NUCLEAR WASTE MANAGEMENT ORGANIZATION
SOCIÉTÉ DE GESTION DES DÉCHETS NUCLÉAIRES

Implementing Adaptive Phased Management 2015 to 2019

DRAFT FOR PUBLIC REVIEW
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Table of Contents

Preface 1

Executive Summary 2

Progress Since Last Implementation Plan 5

NWMO Organization 8

Canada's Plan for Used Nuclear Fuel 11

Planning Priorities for 2015 to 2019 19

- Build Sustainable Relationships 23
- Collaboratively Implement the Site Selection Process 28
- Optimize Repository Designs 36
- Continuously Improve Technical Knowledge 38
- Develop Transportation Plans 40
- Provide Financial Surety 43
- Ensure Governance and Accountability 45

The Road Ahead 49

Glossary 50

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, Canada's plan for the safe, long-term care of used nuclear fuel. Adaptive Phased Management 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 our 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 we receive through our engagement initiatives.

Implementing Adaptive Phased Management 2015 to 2019 is released in draft for public review between October and December 2014. 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 2015-2019 Plan at www.nwmo.ca.

The NWMO welcomes all suggestions and ideas about our work and how we can help you learn more about Adaptive Phased Management.

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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 2015 to 2019* describes our five-year work program.

Adaptive Phased Management, 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, provincial and international regulatory standards and requirements for protecting the health, safety and security of humans and the environment.

One focus of the 2015 to 2019 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 communities to engage and build relationships with potentially affected First Nations and Métis peoples, and other communities in the area 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. A narrowing down process has since begun, as the NWMO and an early group of communities considered findings from the first phase of preliminary assessments.

Currently, 14 communities continue to explore their interest in hosting Adaptive Phased Management, and Aboriginal peoples and communities in the surrounding area are progressively being engaged in learning and decision-making. We expect that the advancement of preliminary assessments (Step 3, Phase 2) over the five-year period will build information to guide a future decision on selection of the one or possibly two areas to proceed to site characterization (Step 4).

Another 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 system and emplacement system 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 on our 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.

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 one or two communities to progress to the detailed site characterization phase of work;
- Conduct this work collaboratively with the communities involved, First Nations 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 transportation plans through container design, testing and through engagement of citizens to inform the development of a planning framework;
- Work with waste owners in planning for future transport of used nuclear fuel from the interim storage facilities where it is currently stored; and
- Complete an update to the conceptual design and cost estimate for Adaptive Phased Management.

This strategic plan is a 'living' document that is regularly assessed, strengthened and redirected in the face of new information, advances in science and technology, insight from Aboriginal Traditional Knowledge, changes in societal values, and evolving public policy. Adaptive Phased Management 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 seven strategic objectives outlined in the following pages. The NWMO continues to evolve these objectives as implementation of Adaptive Phased Management progresses. The 2015-2019 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

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 informed, willing host community.
- 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.
- 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 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.

Building Sustainable Relationships

The NWMO continued to engage with the many groups involved in the long-term management of Canada's used nuclear fuel at this early phase of work. The NWMO:

- Worked 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.
- Strengthened relationships with federal and provincial governments and briefed elected representatives about the project and the site selection process.
- Supported initiatives designed to increase youth interest and participation in science, including Youth Science Canada, Shad Valley, 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.

Collaboratively Implementing the Site Selection Process

Working with communities, the NWMO continued to advance the site selection process. The NWMO:

- Concluded studies in three communities based on findings to date. To date, studies have been concluded in 8 communities; studies continue in 14 communities.
- Supported community engagement and learning to support the objective of seeking an informed and willing host for the facility.
- Worked with interested communities to engage and build relationships with potentially affected First Nations and Métis peoples, and other communities in the area to learn about and consider the project to support the objective of developing a partnership to support implementation.

Optimizing Repository Designs and Further Increasing Confidence in Safety

The NWMO's technical program continued development and testing in the key areas of repository engineering, geoscience and repository safety as well as the transportation of used nuclear fuel. The NWMO:

- Maintained and advanced geoscientific research specific to the long-term behaviour and evolution of deep-seated, low-permeability groundwater systems in crystalline and sedimentary bedrock settings.
- Worked collaboratively with Switzerland's nuclear waste management organization (Nagra) to develop copper coatings for repository containers using Canadian technologies developed by the National Research Council, the University of Ottawa, the University of Windsor, and the University of Toronto.
- Prepared conceptual designs for the handling, transfer, loading and sealing of used nuclear fuel containers.
- Continued to collaborate with other nuclear waste management organizations in repository-related research activities at underground rock laboratories in sedimentary and crystalline rock formations.
- Developed a proof test plan that will provide all of the data required to obtain a license to construct and operate a facility once a suitable site has been selected.
- Manufactured a prototype used fuel container using appropriate technologies.

Providing Financial Surety

The NWMO, in compliance with the *Nuclear Fuel Waste Act*, continued to monitor the segregated funds whose sole purpose is to fund the implementation of the Deep Geological Repository and centre of expertise once a construction licence has been granted by the Canadian Nuclear Safety Commission, many years in the future.

Adapting Plans

The NWMO engaged in continuous learning so as to be able to adapt its plans in response to new knowledge, international best practices, advances in technical learning, evolving societal expectations and values, changes in public policies and insight from Aboriginal Traditional Knowledge. The NWMO continued to work with specialists across Canada, as well as internationally. The NWMO:

- Continued to solicit public input, including review of the NWMO's strategic objectives and implementation plan, so that evolving societal expectations and insight from Aboriginal Traditional Knowledge are reflected in Adaptive Phased Management.
- Continued to monitor any developments in reprocessing used nuclear fuel and report findings to the public on an annual basis.
- Continued to partner with universities and other nuclear waste management organizations to keep abreast of the latest advances in the field.

Ensuring 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 an Independent Technical Review Group, Advisory Council, and a forum of Aboriginal Elders.
- Continued to update the Canadian Nuclear Safety Commission (CNSC) and seek feedback as part of the organization's agreement to obtain CNSC review of illustrative safety assessments for a used nuclear fuel repository in both crystalline and sedimentary rock formations.
- Continued to report annually to the Minister of Natural Resources Canada, as required by the *Nuclear Fuel Waste Act*.

Sustaining a High-Performing Organization

The NWMO continued to enhance its staffing and contractor capability through a variety of initiatives, including research partnerships with universities, staff training and development, and investment in business systems and processes. The NWMO:

- Supported the site selection process by continuing to recruit specialists in such areas as repository design and construction, environmental assessment, Aboriginal Traditional Knowledge, social research, ethics, finance, communications, and public engagement.
- Opened, and where warranted expanded, community offices in Step 3 communities and advanced the development of local hiring programs.
- Promoted knowledge transfer to future generations by encouraging youth involvement in science and by providing financial support to graduate students through the Natural Sciences and Engineering Research Council's Industrial Postgraduate Scholarships Program.

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 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 NB Power[1]. 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[2].

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 recommendations, selected Adaptive Phased Management 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 Adaptive Phased Management will be regulated by the Canadian Nuclear Safety Commission (CNSC) under the *Nuclear Safety and Control Act* 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 Adaptive Phased Management, and the project. As the siting process advances, an increasingly important focus is working with these communities to engage and build relationships with First Nations and Métis peoples, and other communities in the area to learn about and consider the project together. Technical assessments in the area 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, public engagement, Aboriginal relations, communications, finance and governance. We continue to collaborate with an extensive network of consultants, practitioners and academics from across Canada and around the world to ensure that our 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 Adaptive Phased Management. These specialists are critical to implementing the siting process, supporting community interest and partnerships, and undertaking the 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 Adaptive Phased Management and builds partnerships to facilitate this implementation, capacity at the local and regional levels to participate in the implementation of the deep geological repository and associated facilities will become a critical component of the larger organization required to implement the project. Capacity building at the local and regional level will be important.

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 (DGR) for the long-term management of low- and intermediate-level waste (L&ILW) from OPG-owned or -operated reactors. The NWMO has provided expertise in repository design and implementation to OPG's project.

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[1] In 2004, through a transfer order, the Government of New Brunswick assigned responsibility for all aspects of the provincially owned nuclear generating assets to a new subsidiary corporation, NB Power Nuclear.

[2] 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 Western Waste Management Facility. See glossary for more information about low and intermediate level waste.

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 humans and the environment.

Implementation of a deep geological repository under Adaptive Phased Management falls within federal jurisdiction and will be regulated under the *Nuclear Safety and Control Act* (*NSCA*) and its associated regulations. The Canadian Nuclear Safety Commission (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 Adaptive Phased Management repository will be subject to the CNSC's comprehensive licensing process, which covers the entire life cycle of the repository. This stepwise approach will require a licence for each phase of the repository life cycle. A licensing decision by the CNSC on a repository can be taken only after the successful completion of the environmental assessment process. 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. 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. Adaptive Phased Management 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*). The facility is to be sited in an informed, willing host community. 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.

Adaptive Phased Management 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[3]
- Long-term stewardship through the continuous monitoring of used fuel
- Ability to retrieve the used 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

[3] 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. 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 Atomic Energy of Canada Limited's nuclear research sites in Whiteshell, Manitoba, and Chalk River Laboratories in Ontario.

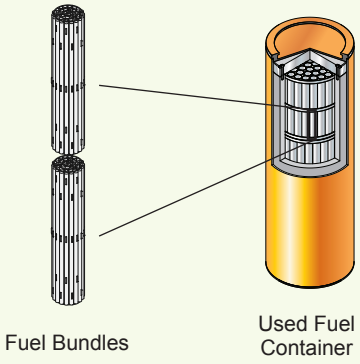
Canadian nuclear power plants are fuelled by natural uranium, formed into ceramic pellets which are encased in Zircaloy tubes welded together in the shape of a fireplace log weighing approximately 24 kilograms. Once the fuel bundle has been used to generate electricity, it is removed from the reactor. 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.

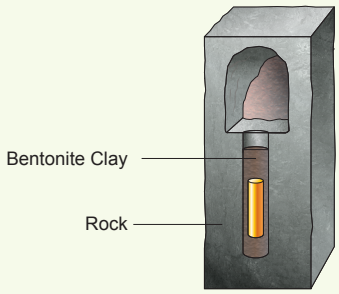
About 85,000 used nuclear fuel bundles are generated in Canada each year. Over 40 years, Canada's nuclear power program has produced more than 2.5 million used nuclear fuel bundles. A small amount of used nuclear fuel, and components, is also created at research and development facilities operated by Atomic Energy of Canada Limited, 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/technicalresearch.

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.

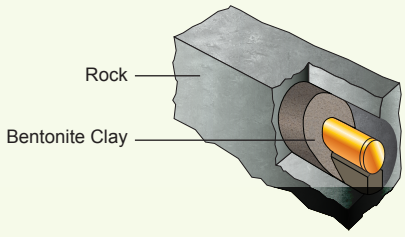
The Project

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.

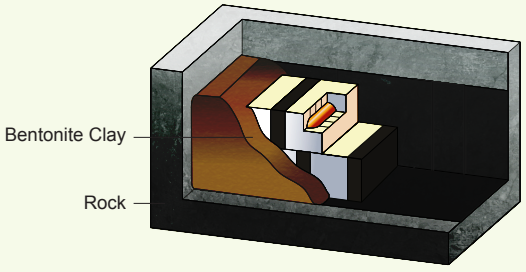




Vertical In-Floor Borehole Approach

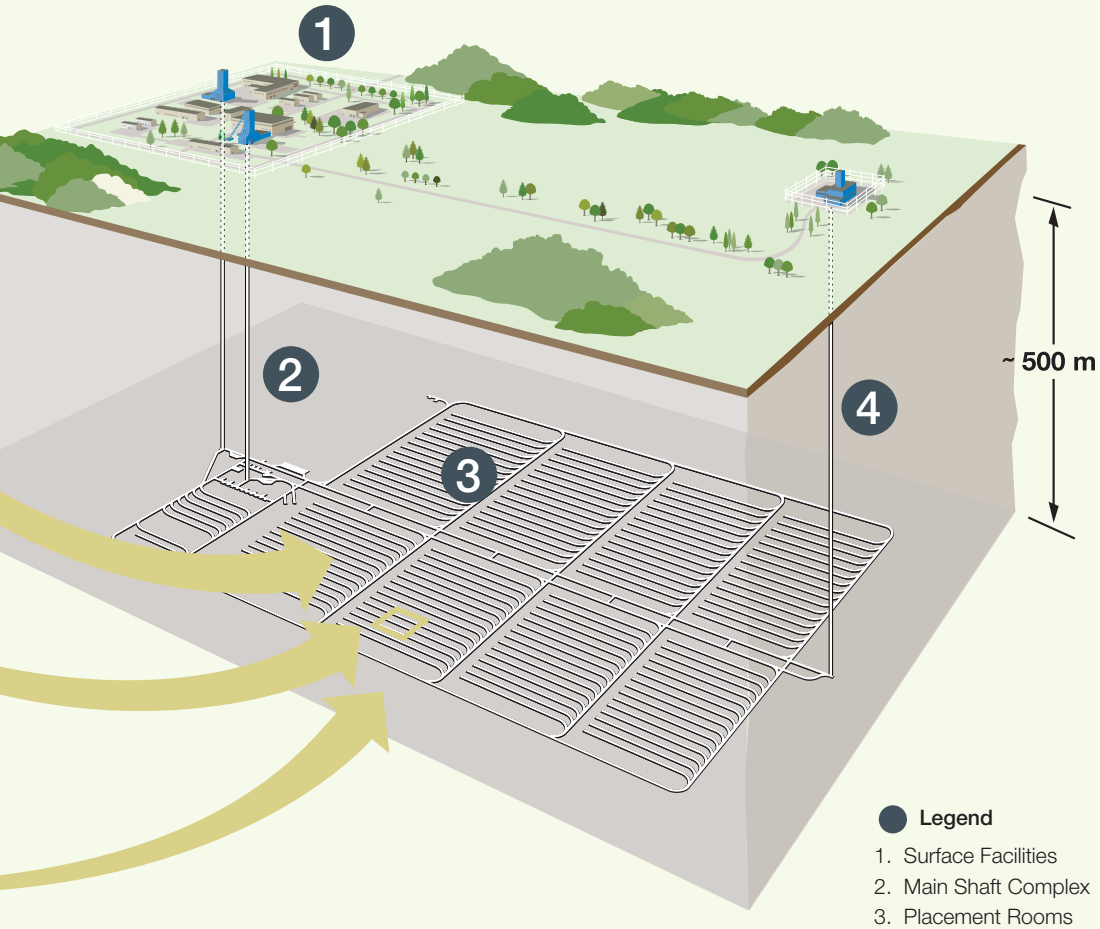


Horizontal Tunnel Approach



Lateral Tunnel Approach

The containers will be placed in vertical boreholes drilled in the floor along the axis of a placement room (in-floor borehole method), or placed horizontally within the confines of a placement room (horizontal tunnel method or lateral tunnel method), depending on the nature of the rock and characteristics of the site.



Legend

1. Surface Facilities
2. Main Shaft Complex
3. Placement Rooms
4. Ventilation Exhaust Shaft

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 (see diagram). 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. Land above the underground footprint that is not required for the surface facilities or to meet regulatory requirements could be available for other uses. However, regulatory or other requirements may limit activities in the immediate area surrounding the surface facilities. Based on current inventory projections, the underground repository requires a subsurface area in suitable host rock of about 2 kilometres by 3 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. Storage of this rock during operation of the facility is expected to require an area of about 700 metres by 700 metres, with a height between 3 metres and 8 metres. The area will include a storm water runoff pond, to collect and manage surface water. The excavated rock management facility is assumed to be located off-site and the size and the location of the excavated rock would be determined in consultation with the community and surrounding region.

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 transported underground to one of many placement rooms. The containers will be placed in vertical boreholes, or placed horizontally within the confines of a placement room, drilled into the rock 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 site, the NWMO will backfill and seal the access tunnels, and seek the appropriate regulatory approvals prior to decommissioning. Following successful decommissioning, the NWMO will seek appropriate regulatory approvals for postclosure monitoring.

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.

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

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

Transportation of Used Nuclear Fuel

Used nuclear fuel is currently safely stored in facilities licensed by the 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 Canadian Nuclear Safety Commission (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/brochures.

Centre of Expertise

A centre of expertise will be established for the one or more communities in which a site has been selected for detailed evaluation (Step 4 of the siting process). The centre will be located in or near the community, as determined with the community. 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, involving scientists and other experts in a wide variety of disciplines, including geoscience, engineering, and environmental, socioeconomic 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 community, affected Aboriginal peoples 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.

Should the site ultimately be selected to host the deep geological repository, the centre of expertise would be expanded to include and support construction and operation of an underground facility designed to confirm the characteristics 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 of the area, will be a subject of discussion and shared planning with those living in the area.

A Partnership Approach

Implementation of the APM project will require a long-term partnership among the interested community, Aboriginal peoples and surrounding communities, and the NWMO to ensure the project fosters well-being and sustainability in the area. The project will only proceed with the involvement of the interested community, potentially affected First Nations and Métis peoples, and other communities in the surrounding area working in partnership to implement the project.

The NWMO will work with the community, Aboriginal peoples 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 host 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.

The deep geological repository and centre of expertise will have a significant impact on any community and region in which they are located. It is a multi-generational project that will be developed in phases. The repository will be sited and constructed over two to three decades. The used nuclear fuel will be placed in the facility over a period of four decades or more, and then monitored for an extended period of time before decommissioning.

The project will provide significant economic benefits. It offers direct employment for hundreds of people at the facility for many decades, and many more indirect jobs in the host area and host province, with the opportunity to develop transferable skills and capacities. Implementation of the project will involve scientists, engineers, trades people and many others. The project may contribute to social and economic pressures that will need to be carefully managed to ensure the long-term health and sustainability of the community. For example, the influx of temporary construction workers may increase demand for social and physical infrastructure. To minimize social costs and help communities adapt to the opportunities and challenges of the project, the need for assistance, such as job training, affordable housing and infrastructure, would be examined.

Planning Priorities for 2015 to 2019

To guide implementation of Adaptive Phased Management (APM), the NWMO established seven strategic objectives. The objectives identify program areas in the implementation of Adaptive Phased Management and the planning priorities for 2015 to 2019.

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 Adaptive Phased Management, 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 Adaptive Phased Management, to confirm support for the strategic direction and to invite suggestions on the associated work programs.

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

The 2015-2019 Implementation Plan reflects two refinements in focus of work with strategic objectives dedicated to:

- **Transportation:** The 2015-2019 Implementation Plan brings together in a single program stream the NWMO's ongoing work to establish safe, secure and socially acceptable plans for transporting used nuclear fuel. This reflects the importance of transportation as an element of the APM program. It also reflects feedback the NWMO has received urging it to communicate in an integrated way about its plans in the important area of transportation.

- **Continuously improving technical knowledge in collaboration with universities and international partners:** The 2015-2019 Implementation Plan brings together in a single program stream the NWMO's ongoing work to advance technical knowledge to support the implementation of Canada's plan. This change reflects the importance of the NWMOs collaboration with universities and international partnerships to stay abreast of and contribute to the advancement of developments in the field of used nuclear fuel management.

In 2015, the NWMO will be in its 13th year of operation. While "building and sustaining a high performance organization" is no longer a stated planning objective, the NWMO remains committed to maintaining an effective organization with the broad range of expertise required to implement Canada's plan.

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

Strategic Objectives 2015–2019

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 informed, willing host community.
- 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.
- 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

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 confirming compliance with regulatory requirements.

A wide range of work programs and activities are planned for 2015 to 2019 to ensure the organization is prepared for each sequence of field investigations and detailed assessment, transportation planning, refined repository design and safety case development. The detailed scoping of activities and schedules for these projects will be further articulated over the planning period.

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. Over the period 2015 to 2019, 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 Adaptive Phased Management 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. Progress through the site selection process will necessarily evolve on timelines shaped by communities rather than schedules prescribed by the NWMO.

Adaptive Phased Management Timeline

2002-2007	*Nuclear Fuel Waste Act*	*NFWA* requires NWMO to consider alternative technical methods for long-term management of Canada's used nuclear fuel
	NWMO Study	NWMO's 3-year study recommends Adaptive Phased Management as the best approach
	Government Decision	Government selects Adaptive Phased Management and mandates NWMO to begin implementation
2008-2009	Design Process for Selecting a Site	NWMO works collaboratively with citizens to design a process for selecting a preferred central site for the optional shallow underground storage facility and the deep geological repository
10 or more years	Implement Siting Process (May 2010)	NWMO implements the siting process collaboratively with interested Canadians, during which communities express interest in being considered willing hosts
	Assess Suitability of Candidate Sites	NWMO conducts feasibility and characterization studies to assess the suitability of the candidate sites identified through the siting process
	DECISION: Select Site	NWMO selects a preferred site with a willing host community
	Licensing & EA Process	The process for obtaining a 'site preparation' licence is initiated by the NWMO. This triggers the start of an environmental assessment of the optional shallow underground storage facility, if needed, the characterization facility and the deep geological repository
	Implementation continues...	

Build Sustainable Relationships

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. 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 and will seek and respond to a diversity of views and perspectives. Interweaving of Aboriginal worldviews and knowledge systems with Adaptive Phased Management will strengthen the long-term management of used nuclear fuel. Our commitment to engagement and shared decision-making helps ensure that Adaptive Phased Management continues to respond to the values and concerns of Canadians. Building awareness and confidence in Adaptive Phased Management, and the NWMO as implementer, will continue throughout the planning period.

During the period 2015 to 2019, 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 together with affected Aboriginal peoples as holders of Traditional Knowledge, users of environmental resources and environmental stewards, to be active participants in the site selection process and to share that knowledge with the NWMO 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 engagement, 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 Adaptive Phased Management. Our engagement activities related to the broad Canadian public. As the siting phase of the implementation of Adaptive Phased Management progresses, the engagement program is evolving to focus more directly on the communities interested in hosting the project in the area, Aboriginal peoples 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 organization wishes to build long-term relationships with Aboriginal peoples that may be affected by the implementation of Adaptive Phased Management. 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). Understanding the nature of any impacts of the implementation of Adaptive Phased Management on Aboriginal rights, treaties and land claims and how

Aboriginal peoples should be accommodated as a result of any impacts is an important component of the NWMO's work. The NWMO needs to ensure effective consultation with Aboriginal peoples and that all those affected have the opportunity for meaningful involvement. The NWMO acknowledges that the Crown has a legal duty to consult and accommodate and will support the Crown's work to meet its obligations. Through all stages of program implementation, the NWMO seeks to work with Traditional Knowledge holders to bring this important and necessary complement to the project.

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

A fundamental tenet of Adaptive Phased Management 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 Adaptive Phased Management may pose technical and ethical challenges. The NWMO's approach and response to these challenges will be critical to the success of Adaptive Phased Management. One of the strengths of Adaptive Phase Management is the flexibility to adapt to evolution of 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 a Social and Ethical 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 of Adaptive Phased Management 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 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 Adaptive Phased Management. 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 has a process for ongoing monitoring, review and discussion of the potential implications of these developments on the quantities and characteristics of used nuclear fuel that the NWMO may be asked to manage in the future.

Consistent with the NWMO Transparency Policy and Engagement Procedure, the NWMO reports regularly on its progress in implementing Adaptive Phased Management, 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 Adaptive Phased Management at key milestones and decision points.

Going Forward

In the period 2015 to 2019, to build sustainable, long-term relationships the NWMO will:

- Continue work to increase awareness among Canadians and Aboriginal peoples of Canada about Adaptive Phased Management, the site selection process and the NWMO;
- Implement communications and media relations programs to help interested individuals and organizations understand Adaptive Phased Management;
- Seek comment from interested individuals and organizations on the NWMO's plans and the implementation of Adaptive Phased Management;
- Brief waste owners on plans for the implementation of Adaptive Phased Management so they may ensure their used nuclear fuel strategies are aligned with the implementation of Adaptive Phased Management;
- Brief Canada's nuclear host communities about progress in implementing Adaptive Phased Management, including planning for eventual transportation of used nuclear fuel from their communities to the deep geological repository;
- Develop and sustain relationships with communities that choose to engage in the site selection process, surrounding communities and Aboriginal peoples. This is expected to include working together in the conduct of studies;
- Develop and sustain relationships with municipal associations to better understand local governments' points of view, and work with them to implement Adaptive Phased Management;
- Develop and maintain relationships with the federal government, and provincial and local governments in nuclear provinces to help coordinate and support their roles in the implementation of Adaptive Phased Management;
- Develop and maintain relationships with national, provincial and regional Aboriginal organizations, and keep them apprised of progress in the implementation of Adaptive Phased Management and the site selection process;
- Continue to seek the advice of Elders and Aboriginal 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 among Aboriginal communities; the identification of sacred areas; understanding traditional laws, practices and use of land; and 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;
- Assess the effectiveness of the NWMO website and other communication vehicles to identify opportunities for improvement and make refinements;
- Assess effectiveness of NWMO engagement activities and continue to make refinements; and
- Continue to report publicly on the input that the NWMO receives and how this advice has been considered.

In the period 2015 to 2019, 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 Nuclear Energy Agency's Radioactive Waste Management Committee and Forum on Stakeholder Confidence;
- Continue to research citizen priorities and concerns relating to Adaptive Phased Management;
- Build understanding of the interweaving of Aboriginal Traditional Knowledge and other assessment approaches into implementation;
- Review and update the social and ethical framework and consider emerging and potential challenges;
- Post research papers and the results of engagement activities on the NWMO website;
- Seek the input of Canadians on how the implementation of Adaptive Phased Management 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 Adaptive Phased Management in the future.

In 2015, the NWMO will:

- Provide briefings and information upon request to interested individuals and organizations about Adaptive Phased Management and the site selection process;
- Continue to support interested communities, First Nations 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 to 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 (CANHC), 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 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 from Aboriginal organizations and incorporating Aboriginal Traditional Knowledge provided by Aboriginal contractors and Traditional Knowledge holders.

Collaboratively Implement the Site Selection Process

The 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 community.

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 community 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 *Steps in the Siting Process – At a Glance*, and the complete description of the siting process cited above). It is expected that individual communities 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 for communities. Preliminary assessments (feasibility studies) of potential sites will be done in partnership with communities as they come forward and express interest. A community may end its involvement in the process at any point up to and until the final agreement is signed.

As communities advance in the site selection process, a more regional perspective becomes a focus. Work can proceed only with the involvement of affected Aboriginal peoples 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 through the implementation of the project.

The nine-step site selection process spans from communities learning about the project to construction and operation. The process is designed to be driven by the interest of communities, the progressively more detailed conduct of scientific and technical studies, and the involvement of First Nations and Métis peoples and surrounding communities. 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 Project together are beginning to emerge. This project will only proceed with the involvement of the interested community, affected Aboriginal peoples 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.

Steps in the Siting Process – At a Glance

Getting Ready	**The NWMO publishes the finalized siting process, having briefed provincial governments, the Government of Canada, national and provincial Aboriginal organizations, and regulatory agencies on the NWMO's activities.** The NWMO will continue briefings throughout the siting process to ensure new information is made available and requirements which might emerge are addressed.
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.** Awareness-building activities will continue throughout the full duration of the siting process.
Step 2	**Communities identify their interest in learning more, and the NWMO provides detailed briefing. An initial screening is conducted.** At the request of the community, the NWMO will evaluate the potential suitability of the community against a list of initial screening criteria.
Step 3	**For interested communities, a preliminary assessment of potential suitability is conducted.** At the request of the community, the NWMO will conduct a feasibility study collaboratively with the community to determine whether a site has the potential to meet the detailed requirements for the project. Regional engagement will be initiated, and an initial review of transportation considerations will be conducted. Interested communities will be encouraged to inform surrounding communities, including potentially affected Aboriginal communities and governments, as early as possible to facilitate their involvement. Preliminary assessments are conducted in two phases: **Phase 1**: Desktop study and engagement; **Phase 2**: Field investigations and expanded engagement.
Step 4	**For interested communities, potentially affected surrounding communities are engaged if they have not been already, and detailed site evaluations are completed.** In this step, the NWMO will select one or more suitable sites from communities expressing formal interest for regional study and/or detailed multi-year site evaluations. The NWMO will work collaboratively with these communities to engage potentially affected surrounding communities, Aboriginal governments and the provincial government in a study of health, safety, environment, social, economic and cultural effects of the project at a broader regional level (Regional Study), including effects that may be associated with transportation. Involvement will continue throughout the siting process as decisions are made about how the project will be implemented. A centre of expertise will be launched in or near the community.
Step 5	**Communities with confirmed suitable sites decide whether they are willing to accept the project and propose the terms and conditions on which they would have the project proceed.**
Step 6	**The NWMO and the community with the preferred site enter into a formal agreement to host the project.** The NWMO selects the preferred site, and the NWMO and community ratify a formal agreement.
Step 7	**Regulatory authorities review the safety of the project through an independent, formal and public process, and if all requirements are satisfied, give their approvals to proceed.** The implementation of the deep geological repository 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. Regulatory requirements will be observed throughout all previous steps in the siting process. The documentation produced through previous steps, as well as other documentation that will be required for a licence application, will be formally reviewed by regulatory authorities at this step through an Environmental Assessment, and if this assessment is successful, then licensing hearings related to site preparation (and possible construction) of facilities associated with the project. Various aspects of transportation of used nuclear fuel will also need to be approved by regulatory authorities.
Step 8	**Construction and operation of an underground demonstration facility proceeds.** The NWMO will develop the centre of expertise, launched in Step 4, to include and support the construction and operation of an underground demonstration facility designed to confirm the characteristics of the site before applying to regulatory authorities for an operating licence. Designed in collaboration with the community, it will become a hub for knowledge-sharing across Canada and internationally.
Step 9	**Construction and operation of the facility.** The NWMO begins construction of the deep geological repository and associated surface facilities. Operation will begin after an operating licence is obtained from regulatory authorities. The NWMO will continue to work in partnership with the host community in order to ensure the commitments to the community are addressed throughout the entire lifetime of the project.

The business plan assumes that over the five-year period, some communities will elect to move through sequential steps of preliminary assessments and site evaluations. As communities advance in the site selection process, work will proceed together with the involvement of Aboriginal peoples and surrounding communities. Work plans for the 2015 to 2019 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. The NWMO will assist interested communities in engaging First Nations and Métis peoples and surrounding communities in a regional study of environmental, social, cultural and economic effects, and detailed site investigations. Involvement of communities in the area will help ensure that the broad 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 must work to assist provincial governments to become informed and 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 Adaptive Phased Management and to address questions and concerns, including how used nuclear fuel will be contained and isolated from groundwater, people and the environment. The NWMO also supports communities to build understanding of how the project may help or hinder a community's ability to achieve its long-term plan; to engage citizens, surrounding communities and Aboriginal peoples; and to assess willingness to host the project. Funding and resources will be provided to support interested communities as they work through each step. To assist communities in capacity building, the NWMO will provide funding and resources through a program collaboratively developed with communities involved in the site selection process. As the siting process advances, funding and resources will also be provided to Aboriginal peoples and communities in the surrounding area.

As communities advance in their learning about the project and in the site selection process, understanding what would constitute a 'compelling demonstration of willingness', is an important question. Those in the surrounding area would also like to better understand the nature of their involvement. Working collaboratively with those involved in the siting process to articulate expectations in this area 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 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 support a narrowing down of potential siting areas, and support future selection of a preferred location to be the focus of Step 4 detailed site characterization. Detailed site characterization (Step 4) will include further geological investigations, safety assessments, environmental assessments, and social and economic impact assessments. This work will be planned and conducted, in collaboration with interested communities, Aboriginal peoples and surrounding areas. 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 siting 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 to be able to safely contain and isolate used nuclear fuel for a very long period of time, the community must be informed and willing to host the facility, 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 the communities 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 we continue implementing the site selection process, we understand it will take our 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)

In 2015, many communities are expected to be involved in preliminary assessments as part of Step 3 in the site selection process.

These studies are 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 and the NWMO to explore suitability together.

The Two Phases of Work

Work is conducted in two phases during the planning period, with the opportunity for stock-taking by both the community and the NWMO at the end of each phase. Some communities with relatively low potential to be suitable for the project may be screened out of the process at the end of the first phase of work. By the end of the second phase of work, one or two communities or siting areas with strong potential to meet the requirements of the project may be selected for the next step in the site selection process: detailed studies over a three- to five-year period (Step 4). Resources are available to communities participating in the site selection process to cover costs associated with participation in the project throughout all phases of work.

Preliminary assessment studies involve work in a number of areas:

- Geoscientific studies: Is there potential to find a suitable site in the community?
- Engineering studies: Is there potential to safely construct the facility in the community?
- Transportation studies: Is there potential for safe and secure transportation?
- Environment and safety studies: Is there potential to manage any environmental effects and to ensure safety of people and the environment?
- Social, economic and cultural studies: Is there potential to foster the well-being of the community and region and to lay the foundation for moving forward?

Focus of Phase 2 Preliminary Assessments

The primary goal of Phase 2 preliminary assessments is to select a preferred location to take into detailed site characterization (Step 4):

- Build confidence that a strong safety case for the site can be developed, as shown through:
  - Geoscientific assessments – surveys, field mapping, limited borehole drilling
  - Environmental surveys, mapping, sampling and analysis
  - Engineering design and repository layout
  - Safety assessment modelling
- Build confidence that used nuclear fuel can be safely transported to location; and
- Build confidence that a strong partnership can be developed with the interested community, local Aboriginal peoples and surrounding communities.

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

- Technical evaluation of potentially suitable areas continues 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, secure long-term containment and isolation of used nuclear fuel. Activities will 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. Community members and those in the area will be engaged to help identify and refine the list of potentially suitable siting areas that would be socially acceptable.
- Environment and safety evaluations will focus on specific areas guided by input from the interested community, Aboriginal peoples and surrounding communities. Field studies and discussions with the local community and Aboriginal peoples will build understanding of the environmental conditions of the areas being studied.
- Potential transportation routes and mode(s) 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 assessments 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 community and with First Nations and Métis peoples and surrounding communities will be broadened to 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 the foundation to work together to implement the project. Engagement will explore the potential for these 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.

Phase 2 assessments are expected to take at least three to four years to complete, and likely longer. Additional time may be required to support assessments to provide the confidence required to narrow down potential siting areas and select a preferred siting area. Not all communities that begin this phase of work will necessarily complete the full sequence of Phase 2 studies. Through regular stock-taking by the NWMO and the community as Phase 2 studies progress, a decision may be made part way through the work to conclude studies. This would be the case if studies at any point suggested the community does not have strong potential to meet the requirements of the project.

Aboriginal Traditional Knowledge

Aboriginal peoples have a special relationship with the natural environment, and unique stewardship responsibilities that are part of this relationship. The knowledge that comes from this relationship with the land brings special understanding to the broad range of factors that should be considered in field studies, social assessments, and assessing benefits and effects to be managed.

The NWMO will work together with Aboriginal communities in potential siting areas to respectfully apply Traditional Knowledge to both technical safety and community well-being aspects of the site selection process. Traditional Knowledge will also guide the NWMO's engagement with Aboriginal communities and local Elders, providing guidance on spiritual and cultural considerations, and developing and maintaining effective and meaningful relationships between generations and within and between communities. The NWMO expects that integrating Aboriginal Traditional Knowledge into the identification and assessment of potentially suitable sites will lead to an expanded set of considerations to assess the suitability of a site, new and different approaches to data collection and interpretation, and a perspective on ways of life that will be important to informing more detailed studies.

Review by Geoscientific Review Group

Geoscientific studies are reviewed by the Adaptive Phased Management Geoscientific Review Group (APM-GRG), and their reports are published on the NWMO website at www.nwmo.ca/sitingprocess_preliminaryassessments_apm-grg. This group was established by the NWMO to provide advice and guidance on the approach, methods and findings of the geoscientific preliminary assessments that are part of the studies conducted in Step 3 of the site selection process. The five APM-GRG members are internationally recognized experts from Canada, Switzerland, Sweden and Australia. They bring a wide range of expertise and experience relevant to geoscientific site evaluations.

Going Forward

In the period 2015 to 2019, the NWMO will:

- Continue work to explore technical safety considerations through illustrative postclosure safety assessments of the deep geological repository and preparation of generic used nuclear fuel transportation risk assessments, including disruptive scenarios;
- Continue to support communities in developing capacity to consider their interest in the site selection process;
- Continue to support communities in responding to the values-based requirements of the process, including appropriate engagement of citizens and transparency;
- Continue to seek advice of municipal associations and Aboriginal organizations on materials and tools to support a community-driven siting process;
- Continue to develop mobile exhibits and tools to support local and regional-based discussions of Adaptive Phased Management and siting;
- Refine and enhance approaches to assessing willingness;
- Refine and enhance approaches to engaging Aboriginal peoples and those in the surrounding area in siting decision-making in the spirit of partnership;
- Refine tools and methods for geoscientific assessment of candidate sites in both crystalline and sedimentary rock settings;
- Provide engineering designs to support evaluation of candidate sites;
- Provide preliminary environment and safety assessments to support evaluation of candidate sites;
- 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;
- Refine tools and methods for informing and engaging citizens in decision-making;
- Engage interested communities in more intensive learning about the project, and explore and help assess the extent to which the project might contribute to or detract from the well-being of the community;
- Establish and sustain NWMO presence in communities that decided to enter the site selection process to provide information and support public engagement;
- 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;
- Conduct preliminary assessments (Step 3 – Phase 1 Preliminary Assessment) collaboratively with the communities that pass initial screening and decide to proceed to Step 3;
- Upon conclusion of Phase 1 work, identify a smaller number of communities eligible to be carried forward to next phase of work (Step 3 – Phase 2 Preliminary Assessment) and seek their agreement to proceed to the next phase of work;
- Initiate preliminary field investigations, and engage surrounding communities and Aboriginal peoples (Step 3 – Phase 2 Preliminary Assessment);

- Through Phase 2 work, build information to guide a future decision on selection of siting area(s) to be the focus of detailed site characterization (Step 4) and seek agreement to proceed to the next phase of work;
- Ensure readiness to begin detailed site evaluations (Step 4) and expanded regional studies in collaboration with communities;
- Plan for future centres of expertise to support technical and social assessments and discussion of community wellbeing issues;
- Conduct research on partnership and power-sharing frameworks for consideration in structuring of a formal agreement with the community, Aboriginal peoples and the area, once selected; and
- Explore long-term knowledge transfer considerations, such as markers and archives, as part of international collaborative research efforts (Nuclear Energy Agency).

In 2015, the NWMO will:

- Work in partnership with communities as they proceed through the siting process;
- Implement, support and further develop the *Learn More Program* for community capacity building to meet the needs of interested communities, First Nations and Métis peoples and surrounding areas;
- Conduct preliminary desktop assessments upon request of interested communities with potentially suitable sites (Step 3 – Phase 1). Continue desktop work to assess geoscientific, engineering, transportation, and environment and safety factors, as well as potential to foster well-being of the community, Aboriginal peoples and surrounding area, including factors identified by Aboriginal Traditional Knowledge;
- Conduct field studies upon request of interested communities with strong potential to meet the requirements of the project (Step 3 – Phase 2). Field studies will help advance the assessment of geoscientific, engineering, transportation, and environment and safety factors, as well as potential to foster well-being of the community, Aboriginal peoples and surrounding area, including factors identified by Aboriginal Traditional Knowledge;
- Develop and implement local and regional outreach plans to deepen understanding of regional perspectives and build relationships in the broader area;
- Continue to seek opportunities to engage First Nations 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 coordination and collaboration with provincial governments aimed at identifying mechanisms and processes to address provincial areas of interest; and
- Continue to develop communication materials to support learning and dialogue on the project description, the safety of the repository, and transportation considerations.

Optimize Repository Designs

The 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 containment and repository performance to meet or exceed the regulatory expectations of the Canadian Nuclear Safety Commission (CNSC), the guidance of the International Atomic Energy Agency and the experience in other countries.

The NWMO's technical program supports Adaptive Phased Management in three key areas: siting, conceptual 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 Adaptive Phased Management.

A strong technical program ensures that Adaptive Phased Management benefits from knowledge and innovation in the long-term care of used nuclear fuel from Canada and abroad, including Finland, France, Japan, Sweden, Switzerland, the United Kingdom and the United States. 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 optimization. Over the next five years, physical prototypes of the long-lived repository container designs will be manufactured and tested. This will incorporate the best design practices, state-of-the-art manufacturing technologies, and demonstrate our 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 Adaptive Phased Management 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 Adaptive Phase Management is the incorporation of new learning and knowledge.

Going Forward

In the 2015 to 2019 time period, technical program activities will complete work to update repository designs and safety assessments, complete CNSC pre-project review in both crystalline and sedimentary rock, and implement a proof test plan to verify a Canadian-engineered barrier system in advance of submission of site preparation and construction licences. Further studies, analyses and joint activities will continue with international partners to improve understanding of advancing processes and to provide further confidence in the safety case for a deep geological repository.

In the period 2015 to 2019, the NWMO will:

- Complete CNSC pre-project reviews of postclosure safety assessments of a used nuclear fuel deep geological repository in crystalline and sedimentary rock;
- Complete design, fabrication and testing of prototype repository containers, buffer system and emplacement system;
- Complete the update to the conceptual design and cost estimate for Adaptive Phased Management;
- 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
- Establish a prototype test and demonstration facility for engineered barrier evaluations.

In 2015, the NWMO will:

- Begin to operate an engineered barrier test and demonstration facility;
- Build and pressure test a prototype used fuel container;
- Build a full scale buffer box; and
- Demonstrate bentonite placement.

Focus on Safety

Used Nuclear Fuel Repository Container

The NWMO's container technology program focuses on integrating state-of-the-art manufacturing and materials technologies related to geometry (container size and shape), corrosion barrier (coating and fabrication), welding and inspection to develop and demonstrate robust containers for holding the used nuclear fuel within the repository. An extensive proof testing of the containers and the engineered barrier system is planned.

Health and Safety of the Public and Workers

The NWMO's repository design will protect public health and worker safety. The design will be optimized to minimize the risk of exposure to radioactive or other hazardous materials, and the risk from accidents. This will be tested in part through safety assessments, which examine the behaviour of the design under both likely and unlikely scenarios. The NWMO has submitted generic safety assessments to the CNSC to illustrate our methodology for assessing long-term safety. We are continuing to apply and improve our safety assessment approach, considering both operational and long-term safety.

Continuously Improve Technical Knowledge

The NWMO will continuously improve technical knowledge in collaboration with universities and international partners, and adapt plans consistent with international best practices.

New to this Implementation Plan

The 2015-2019 Implementation Plan brings together in a single program stream the NWMO's ongoing work to advance technical knowledge to support the implementation of Canada's plan.

This reflects the importance of the NWMO's collaboration with universities and international partnerships to stay abreast of and contribute to the advancement of developments in the field of used nuclear fuel management. This work will be increasingly important over the next five years as the NWMO develops and refines site specific designs as assessments of potential host areas continue.

In order to continuously improve technical knowledge, the NWMO maintains a multi-faceted program. This program includes: collaboration with waste management organizations around the world and international agencies to advance knowledge through design refinements and cooperative research; partnership with universities in Canada and internationally; and support for post-secondary education.

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 optimization and improvement of designs, illustrative safety analyses, and the advancement of related engineering and scientific methods, 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 of the Organisation for Economic Co-operation and Development (OECD), to exchange best international practices 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 repository design 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 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 and use of technologies.

Going Forward

In the period 2015 to 2019, the NWMO will:

- Advance learning and exchange experiences through collaboration with interested academics and organizations in Canada and internationally;
- Continue to participate in the OECD Nuclear Energy Agency's Radioactive Waste Management Committee and Integration Group on the Safety Case;
- Continue to participate in SKB's Äspö Hard Rock Laboratory in crystalline rock through the Task Force on Engineered Barrier Systems and the Long-Term Test of Buffer Material;
- Continue to partner in 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. This underground facility hosts experiments to advance the scientific understanding of geologic disposal for long-term nuclear waste management;
- Continue to support the Nuclear Energy Agency's (NEA) 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 such organizations as the Canadian Nuclear Society (CNS), the NEA of the Organisation for Economic Co-operation and Development, and the International Atomic Energy Agency;
- Continue to host an annual Geoscience Seminar to bring together researchers from academia and industry;
- Continue to support research partnerships with universities across Canada and internationally to ensure the NWMO's technical work is scientifically rigorous;
- Continue to support, along with the Natural Sciences and Engineering Research Council of Canada (NSERC), graduate students through the NSERC's Industrial Postgraduate Scholarship Program;
- Continue to provide support to university students by acting as mentors, by participating on PhD thesis committees, and by sharing expertise through review of research proposals and theses, and hands-on assistance with the design and setup of specific experiments or methods;
- 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;
- 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 Adaptive Phased Management in the future.

Develop Transportation Plans

The NWMO will establish safe, secure and socially-acceptable plans for transporting used nuclear fuel.

New to this Implementation Plan

The 2015-2019 Implementation Plan brings together in a single program stream the NWMO's ongoing work to establish safe, secure and socially acceptable plans for transporting used nuclear fuel.

This change reflects the importance of transportation as an element of the APM program. It also reflects the feedback the NWMO has received in its engagement activities. People have urged the NWMO to communicate in an integrated way about its plans in the important area of transportation.

The NWMO has heard that there is societal interest in seeing explicit recognition of the range of technical aspects being considered, including safety of container designs, possible modes and infrastructure requirements, safety of health and workers, risk assessment, security, and emergency response planning. There is also interest in knowing more about the engagement activities planned by the NWMO. Governments, organizations and communities have advised that the NWMO should put resources in place now to support transportation work and dialogue, which in future years will become a more prominent component of the program.

The NWMO Advisory Council emphasizes that technical and social considerations of transportation must be a key priority for the NWMO for the five-year planning period. The Advisory Council has urged that the NWMO take timely action to understand public perceptions of risk around transportation, with engagement designed to explore concerns and provide opportunities to address them. Going forward, the NWMO's specific activities will be guided also by the many suggestions received for the broad scope of engagement required to involve all those potentially affected.

Transportation of used nuclear fuel is an important element of the APM project. Implementation of the APM program may involve transporting used nuclear fuel long distances from the current interim storage sites to the host area for the used fuel repository and centre of expertise.

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 to the site from the locations at which it is currently stored. Transportation planning and evaluations must fully address regulatory requirements for transporting used 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 nuclear 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 and preferences, 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, concerns and preferences 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.
- Identification and design of the necessary transportation equipment and facilities.
- A completed full transportation risk assessment, including public and worker dose assessments.
- Defined an approach for emergency response.
- Clearly identified security requirements.
- Addressed and take 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 2015 to 2019, the NWMO will:

- Develop logistics studies for transporting used nuclear fuel by road and/or rail from interim storage sites to potential host communities, including potential transportation routes and mode(s) to each potential repository site against technical safety criteria;
- Conduct transportation risk assessment studies for Phase 2 communities;
- Update the public dose assessment study and conduct a worker dose assessment;
- Seek certificates of approval for road and rail packages;
- Construct and test all equipment;
- Develop updated package designs for transportation container, with consideration of 'beyond design basis' scenarios;
- 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 wastes in Canada and internationally, to identify lessons that apply to Adaptive Phased Management.

Provide Financial Surety

The 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 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 Adaptive Phased Management lifecycle 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 Adaptive Phased Management Project is estimated to be $19.5 billion (2014 $), or taking into account the time value of money, present value of $8.4 billion (2014 $) for the lifecycle liabilities from 2014 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 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 *Nuclear Fuel Waste Act*

The planning, development and implementation of the Adaptive Phased Management Project is funded by the major owners of used nuclear fuel in Canada: Ontario Power Generation, NB Power, Hydro-Québec and Atomic Energy of Canada Limited. The *Nuclear Fuel Waste Act* (*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 *Nuclear Fuel Waste Act*, 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 2015 to 2019, the NWMO will:

- Annually assess all factors that impact Adaptive Phased Management cost estimating and funding requirements;
- Update the total cost estimate for Adaptive Phased Management no later than 2017;
- Continue to publish the audited financial statements of the Members' nuclear fuel waste trust funds as they are provided by the financial institutions (see www.nwmo.ca), and provide updates to confirm that the waste owners 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 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 will be regulated under the *Nuclear Safety and Control Act* (*NSCA*) 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 Adaptive Phased Management repository can only be taken after the successful completion of the environmental assessment process under the *Canadian Environmental Assessment Act*. 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, NB Power 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 and public affairs, business ethics, environment, law, medicine, political science, municipal affairs, Aboriginal relations and Aboriginal Traditional Knowledge. 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 Adaptive Phased Management site selection. As the NWMO's work leads to the selection of an informed and willing host community, and as affected Aboriginal organizations and 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 scientific disciplines, as well as expertise in Traditional Aboriginal Knowledge, as outlined in the *Act*.

POLICIES AND PROCEDURES

Since 2010, the NWMO has maintained ISO 9001:2008 certification covering its quality management system for activities in support of site selection and development of repositories for the long-term management of nuclear waste. In addition, NWMO governance is designed to meet the requirements of CSA N286-12, Management System Requirements for Nuclear Facilities, as they apply to the development of a deep geological repository.

In 2012, the NWMO received certification that its health and safety governance is in compliance with CSA Z1000:2006 Occupational Health and Safety Management, and that its environmental governance is in accordance with ISO 14001:2004 Environmental Management Systems. Monitoring, auditing and management review activities where safety is paramount to maintain these certifications will continue.

INDEPENDENT TECHNICAL REVIEWS

The NWMO will continue to seek external expert review and comment of its technical program. The NWMO has used the Independent Technical Review Group (ITRG) since 2008 to provide comment on the technical research program and informed the Advisory Council and the Board of Directors. Moving forward, as the technical program moves from research into design and fabrication, the nature of the technical reviews will be more focused to the specific designs such as the engineered barrier design. As with the ITRG, 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, 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 Adaptive Phased Management. 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 2015 convention as part of the delegation led by the CNSC.

Triennial Report

The *Nuclear Fuel Waste Act* sets out very specific reporting requirements for the triennial reports. Triennial reports were issued in 2011 and 2014, and the next triennial report will be issued in 2017. The triennial reports include:

a) a summary of [the NWMO's] activities respecting the management of nuclear fuel waste during the last three fiscal years, including an analysis of any significant socio-economic effects of those activities on a community's way of life or on its social, cultural or economic aspirations;

b) its strategic plan for the next five fiscal years to implement the approach that the Governor in Council selects under section 15 or approves under subsection 20(5);

c) its budget forecast for the next five fiscal years to implement the strategic plan;

d) the results of its public consultations held during the last three fiscal years with respect to the matters set out in paragraphs *a)* and *b)*; and

e) the comments of the Advisory Council on the matters referred to in paragraphs *a)* to *d)*.

Going Forward

In the period 2015 to 2019, the NWMO will:

- Convene regular meetings of NWMO Members, Board of Directors, Board Committees and Advisory Council;
- Coordinate annual reviews of the NWMO's technical program;
- Coordinate annual reviews of the APM geoscience plans with the APM Geoscientific Review Group;
- Conduct assessments and audits of internal governance to maintain and achieve certifications to management system standards for quality, safety and environmental management;
- Interact with the CNSC on Adaptive Phased Management in the pre-licence application period consistent with the terms of the service agreement that identifies the CNSC's early involvement in the Adaptive Phased Management Project prior to submission of a licence application. These areas include the CNSC participating in community or other meetings to provide information on the regulator's role, identifying regulatory requirements for a repository and providing regulatory review of conceptual Adaptive Phased Management safety assessments;
- Report to Canadians on its progress in implementing Adaptive Phased Management. 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 the Advisory Council;
- Report internationally on progress for the long-term management of Canada's used nuclear fuel at the 2015 meeting of the *Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management*; and
- Undertake membership review, and make appointments to the Advisory Council to ensure members bring a broad range of expertise.

The Road Ahead

The NWMO invites all Canadians and Aboriginal peoples of Canada to stay involved in Adaptive Phased Management 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.

Adaptive Phased Management will proceed as expeditiously as Canadians, successful technology demonstration and the regulatory authorities allow. 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.

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 as an option, should it be needed, to provide a contingency in the event of unplanned circumstances. 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 Adaptive Phased Management 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 to take advantage of new technologies which may emerge in the future; for instance, technologies which might reduce the hazard associated with used nuclear fuel over the long term.

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 2015 to 2019

DRAFT FOR PUBLIC REVIEW

1. The draft Plan is built around seven 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

Please reply by December 15, 2014, to:
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SOCIÉTÉ DE GESTION DES DÉCHETS NUCLÉAIRES