation packages that are certified in Canada and could be used to transport used nuclear fuel to the repository: a Used Fuel Transportation Package and a Dry Storage Container Transportation Package. The NWMO owns and maintains the certificate for the Used Fuel Transportation Package.

5.2 Transportation Engagement Program

The NWMO's staff engage with community members and interested individuals at a wide variety of venues, including monthly meetings of community liaison committees, open houses, festivals and other local events. The NWMO's outreach includes First Nation and Métis communities and municipalities in the surrounding areas.

The NWMO has a mobile exhibit featuring an actual container that is certified as a transport package for used nuclear fuel. This exhibit, supported by subject-matter experts, has been taken to many communities and to conferences to allow hands-on viewing.

To further support the discussion, the NWMO has released a Transportation Discussion Document, along with activities to encourage discussion on five key questions that will help identify the social considerations that will need to be taken into account in the future in transportation planning [NWMO 2016d].

The NWMO regularly meets with local emergency management authorities to share information and seek their perspectives. At the provincial and federal levels, it meets with officials in ministries and departments responsible for transportation safety.

6.0 NEXT STEPS / IMPLEMENTATION PLAN

Figure 5 presents the NWMO's general planning timeline for implementation of APM.

Since its creation in 2002, the NWMO has worked with Canadians to develop and implement an approach for long-term management of used nuclear fuel. The NWMO regularly communicates its plans through its annual and triennial reports, annual implementation plans, its website, other reports and a range of engagement activities.

During the next five years, NWMO's work will focus on completing site assessments, developing partnerships with interested and key neighbouring indigenous and non-indigenous communities, and on decisions to narrow the number of communities down to a single preferred site for the deep geological repository. This is consistent with the direction provided by the Minister that *"… the NWMO will… find a suitable site located in a willing host community."* [GoC 2007b]

During this pre-licensing period, the NWMO plans to keep the CNSC staff and Commission informed of its activities and progress. Recognizing the long timeframes for siting and the unique nature of a deep geological repository, the NWMO and the CNSC have established a special project arrangement for this pre-licensing period. This arrangement provides a mechanism that (a) informs the NWMO on regulatory expectations; (b) informs CNSC on the APM program status, and (c) allows interested communities to invite the CNSC to present on the Canadian regulatory system.

The NWMO expects to select a site by 2023. This would be followed by a phase focussed on seeking regulatory approval. During this period, detailed site characterization will be undertaken at the site, a centre of expertise will be built, and when appropriate the NWMO will file the documents required to support obtaining an environmental assessment approval and licence for site preparation and construction.

The licensing process is assumed to take 4 years for planning purposes. Subject to regulatory approval, the planning assumption is that the detailed design would be completed, followed by site preparation and construction, with operations starting about 2043.

More details on near-term activities are presented in the NWMO's Implementation Plans at www.nwmo.ca/implementation.

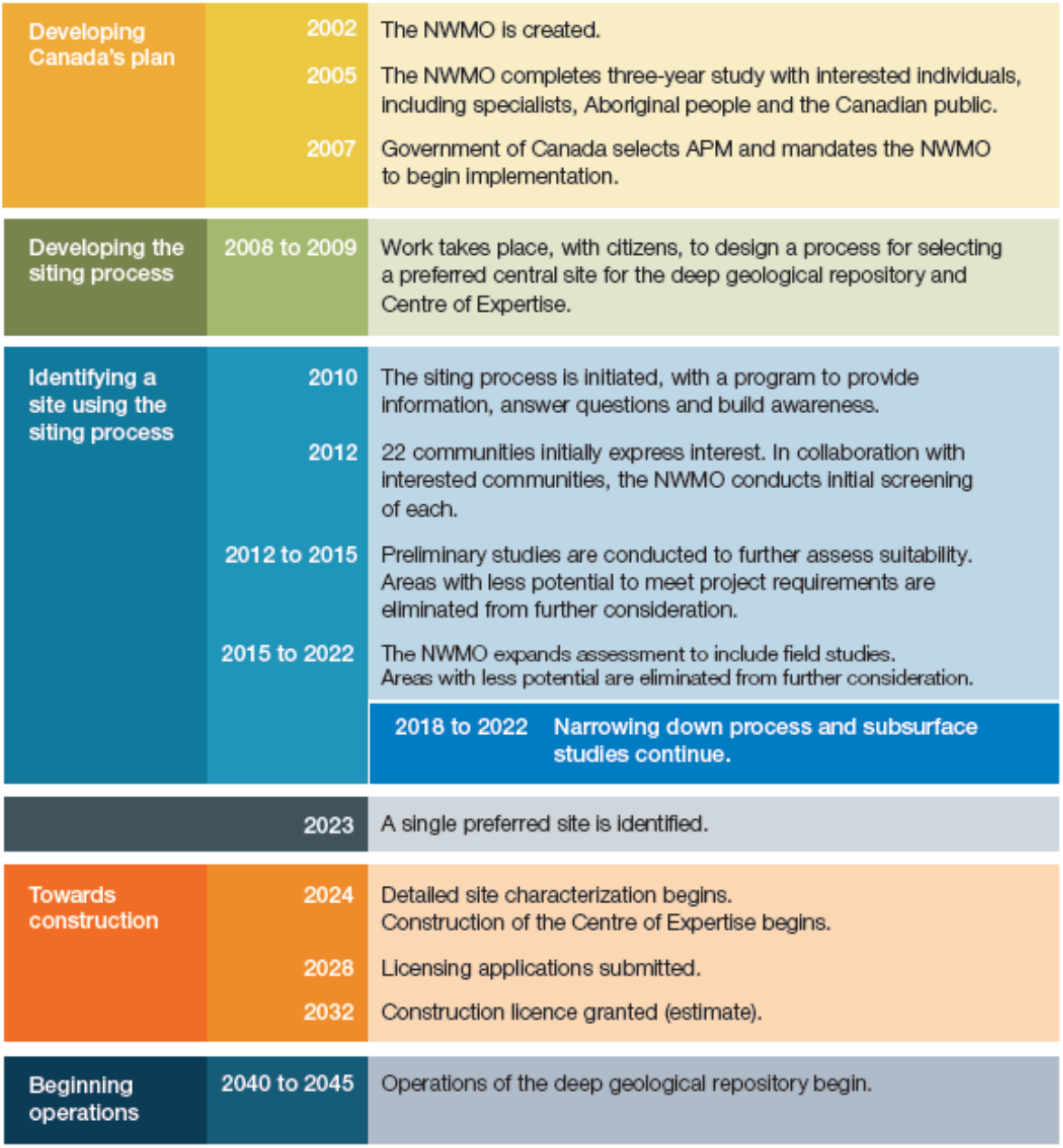

Figure 5: NWMO's Planning Timeframe for Implementation of APM [2]

[2] Licence is an NWMO planning assumption only. This will be subject to independent regulatory process.

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Glossary

AECL	Atomic Energy of Canada Limited
APM	Adaptive Phased Management – Canada's plan for the long-term management of used nuclear fuel.
CEAA	Canadian Environmental Assessment Agency
CLC	Community Liaison Committee
CMD	Commission Member Document
CNSC	Canadian Nuclear Safety Commission
DGR	Deep Geological Repository
EA	Environmental Assessment
GoC	Government of Canada
HQ	Hydro-Québec
NBP	New Brunswick Power
NFWA	Nuclear Fuel Waste Act (2002)
NWMO	Nuclear Waste Management Organization
OECD	Organisation for Economic Co-operation and Development
OPG	Ontario Power Generation

ADDENDUM A: ATTACHED REFERENCES

The following key references are attached:

- Order selecting an approach for the long-term management of nuclear fuel waste [GoC 2007a]
- Minister of Natural Resources letter to NWMO on the selection of APM [GoC 2007b]
- Minister of Natural Resources letter to NWMO on the funding formula and the amount of deposits required [GoC 2009]
- Minister of Natural Resources letter to NWMO on the siting plan [GoC 2010]

Registration
SI/2007-63 June 27, 2007

NUCLEAR FUEL WASTE ACT

Order Selecting an Approach for the Long-term Management of Nuclear Fuel Waste

P.C. 2007-834 May 31, 2007

Her Excellency the Governor General in Council, on the recommendation of the Minister of Natural Resources, pursuant to section 15 of the *Nuclear Fuel Waste Act*[a], hereby selects the Adaptive Phased Management approach for the long-term management of nuclear fuel waste from among the approaches set out in the November 2005 Final Study by the Nuclear Waste Management Organization entitled "Choosing a Way Forward", that was submitted to the Minister of Natural Resources on November 3, 2005, in accordance with subsection 12(1) of that Act.

EXPLANATORY NOTE

(This note is not part of the Order.)

The Order provides for the selection of the Adaptive Phased Management (APM) approach as the approach for the long-term management of nuclear fuel waste from among the approaches set out in the November 2005 final study by the Nuclear Waste Management Organization entitled "Choosing a Way Forward", that was submitted to the Minister of Natural Resources on November 3, 2005, in accordance with subsection 12(1) of the *Nuclear Fuel Waste Act*.

The APM approach, which was the approach recommended by the Nuclear Waste Management Organization in the study, consists of three phases: the first maintains the waste at the reactor sites while preparing for centralization; the second involves an optional interim step of central storage; and the third ensures long-term containment and monitoring of the waste in a geological repository. The APM approach is also made up of two important components: a management component that will provide opportunities for communities and citizens to participate throughout the site selection process and a technical component to make sure that the best scientific and technical knowledge will be applied for the long-term management of nuclear fuel waste. The APM approach provides sufficient flexibility for waste owners to exercise prudence in view of social and technical uncertainties over the long-term, and enables this generation to put measures in place to safeguard the public in a way that is sustainable, ethically and socially acceptable and respectful to the environment now and in the future.

[a] S.C. 2002, c. 23

Enregistrement
TR/2007-63 Le 27 juin 2007

LOI SUR LES DÉCHETS DE COMBUSTIBLE NUCLÉAIRE

Décret choisissant la méthode pour la gestion à long terme des déchets de combustible nucléaire

C.P. 2007-834 Le 31 mai 2007

Sur recommandation du ministre des Ressources naturelles et en vertu de l'article 15 de la *Loi sur les déchets de combustible nucléaire*[a], Son Excellence la Gouverneure générale en conseil choisit la méthode de gestion adaptative progressive pour la gestion à long terme des déchets de combustible nucléaire, parmi les propositions présentées dans l'exposé final de novembre 2005 de la Société de gestion des déchets nucléaires intitulé « Choisir une voie pour l'avenir », qui a été remis au ministre des Ressources naturelles le 3 novembre 2005, conformément au paragraphe 12(1) de cette loi.

NOTE EXPLICATIVE

(La présente note ne fait pas partie du Décret.)

Le Décret prévoit le choix de la méthode de gestion adaptative progressive (GAP) pour la gestion à long terme des déchets de combustible nucléaire, parmi les propositions présentées dans l'exposé final de novembre 2005 de la Société de gestion des déchets nucléaires intitulé « Choisir une voie pour l'avenir », qui a été remis au ministre des Ressources naturelles le 3 novembre 2005, conformément au paragraphe 12(1) de la *Loi sur les déchets de combustible nucléaire*.

La méthode GAP, qui a été recommandée par la Société de gestion des déchets nucléaires dans l'exposé, comprend trois phases : la première vise à conserver les déchets à l'emplacement des réacteurs nucléaires pendant que l'on se prépare pour la centralisation; la deuxième est en fait une étape intérimaire facultative d'entreposage centralisé; la troisième vise à assurer le confinement et le suivi à long terme des déchets entreposés dans un dépôt situé dans une formation géologique. La méthode GAP comporte également deux volets importants : un volet de gestion qui permettra aux collectivités et aux citoyens de participer à l'ensemble du processus de sélection du site et un volet technique qui garantira que les meilleures connaissances scientifiques et techniques seront appliquées pour la gestion à long terme des déchets de combustible nucléaire. La méthode GAP offre suffisamment de souplesse pour permettre aux propriétaires de déchets d'exercer toute la prudence nécessaire eu égard aux incertitudes sociales et techniques à long terme et donne à la présente génération la possibilité de mettre en place des mesures qui protégeront le public d'une manière durable, moralement et socialement acceptable, et respectueuse de l'environnement, présentement et dans l'avenir.

[a] L.C. 2002, ch. 23

Published by the Queen's Printer for Canada, 2007 Publié par l'Imprimeur de la Reine pour le Canada, 2007

Minister
of Natural Resources Canada

Ministre
des Ressources naturelles Canada

Ottawa, Canada K1A 0E4

JUL - 9 2007

RECEIVED
JUL 12 2007

Mr. Ken Nash
President
Nuclear Waste Management Organization
49 Jackes Avenue
Toronto, Ontario M4T 1E2

Dear Mr. Nash:

On June 14, 2007, the Government of Canada announced its decision to select the Adaptive Phased Management (APM) approach as Canada's best option for the long-term management of nuclear fuel waste. This approach enables this generation to take action now to put measures in place that safeguard the public while being respectful to the environment and to future generations.

Now that the Government has made its decision, the NWMO should proceed to the next phase of its mandate — to implement the APM approach. My expectation is that the NWMO will take at least two years to develop a collaborative community-driven site-selection process and then it will begin consultations with citizens, communities, Aboriginals and other interested parties to find a suitable site located in a willing host community. I am very supportive of the NWMO taking the necessary time to develop a process that is open, transparent, inclusive and that is built on a solid foundation of trust, integrity and respect for Canadians and the environment.

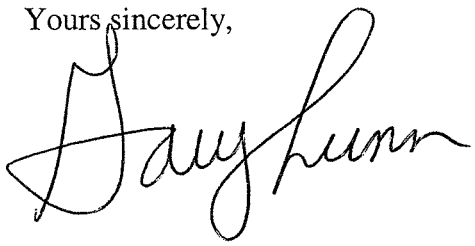
As the NWMO carries out this important project, I look forward to reviewing its annual reports and, in particular, to receiving NWMO's plan for a public process to determine a site, prior to the launching of such a process. I understand that the NWMO will work with informed, willing host communities — focusing on Ontario, New Brunswick, Quebec and Saskatchewan. This process will result in building knowledge, skills and capacity in response to requests from willing host communities.

Following the government's decision and pursuant to the *Nuclear Fuel Waste Act*, the NWMO's next annual report must contain a funding formula that will be used to calculate the amount of monies that the nuclear energy corporations must set aside to finance the APM approach for the long-term management of nuclear fuel waste. As part of continuing government oversight, pursuant to the *Nuclear Fuel Waste Act*, this funding formula is subject to my approval.

I recognize that this is a big undertaking with tremendous opportunities and that it will require considerable time, patience and effort to effectively implement the government's decision. The APM approach provides for a balance between responsiveness to societal needs and concerns, and incorporation of the best scientific and technical knowledge.

I wish you well in your endeavour as you move forward on this extremely important project.

Yours sincerely,



The Honourable Gary Lunn, P.C., M.P.

Minister
of Natural Resources

Ministre
des Ressources naturelles

Ottawa, Canada K1A 0E4

RECEIVED
APR 15 2009

APR - 7 2009

Mr. Ken Nash
President
Nuclear Waste Management Organization
22 St. Clair Avenue East
Toronto, Ontario M4T 2S3

Dear Mr. Nash:

After careful review and consideration, I am pleased to inform you that I have approved the Nuclear Waste Management Organization's (NWMO) proposed funding formula and the amount of the deposits required to be paid by each of the nuclear energy corporations (i.e. Ontario Power Generation, Hydro-Québec, New Brunswick Power) and Atomic Energy of Canada Limited (AECL) for the year 2008, as proposed in the NWMO's 2007 Annual Report. As you know, the purpose of the funding formula is to ensure that enough money will be available to pay for the costs of managing Canada's nuclear fuel waste over the long term.

I am aware that the nuclear energy corporations and AECL have made contributions in trust for 2008 in the amounts set out in subsection 10(2) of the *Nuclear Fuel Waste Act* (NFWA). However, as a consequence of my decision to approve the funding formula, each of these organizations will be required to make additional deposits to their trust accounts as indicated in the NWMO proposed funding formula in order to meet their obligation under section 17 of the NFWA. These deposits must be made within 30 days of the date of this letter. As you know, payments for 2009 must be made within 30 days of the date on which the NWMO submits its 2008 Annual Report.

There is a renewed interest in nuclear as an important clean energy source that produces virtually no greenhouse gas emissions. Consequently, a number of provinces and electricity generators are considering the possibility of new builds in Canada and this would lead to the creation of wastes from not only a new fleet of nuclear reactors but also from new waste producers. With this in mind, I would like to remind you that the NFWA requires the NWMO to provide its services to new waste owners for managing nuclear fuel waste over the long term at a fair and reasonable cost. Although, it will be several years before these wastes

begin to be generated, it would be prudent for the NWMO to take into consideration how it might adjust the funding formula to accommodate these new waste owners and these new wastes. I encourage the NWMO to report on its progress regarding this important matter.

I look forward to reviewing the NWMO's annual reports recognizing that the funding formula will evolve over time. I also look forward to monitoring the NWMO's progress towards implementing the Adaptive Phased Management approach.

Yours sincerely,

Lisa Raitt

The Honourable Lisa Raitt, P.C., M.P.

Minister
of Natural Resources

Ministre
des Ressources naturelles

Ottawa, Canada K1A 0E4

JUIN
JUN - 9 2010

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

Dear Mr. Nash:

Thank you for sending me a copy of the Nuclear Waste Management Organization's (NWMO) siting plan, "*Moving Forward Together: Process for Selecting a Site for Canada's Deep Geological Repository for Used Nuclear Fuel.*" As you mention in your letter of May 13, 2010, this plan will guide the NWMO's process towards selecting a suitable site in a willing host community for the safe and secure long-term management of nuclear fuel waste in Canada.

The siting plan is an important milestone document in the evolution of the NWMO's work towards implementing the Government of Canada's decision. In 2007, the Government accepted the NWMO's recommendation of Adaptive Phased Management (APM) as the most appropriate approach for managing nuclear fuel waste that is in the best interest of Canadians and the environment. The siting process is an essential component of implementing the APM approach as it will eventually lead to the identification of a site for the long-term management of nuclear fuel waste. A future site for the isolation and containment of the waste will be an important element of Canada's nuclear infrastructure.

The process, described in your May 2010 plan, is a reasonable approach for moving forward with the implementation of this project. I understand that it builds on lessons learned and best practices in other countries where they have been achieving success in this area. Most importantly, it represents an open, transparent and equitable approach, which was developed in consultation with Canadians over the last two years, for proceeding with this project. These three elements are critical to instilling confidence in the process; to building and maintaining long-lasting, trusting partnerships with citizens, municipalities, communities, governments and stakeholders; and to successfully identifying a future site.

Pursuant to my responsibilities under the *2002 Nuclear Fuel Waste Act*, I look forward to continuing to monitor your progress on the implementation of the APM approach and to ensuring that it is carried out in the best interests of Canadians and the environment.

I wish you well with the initiation of the siting process this coming year. I look forward to reviewing and commenting on the NWMO's annual reports and, in particular, the NWMO's March 2011 triennial report, which will outline the organization's activities for the next five years towards implementing this project.

Again, thank you for writing on this important matter.

Yours sincerely,

The Honourable Christian Paradis, P.C., M.P. (Mégantic–L'Érable)

ADDENDUM B: SAFETY CRITERIA FROM NWMO SITING PROCESS DOCUMENT

FACTORS AFFECTING SAFETY	PERFORMANCE OBJECTIVES	EVALUATION FACTORS TO BE CONSIDERED
Containment and isolation characteristics of the host rock	1. The geological, hydrogeological, chemical and mechanical characteristics of the site should: » promote long-term isolation of used nuclear fuel from humans, the environment and surface disturbances; » promote long-term containment of used nuclear fuel within the repository; and » restrict groundwater movement and retard the movement of any released radioactive material.	1.1 The depth of the host rock formation should be sufficient for isolating the repository from surface disturbances and changes caused by human activities and natural events. 1.2 The volume of available competent rock at repository depth should be sufficient to host the repository and provide sufficient distance from active geological features such as zones of deformation or faults and unfavourable heterogeneities. 1.3 The mineralogy of the rock, the geochemical composition of the groundwater and rock porewater at repository depth should not adversely impact the expected performance of the repository multiple-barrier system. 1.4 The hydrogeological regime within the host rock should exhibit low groundwater velocities. 1.5 The mineralogy of the host rock, the geochemical composition of the groundwater and rock porewater should be favourable to retarding radionuclide movement. 1.6 The host rock should be capable of withstanding natural stresses and thermal stresses induced by the repository without significant structural deformations or fracturing that could compromise the containment and isolation functions of the repository.

FACTORS AFFECTING SAFETY	PERFORMANCE OBJECTIVES	EVALUATION FACTORS TO BE CONSIDERED
Long-term stability of the site	2. The containment and isolation functions of the repository should not be unacceptably affected by future geological processes and climate changes, including earthquakes and glacial cycles.	2.1 Current and future seismic activity at the repository site should not adversely impact the integrity and safety of the repository system during operation and in the very long term. 2.2 The expected rates of land uplift, subsidence and erosion at the repository site should not adversely impact the containment and isolation functions of the repository. 2.3 The evolution of the geomechanical, hydrogeological and geochemical conditions at repository depth during future climate change scenarios such as glacial cycles should not have a detrimental impact on the long-term safety of the repository. 2.4 The repository should be located at a sufficient distance from geological features such as zones of deformation or faults that could be potentially reactivated in the future.
Repository construction, operation and closure	3. The surface and underground characteristics of the site should be favourable to the safe construction, operation, closure and long-term performance of the repository.	3.1 The strength of the host rock and in-situ stress at repository depth should be such that the repository could be safely excavated, operated and closed without unacceptable rock instabilities. 3.2 The soil cover depth over the host rock should not adversely impact repository construction activities. 3.3 The available surface area should be sufficient to accommodate surface facilities and associated infrastructure.

FACTORS AFFECTING SAFETY	PERFORMANCE OBJECTIVES	EVALUATION FACTORS TO BE CONSIDERED
Human intrusion	4. 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.	4.1 The repository should not be located within rock formations containing economically exploitable natural resources such as gas/oil, coal, minerals and other valuable commodities as known today. 4.2 The repository should not be located within geological formations containing groundwater resources at repository depth that could be used for drinking, agriculture or industrial uses.
Site characterization	5. The characteristics of the site should be amenable to site characterization and site data interpretation activities.	5.1 The host rock geometry and structure should be predictable and amenable to site characterization and site data interpretation.
Transportation	6. The site should have a route that exists or is amenable to being created that enables the safe and secure transportation of used fuel from storage sites to the repository site.	6.1 The repository should be located in an area that is amenable to the safe transportation of used nuclear fuel. 6.2 The repository should be located in an area that allows appropriate security and emergency response measures during operation and transportation of the used nuclear fuel.