NUCLEAR WASTE MANAGEMENT ORGANIZATION
SOCIÉTÉ DE GESTION DES DÉCHETS NUCLÉAIRES

# Implementing Adaptive Phased Management 2016 to 2020

**DRAFT FOR PUBLIC REVIEW**

**OCTOBER 2015**

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## The NWMO is guided by five fundamental values:

### Integrity
We will conduct ourselves with openness, honesty and respect for all persons and organizations with whom we deal.

### Excellence
We will pursue the best knowledge, understanding and innovative thinking in our analysis, engagement processes and decision-making.

### Engagement
We will seek the participation of all communities of interest and be responsive to a diversity of views and perspectives. We will communicate and consult actively, promoting thoughtful reflection and facilitating a constructive dialogue.

### Accountability
We will be fully responsible for the wise, prudent and efficient management of resources, and be accountable for all our actions.

### Transparency
We will be open and transparent in our process, communications and decision-making, so that the approach is clear to all Canadians.

# Preface

**The Nuclear Waste Management Organization (NWMO) is responsible for the implementation of Adaptive Phased Management (APM), Canada's plan for the safe, long-term care of used nuclear fuel. APM involves the development of a large infrastructure project that will include a deep geological repository and a Centre of Expertise for technical, environmental and community studies.**

The NWMO invites all Canadians and Aboriginal peoples of Canada to learn more and become involved in the management of Canada's used nuclear fuel. To support this involvement and demonstrate its commitment to transparency and accountability, the NWMO publishes an annual update to its five-year strategic plan, titled *Implementing Adaptive Phased Management*. The plan is regularly assessed, strengthened and redirected as appropriate in the face of new information and comments the NWMO receives through its engagement initiatives.

*Implementing Adaptive Phased Management 2016 to 2020* is released in draft for public review through to December 31, 2015. Following the review period, the Plan will be revised to reflect comments received. An overview of comments received about the Draft Plan and how they helped to refine the plan will be published along with the revised 2016 to 2020 plan at www.nwmo.ca.

**The NWMO welcomes all suggestions and ideas about its work and how it can help you learn more about Adaptive Phased Management. Please share your thoughts on this plan. You may wish to use the questionnaire at the end of the document as a guide.**

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# Executive Summary

**The Nuclear Waste Management Organization (NWMO) is responsible for the long-term care of Canada's used nuclear fuel. *Implementing Adaptive Phased Management 2016 to 2020* describes its five-year work program.**

Adaptive Phased Management (APM), Canada's long-term plan for used nuclear fuel, is a management system and a technical method. The management system is based on phased and adaptive decision-making supported by public engagement and continuous learning. The end point of the technical method is a repository that will contain and isolate Canada's used nuclear fuel deep underground in a suitable rock formation. A safe and secure transportation system will be developed to transport used nuclear fuel from the facilities where it is currently stored on an interim basis to the centralized site. The NWMO's primary motivation is safety – to protect people and the environment from Canada's highly radioactive used nuclear fuel. This objective and common vision underpins all the work of the NWMO. All aspects of the NWMO's work will meet or exceed all applicable federal and provincial regulatory standards and requirements for protecting the health, safety and security of humans and the environment.

One focus of the 2016 to 2020 period will be on siting and working with potentially interested communities as they move through the Preliminary Assessment step in the siting process. Activities will support community learning and engagement, as well as site evaluation. Importantly, this involves working with interested and potentially affected First Nation and Métis peoples, and other surrounding communities to learn about and consider whether the project might fit in the area.

Twenty-one communities successfully passed an initial screening and elected to advance to preliminary assessments, initiating Step 3, Phase 1 of the site selection process. These Phase 1 assessments have guided a gradual narrowing down process. Siting activity is now focused on a smaller number of areas, as the NWMO works with communities on multi-year Phase 2 preliminary assessments.

Currently, work is continuing in and around nine of the communities[1] that initiated their areas' involvement in the process. Aboriginal peoples and communities in the surrounding area are progressively being engaged in learning and decision-making. The NWMO expects that the advancement of preliminary assessments (Step 3, Phase 2) over the five-year planning period will continue to build information to guide a future decision on selection of the preferred area to proceed to site characterization (Step 4).

Another important focus of the next five years will be to conduct testing to demonstrate that engineered barriers meet all safety requirements and can be produced effectively and efficiently. Over the planning period, the NWMO will complete design, fabrication, and testing of prototype repository containers, buffer and emplacement systems, and will establish a prototype test facility for engineered barrier evaluations.

The NWMO will continue to refine conceptual designs and postclosure safety assessments for a repository in both crystalline and sedimentary rock formations, and keep the Canadian Nuclear Safety Commission informed about its work. Throughout the planning period, engagement and social research will continue. Attention to sound governance and assurances around program funding will be maintained. Investing in people and the skills key to program success and continuity will remain a priority.

The addition of a new strategic objective for the planning period reflects an escalation in planning activity for next steps in APM implementation. The NWMO and communities involved in the site selection process will be planning for the establishment of the Centre of Expertise and many local activities that will be initiated once a preferred site is identified, which may be as early as 2023.

[1] Blind River, Central Huron, Elliot Lake, Hornepayne, Huron-Kinloss, Ignace, Manitouwadge, South Bruce, and White River.

## Key milestones for the next five-year planning period include:

- Advance preliminary field studies and assessments (Step 3, Phase 2) to support future identification of the preferred site to progress to the detailed site characterization phase of work;
- Conduct this work collaboratively with the communities involved, First Nation and Métis peoples, and surrounding communities in order to establish a foundation to proceed in partnership to implement the project;
- Design and manufacture physical prototypes of the used nuclear fuel container;
- Establish a container engineering and test facility for both the repository and transportation containers;
- Complete an integrated review of microbiological processes that could occur within the repository environment;
- Advance planning for the design of the national Centre of Expertise to be established at the selected site, through discussion with communities engaged in the site selection process;
- With communities in the site selection process, expand opportunities for local employment and building capacity and skills for future jobs associated with APM construction and operations;
- Advance transportation plans through container design and testing, and through engagement of citizens to inform the development of a planning framework; and
- Work with waste owners in planning for future transport of used nuclear fuel from the interim storage facilities where it is currently stored.

This strategic plan is a 'living' document that is regularly assessed, strengthened and redirected in the face of new information, direction and guidance from communities, advances in science and technology, insight from Aboriginal Traditional Knowledge, changes in societal values, and evolving public policy. APM will only proceed as quickly as Canadians, successful technology development and demonstration, and the regulatory authorities allow.

The plan for the next five years is organized along eight strategic objectives outlined in the following pages. The NWMO continues to evolve these objectives as implementation of APM progresses. The Draft 2016 to 2020 plan reflects refinements to the strategic objectives that have been adapted and evolved in response to public review.

**The NWMO approaches its work with the following vision: the long-term management of Canada's nuclear waste in a manner that safeguards people and respects the environment, now and in the future.**

# Strategic Objectives 2016–2020

## The NWMO will:

- Build sustainable, long-term relationships with interested Canadians and Aboriginal peoples of Canada, and involve them in setting future directions for the safe, long-term management of used nuclear fuel. Continue to adapt plans for the management of used nuclear fuel in response to evolving societal expectations and values, insight from Aboriginal Traditional Knowledge, and changes in public policies.

- Implement collaboratively with communities the preliminary assessments of site suitability for locating the deep geological repository and Centre of Expertise in a safe location with an informed, willing host.

- Conduct testing to prove that engineered barriers meet all safety requirements and can be produced effectively and efficiently.

- Continuously improve technical knowledge in collaboration with universities and international partners, and adapt plans consistent with international best practices.

- Advance planning and capabilities for the construction and operation of the deep geological repository and the associated Centre of Expertise at the site selected to host the project.

- Establish safe, secure and socially acceptable plans for transporting used nuclear fuel.

- Ensure funds are available to pay for the safe, long-term management of Canada's used nuclear fuel.

- Maintain an accountable governance structure that provides confidence to the Canadian public in the conduct of the NWMO's work.

# Progress Since Last Implementation Plan

The Nuclear Waste Management Organization (NWMO) reports in detail on its progress in achieving the activities outlined in the Implementation Plan each year in its Annual Report and every three years in its Triennial Report. Selected highlights of progress over the past year against the strategic objectives that guided that work are outlined below.

## Build Sustainable Relationships and Continue to Adapt Plan

The NWMO continued to engage with interested individuals and groups, communities, and Aboriginal peoples of Canada in the development and implementation of NWMO plans. The NWMO also continued a program of continuous learning in order to adapt plans in response to evolving societal expectations and values, changes in public policies, and insight from Aboriginal Traditional Knowledge. The NWMO:

- Continued to work with the Municipal Forum to develop a better understanding of the needs and processes of municipalities involved in the site selection process and of the communities in the surrounding area.
- Worked closely with the Council of Elders to incorporate Aboriginal Traditional Knowledge in the NWMO's work.
- Engaged with a broad range of municipalities and Aboriginal organizations through a program of involvement in municipal association conferences and First Nation and Métis organization events and learning agreements.
- Strengthened relationships with federal and provincial governments, and briefed elected representatives about the project and site selection process.
- Supported initiatives designed to increase youth interest and participation in science, including Shad, the Science North School Outreach Program, and Scientists in School.
- Used a wide variety of communications media to keep communities and the public at large informed about the NWMO, its work, and the site selection process.
- Continued to solicit input on its plans, including evolving societal expectations and values, and also insight from Aboriginal Traditional Knowledge, in order to adapt plans as needed.

## Collaboratively Implement Preliminary Assessments

Working with communities, the NWMO continued to advance preliminary assessments of site suitability. The NWMO:

- Concluded studies in the vicinity of the five communities of Brockton, Creighton, Schreiber, The North Shore and Spanish. As of October 2015, preliminary assessment studies were continuing in the vicinity of nine communities that expressed interest in the project.
- Supported community engagement and learning with the objective of seeking an informed and willing host for the facility.
- Worked independently and with interested communities to engage, build relationships, learn about and consider the project with potentially affected First Nation and Métis peoples and other communities in the area, with the objective of developing a partnership to support implementation.

## Demonstrate Safety and Feasibility of Repository and Engineered Barrier Design

The NWMO continued technical work on the repository design and engineered barriers. The NWMO:

- Designed the slip-skid pallet for container emplacement.
- Completed updates to the conceptual repository designs.
- Established process tolerances for cold-spray copper production.
- Fabricated a full-scale buffer box.
- Fabricated and pressure tested a full-scale prototype steel used fuel container.

## Continuously Improve Technical Knowledge

The NWMO continued to collaborate with universities and international partners to stay abreast of best practice and developments in the field of used nuclear fuel management. The NWMO:

- Completed a repository geomechnical stability case study.
- Hosted an annual Geoscience Seminar.
- Participated in collaborative research programs in international underground research labs, including the POST project with Sweden and Finland, various experiments at Mont Terri in Switzerland, and the GAST experiment at Grimsel in Switzerland.
- Published peer-reviewed journal articles, conference papers, and technical reports.
- Supported research projects with 15 Canadian university groups.

## Develop Transportation Plans

The NWMO made progress in its technical program, which is designed to address all aspects of safety and security, and its engagement program to help communities learn about transportation of used nuclear fuel and become involved in its planning. The NWMO:

- Published two generic radiation dose reports, one for people along potential transportation routes and the other for transportation workers.
- Co-organized a panel on transportation at the 2015 conference of the Canadian Nuclear Society.
- Conducted fire and impact modelling on its used fuel transportation package.
- Began conceptual work on a used fuel transportation package for Atomic Energy of Canada Limited waste.
- Facilitated community learning with 16 visits of the mobile transportation exhibit and participation at 14 municipal conferences, and updated material to further support this learning.

## Provide Financial Surety

The NWMO, in compliance with the *Nuclear Fuel Waste Act* (*NFWA*), continued to monitor the segregated funds whose sole purpose is to fund the implementation of the deep geological repository and facilities once a construction licence has been granted by the Canadian Nuclear Safety Commission, many years in the future. In 2015, the NWMO also initiated a full update of the lifecycle cost estimate for Adaptive Phased Management, to be completed in the first quarter of 2016.

## Ensure Governance and Accountability

Multiple layers of oversight and peer review, complemented by externally audited international certifications, helped ensure that the NWMO's work was both transparent and guided by the highest scientific and professional standards.
The NWMO:

- Continued to seek independent review of the organization's work through independent technical reviews, its Advisory Council, and a forum of Aboriginal Elders.
- Continued to report annually to the Minister of Natural Resources Canada, as required by the *NFWA*.

# NWMO Organization

**NWMO Vision: The long-term management of Canada's nuclear waste in a manner that safeguards people and respects the environment, now and in the future.**

The Government of Canada, through the *Nuclear Fuel Waste Act* (2002), assigned responsibility for the long-term management of Canada's used nuclear fuel to the Nuclear Waste Management Organization (NWMO). The NWMO was established to operate on a not-for-profit basis by Canada's major nuclear fuel waste owners – Ontario Power Generation (OPG), Hydro-Québec and New Brunswick Power Corporation. The NWMO's mission 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.

Over the period 2002 to 2005, the NWMO engaged a broad cross-section of citizens in a study to examine options for the long-term care of Canada's used nuclear fuel. The study and the NWMO's recommendation to the Government of Canada are available on the NWMO website at www.nwmo.ca.

In 2007, the Government of Canada, based on the NWMO's recommendation, selected Adaptive Phased Management (APM) as the best plan for Canada for safeguarding both the public and the environment over the very long time in which used nuclear fuel must be managed. Implementation of a deep geological repository under APM will be regulated by the Canadian Nuclear Safety Commission (CNSC) under the *Nuclear Safety and Control Act* (*NSCA*) and its associated regulations.

Since its inception in 2002 and as required by Canada's plan, the NWMO has advanced and refined designs for a deep geological repository for the long-term containment and isolation of used nuclear fuel. This work has advanced substantially since 2002, and proof testing is an important focus of current work.

In 2010, the NWMO initiated the site selection process, following a two-year dialogue with Canadians to design a community-driven process for identifying the location for the deep geological repository. Since that time, the NWMO has worked with communities that chose to become involved in the site selection process through the early steps of learning more about APM and the project. As the siting process advances, an increasingly important focus is working with these communities to engage and build relationships with First Nation and Métis peoples, and other communities in the area to learn about and consider the project together. Technical assessments in the areas of these communities are advancing from desktop studies to field studies, including airborne surveys, and geological and environmental mapping.

The NWMO continues to build a multidisciplinary team with a range of experience in the fields of social research, technical research and development, engineering and design, public engagement, Aboriginal relations, communications, finance, and governance. The NWMO continues to collaborate with an extensive network of consultants, practitioners and academics from across Canada and around the world to ensure that its work benefits from the best available knowledge. Investment in human resources, skills training and networks of specialists is important to building and sustaining a capability for inquiry, assessment and decision-making to support the implementation of APM. These specialists

are critical to implementing the siting process, supporting community interest and partnerships, and undertaking technical, socio-economic and cultural site investigations.

Management of used nuclear fuel is a very long-term responsibility. The NWMO must be steady, stable and long term in its outlook and actions. This requires sustained investment in the organization to ensure resource capacity, capability, expertise, and sound administrative and management policies and practices that provide a foundation for operations spanning decades. The long time frames associated with management of used nuclear fuel give rise to the additional priority of intergenerational knowledge management. The preservation and transfer of knowledge and institutional memory across generations will be integral to supporting lengthy decision-making processes, and the integration of technical, scientific and social information over long periods of time.

As the NWMO proceeds with the implementation of APM and builds partnerships to facilitate it, having capacity at the local and regional levels to participate will become a critical component of the larger organization required to implement the project. Going forward, the NWMO will seek opportunities to meet emerging resource needs by recruiting staff locally in the siting areas wherever possible. The organization will also work with communities to build capacity, training and skills for jobs associated with the APM Project in the years ahead and to ensure well-being is fostered.

In addition to its responsibility for implementing Canada's plan for the long-term management of used nuclear fuel, the NWMO is assisting OPG in seeking regulatory approval to construct a proposed deep geologic repository for the long-term management of low- and intermediate-level waste from OPG-owned or -operated reactors. The NWMO has provided expertise in repository design and implementation to OPG's project.

# Regulatory Oversight of Adaptive Phased Management

The NWMO is committed to meeting or exceeding all applicable regulatory standards and requirements for protecting the health, safety and security of people and the environment.

Implementation of a deep geological repository falls within federal jurisdiction and will be regulated under the *NSCA* and its associated regulations. The CNSC, as Canada's independent regulatory authority, regulates the use of nuclear energy and materials to protect the health, safety, and security of Canadians and the environment; and to implement Canada's international commitments on the peaceful use of nuclear energy. The CNSC also disseminates objective scientific, technical and regulatory information to the public.

Under section 26 of the *NSCA*, activities associated with a nuclear facility can occur only in accordance with a licence issued by the CNSC. The repository for Canada's used nuclear fuel will be subject to the CNSC's comprehensive licensing system, which covers the entire life cycle of the repository, from site preparation, to construction, operation, decommissioning (closure and postclosure), and abandonment (release from CNSC licensing). This stepwise approach will require a licence for each phase of the repository life cycle. The process for obtaining a "site preparation" licence will be initiated by the NWMO. The NWMO would submit an application for a Licence to Prepare Site (and possibly construct) to the CNSC. A licensing decision by the CNSC on a repository can be taken only after the successful completion of the environmental assessment, following the process established by the *Canadian Environmental Assessment Act*, 2012. More information about the CNSC's licensing process is available at www.cnsc-ccsn.gc.ca.

The transportation of used nuclear fuel is jointly regulated by the CNSC and Transport Canada.

Although the CNSC is the main licensing authority, the CNSC administers its licensing system in co-operation with other federal and provincial government departments and agencies in areas such as health, environment, transport, and labour.

Relevant aspects of the NWMO's work will also comply with applicable provincial regulatory requirements. For example, some aspects of siting or construction of the project and the transportation of used nuclear fuel may be governed by provincial legislation:

- Most provinces and territories include nuclear substances in legislation and regulations addressing the transportation of dangerous goods within that province or territory.
- Provincial governments are responsible for protecting public health and safety, property and the environment within their borders, which often includes provincial emergency preparedness legislation.
- Provincial governments are responsible for the regulation of resource exploration and/or extraction (e.g., drilling and underground mining) and Crown land management (e.g., disposition of provincial lands).
- Provincial legislation requiring the assessment of potential environmental effects of an activity, plan or program may apply to some aspects of this work. Legislation governing endangered species, environmental protection, heritage protection or preservation, water resources protection, occupational health and safety, employment standards, or labour relations may be relevant.
- Various permits, licences and approvals will be required, and provincial policies and guidelines may be applicable at the site selection stage.
- Municipalities, which derive their authority from provincial legislation, may have requirements such as permits, codes, standards and/or bylaws that also need to be addressed.

# Canada's Plan for Used Nuclear Fuel

**Canada's plan for the long-term care of used nuclear fuel is known as Adaptive Phased Management (APM). Used nuclear fuel will be safely and securely contained and isolated from people and the environment in a deep geological repository in a suitable rock formation using a multiple-barrier system. A fundamental tenet of Canada's plan is the incorporation of learning and knowledge at each step to guide a process of phased decision-making. APM is designed to be flexible and respond to new learning, social priorities and evolving public policy.**

The development of the long-term management facility for Canada's used nuclear fuel is a national infrastructure project (see *The Project* on page 14). The facility is to be sited in an area with an informed, willing host. The process for identifying the site reflects the ideas, experience and best advice of a broad cross-section of Canadians who participated in dialogues conducted over a two-year period to design the process to select a site.

APM moves towards a goal that Canadians themselves identified: safe, secure, long-term containment and isolation of used nuclear fuel produced in Canada with flexibility for future generations to make their own decisions, and adapt to experience and societal changes.

## Adaptive Phased Management

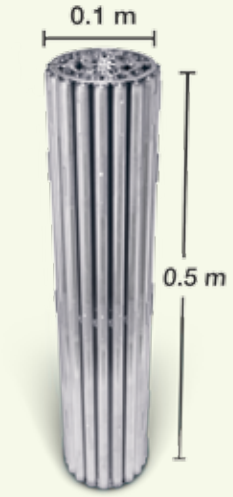
- Centralized containment and isolation of used nuclear fuel in a repository deep underground in a suitable rock formation
- A series of steps and clear decision points that can be adapted over time
- An open, inclusive and fair siting process to identify an informed and willing host community
- Opportunities for people and communities to be involved throughout the implementation process
- Provision of optional temporary shallow storage at the central site, if needed[2]
- Long-term stewardship through the continuous monitoring of used nuclear fuel
- Ability to retrieve the used nuclear fuel over an extended period should there be a need to access the waste or take advantage of new technologies
- Financial surety and long-term program funding to ensure the necessary money will be available for the long-term care of used nuclear fuel

[2] Temporary shallow storage at the deep geological repository is optional and not currently included in the NWMO's implementation plan.

## Canadians' objectives for the long-term management of used nuclear fuel, as identified during the study phase:

- **Fairness:** To ensure fairness (in substance and process) in the distribution of costs, benefits, risks, and responsibilities, within this generation and across generations.
- **Public Health and Safety:** To protect public health from the risk of exposure to radioactive or other hazardous materials, and from the threat of injuries or deaths due to accidents.
- **Worker Health and Safety:** To protect workers from and minimize hazards associated with managing used nuclear fuel.
- **Community Well-Being:** To ensure the well-being of all communities with a shared interest.
- **Security:** To ensure the security of facilities, materials and infrastructure.
- **Environmental Integrity:** To ensure that environmental integrity is maintained over the long term.
- **Economic Viability:** To ensure the economic viability of the used nuclear fuel management system, while simultaneously contributing positively to the local economy.
- **Adaptability:** To ensure a capacity to adapt to changing knowledge and conditions over time.

# Used Nuclear Fuel




Used nuclear fuel is a by-product of the generation of electricity by nuclear power plants[3]. It remains radioactive for a long period of time, and the material must be contained and isolated from people and the environment essentially indefinitely. Canada's used nuclear fuel is currently safely managed in facilities licensed for interim storage at nuclear reactor sites in Ontario, Quebec, and New Brunswick, and at Canadian Nuclear Laboratories's (CNL) nuclear research sites at Whiteshell Laboratories in Manitoba and Chalk River Laboratories in Ontario.

Canadian nuclear power plants are fuelled by natural uranium, formed into ceramic pellets which are encased in Zircaloy tubes welded together in the shape of a fireplace log weighing approximately 24 kilograms. Once the fuel bundle has been used to generate electricity, it is removed from the reactor. Physically, the bundle looks the same as when it was placed in the reactor. When used nuclear fuel is removed from a reactor, it is considered a waste product, is radioactive and requires careful management. It is first placed in a water-filled pool where its heat and radioactivity decrease. After seven to 10 years, the used bundles are placed in dry storage containers, silos or vaults. The storage containers have a minimum design life of 50 years. Although its radioactivity decreases with time, chemical toxicity persists and the used nuclear fuel will remain a potential health risk for many hundreds of thousands of years. For this reason, used nuclear fuel requires careful management.

About 85,000 used nuclear fuel bundles are generated in Canada each year. Over 40 years, Canada's nuclear power program has produced more than 2.6 million used nuclear fuel bundles. A small amount of used nuclear fuel and components is also created at research and development facilities operated by AECL, and Canadian university facilities. If the entire inventory of used nuclear fuel bundles could be stacked end-to-end like cordwood, it would fit into a space the size of seven hockey rinks, from the ice surface to the top of the boards. The NWMO publishes an annual update on the number of fuel bundles currently in storage, along with a range of projections for future quantities. This report is available on the NWMO website at www.nwmo.ca.

The NWMO has a legal obligation to provide long-term management of all Canada's used nuclear fuel, that which exists now and that which will be produced in the future.

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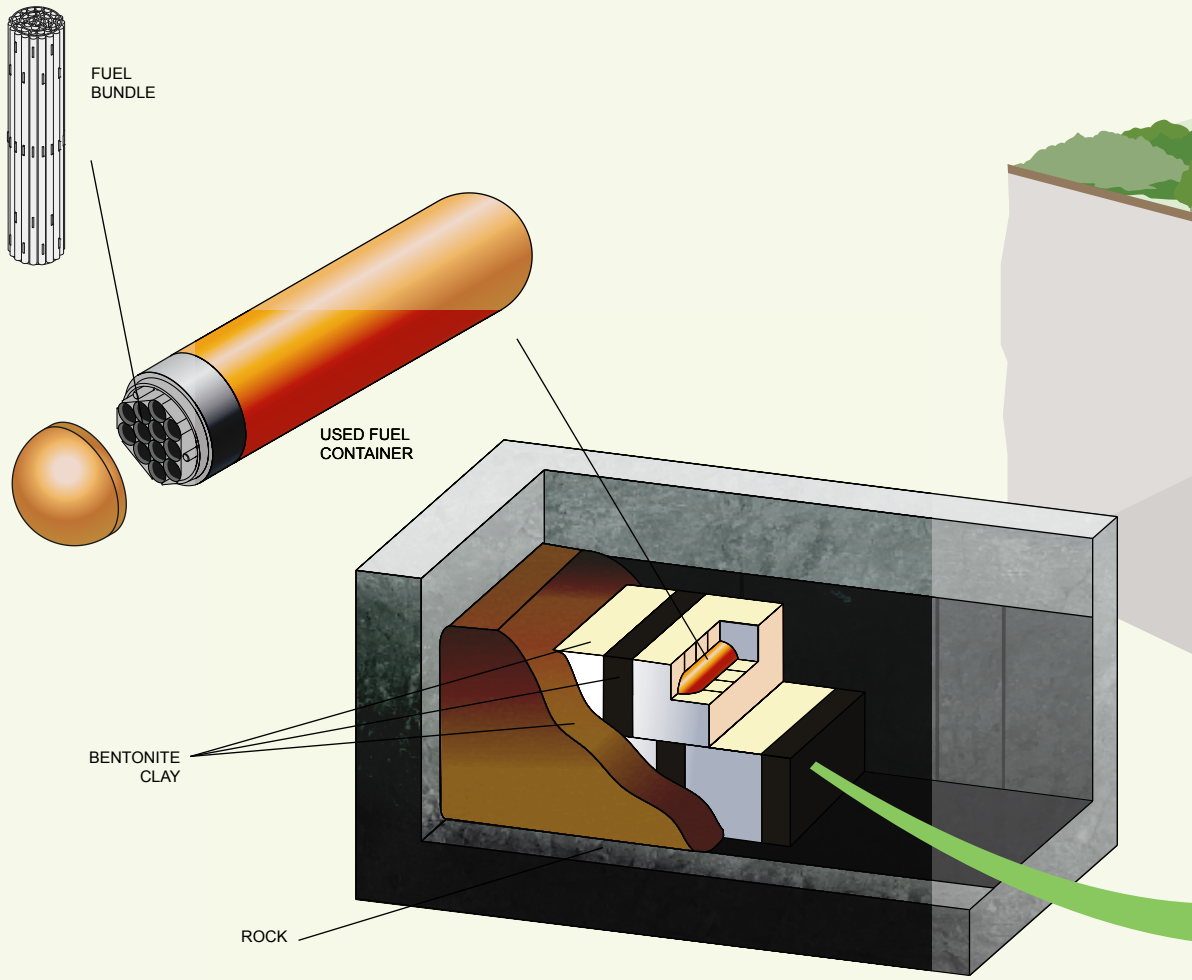
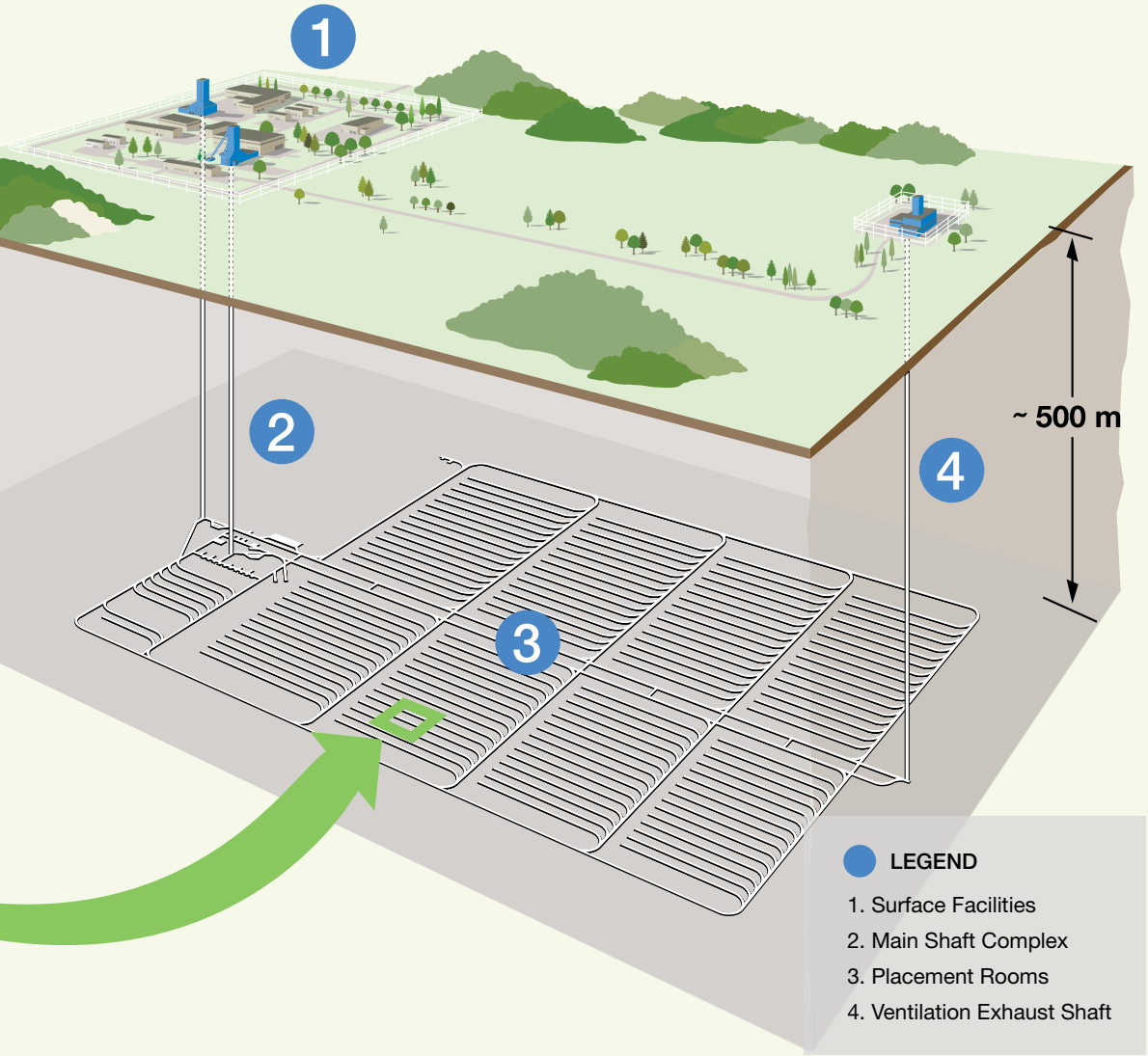
[3] A small amount of used nuclear fuel comes from research reactors. In addition to used nuclear fuel, the operation of nuclear reactors produces low- and intermediate-level waste that is managed at the reactor sites and Ontario Power Generation's (OPG) Western Waste Management Facility. Waste owners are directly responsible for management of low- and intermediate-level waste. See glossary for more information about low- and intermediate-level waste.

# The Project

This national infrastructure project will include the development of a deep geological repository and used nuclear fuel transportation system, and a national Centre of Expertise.



The containers will be placed into a bentonite buffer box in the used fuel packaging plant. These buffer boxes are stacked (two high) in the horizontal placement room, and any spaces are backfilled with bentonite pellets.



# Deep Geological Repository

The deep geological repository is a multiple-barrier system designed to safely contain and isolate used nuclear fuel over the long term. It will be constructed at a depth of approximately 500 metres, depending upon the geology of the site, and consist of a network of placement rooms for the used nuclear fuel. The surface facilities require a dedicated surface area of about 600 metres by 550 metres for the main buildings and about 100 metres by 100 metres for the ventilation exhaust shaft. The NWMO expects that land above the underground footprint that is not required for the surface facilities or to meet regulatory requirements would be available for other uses. The NWMO will have to demonstrate that regulatory or other requirements for safety that could limit those activities in the immediate area surrounding the surface facilities have been met. Based on current inventory projections, the underground repository requires a subsurface area in suitable host rock of about two kilometres by three kilometres.

In addition to the surface area described above, the excavated rock from the underground repository will need to be managed for use in backfilling and sealing the repository. Any remaining excavated rock may have a public or commercial use by the community and surrounding region as aggregate for construction. An excavated rock management area could require a surface area of about 460 metres by 380 metres, with a height of 15 metres. The footprint, height and location(s) of excavated rock could be planned in a way that takes into account community preferences. The area will also include a storm water runoff pond to collect and manage surface water. The excavated rock management area is currently assumed to be located off-site; its size and location will be determined in collaboration with the community and surrounding area.

Used nuclear fuel will be loaded into specially designed and certified containers at the reactor sites and transported to the repository site where it will be repackaged in corrosion-resistant containers for placement in the repository. The containers will be packed into buffer boxes in the used fuel packaging plant and transported underground to one of the many placement rooms. The containers will be placed horizontally within the confines of a placement room and sealed with an effective sealing material such as bentonite clay.

The used nuclear fuel will be monitored to ensure safe management and retrievability throughout all phases of implementation consistent with the direction from Canadians. Once a decision has been made to close the facility, the NWMO will seek the appropriate regulatory approvals prior to decommissioning. Any remaining equipment will be removed, and then the access tunnels and shafts will be backfilled and sealed. The nature and duration of postclosure monitoring of the facility will be decided in the future in collaboration with those living in the community once safety requirements have been met.

A robust safety case must be developed to demonstrate that the project can be safely implemented at the site, including transportation, and that it can meet or exceed the requirements of regulatory authorities and the host community. Further details on regulatory oversight are provided on page 10.

No foreign waste (used nuclear fuel from outside Canada) will be placed in this facility.

## Transportation of Used Nuclear Fuel

Used nuclear fuel is currently safely stored in facilities licensed by the Canadian Nuclear Safety Commission (CNSC) at sites where it is produced. Placing all Canada's used nuclear fuel in a single central location will require transportation from these interim storage facilities to the deep geological repository. The NWMO will need to demonstrate to regulatory authorities and citizens the safety and security of any transportation system before transport of used nuclear fuel to the repository can begin. Transportation of the used nuclear fuel will have to meet the stringent packaging and transport requirements of the CNSC and Transport Canada regulations prior to obtaining the certificate for the design of the package and a licence to transport being issued. For more information, please see *Safe and Secure Transportation of Canada's Used Nuclear Fuel* at www.nwmo.ca.

## Centre of Expertise

A Centre of Expertise will be established at a location selected for detailed site evaluation (Step 4 of the siting process). The Centre will be located in or near this site, as determined with communities in the area. Its purpose will be to support the multi-year testing and assessment of the site on technical safety and community well-being related dimensions, which are key components of the site selection process. It will be the home for an active technical and social research and technology demonstration program during this period. It will involve scientists and other experts in a wide variety of disciplines, including geoscience and engineering. It will also involve specialists in environmental, socio-economic and cultural impact assessment. The technologies and monitoring processes involved in the operation of a deep geological repository may be of interest and have applications in the community beyond the deep geological repository. This will be explored with the community.

The design details of the Centre of Expertise would be developed with the interested community, First Nation and Métis communities in the area, and surrounding communities with their preferences in mind. Discussion of the design details is also an important opportunity for involvement of youth. The Centre of Expertise could also be designed as a focus for engaging members of the community to learn more about the project, and to view the scientific and engineering work-in-progress involved in site assessment, through public viewing galleries and interactive displays. The Centre could be created as a small science centre, highlighting and demonstrating the science and technology being used to determine whether the site is suitable. It may be developed as a meeting place and learning centre for the community, and as a destination that welcomes interested visitors from the region and beyond.

The Centre of Expertise would be expanded to support construction and operation of an underground facility at the repository site designed to confirm the characteristics and operating performance of the site. The centre would become a hub for knowledge sharing across Canada and internationally.

As with some other aspects of the project, the exterior design of facilities and the way they are incorporated into the landscape will be a subject of discussion and shared planning with those living in the area.

Read more about the Centre of Expertise in the chapter beginning on page 39.

# A Partnership Approach

The project will only proceed with the involvement of the interested community, First Nation and Métis communities in the area, and surrounding communities, working in partnership to implement it.

The NWMO will work with the interested community, First Nation and Métis communities in the area, and surrounding communities to harness the economic benefits associated with the project in a manner that will directly and positively contribute to the well-being of not only the interested community, but also other communities within the surrounding area, and as much as possible, drive future growth, capabilities and expertise that will sustain the community over time.

By working with the NWMO, action plans will be developed to ensure the well-being goals the community has set for itself help guide decision-making at each phase of the project, from construction through operation and long-term monitoring, so that each phase benefits the community.

**For a fuller description of the project, please see *Description of a Deep Geological Repository and Centre of Expertise for Canada's Used Nuclear Fuel* at www.nwmo.ca.**

# Planning Priorities for 2016 to 2020

**To guide implementation of Adaptive Phased Management (APM), the Nuclear Waste Management Organization (NWMO) has established eight strategic objectives. The objectives identify program areas in the implementation of APM and the planning priorities for 2016 to 2020.**

First developed in 2007, the objectives were the subject of public review and discussion in 2007 and 2008. Subsequent evolution of the strategic objectives reflects advancement in the implementation of APM, as planning milestones are met and major areas of focus for the used nuclear fuel program evolve. On an annual basis, the NWMO publishes for review and comment the rolling five-year implementation plan for APM to confirm support for the strategic direction and invite suggestions on the associated work programs.

The NWMO has adapted its strategic objectives to capture the priorities identified in public review and reflect the advancement in implementation of APM.

In the 2016 to 2020 Implementation Plan, the NWMO introduces one new objective focused on planning for future construction and operations.

The strategic objectives guiding the next five years of work on the APM program are summarized below. These strategic objectives also provide the framework for the specific activities and deliverables outlined in this document.

## Strategic Objectives 2016–2020

### The NWMO will:

- Build sustainable, long-term relationships with interested Canadians and Aboriginal peoples of Canada, and involve them in setting future directions for the safe, long-term management of used nuclear fuel. Continue to adapt plans for the management of used nuclear fuel in response to evolving societal expectations and values, insight from Aboriginal Traditional Knowledge, and changes in public policies.
- Implement collaboratively with communities the preliminary assessments of site suitability for locating the deep geological repository and Centre of Expertise in a safe location in an area with an informed, willing host.
- Conduct testing to prove that engineered barriers meet all safety requirements and can be produced effectively and efficiently.
- Continuously improve technical knowledge in collaboration with universities and international partners, and adapt plans consistent with international best practices.
- Advance planning and capabilities for the construction and operation of the deep geological repository and the associated Centre of Expertise at the site selected to host the project (new).
- Establish safe, secure and socially acceptable plans for transporting used nuclear fuel.
- Ensure funds are available to pay for the safe, long-term management of Canada's used nuclear fuel.
- Maintain an accountable governance structure that provides confidence to the Canadian public in the conduct of the NWMO's work.

## Planning Priorities

In May 2010, the NWMO initiated a multi-year process for selecting an informed, willing host for a national facility for the long-term care of used nuclear fuel. The primary focus of the APM program over the five-year planning period will be on two multi-year projects:

- The delivery of Step 3, Phase 2 preliminary assessments in support of the APM site selection process, with the objective of identifying in the future the preferred siting area to take forward for detailed site characterization.
- The proof testing of the engineered barrier system for the used fuel repository, with the objective of demonstrating that it meets regulatory requirements.

Over the period 2016 to 2020, the NWMO will continue to implement the process to decide where to contain and isolate Canada's used nuclear fuel for the long term. Site selection for the APM Project is, by design, a community-driven process in which potentially interested communities decide to engage with the NWMO to learn more. Together with the NWMO, they explore their potential suitability to host the project through a range of technical studies and assessment activities in the area. Over the course of the studies, First Nation and Métis communities in the vicinity and surrounding communities are engaged. The NWMO's current planning assumptions anticipate that all Phase 2 assessments may be completed in 2022, enabling selection of the preferred site in 2023. To ensure organizational readiness, the NWMO will undertake preparatory work so it is positioned at that time to move forward the next steps of site characterization with local communities.

Proof testing will serve two main purposes: 1) to demonstrate the performance of the engineered barrier to provide evidence that the design meets the requirements of the NWMO's safety case; and 2) to prove 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 engineered barrier system, including the ability of the container to withstand repository loads and resist corrosion throughout the life of the repository. From an operability perspective, the plan includes development of a manufacturing program for welding and copper coating of the used fuel container.

A wide range of technical work programs and activities are planned for 2016 to 2020 to ensure the organization is prepared for each sequence of field investigations and detailed assessment, transportation planning, refined repository design, and safety case development. Preparatory work on the Centre of Expertise will be an important focus as the NWMO ensures it is ready to start site characterization, demonstration and verification work as early as 2023. The detailed scoping of activities and schedules for these projects will be further articulated over the planning period.

## Reference Planning Timelines

By design, the NWMO has not prescribed schedules or set deadlines for reaching each milestone related to APM project implementation. The pace and manner of progressing through the site selection process will necessarily reflect timelines shaped by communities. The time required to move through implementation steps will also be determined by the time needed to complete the rigorous process of confirming safety. The NWMO is committed to leading quality processes to establish strong technical, scientific and social bases for siting decisions. The NWMO will take the time required to complete community engagement, learning and technical assessments needed to confirm safety and community well-being.

While it is not appropriate to set deadlines for APM implementation steps, it is understandable that the many communities and organizations with whom the NWMO works wish to understand the potential duration of these steps and the overall process. To guide project planning, it is also important that the NWMO establish reference assumptions about timing associated with the phases of APM work. This planning process ensures that budgets are anticipated and money is set aside in trust funds to fully cover project implementation costs at each stage. Reference planning assumptions help ensure the NWMO prepares in advance and is in a state of readiness to move forward to each future phase of work.

This Plan outlines the NWMO's most current understanding of the time that may be required to complete Step 3, Phase 2 siting assessments and to support a decision on a preferred location, based on latest available information.

We will continue to report our best assumptions on expected timing of siting and other stages of the project as work advances. Detailed planning is continuing as part of the update of the APM lifecycle cost estimate, planned for completion in 2016. Further planning assumptions and timelines will be published at that time.

## Adaptive Phased Management History and Project Stages

| | | |
|---|---|---|
| 2002-2007 | *Nuclear Fuel Waste Act* | The *NFWA* requires the NWMO to consider alternative technical methods for the long-term management of Canada's used nuclear fuel. |
| | NWMO Study | The NWMO's three-year study recommends APM as the best approach. |
| | Government Decision | Government selects APM and mandates the NWMO to begin implementation. |
| 2008-2009 | Design Process for Selecting a Site | The NWMO works collaboratively with citizens to design a process for selecting a preferred central site for the deep geological repository and Centre of Expertise. |
| Beginning in 2010 | Implement Siting Process (May 2010) | The NWMO implements the siting process collaboratively with interested Canadians, during which communities express interest in being considered willing hosts. |
| | Assess Suitability of Candidate Sites | The NWMO conducts feasibility and characterization studies to assess the suitability of the candidate sites identified through the siting process. |
| | DECISION: Select Site | The NWMO selects a preferred site with a willing host. |
| | Licensing and Environmental Assessment Process | The NWMO submits an application for a Licence to Prepare Site (and possibly construct) to the Canadian Nuclear Safety Commission. This also initiates an environmental assessment process. Further details are provided in *Regulatory Oversight of Adaptive Phased Management* on page 10. |
| | *Implementation continues...* | |

# Build Sustainable Relationships

**The Nuclear Waste Management Organization (NWMO) will build sustainable, long-term relationships with interested Canadians and Aboriginal peoples of Canada, and involve them in setting future directions for the safe, long-term management of used nuclear fuel. The NWMO will continue to adapt plans for the management of used nuclear fuel in response to evolving societal expectations and values, insight from Aboriginal Traditional Knowledge, and changes in public policies.**

Engagement is one of the five fundamental values that guide the work of the NWMO. Involving Canadians and Aboriginal peoples of Canada at all stages and in key decisions is critical to meeting the challenges of the long-term management of used nuclear fuel. Through open, transparent and inclusive engagement processes, the NWMO will continue to build awareness and understanding of Adaptive Phased Management (APM), and will seek and respond to a diversity of views and perspectives. Interweaving of Aboriginal world views and knowledge systems with APM will strengthen the long-term management of used nuclear fuel. The NWMO's commitment to engagement and shared decision-making helps ensure that APM continues to respond to the values and concerns of Canadians. Building awareness and confidence in APM, and the NWMO as implementer, will continue throughout the planning period.

During the period 2016 to 2020, engagement will focus on strengthening established relationships to sustain program momentum. This includes engagement activities, such as information sessions, briefings, and joint projects and partnerships, which will be undertaken with municipal, provincial, federal, and Aboriginal governments, and interested individuals and organizations. The organization will continue to work with the NWMO Council of Elders and Municipal Forum. The NWMO will also work with and learn from Aboriginal Traditional Knowledge holders, to share that knowledge to the extent they wish. The NWMO will also continue to build knowledge and understanding, and establish relations with a broader audience through expanding its outreach to organizations and the broader public at large, with provision of information and dialogue.

In the early days of its mandate, much of the NWMO's work focused on developing plans, policies and processes collaboratively with Canadians to support the implementation of APM. Its engagement activities related to the broad Canadian public. As the siting phase of the implementation of APM progresses, the engagement program is evolving to focus more directly on the communities interested in hosting the project in the area, First Nation and Métis communities in the area, and surrounding communities, as well as transportation communities as a group with a shared interest. Engagement of youth is also a continuing priority given the long-term nature of the project and the need for intergenerational transfer of knowledge to support project implementation.

In building and sustaining relationships, the NWMO is mindful of its obligations throughout the conduct of its work. These obligations include: to Canadians and Aboriginal peoples, to manage used nuclear fuel over the long term; to the local communities, and Aboriginal peoples in potential host communities and regions, to identify an appropriate site for a deep geological repository; and to communities and Aboriginal peoples along transportation routes and in transportation hubs, to ensure that used nuclear fuel is transported responsibly and safely.

The NWMO recognizes that there are Aboriginal peoples in all areas of Canada where the NWMO's work will take place. The NWMO acknowledges, respects and honours that Aboriginal peoples – Indian, Métis and Inuit peoples of Canada – have unique status and rights as recognized and affirmed in s.35 of the *Constitution Act* (1982). As a result the Crown has a legal duty to consult and accommodate, and the NWMO will support the Crown's work to meet those obligations. Understanding the nature of any impacts of the implementation of APM on the exercise of Aboriginal rights, and how impacts on the exercise of Aboriginal rights could be mitigated, is an important component of the NWMO's work. The NWMO needs to ensure effective engagement with Aboriginal peoples so that those who could be affected have the opportunity for meaningful involvement. To this end, the NWMO wishes to build long-term relationships with Aboriginal peoples that have an interest in the implementation of APM.

## Adapting plans in response to evolving societal expectations and values, insight from Aboriginal Traditional Knowledge, and changes in public policies

A fundamental tenet of APM is the commitment to adapt plans for the management of used nuclear fuel in response to evolving societal expectations and values, insight from Aboriginal Traditional Knowledge, and changes in public policies. Developments throughout the implementation of APM may pose technical and ethical challenges. The NWMO's approach and response to these challenges will be critical to the success of APM. One of the strengths of APM is the flexibility to adapt to evolving societal objectives and priorities, and sharing of insight from Aboriginal Traditional Knowledge.

The NWMO has identified five fundamental values – integrity, excellence, engagement, accountability, and transparency – that inform its work. A series of principles to guide the siting process, identified in dialogue with Canadians and informed by an Ethical and Social Framework, further builds on these values. Through regular engagement of citizens, specialists and potentially affected communities, the NWMO monitors, reviews, reports, and discusses the challenges that may need to be addressed in implementing APM and changes in the management of used nuclear fuel, especially in the areas of technology development, societal expectations, and energy and environmental policy.

The NWMO continues to learn from best practices and experience with project implementation in Canada and other countries, including ongoing participation in the Nuclear Energy Agency (NEA) of the Organisation for Economic Co-operation and Development (OECD) Forum on Stakeholder Confidence, which focuses on community-based site selection processes and citizen engagement.

Developments in environmental and energy policies are particularly relevant to APM. For example, nuclear reactor refurbishment projects and new nuclear reactor units would produce new quantities of used nuclear fuel, potentially with different characteristics. The NWMO continues its ongoing monitoring, review and discussion of the potential implications of these developments on the quantities and characteristics of used nuclear fuel that the organization may be asked to manage in the future.

Consistent with the NWMO Transparency Policy and Engagement Procedure, the NWMO reports regularly to the public on its progress in implementing APM, especially in response to the advice of Canadians and the changing external environment. The NWMO also seeks formal opportunities, such as House of Commons Standing Committees, for open and transparent review of the implementation of APM at key milestones and decision points.

## Going Forward

**In the period 2016 to 2020, to build sustainable, long-term relationships, the NWMO will:**

- Continue work to increase awareness among Canadians and Aboriginal peoples of Canada about APM, the site selection process and the NWMO;
- Implement communications and media relations programs to help interested individuals and organizations understand APM;
- Seek and consider comment from interested individuals and organizations on the NWMO's plans and the implementation of APM;
- Brief waste owners on plans for the implementation of APM so they may ensure their used nuclear fuel strategies are aligned with the implementation of APM;
- Brief Canada's nuclear host communities about progress in implementing APM, including planning for eventual transportation of used nuclear fuel from their communities to the deep geological repository;
- Develop and sustain relationships with interested communities that choose to engage in the site selection process, First Nation and Métis communities in the area, and surrounding communities. This is expected to include working together in the planning and conduct of studies;
- Develop and sustain relationships with municipal associations to better understand local governments' points of view, and work with them to implement APM;
- Develop and maintain relationships with the federal government, provincial and local governments, and First Nation and Métis governments in nuclear provinces to help co-ordinate and support their contribution to the implementation of APM;
- Develop and maintain relationships with national, provincial and regional Aboriginal organizations, and keep them apprised of progress in the implementation of APM and the site selection process;
- Continue to seek the advice of Aboriginal Elders and youth, and develop awareness and learning opportunities for NWMO staff about cultures, traditional practices, protocols, and governance of Aboriginal peoples;
- Continue to build the foundation of knowledge to ensure that informed choices can be made by Aboriginal communities;
- Continue to work with affected Aboriginal peoples, including Traditional Knowledge holders, recognizing the diversity of cultures and languages, practices and approaches within Aboriginal communities; the identification of sacred areas; understanding of traditional laws, practices and use of land; and the protection of species to sustain community life;
- Continue to work with Natural Resources Canada to implement the memorandum of understanding on the NWMO's obligations with respect to the Crown's constitutional duty to consult;
- Build a multi-generational view of the long-term management of used nuclear fuel through engagement, education and outreach involving young Canadians, including Aboriginal youth;
- Continue to assess the effectiveness of the NWMO website and other communication vehicles to identify opportunities for improvement and make refinements;
- Continue to advance, refine and build upon NWMO engagement activities, including contribution to building partnerships to advance the project; and
- Continue to report publicly on the input that the NWMO receives and how this advice has been considered.

**In the period 2016 to 2020, to continue to adapt plans, the NWMO will:**

- Continue to build understanding of best practices in engagement, capacity building, impact assessment and sustaining community well-being;
- Advance learning and exchange experiences on such issues as retrievability, monitoring, and intergenerational knowledge transfer through collaboration with interested academics and organizations in Canada and internationally, including the OECD NEA's Radioactive Waste Management Committee and Forum on Stakeholder Confidence;
- Continue to seek the input of citizens on priorities and concerns relating to APM;
- Build understanding of the interweaving of Aboriginal Traditional Knowledge and other assessment approaches into implementation;
- Continue to implement the Ethical and Social Framework and refine as appropriate;
- Post research papers and the results of engagement activities on the NWMO website;
- Continue to seek the input of Canadians on how the implementation of APM should be adapted in response to current and projected inventories of used nuclear fuel;
- Continue to monitor developments in energy and environmental policy;
- Continue to monitor, assess and discuss the impact of potential new nuclear reactor units on the long-term management of used nuclear fuel;
- Continue to monitor, assess and plan for changes in industry waste management activities and plans; and
- Continue work to identify and plan for a range of scenarios reflecting possible changes in societal capacity to implement APM in the future.

**In 2016, the NWMO will:**

- Provide briefings and information upon request to interested individuals and organizations about APM and the site selection process;
- Continue to support interested communities, First Nation and Métis peoples, and surrounding communities as they explore their interest in the project and the siting process, including collaborating to facilitate engagement of third-party knowledge specialists to assist in community learning about the project;
- Provide briefings and information to governments to support their participation in the implementation of the site selection process and ensure that they have the information needed to address inquiries from communities;
- Meet on request with nuclear community organizations and their committees, such as the Canadian Association of Nuclear Host Communities, and regional health committees;
- Convene with municipal associations individually and as a forum through meetings, briefings, conferences, trade shows, and special events;
- Continue to seek advice from the Council of Elders on interweaving Aboriginal Traditional Knowledge into the NWMO's work and on respectful engagement of Aboriginal peoples;
- Continue broad-based briefings for Aboriginal organizations and engagement of Elders;
- Continue to develop communications materials and exhibits to support the siting process for a range of audiences;
- Continue to implement the NWMO Corporate Social Responsibility Program;
- Continue to develop and implement an education, outreach and capacity-building strategy for young Canadians and Aboriginal youth that incorporates both technical and social disciplines;
- Continue to seek the perspective of Canadians with the use of web-based tools and other activities; and
- Continue to advance the framework for preliminary assessments (feasibility studies – Step 3, Phase 2) with advice and input, including Traditional Knowledge, from First Nation and Métis communities, organizations, and individual knowledge holders.

# Collaboratively Implement the Site Selection Process

**The Nuclear Waste Management Organization (NWMO) will implement collaboratively with communities the preliminary assessments of site suitability for locating a deep geological repository and Centre of Expertise in a safe location in an informed, willing host.**

In 2010, the NWMO initiated the site selection process. The development of the process began in 2008 with a variety of engagement activities to ensure that a diversity of perspectives was considered. The product of this collaborative process is described in *Moving Forward Together: Process for Selecting a Site for Canada's Deep Geological Repository for Used Nuclear Fuel*, May 2010, available on the NWMO website at www.nwmo.ca.

Implementation of the process, including the selection of an informed and willing host, and demonstration of a safe and secure transportation system, must meet the expectations of Canadians. It must also address their key issues, such as the protection of humans and the environment, fairness and regulatory oversight. Collaboration, shared decision-making and willingness underpin the siting process.

The decision about an appropriate site will be made over a series of steps (see a list of the steps on page 30). It is expected that communities and areas will proceed through the process at a pace and in a manner that reflect their needs and preferences. The siting process begins with a period of learning and capacity building to engage in discussions about the project. Preliminary assessments (feasibility studies) of potential sites will be done in partnership with communities that expressed interest in the project, First Nation and Métis communities in the areas, and surrounding communities.

Work can proceed only with the involvement of the community that initially expressed interest, First Nation and Métis communities in the area, and surrounding communities. The deep geological repository and Centre of Expertise involve a large project that has the potential to benefit a large area. Planning at a broader area scale will ensure benefits associated with the project are maximized. It will also help ensure that questions and concerns are addressed, and that the foundation is established to move forward together in the implementation of the project.

The nine-step site selection process spans from communities learning about the project to construction and operation. In the planning period, the NWMO will support communities and Aboriginal peoples in learning about the project and exploring how long-term well-being or quality of life of the area might be fostered through the implementation of the project.

Through working with communities that have come forward to participate in the site selection process, and through initial outreach with surrounding communities and Aboriginal peoples, the nature and shape of the partnerships required to implement the Adaptive Phased Management (APM) Project together are beginning to emerge. This project will only proceed with the involvement of the interested community, First Nation and Métis communities in the area, and surrounding communities.

In implementing the site selection process, the NWMO is mindful of its obligations throughout the conduct of its work. These obligations include: to Canadians and Aboriginal peoples, to manage used nuclear fuel over the long term; to the local communities and Aboriginal peoples in potential host communities and regions, to identify an appropriate site for a deep geological repository; and to communities and Aboriginal peoples along transportation routes and in transportation hubs, to ensure that used nuclear fuel is transported responsibly and safely.

The focus of the 2016 to 2020 planning period is on delivery of Phase 2 of the preliminary assessment step in the site selection process. The NWMO will continue to work with communities to assess suitability of potential siting areas to host the APM Project. As the site selection process advances, work will proceed together with the involvement of the interested community, Aboriginal peoples and surrounding communities. Work plans for the 2016 to 2020 period will ensure the NWMO is prepared to support all aspects of the site selection process.

Successful implementation of the siting process will require a good understanding of regional priorities, politics and key players. With the interested community, the NWMO will engage First Nation and Métis peoples, and surrounding communities in dialogue and reflection on environmental, social, cultural, and economic effects, and detailed site investigations. Involving the broad area will help ensure that the range of potential effects, both positive and negative, associated with implementation at a particular site are recognized and considered. Involvement of those along the transportation route, as a large group with a shared interest, will ensure that effects associated with the transportation of used nuclear fuel are taken into account in decision-making on a preferred site. The NWMO keeps provincial governments briefed on APM so they are ready to support community interest, and address inquiries about Crown land, and provincial regulations and approvals.

Throughout the siting process, the NWMO will support and assist communities to build understanding of APM, and to address questions and concerns, including how used nuclear fuel will be contained and isolated to ensure the safety of people and the environment, considering air, land and water. The NWMO also supports communities to build understanding of how the project may help or hinder the community and area's ability to achieve its long-term plan and to engage citizens in learning and assessment. Funding and resources are provided to support communities as they work through each step.

As we continue to learn together with communities through implementation of the site selection process, understanding what would constitute a 'compelling demonstration of willingness', inclusion and shared decision-making are important questions. Working collaboratively with those involved in the siting process to articulate expectations in these areas is an important objective. This collaboration will inform work to explore the potential to work together to implement the project in partnership.

In the next few years, technical support to the siting process will focus on assessing the suitability of potential sites through geoscientific and environmental evaluation studies in the vicinity of interested communities. Beyond ensuring safety, the NWMO's commitment is that the long-term well-being or quality of life of the community and area will be fostered through participation in this project. The technical program will be complemented by a phased and progressively more detailed assessment of the suitability of a site in terms of environmental, social, cultural and economic factors. These assessments will continue for the duration of the planning period. They will support a continual narrowing down of potential siting areas and, eventually, selection of a preferred location to be the focus of detailed site characterization. Detailed site characterization (Step 4) will begin once the preferred location is selected. It will include further geological investigations, safety assessments, environmental studies, and social and economic impact assessments. This work will be planned and conducted in collaboration with interested communities, First Nation and Métis communities, and surrounding communities. The application of Aboriginal Traditional Knowledge throughout this work is an important objective.

The NWMO continues to develop the institutional policies, practices and structures required to support the different phases of the siting process. The NWMO will work to ensure that implementation of the site selection process is inclusive, fair and transparent, and continues to build trust and confidence in the NWMO and its operations. Any site that is selected to host this facility must be demonstrated by the NWMO to be able to safely contain and isolate used nuclear fuel for a very long period of time. It must have an informed and willing host, and a strong partnership must be established with local Aboriginal and non-Aboriginal communities. The objectives of the site selection process and the main site evaluation stages are outlined in the description that follows.

The NWMO is committed to reviewing and refining the process with Canadians, and in particular those in areas involved in the site selection process, to ensure that it continues to meet needs and expectations. The NWMO will continuously advance knowledge and adapt plans consistent with international best practices.

As it continues implementing the site selection process, the NWMO understands it will take its best knowledge and expertise, and all of us working together to implement Canada's plan. Among the many challenges to be addressed along the way is the low level of familiarity with and understanding of used nuclear fuel, which leads to fear among some people becoming involved in learning about this project. Information, effective communication and dialogue are key.

# Preliminary Assessment of Potential Suitability (Step 3 in the Site Selection Process)

All communities presently involved in the siting process have requested that preliminary assessments be undertaken as part of Step 3 in the nine-step site selection process. These nine steps include:

| | |
|---|---|
| Getting Ready | The NWMO publishes the finalized siting process. |
| Step 1 | The NWMO initiates the siting process with a broad program to provide information, answer questions and build awareness among Canadians about the project and siting process. |
| Step 2 | Communities identify their interest in learning more, and the NWMO provides a detailed briefing and conducts an initial screening. |
| Step 3 | **For interested communities that successfully complete an initial screening, a preliminary assessment of potential suitability is conducted in two phases.** |
| Step 4 | Detailed site evaluations are completed in one site identified as having strong potential to meet project requirements in Step 3 preliminary assessments. |
| Step 5 | Acceptance to host the repository is confirmed. |
| Step 6 | Formal agreement to host the repository is ratified, subject to all regulatory requirements being met and regulatory approval received. |
| Step 7 | An independent, formal and public process is conducted by regulatory authorities to ensure all requirements are satisfied. |
| Step 8 | Construction and operation of an underground demonstration facility proceeds. |
| Step 9 | Construction and operation of the facility proceeds. |

The current phase of work – Step 3 preliminary assessments – has been divided into two phases. Phase 1 work will be completed by the end of 2015. Step 3 work is designed to assess, in a preliminary way, the suitability of a community and associated site(s) to host the project. These studies are an opportunity for the community, First Nation and Métis communities in the area, surrounding communities and the NWMO to explore suitability together.

# Assessing Site Suitability in 2016 to 2020: Phase 2 Preliminary Assessments

## What is the purpose of Phase 2 assessments?

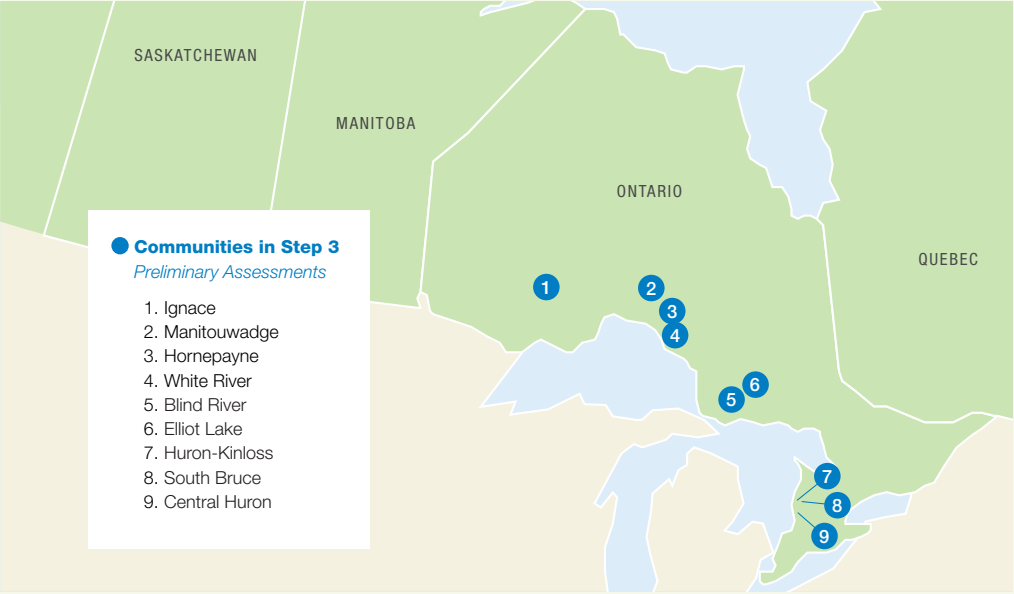
The primary objective of the APM Step 3, Phase 2 preliminary assessments is to advance technical and social assessments to the point where a decision can be made to narrow down to one location to be the focus of detailed site characterization (Step 4). In order to select the preferred location for siting the APM repository, the NWMO would need to have a sufficient degree of confidence from Phase 2 preliminary assessment work that:

- A deep geological repository can be developed with a strong technical safety case at that location;
- A safe, secure and socially acceptable transportation plan can be developed to transport used nuclear fuel to that location; and
- A strong partnership can be developed with the interested community, First Nation and Métis communities in the area, and surrounding communities.

## Which areas are being studied?

Phase 2 assessments will concentrate on the smaller number of study areas that earlier studies identified as having strong potential to meet siting requirements.

Assessments are underway in several areas of Ontario, as indicated in the map below. The communities that initially expressed interest in the project and requested studies in the area are shown on the map. Assessments include broadened dialogue and engagement with surrounding communities, involving municipal, First Nation and Métis communities in the area.



## What is involved in the assessments?

Phase 2 assessments will build upon the learning from Phase 1 studies. The multi-year program of study and engagement is designed to facilitate further learning, deepen understanding of the project and further explore potential suitability of the area being studied. This learning and reflection involves the interested community, First Nation and Métis communities in the area, and surrounding communities. In this phase:

- Technical evaluation of potentially suitable areas will continue in greater detail, focusing on geoscientific suitability, engineering, transportation, environment and safety.
- Geological field investigations will provide site-specific information that will examine whether a suitable location can be identified for the deep geological repository that will ensure safe and secure long-term containment and isolation of used nuclear fuel. Activities may include a sequence of airborne geophysical surveys, geological field mapping, and environmental surveys, and should the findings from these studies warrant, deep borehole drilling and testing. People in the area will be engaged to help identify and refine the list of potentially suitable sites that would be socially acceptable.
- Environment and safety evaluations will focus on specific areas guided by input from the interested community, First Nation and Métis communities in the area, and surrounding communities. Field studies and discussions will build understanding of the environmental conditions of the areas being studied.
- Potential transportation routes and modes to each potential repository site will be identified against technical safety criteria. Transportation planning and evaluations also need to be aligned with community input.
- Engineering designs for the deep geological repository, safety assessments, transportation assessments, and environmental studies will be further developed and refined over the course of Phase 2 for specific study sites. The purpose is to determine whether all technical and safety criteria can be met.
- Engagement in the interested community and with First Nation and Métis communities in the area, and surrounding communities, will support more detailed reflection and assessment. Phase 2 provides the opportunity for all to develop a more detailed understanding of project benefits, opportunities to work together and how potential negative effects of the project can be managed. Interest in the community and area will be explored while continuing to build awareness and understanding of the project.
- The NWMO, the interested community, Aboriginal peoples in the area, and surrounding communities will together reflect on the suitability of the area to host the project and whether there is a foundation to work together to implement the project. Through engagement we will explore the potential for working partnerships to be established. An important outcome of Phase 2 will be to identify the terms under which a working partnership can be developed to implement the project. Phase 2 will also explore whether an implementation plan can be developed to ensure safety, align with expectations of the community and area, and be economically feasible.

## How long will Phase 2 assessments take?

The NWMO's current reference plans anticipate that Phase 2 preliminary assessments may be concluded by the end of 2022, which the NWMO believes is a realistic assumption given information available to it today. This assumption, adopted for planning purposes, was developed based on a detailed review of the technical studies and the dialogue and engagement the NWMO believes will be required. The NWMO drew on the latest information available, including the number of areas engaged in the siting process; the specific geospheres being studied, and the nature of field work required to thoroughly assess each geological setting against best international practice. It also took into account the importance of providing time for communities to learn, engage fully and develop the capacity to make informed decisions.

It must be emphasized that this timeline was developed only for planning purposes. As the steward of the siting process, the NWMO must take the time required to carefully assess sites and confirm a strong safety case. Communities and areas will also dictate the pace at which they are prepared to proceed. The NWMO will take the time needed to implement APM properly.

With the benefit of further experience, the NWMO and communities may continue to evolve understanding about time required to safely select a site and advance the APM Project together. As the NWMO moves forward, it may find the need to move at a different pace, or conduct additional technical work. For example, further into the process, the NWMO may find a need to conduct additional studies on a small number of sites to develop sufficient confidence to identify one preferred site. A need for additional studies would extend the time required to select a site.

## When will a preferred location be identified?

Findings from Phase 2 assessments will inform the NWMO's selection of the preferred location. If Phase 2 assessments are concluded by 2022, the NWMO could be in a position to complete its analysis and take a decision on the preferred location in 2023. This area would then become the focus of the next step in the site selection process: detailed site characterization (Step 4).

For planning purposes and to ensure the NWMO's readiness to advance site characterization work as soon as the site is selected, it is adopting 2023 as a reference planning date for a decision on the preferred site.

## What can communities expect during the Phase 2 assessment process?

The NWMO is committed to delivering a process that is respectful to the many communities engaged in Canada's site selection process for this important national initiative. The NWMO is also committed to building the skills and capacities of communities to be part of the APM Project.

As communities continue in the siting process, they can expect the following from the NWMO:

- Resources and support for learning about the project and building capacity to take informed decisions;
- Funding to cover costs associated with participation in the project throughout all phases of work;
- Inclusion in collaborative development, refinement and delivery of plans and dialogues;
- Processes that respond well to local needs and social and cultural priorities;
- Procurement processes for goods and services that gives preference to qualified local and Aboriginal suppliers in potential siting areas;
- A gradual expansion of local hiring in potential siting areas; and
- Investments in training and education to equip community members, including youth, to work at the Centre of Expertise and in subsequent site preparation, construction and operation activities. These would be transferrable skills that could be applied to other projects as well. The NWMO will discuss with communities the priority areas for skills training and education, and how best to invest in that capacity building. Programs could be put in place beginning in 2016 and extending throughout the duration of involvement in Phase 2 studies.

## Will the areas of focus be narrowed down during Phase 2?

Yes. It is expected that as initial studies are completed in other siting areas, decisions will be taken to further reduce the number of study areas to focus on sites showing the most potential for strong safety cases and strong potential for support and partnership among area communities. It is difficult to predict with certainty the timing for further narrowing down decisions. The NWMO will continue to make decisions as studies are completed and information becomes available. Communities that enter Phase 2 will not necessarily continue for the entire study period.

There will be ongoing stocktaking by the NWMO and communities as results from assessments become available and dialogues continue.

## What happens after a preferred site is identified?

Once a preferred site is selected, there will be a further escalation of activity in the area. This will include construction of the Centre of Expertise, launch of a range of verification and demonstration activities, and initiation of regulatory processes to support future construction and operation of the deep geological repository and related surface facilities. See page 39 for a description of these activities.

## Going Forward

**In the period 2016 to 2020, the NWMO will:**

- Continue preliminary assessments in study areas identified to be the focus of Step 3, Phase 2 study;
- Significantly advance understanding of suitability of study areas through delivery of Phase 2 preliminary assessments and engagement of local communities, First Nation and Métis communities in the area, and surrounding communities;
- Seek a more detailed understanding of the potential of each study area, based on whether:
  - a deep geological repository can be developed with a strong technical safety case at that location;
  - a safe, secure and socially acceptable transportation plan can be developed to transport used nuclear fuel to that location; and
  - a strong partnership can be developed with the interested community, First Nation and Métis communities in the area, and surrounding communities.
- Initiate limited borehole drilling and expand field studies to inform the assessment of geoscientific, engineering, and environment and safety factors and factors identified by Aboriginal Traditional Knowledge holders;
- Undertake geoscientific assessment of study areas in both crystalline and sedimentary rock settings;
- Submit for advice and review by the Adaptive Phased Management-Geoscientific Review Group (APM-GRG) the proposed approach, methods and findings of the geoscientific preliminary assessments that are part of the studies conducted in Step 3 of the site selection process. Publish reports of the APM-GRG on the NWMO website;
- Develop conceptual engineering designs to support evaluation of candidate sites;
- Deliver preliminary environment and safety assessments to support evaluation of candidate sites;
- Respectfully apply Traditional Knowledge to both technical safety and community well-being aspects of the site selection process, and the approach to engagement with Aboriginal communities and local Elders, taking into account spiritual and cultural considerations, effective and meaningful relationships between generations and within and between communities;
- Continue to explore technical safety considerations through illustrative postclosure safety assessments of the deep geological repository;
- Develop and implement engagement activities to discuss and seek input on field studies and assessment work in study areas;
- Engage communities in more intensive learning and dialogue about the project, and explore and help assess the extent to which the project might contribute to or detract from the well-being of local municipal, First Nation and Métis communities in each siting study area;
- Continue to narrow down the number of study areas over the course of Step 3, Phase 2 assessments through ongoing stocktaking of assessment findings with communities. Areas with relatively low potential to be suitable for the project will be screened out;
- Through completion of increasingly intensive Step 3, Phase 2 studies, build information to guide a future decision on the selection of the preferred siting area to be the focus of detailed site characterization (Step 4);
- Continue to support communities in developing capacity to consider their interest in potentially hosting the APM Project in the area;
- Continue to develop exhibits and tools to support local- and area-based discussions of APM and siting;

- Continue to support communities in responding to the values-based requirements of the process, including appropriate engagement of citizens and transparency in decision-making;
- Refine and enhance approaches to assessing willingness;
- Refine and enhance approaches to informing and engaging the interested community, Aboriginal peoples, and those in the surrounding area in siting decision-making in the spirit of partnership;
- Work with municipal and Aboriginal communities, refine tools and methods for assessment of sites in terms of environmental, social, cultural and economic factors, including factors identified by Aboriginal Traditional Knowledge and traditional approaches to land use mapping and planning;
- Establish and sustain an NWMO presence in communities that decided to enter the site selection process, and in the broader area, to provide information and support public engagement;
- Continue to seek advice of municipal associations and Aboriginal organizations on materials and tools to support a community-driven siting process;
- Conduct research on partnership and power-sharing frameworks for consideration in structuring agreements with the community, Aboriginal peoples and the area, once selected;
- Explore the need to design and implement a property value protection program to support the implementation of the project, as has been requested by some communities; and
- Explore long-term knowledge transfer considerations, such as markers and archives, as part of international collaborative research efforts (Nuclear Energy Agency).

**In 2016, the NWMO will:**

- Work in partnership with communities as they proceed through the siting process;
- Implement, support and further develop the *Learn More Program* that is described on the NWMO website for community capacity building to meet the needs of interested communities, First Nation and Métis peoples, and surrounding areas;
- Develop and implement local engagement activities with community members in potential siting areas to discuss and seek input on field studies and assessment work;
- Advance Step 3, Phase 2 preliminary assessments by conducting field studies upon request of interested communities with strong potential to meet the requirements of the project;
- Review geoscientific assessment methods, plans and findings with the APM-GRG;
- Continue discussions with Aboriginal communities engaged in the site selection process about how Aboriginal Traditional Knowledge, or Indigenous Knowledge, should be respectfully reflected in preliminary siting assessments;
- Develop and implement local and regional outreach plans to build awareness of the project, deepen understanding of regional perspectives and build relationships in the broader area;
- Continue to seek opportunities to engage First Nation and Métis peoples at the local and regional level through collaborative work with communities, Treaty organizations, and regional or provincial Aboriginal organizations involved in the siting area;
- Continue to advance co-ordination and collaboration with provincial governments aimed at identifying mechanisms and processes to address provincial areas of interest, and preparing for the permitting process that may be required to support field work; and
- Continue to develop communication materials to support learning and dialogue on activities involved in the multi-year Phase 2 site selection assessments, the project description, the safety of the repository, and transportation considerations.

# Demonstrate Safety and Feasibility of Repository and Engineered Barrier Design

**The Nuclear Waste Management Organization (NWMO) will conduct testing to prove that engineered barriers meet all safety requirements and can be produced effectively and efficiently.**

The ability of the deep geological repository to safely contain and isolate used nuclear fuel relies on the form and properties of the waste, the engineered barriers placed around the waste and the natural barriers provided by the rock formation in which the repository will be located. The preferred site will be in a rock formation with desirable characteristics (geological, hydrogeological, chemical, and mechanical) that support long-term containment and repository performance to meet or exceed the regulatory expectations of the Canadian Nuclear Safety Commission (CNSC). The repository will be consistent with the guidance of the International Atomic Energy Agency and the experience in other countries.

The NWMO's technical program supports Adaptive Phased Management (APM) in three key areas: site selection, engineering design and costing, and safety assessment. The NWMO's technical program objectives are reviewed and updated annually to ensure that they are consistent with the strategic direction from the NWMO Board of Directors and planning assumptions related to progress in implementing APM.

A strong technical program ensures that APM benefits from knowledge and innovation in the long-term care of used nuclear fuel from Canada and abroad, including Finland, France, Japan, Sweden, Switzerland and the United Kingdom. It also ensures that NWMO staff sustain the expertise required to implement the adaptive program.

The NWMO is further developing its technical program in engineering design and demonstration. Over the next five years, physical prototypes of the long-lived repository containers will be manufactured and tested. This will incorporate robust design practices and proven manufacturing technologies, and demonstrate the NWMO's ability to meet the rigorous requirements of the repository environment. Further, a container test facility will be established for both the repository and transportation containers. This facility will be used to continue to investigate manufacturing technologies and for prototype testing.

In order to support understanding and broad dialogue on design and safety considerations, and in particular the development of the safety case, communication materials written in plain language will be prepared. This material will include periodic reports on work to date, as well as discussion of the parameters and assumptions being used in the safety assessments, and how detailed information about a site, once known, will be used to refine work in the future.

## Adapting plans to incorporate new learning and knowledge

A fundamental tenet of APM is the ongoing incorporation of new learning and knowledge to guide decision-making. The NWMO is committed to re-evaluating decisions where warranted, maintaining the option to change course and being prepared to act on new knowledge or information. A program that is implemented over a long time will have many opportunities to improve safety and performance, enhance effectiveness, build understanding, and reduce uncertainty. One of the strengths of APM is the incorporation of new learning and knowledge.

**In the period 2016 to 2020, the NWMO will:**

- Seek CNSC pre-licensing review of safety assessments based on hypothetical repositories in crystalline and sedimentary rocks;
- Complete the update to the conceptual design and cost estimate for APM;
- Complete design, fabrication and testing of prototype repository containers, buffer and emplacement systems;
- Conduct independent peer reviews of specific aspects and features of the engineered barrier design;
- Seek CNSC review of the engineered barrier design and proof testing program;
- Initiate design and development of used fuel handling systems;
- Complete an integrated review of the microbiological process that could occur within the repository environment in support of corrosion models;
- Maintain and improve safety assessment models, including groundwater flow, containment release and transport, and coupled thermal-hydraulic-mechanical processes;
- Further enhance scientific understanding of processes that may influence repository safety; and
- Maintain a prototype test and demonstration facility for engineered barrier evaluations.

**In 2016, the NWMO will:**

- Continue prototype and equipment testing at the demonstration facility;
- Conduct an independent peer review of the generic corrosion program;
- Complete an update of the safety assessment reflecting the updated repository and engineered barrier designs;
- Fabricate and pressure test a prototype copper-coated used fuel container;
- Further develop used fuel container manufacturing process tolerances;
- Fabricate buffer box emplacement equipment and undertake placement room mock-ups;
- Fabricate a full-scale shaped bentonite buffer block and associated buffer box assembly; and
- Demonstrate backfill bentonite pellet placement.

# Planning for Construction and Operation of Centre of Expertise and Deep Geological Repository

**The Nuclear Waste Management Organization (NWMO) will advance planning and capabilities for the construction and operation of the deep geological repository and the associated Centre of Expertise at the site selected to host the project.**

## New to this Implementation Plan

The 2016 to 2020 Implementation Plan introduces a new strategic objective to reflect the work planned to support construction and operation of the deep geological repository and the Centre of Expertise.

Once a preferred site is selected for the Adaptive Phased Management (APM) Project, for planning purposes assumed to be as early as 2023, there will be an escalation of activity on many fronts in the local and regional area. These activities include a range of verification and demonstration activities and initiation of the regulatory processes to support the future construction and operation of the deep geological repository and related surface facilities.

In the meantime, as part of its 2016 to 2020 work plan, the NWMO will work with communities engaged in the site selection process to initiate important preparatory work in support of this eventual expansion of local activity at the selected site. Activities during this period will include preparing for future regulatory approvals, detailed site characterization, construction and operation phases of the project. This advance planning will make it possible for the project to proceed expeditiously once the preferred location is identified, and for the community to be prepared to fully participate.

Introducing this new strategic objective enables the NWMO to work closely with communities to initiate planning for these important future phases of work. Placing new focus on these future steps is also responsive to what the NWMO heard through past public reviews of APM implementation plans. People told us they want to know more about future phases of work. Similarly, communities engaged with the NWMO in the site selection process wish to know more about activities that would take place once a decision is taken on the host site and how we can begin to prepare for them together.

# Getting Ready for Activity at the Site

## Planning for Future Regulatory Approvals

The NWMO's overriding objective in implementing the APM Project on behalf of Canadians is safety and security. The NWMO will have to demonstrate that the project meets or exceeds strict regulatory requirements to protect the health, safety and security of people and the environment, while also respecting Canada's international commitments on the peaceful use of nuclear energy.

The Canadian Nuclear Safety Commission (CNSC) is the main licensing authority for the APM Project. The CNSC's comprehensive licensing system is described in *Regulatory Oversight of Adaptive Phased Management* on page 10.

After a site has been selected for the project, the NWMO will initiate the federal regulatory licensing process with the CNSC. As part of this licensing process, the NWMO will be required to submit detailed environmental assessment and licensing documentation to the CNSC.

In preparing for the future period of regulatory review, the NWMO will continue to seek pre-licensing review of its work from the CNSC. The NWMO will confirm that its work plans are addressing federal regulatory expectations, including requirements for the federal environmental assessment. The NWMO will also identify the range of provincial regulatory requirements and approvals needed for the project, as well as relevant municipal requirements. This advance work will provide clarity on regulatory expectations, for the NWMO and the public. It will ensure the NWMO is meeting regulatory expectations for comprehensive and high quality plans and processes as site investigations are conducted.

## Planning the Centre of Expertise

The Centre of Expertise will be located in or near the area selected to host the deep geological repository. The Centre's key purpose following site selection will be to support the multi-year program of technical testing, verification and demonstrations, and to support ongoing planning and discussion with community members. The Centre of Expertise would later be expanded to support construction and operation of the deep geological repository.

Once a preferred repository site is identified, the Centre of Expertise will support detailed underground site characterization work that will take place to confirm geological conditions at depth and gather additional data to develop the safety case. It may also serve as a training centre to prepare personnel to work on various aspects of project implementation.

An engineering test facility will be located within the Centre of Expertise. Activities in this facility will include demonstrations of container laser welding and copper coating processes, bentonite clay buffer shaping and forming, as well as container placement equipment for the underground repository. The engineering test facility will also house mock-ups of fuel handling cells to show how the used nuclear fuel would be packaged into containers and prepared for emplacement in the repository.

The Centre of Expertise will be home to an active technical and social research and technology demonstration program during this period, involving scientists and other specialists in a wide variety of disciplines, including geoscience, engineering, and environmental, socioeconomic and cultural impact assessment. The Centre will become a hub for knowledge sharing across Canada and internationally. The high level of international collaboration on the APM Project will be expanded as Canada's Centre welcomes scientists and visitors from abroad who wish to benefit from the work being led out of Canada's national facility.

## Designing the Centre of Expertise with Communities

Planning the Centre of Expertise will take into account local preferences. A first step following site selection would be to elaborate plans so that construction could begin as soon as possible. The NWMO would work with local communities to lead detailed planning for the Centre. It is important that communities be part of this discussion so that design details of the Centre can reflect preferences and priorities of the municipal and First Nation and Métis communities in the area. The Centre of Expertise provides an opportunity for the NWMO and communities to consider how it may provide synergies with other local plans and aspirations:

- The location of the Centre of Expertise will be determined with people who live in the area.
- There will be many design features for communities to shape. For example, the exterior design of facilities and the way they are best incorporated into the surrounding landscape will be a subject of discussion and shared planning with those living in the area.
- The information provided at the Centre could reflect local, regional and First Nation and Métis history, and social, cultural, spiritual and economic values and priorities.
- The Centre of Expertise could be designed as a focus for engaging members of the community to learn more about the project, and to view scientific and engineering work involved in site assessment, through public viewing galleries and interactive displays.
- The Centre could demonstrate the science and technology being used to determine whether the site is suitable and to encourage youth science literacy and capacity development. Discussion of design details also provides an important opportunity for involvement of youth.
- The Centre of Expertise could feature a learning and demonstration area focused on how Aboriginal Traditional Knowledge is being applied to the project.
- Opportunities to develop public spaces may also provide an opportunity for collaboration. The Centre may be developed as a meeting place and learning centre for the community more generally, in addition to welcoming Canadian and international experts contributing to the APM Project.
- The technologies and monitoring processes involved in operating a deep geological repository may be of interest and have applications in the community beyond the repository. For example, repository technologies may have broader application in monitoring and protection of natural water systems in the area. The knowledge and expertise of scientists and technical specialists leading the implementation and operation of the repository could support environmental sustainability planning in the area. Opportunities to support and work collaboratively with the community to sustain and enhance the natural environment, the community and current land uses throughout the course of operation of the facility, will be explored with the community.

These early illustrations show just two examples of how a Centre of Expertise could be designed. Communities are invited to consider what architectural design styles and features they would prefer.

## Topics for Early Discussion with Communities

Starting in 2016, the NWMO will seek dialogue with communities engaged in the site selection process to discuss the Centre of Expertise. Topics to explore will include the wide range of technical and social activities planned for the Centre in support of the APM Project. In addition, the NWMO will seek to understand community preferences for how the Centre is developed. Envisioning how the Centre might be established in the area will be part of the discussion with communities engaged in Phase 2 site selection assessments as they and their neighbours continue to learn about the project and assess interest in hosting the APM Project.

Topics for early community discussion might include:

- Where might we wish to locate the Centre of Expertise if our area hosts the APM Project?
- What would we like the Centre to look like? What architectural style?
- What kinds of facilities and meeting venues would the community find useful if available for general purpose?
- What other opportunities are there for the Centre of Expertise to contribute to community priorities?
- How might we like to see local history and culture reflected in the design?
- How might we like to see indigenous knowledge and local First Nation and Métis cultures reflected?
- How will we involve local people in the day-to-day operation of the Centre and how can we plan for this?
- What other decision points would the community like to be part of?

## Advancing Plans for Confirming Site Characteristics and Demonstrating Safety

Once the NWMO selects the preferred site, it will become the focus of detailed investigations to verify and demonstrate safety in specific in-situ conditions. The purpose of verification activities is to confirm the properties/characteristics of the site (geological, hydrogeological, geomechanical, surface geotechnical). This site characterization work will be important to confirm and verify the underground conditions required to support a final safety case based on the specific site proposed for the project.

The detailed investigations will build on work completed in Phase 2 assessments, and will include activities such as advancing borehole drilling and monitoring and detailed geotechnical assessments of areas where the surface facilities and waste rock management area will be constructed. In support of an Environmental Assessment (EA) and future licensing, the NWMO will also conduct detailed environmental studies at the proposed site to provide an understanding of baseline environmental conditions and to assess the potential impacts of the repository.

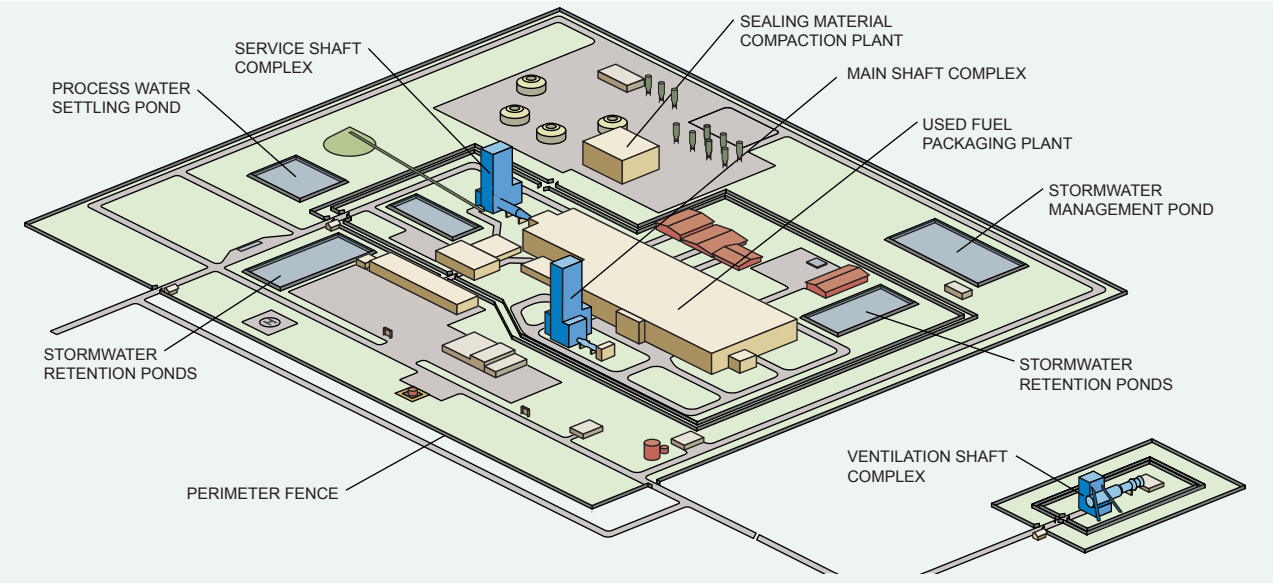
Over the 2016 to 2020 business planning period, the NWMO will prepare detailed plans and steps required to fully understand the site at depth. This will involve reviewing draft plans with the APM-Geological Review Group (APM-GRG). The NWMO would also seek CNSC comments on these plans. This important confirmatory work will contribute to safety case development and documentation required for the future regulatory approvals process.

Following the receipt of regulatory approvals to initiate site development, including construction of the shafts, further site verification will be completed through the sinking of the shafts and initial development at repository level. These verification activities will be used to confirm detailed site characterization completed as part of the surface investigations and monitoring.

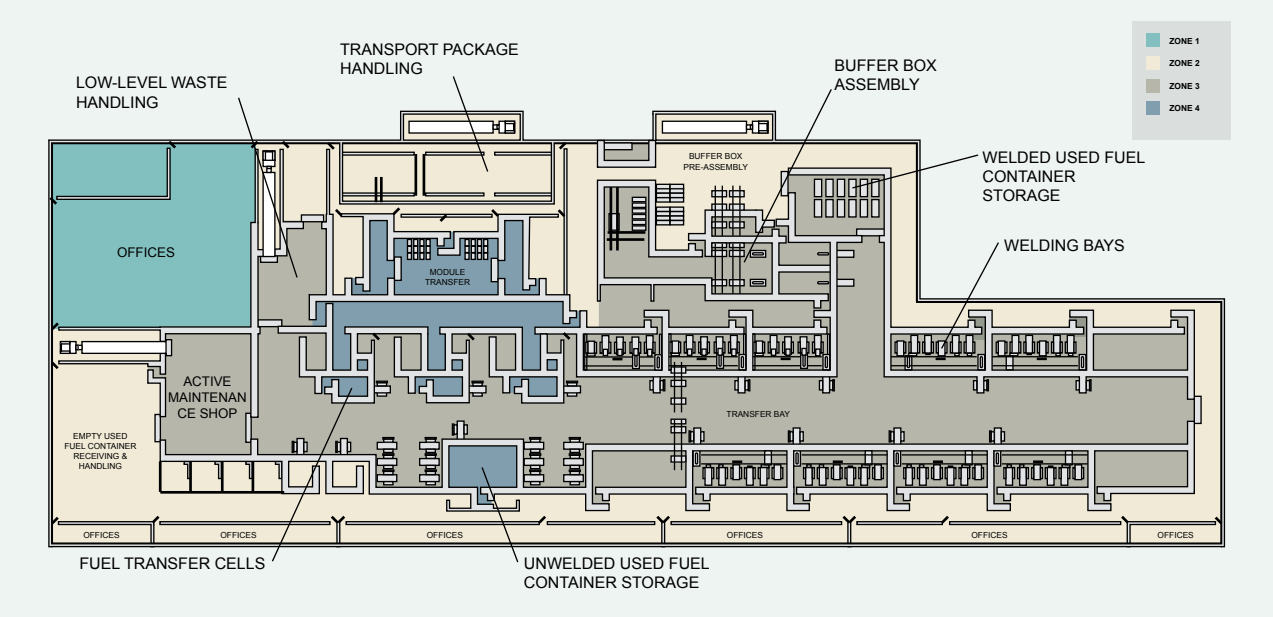
The initial repository development will include an Underground Demonstration Facility (UDF). The UDF will be used to conduct geological and geomechanical investigations, and to provide an opportunity for in-situ demonstrations of used fuel emplacement processes and equipment.

## Detailing Engineering Designs and Infrastructure Requirements

Following selection of the site for the APM Project and building from subsequent detailed site characterization activities, more detailed designs will be completed for all aspects of the deep geological repository and associated surface facilities, such as the Used Fuel Packaging Plant. Designs will be developed to reflect the specific location for the repository and facilities as agreed with communities.




Example of a Layout of APM Surface Facilities for a Deep Geological Repository




Example of a Layout for a Used Fuel Packaging Plant

The engineered barrier design will also be assessed against the specific conditions of the selected site. This could include verification of the design for factors such as geological loading conditions, site specific water chemistry and groundwater flow.

## Building Local Capacity and Employment Opportunities

The APM Project is a large national infrastructure project that will bring about significant economic benefits to the area in which it is sited, including jobs for the initiating community, First Nation and Métis communities in the area, and the host province. It is a multi-generational project that will be developed and implemented in phases over a period spanning more than 150 years. The project will generate hundreds of direct, indirect and induced jobs involving scientists, engineers, trades people and others with transferable skills and capacities in the siting region for many decades. The number of jobs sourced from the siting area will depend in part on the location of the repository and the capacity of the communities in the siting area, economic region and host province to support the project.

The NWMO will seek to maximize job opportunities that will go to the local area hosting the project, and to build capacity in communities to secure jobs on the APM Project. Lead times associated with the siting process, construction and operations provide opportunities for the NWMO to work closely with communities to invest in training, transferrable skills and business development. For example, the used fuel container and supporting components will be manufactured and assembled at a container manufacturing plant, which could potentially be located in the host area. Possible locations for this facility would be the subject of dialogue between the NWMO and communities over the 2016 to 2020 time period.

Over the 2016 to 2020 planning period, the NWMO will begin to build on and plan for a stronger local staffing presence.

- The NWMO will build its local staffing presence in potential siting areas during Phase 2 preliminary assessments of sites. As Phase 2 assessments continue, the NWMO plans to expand its hiring, to have some locally based staff to support community engagement and field studies in each area.
- During Phase 2 assessments, local contract opportunities for businesses in municipal and Aboriginal communities to supply goods and services in each siting area will also build capacity of suppliers to contribute to future APM-related work.
- The NWMO will invest in building capacity in potential siting communities to compete for jobs related to APM implementation. The NWMO will seek to enable capacity development for communities by building up skills and trades that will also be applicable to other projects. Plans will be developed with communities to identify priority areas for training and capacity building.

Immediately following site selection, the NWMO will start to significantly increase its local staffing levels. Skills needed would include geoscience, drilling, engineering, equipment operation, technical support, environmental assessment, safety assessment, monitoring, engagement, social science, and communications. As part of planning for these future opportunities, the NWMO will discuss in more detail with communities the numbers and range of jobs that will be created in future phases of the project. In planning for future employment potential, the NWMO will also discuss what additional investments in training, strategic hiring or business incubation may be important in building prospects for local employment and businesses.

**In the period 2016 to 2020, the NWMO will:**

- Seek input from the CNSC consistent with the pre-licensing agreement with respect to regulatory information, expectations and reviews;
- Plan for the future federal environmental assessment by preparing to meet requirements under the *Canadian Environmental Assessment Act*, 2012;
- Confirm provincial regulatory requirements and approvals required for the APM Project;
- Develop work plans and assess resource requirements to progress detailed site characterization, environmental assessments, engineering designs and safety case development for the selected siting area in support of the future licensing application;

- Define the technical assessment and demonstration requirements for the UDF after the commencement of construction activities;
- Advance the definition of concept and scope for the national Centre of Expertise that will be constructed in the selected siting area;
- Elaborate technical requirements and plans for the Centre of Expertise;
- Further define the pre-construction technical demonstration activities that will be conducted at the Centre of Expertise;
- Initiate discussion with local municipal, First Nation and Métis communities in the Phase 2 siting study areas on the Centre of Expertise, and their respective local preferences to be considered should the APM Project be hosted in their area;
- Begin to build a stronger local staffing presence in the potential siting areas through locally-based NWMO staff;
- Where possible, meet the NWMO's growing project needs for engagement and technical studies through staff based in potential siting areas;
- Invest in building the skills and capacity of youth and community members in the municipal, First Nation and Métis communities engaged in siting studies to position them to secure jobs related to future phases of the APM Project, or other large projects in the area;
- Invest in building the transferable skills and capacity of community members that will also be applicable to other projects beyond APM; and
- Provide local contracting opportunities in each potential siting area for municipal and Aboriginal communities that may be qualified to supply goods and services for the project.

**In 2016, the NWMO will:**

- Seek guidance from the CNSC with respect to future regulatory requirements for different phases and elements of the APM Project;
- Continue discussions with governments to clarify required permits and processes to advance the project;
- Lead technical briefings about the Centre of Expertise within communities engaged in the site selection process to outline the technical and social activities planned for the Centre in support of the project;
- Invite communities engaged in the site selection process to discuss social preferences for how the Centre might be designed and developed, should their area be selected for the project;
- Initiate development of a jobs and skill inventory to identify the professions, trades, skills and capabilities required to support the Centre of Expertise, the regulatory process and the construction and operation of the deep geological repository;
- Implement a hiring plan to build up locally based staff to support community engagement and field studies in potential siting areas;
- Initiate discussion with communities engaged in the site selection process about priority steps for developing skills and job opportunities for youth and local community members; and
- Discuss with communities what investments in training, strategic hiring or business incubation may be important in building the prospects for local employment and businesses.

# Continuously Improve Technical Knowledge

**The Nuclear Waste Management Organization (NWMO) will continuously improve technical knowledge in collaboration with universities and international partners, and adapt plans consistent with international best practices.**

The technical end point of Adaptive Phased Management (APM) is a deep geological repository where Canada's used nuclear fuel will be safely contained and isolated on an indefinite basis. Through improving our understanding of processes relevant to the safety case, including geoscience and safety assessment, the APM technical program works to ensure the repository will meet high technical standards.

In support of this program, the NWMO contributes to and learns from best practices and experience with project implementation in Canada and other countries. The NWMO continues to participate in the Nuclear Energy Agency (NEA) of the Organisation for Economic Co-operation and Development (OECD) to exchange information in such areas as safety case development.

The NWMO also participates in international research projects. The APM technical program conducts joint research projects with international organizations and counterparts in other countries, including Sweden, Switzerland, Finland, France and the United Kingdom. Partnering with other radioactive waste management organizations allows the NWMO to foster international co-operation on research, development and demonstration of technology; learn from other countries' experience; and keep abreast of developments in geoscience and safety case development for various host rock formations.

Research partnerships with universities also play an important role in ensuring the NWMO's technical work is scientifically rigorous.

The NWMO regularly reports on new learning through reports such as a watching brief on used nuclear fuel reprocessing and alternative used nuclear fuel management technologies. It also monitors potential inventories of used nuclear fuel quantities and types for implications to repository design.

## Going Forward

**In the period 2016 to 2020, the NWMO will:**

- Advance understanding of relevant processes through collaboration with universities in Canada and internationally, with the results presented in journal articles, conference papers and technical reports;
- Continue to partner in the installation, monitoring and analysis of experiments at the Mont Terri Rock Laboratory Project and Grimsel Test Site, both in Switzerland, along with researchers from Switzerland, France, Spain, Germany, Belgium and the United States;
- Continue to participate in the OECD NEA's Radioactive Waste Management Committee and Integration Group on the Safety Case;
- Continue to support the NEA's Thermodynamic Database Project, which is developing a quality-assured database for key elements in radioactive waste management systems;
- Continue to participate in BIOPROTA, an international forum on biosphere modelling for radioactive waste facilities;
- Continue to collaborate with researchers from the United States Geological Survey, the Geological Survey of Finland, and swisstopo, Switzerland's geoinformation centre;
- Continue to participate in workshops and conferences sponsored by organizations such as the Canadian Nuclear Society, the NEA, and the International Atomic Energy Agency;
- Continue to host an annual Geoscience Seminar to bring together researchers from academia and industry;
- Continue to support, along with the Natural Sciences and Engineering Research Council of Canada (NSERC), graduate students through the NSERC's Industrial Postgraduate Scholarships Program;
- Publish reviews of developments in used nuclear fuel reprocessing and alternative used nuclear fuel management technologies;
- Publish an annual update on current and future potential inventories of used nuclear fuel quantities and types in Canada; and
- Continue to monitor, assess and plan for changes in industry waste management activities and plans.

# Develop Transportation Plans

**The Nuclear Waste Management Organization (NWMO) will establish safe, secure and socially acceptable plans for transporting used nuclear fuel.**

Transportation of used nuclear fuel is an important element of the Adaptive Phased Management (APM) Project. Implementation of the APM program will involve transporting used nuclear fuel from the current interim storage sites to the used fuel repository.

From a technical perspective, used nuclear fuel can be transported safely and securely, with radiological safety assured through the robust transportation packages.

As part of the process of selecting a site, a transportation route must be identified, or be capable of development, by which used nuclear fuel can safely and securely be transported from the locations at which it is currently stored. Transportation planning and evaluations must fully address regulatory requirements for transporting used nuclear fuel through different provinces. During the Step 3, Phase 2 preliminary assessments of different potential siting areas, an important focus will be identifying potential transportation routes and modes to each site against technical safety criteria. Phase 2 assessment activities will provide additional information to assess and compare potential areas for siting the used fuel repository and Centre of Expertise.

Beyond safety, transportation is also an important consideration in identifying and assessing effects on community well-being. The NWMO will need to demonstrate the safety and security of any transportation system to regulatory authorities and citizens before transportation of used nuclear fuel to the repository can begin. Transportation planning and evaluations will also need to be aligned with community input, which requires taking into account social values as well as understanding and addressing social questions and concerns. This also requires inviting input from communities on potential transportation routes, as a group with a shared interest. Through the multi-year period of Phase 2 assessments of different potential host areas for the APM Project, transportation will be an important focus of public engagement, led by the NWMO, to understand societal considerations. It is expected that groups and individuals will have questions and concerns to be addressed as assessments continue through this second phase of study and engagement.

The transportation program is designed to achieve a number of specific outcomes by the end of the multi-year Phase 2 siting assessments:

- Completed assessments of preferred and alternative road and rail routes between each of the interim storage sites and each Phase 2 siting study area.
- Identified and designed the necessary transportation equipment and facilities.
- Completed a transportation risk assessment, including public and worker dose assessments.
- Defined an approach for emergency response.
- Clearly identified security requirements.
- Addressed and took into account questions and concerns of potentially affected Aboriginal communities and transportation communities in decision-making on a preferred site.
- Ensured the transportation program meets or exceeds regulatory requirements.

Specific activities planned in support of these desired outcomes involve both a technical program and an engagement program.

## Going Forward

**In the period 2016 to 2020, the NWMO will:**

- Undertake transportation logistics analyses;
- Conduct transportation risk assessment study;
- Construct and test all equipment required for loading, transporting and unloading used nuclear fuel transportation packages, including truck trailers and rail cars;
- Develop updated package designs for transportation containers, with consideration of 'beyond-design-basis' scenarios;
- Seek Canadian Nuclear Safety Commission design approval certificates for road and rail transport packages;
- Work closely with waste owners in planning for future transport of used nuclear fuel from the facilities where it is currently stored on an interim basis;
- Continue to develop communication materials to support learning and dialogue about transportation safety and transportation considerations;
- Continue to seek advice from municipal associations regarding ways to communicate transportation plans and engage with communities that may be on a transportation corridor for used nuclear fuel;
- Provide briefings and information about the transportation of used nuclear fuel, seek input to enhance the technical development program, and refine processes and plans;
- Conduct dialogue and use public attitude research techniques to explore public understanding, questions and concerns; and
- Continue review of experience and best practices with transportation of hazardous materials, including transportation of nuclear waste in Canada and internationally, to identify lessons that apply to APM.

# Provide Financial Surety

**The Nuclear Waste Management Organization (NWMO) will ensure funds are available to pay for the safe, long-term management of Canada's used nuclear fuel.**

Canadians expect that the money necessary to pay for the long-term care of used nuclear fuel will be available when it is needed and will be fully funded by the waste producers. The NWMO has the objective of determining what costs can reasonably be expected to occur over the life of the project, along with a contingency for unexpected events, and then designing a system that collects enough money from the waste producers and protects this money to ensure that the entire cost can be covered under a variety of social and economic circumstances, and within the required time frame.

Adaptive Phased Management (APM) cost estimates include costs to develop, construct and operate a central long-term facility, including a deep geological repository and transporting the used nuclear fuel to the repository. These activities will be carried out and funded by the NWMO. Reactor site storage is carried out and directly funded by individual waste owners.

The NWMO completed a full update of these estimates in 2011. The updated cost estimates cover many decades of APM life cycle activity for the deep geological repository and related transportation of used nuclear fuel. For purposes of the last full estimate update, it was assumed that the repository may need to manage 3.6 million used nuclear fuel bundles. The total cost of the APM Project is estimated to be $19.4 billion (2015 $), or taking into account the time value of money, present value of $8.7 billion (2015 $) for the lifecycle liabilities from 2015 onwards.

The eventual cost of the project is impacted by many factors, including the volume of used nuclear fuel to be managed. The current projection of the final volume of used nuclear fuel from existing reactors is between 3.4 million and 5.2 million bundles. The specific volume of Canada's used nuclear fuel to be placed in the repository will be agreed with the community using the best information available at the time, and an open and transparent consultation process involving surrounding communities and others who are interested and potentially affected.

Other factors that impact the eventual costs include the location of the facility, surrounding infrastructure, the rock type and characteristics, the design of the repository, and the period of extended monitoring following used nuclear fuel placement. The next full update of the APM cost estimate will be completed in 2016.

## *The Nuclear Fuel Waste Act* (*NFWA*)

The planning, development and implementation of the APM Project is funded by the major owners of used nuclear fuel in Canada: Ontario Power Generation, New Brunswick Power Corporation, Hydro-Québec and Atomic Energy of Canada Limited (AECL). The *NFWA* (2002) requires each of these four companies to establish independently managed trust funds and make annual deposits to ensure the money to fund this project will be available when needed.

The *NFWA* includes explicit provisions to ensure the trust funds are maintained securely and used only for the intended purpose.

As required by the *NFWA*, the NWMO's Annual Report must outline the funding formula for the next fiscal year to ensure funds required to cover the full cost of APM implementation is borne by the waste producers and an explanation of assumptions is provided. Trust funds must be maintained, and annual contributions made by major waste producers, reflecting the updated funding formula.

## Going Forward

**In the period 2016 to 2020, the NWMO will:**

- Annually assess all factors that impact APM cost estimating and funding requirements;
- Update the total cost estimate for APM in 2016;
- Continue to publish the audited financial statements for nuclear fuel waste trust funds, established by the Members and AECL, as they are provided by the financial institutions (see www.nwmo.ca), and provide updates to confirm that they are meeting their financial obligations;
- Estimate and publish the financial implications of potential future scenarios of varying volumes of used nuclear fuel, when available; and
- Monitor the development of new reactors and new owners of used nuclear fuel, applying the appropriate principles to update the funding formula when the specific circumstances arise.

# Ensure Governance and Accountability

**The Nuclear Waste Management Organization (NWMO) will maintain an accountable governance structure that provides confidence to the Canadian public in the conduct of the NWMO's work.**

The NWMO's governance comprises the Member organizations, the Board of Directors and its Advisory Council. The NWMO is subject to the requirements of the *Nuclear Fuel Waste Act* (*NFWA*) and oversight by the Minister of Natural Resources Canada. The NWMO's implementation of a repository as part of Adaptive Phased Management (APM) will be regulated under the *Nuclear Safety and Control Act* and its associated regulations to protect the health, safety and security of Canadians and the environment, and to respect Canada's international commitments on the peaceful use of nuclear energy. A licensing decision by the Canadian Nuclear Safety Commission (CNSC) on an APM repository can only be taken after the successful completion of the environmental assessment conducted under the *Canadian Environmental Assessment Act*, 2012. All aspects of the NWMO's work will meet or exceed all applicable regulatory standards and requirements for protecting the health, safety and security of humans and the environment.

## MEMBERS

Ontario Power Generation, New Brunswick Power Corporation and Hydro-Québec are the founding Members of the NWMO. The Membership Agreement and bylaws set out Member roles and responsibilities in supporting the objectives of the *NFWA* and the NWMO's implementation mandate. The NWMO regularly briefs its member organizations.

## BOARD OF DIRECTORS

The Board of Directors is responsible for oversight of the organization and taking a leadership role in the development of the corporation's strategic direction. The Members appoint the Board of Directors. There are currently nine members of the Board of Directors, representing a range of perspectives from both within and outside the nuclear industry, including capabilities in ethics, Aboriginal culture and finance management. The membership of the Board is profiled on the NWMO website.

## ADVISORY COUNCIL

The *NFWA* requires that the governing body of the NWMO appoint an Advisory Council to review and comment on its work as part of the NWMO's triennial reports. In addition to fulfilling its legislated reporting requirements, the Council meets regularly with the NWMO's senior management, closely following the development of the organization's plans and activities, and providing ongoing counsel and advice. At any time, the Council may choose to deliberate in camera. The Board of Directors appointed the Advisory Council in 2002, with membership renewed at regular intervals.

Current membership of the Advisory Council represents a broad range of expertise, including geotechnical engineering, chemical engineering, nuclear engineering, engagement, public affairs, nuclear community relations, environment, sustainable development, law, political science, municipal affairs and government relations, Aboriginal relations, Aboriginal Traditional Knowledge and community-based research. This group of individuals is knowledgeable in nuclear waste management issues, and experienced in working with citizens and communities on a range of public policy issues. The membership of the Advisory Council is profiled on the NWMO website.

The NWMO Board continues to ensure appointments remain consistent with the requirements of the *NFWA*, and take into account the range of expertise required to support the regional and local activity associated with APM site selection. As the NWMO's work leads to the selection of an informed and willing host community, and as affected Aboriginal organizations and the host region are identified, the *NFWA* requires that representatives from these communities be included in the Advisory Council. This is in addition to members with expertise in a broad range of scientific, technical and social disciplines, as well as expertise in Aboriginal Traditional Knowledge, as outlined in the *Act*.

## MANAGEMENT SYSTEM

In 2010, the NWMO established its integrated management system for activities in support of the long-term management of nuclear waste. As part of its plan to ensure excellence and accountability in governance, the organization obtained certifications to ISO 9001:2008 for quality, ISO 14001:2004 for environment, and CSA Z1000:2006 for health and safety management. In addition to maintaining conformance to these standards, the NWMO's management system was further enhanced to meet the requirements of CSA N286-12 Management System Requirements for Nuclear Facilities, which includes nuclear waste facilities. The NWMO's integrated management system ensures the organization is well equipped to implement its vision, which is the "long-term management of Canada's nuclear waste in a manner that safeguards people and respects the environment, now and in the future". The focus on safeguarding of people is fully aligned with the CSA N286-12 management system principle that safety is the paramount consideration guiding decisions and actions.

## INDEPENDENT TECHNICAL REVIEWS

The NWMO will continue to seek external expert review and comment of its technical program. As the technical program moves from research into design, fabrication and demonstration, the nature of the technical reviews will be more focused to the specific design aspects and features. The results of these reviews would help guide the technical program and inform NWMO stakeholders.

## PEER REVIEWS

The NWMO will continue to seek opportunities for peer review of its work and to invite independent comment.

The APM-Geoscientific Review Group (GRG), described earlier, is an example. This will benefit program design and delivery, contribute to overall program quality, and help to enhance public confidence in the NWMO's implementation plans and decision-making.

## REPORTING

The NWMO maintains high standards of reporting to demonstrate integrity, excellence, engagement, accountability, and transparency in the implementation of APM. The NWMO reports regularly on its progress, and especially in response to the advice of Canadians and the changing external environment.

The *NFWA* requires the NWMO to issue annual reports and triennial reports. In each case, reports are to be submitted to the Minister of Natural Resources Canada and to the public at the same time. The Minister must table the reports in Parliament and issue a statement on each report.

## INTERNATIONAL COMMITMENTS

The NWMO will continue to report internationally on its progress at meetings of the *Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management* (*Joint Convention*). Under the *Joint Convention*, Canada must demonstrate that it is meeting international commitments to manage radioactive waste and used nuclear fuel safely. The NWMO will next contribute to Canada's reporting at the 2018 convention.

## Going Forward

**In the period 2016 to 2020, the NWMO will:**

- Convene regular meetings of NWMO Members, Board of Directors, Board Committees, and Advisory Council;
- Co-ordinate reviews of the NWMO's technical program;
- Co-ordinate annual reviews of the APM geoscience plans with the APM-GRG;
- Conduct assessments and audits, benchmark, and improve processes to maintain and improve the management system, including maintaining certifications to standards for quality, safety and environment management;
- Continue to interact with the CNSC consistent with the terms of the arrangement prior to submission of a licence application. These activities include the CNSC participating in community or other meetings to provide information on the regulator's role, identifying regulatory requirements for a deep geological repository, and conducting pre-licensing reviews of conceptual designs and illustrative safety assessments;
- Report to Canadians on its progress in implementing APM. The NWMO will submit its Annual Report to the Minister of Natural Resources Canada and the public in the first quarter of each year, including its third triennial report in 2017;
- Publish the five-year strategic plan, *Implementing Adaptive Phased Management*;
- Publish the minutes of the meetings of the Board of Directors and Advisory Council;
- Report internationally on progress for the long-term management of Canada's used nuclear fuel at the 2018 meeting of the *Joint Convention*; and
- Undertake membership review, and make appointments to the Advisory Council to ensure members bring a broad range of expertise.

# The Road Ahead

**The Nuclear Waste Management Organization (NWMO) invites all Canadians and Aboriginal peoples of Canada to stay involved in Adaptive Phased Management (APM) of Canada's used nuclear fuel. *Implementing Adaptive Phased Management* is updated annually to guide the five-year planning period ahead. As such, the Plan is regularly assessed, strengthened and redirected, as needed.**

Implementation of the site selection process for the deep geological repository for used nuclear fuel has begun. This community-led process is supported by the resources and work programs described in this plan. APM will proceed as quickly as Canadians, successful technology demonstration and the regulatory authorities allow.

# Glossary

**Deep geological repository** is a facility for the placement of used nuclear fuel deep underground where both natural and engineered barriers contain and isolate it from humans and the environment. There is the potential for retrieving the used nuclear fuel.

**Fuel bundle** for CANDU nuclear reactors is manufactured by sintering uranium oxide powder into pellets. The pellets are loaded into Zircaloy (an alloy of the metal zirconium) tubes, which are then welded into a bundle of tubes – a fuel bundle. Each bundle contains about 1,000 uranium oxide pellets.

**Intermediate-level nuclear waste** consists primarily of used reactor core components, and resins and filters used to keep reactor water systems clean. It requires shielding to protect workers during handling. Intermediate-level waste is stored mainly in steel-lined concrete containers that have been set into the ground.

**Long-term management of used nuclear fuel** involves containment and isolation of the radioactive material.
The radioactivity decreases substantially with time, due primarily to the decay of short-lived radionuclides. The radioactivity of used nuclear fuel decreases to about one percent of its initial value after one year, decreases to about 0.1 percent after 10 years and decreases to about 0.01 percent after 100 years. After approximately one million years, the radioactivity in used nuclear fuel approaches that of natural uranium.

**Low-level nuclear waste** consists of common industrial items that have become contaminated with low levels of radioactivity during routine cleanup and maintenance at the nuclear generating stations. Low-level waste includes mops, rags, paper towels, temporary floor coverings, floor sweepings, protective clothing and hardware items such as tools. It consists of paper, plastics, metal, rubber, cotton, and other miscellaneous materials. Low-level waste can be safely handled using normal industrial practices and equipment without any special radiation protection.

**Optional shallow underground storage facility** would involve building a shallow rock cavern storage facility at the chosen site for the deep geological repository. This is included in Adaptive Phased Management (APM) as an option. This option is not expected to be needed and is not included in the current Implementation Plan.

**Retrievability** is the ability to remove the used nuclear fuel from where it has been placed. Retrievability is an important component of APM and was included on the direction of Canadians. It is part of a risk management approach to allow corrective action to be taken if the repository does not perform as expected or if new technologies emerge in the future that could significantly improve the safety of used fuel long-term management. While used nuclear fuel will be retrievable as part of APM, the process will become progressively more demanding as the used fuel containers are sealed in the placement rooms, and then years later when access tunnels and shafts are eventually backfilled and sealed.

**Safety** is the protection of individuals, society and the environment, from the harmful or dangerous effects of used nuclear fuel, now and in the future.

**Used nuclear fuel** means the irradiated fuel bundles removed from a commercial or research nuclear fission reactor. Used nuclear fuel is classified as a high-level nuclear waste.

Share Your Thoughts on

# Implementing Adaptive Phased Management 2016 to 2020

DRAFT FOR PUBLIC REVIEW

1. The Draft Plan is built around eight strategic objectives. Are the objectives that we have identified appropriate? Have we missed key areas?

2. The Draft Plan identifies work and activities we propose to undertake to accomplish these objectives. Have we set out appropriate activities?

3. The Draft Plan is intended to anticipate the challenges ahead and plan for them. Over the next five years, what are the key challenges that will need to be addressed?

4. What will the NWMO need to put in place to respond to these challenges?

5. Other comments, questions or suggestions?

Name (optional): _____

Organization (if appropriate): _____ Date: _____

Address: _____

Email: _____ Tel: _____

Would you like your comments posted on the NWMO website? Yes No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NUCLEAR WASTE MANAGEMENT ORGANIZATION

SOCIÉTÉ DE GESTION DES DÉCHETS NUCLÉAIRES