NUCLEAR WASTE MANAGEMENT ORGANIZATION
SOCIÉTÉ DE GESTION DES DÉCHETS NUCLÉAIRES

# Frequently Asked Questions

Implementing Canada's plan for the long-term management of used nuclear fuel requires public confidence. The Nuclear Waste Management Organization (NWMO) is committed to openness and transparency, and to providing the information that people need to understand and participate in our processes. This document provides responses to some of the questions most frequently asked about the NWMO, Adaptive Phased Management and the Process to Select a Site for a Deep Geological Repository.

## The NWMO

### What is the Nuclear Waste Management Organization?

The Nuclear Waste Management Organization (NWMO) was created by Canada's nuclear electricity producers to provide recommendations on the long-term management of used nuclear fuel and to implement the approach selected by the Government of Canada. Ontario Power Generation Inc., NB Power Nuclear and Hydro-Québec are the founding Members, and along with Atomic Energy of Canada Limited, fund the NWMO's operations.

The NWMO derives its national mandate from the *Nuclear Fuel Waste Act*, which came into force in November 2002.

### What is the role of the NWMO Advisory Council?

The Advisory Council's role is to provide independent comment every three years on the activities of the NWMO. The Council's statements, which include observations on the results of NWMO public consultations and analysis of any significant socio-economic effects of the organization's activities, are published in the NWMO's triennial reports, beginning with the 2010 report. The Council is also obliged by the *Nuclear Fuel Waste Act* to comment on the organization's five-year strategic plans and budget forecasts. Advisory Council comments are submitted to the Minister of Natural Resources Canada and made public at the same time.

In addition to its legislated reporting requirements, the Advisory Council outlines its activities on a yearly basis for inclusion in the NWMO Annual Report. The Council meets regularly with the NWMO, following closely the development of the organization's plans and activities, and providing ongoing counsel and advice.

### Who is on the NWMO Board of Directors?

The NWMO Board is composed of nine Directors appointed by the Member companies. Dr. Gary Kugler serves as Chairman, and Mr. Ken Nash is President and CEO. Others appointed by Ontario Power

Generation are Mr. C. Ian Ross, Mr. Ron Jamieson, Dr. Deborah Poff, Mr. Pierre Charlebois and Mr. Donn Hanbidge. Ms. Josée Pilon is appointed by Hydro-Québec, and Mr. Darren Murphy is appointed by NB Power Nuclear.

### When does the NWMO report?

The NWMO was required to present its study and recommended approach to the Government of Canada by November 15, 2005. It did so on November 3, 2005. The organization is also required to report annually to the Minister of Natural Resources Canada, who tables the NWMO annual reports in Parliament. The NWMO's reports are made public at the same time that they are submitted to the Minister.

### What is used nuclear fuel?

Used nuclear fuel is a by-product of electricity generation by nuclear power plants. Canadian nuclear power plants are fuelled by uranium pellets that are sealed inside zirconium tubes and arranged into fuel bundles. Once a fuel bundle has been used to generate electricity, it is highly radioactive and must be carefully managed for a very long period of time, essentially indefinitely.

Used nuclear fuel in Canada is safely managed on an interim basis in licensed facilities at nuclear reactor sites. The NWMO is responsible for its long-term management.

CANDU fuel bundle

### How much used nuclear fuel exists in Canada, and how is it being managed now?

Canada has been generating electricity from nuclear power for more than 40 years. In that time, we have produced just over two million used fuel bundles. Each bundle is about the size and shape of a fireplace log, weighing approximately 24 kilograms. If the entire current inventory could be stacked like cordwood, they could fit into a space the size of six hockey rinks from the ice surface to the top of the boards.

Used nuclear fuel dry storage containers at Ontario Power Generation's Western Waste Management Facility

Used nuclear fuel is safely stored on an interim basis in licensed facilities located at reactor sites where it is produced. After a fuel bundle is removed from a reactor, it is first placed in a water-filled pool for seven to 10 years where its heat and radioactivity decrease. Afterwards, used fuel bundles are typically placed in dry storage containers, silos or vaults.

About 85,000 used nuclear fuel bundles are produced in Canada each year.

## Adaptive Phased Management

### What is Canada's plan for the long-term management of used nuclear fuel?

Canada's plan for the long-term management of used nuclear fuel is called Adaptive Phased Management. Adaptive Phased Management is both a technical method and a management system, with an emphasis on adaptability.

Technically, Adaptive Phased Management has as its end point the containment and isolation of used nuclear fuel in a deep geological repository constructed in an appropriate rock formation where the used fuel will be safely and securely contained by engineered barriers and the surrounding geology. The management system involves realistic, manageable phases – each marked by explicit decision points with continuing participation by interested Canadians. It is flexible, allowing for "go, no-go" decisions at each stage to take advantage of new knowledge or changing societal priorities.

The NWMO will seek an informed, willing community to host the repository, the underground demonstration facility and the associated centre of expertise that will be a hub for national and international scientific collaboration. Continuous learning and adaptability will underpin implementation of this high-technology, national infrastructure initiative that will unfold over many decades, subject to extensive regulatory approvals and oversight. The NWMO will involve citizens at all key stages and in decision-making through engagement that is transparent and inclusive.

Adaptive Phased Management provides an option for shallow underground storage at the central site if some or all the used fuel need to be moved before the deep repository is available. It also provides for continuous monitoring throughout implementation for retrievablity for an extended period.

Adaptive Phased Management is the plan that the NWMO recommended following its three-year study and dialogue with Canadians (2002-2005), and the plan approved by the Government of Canada in 2007.

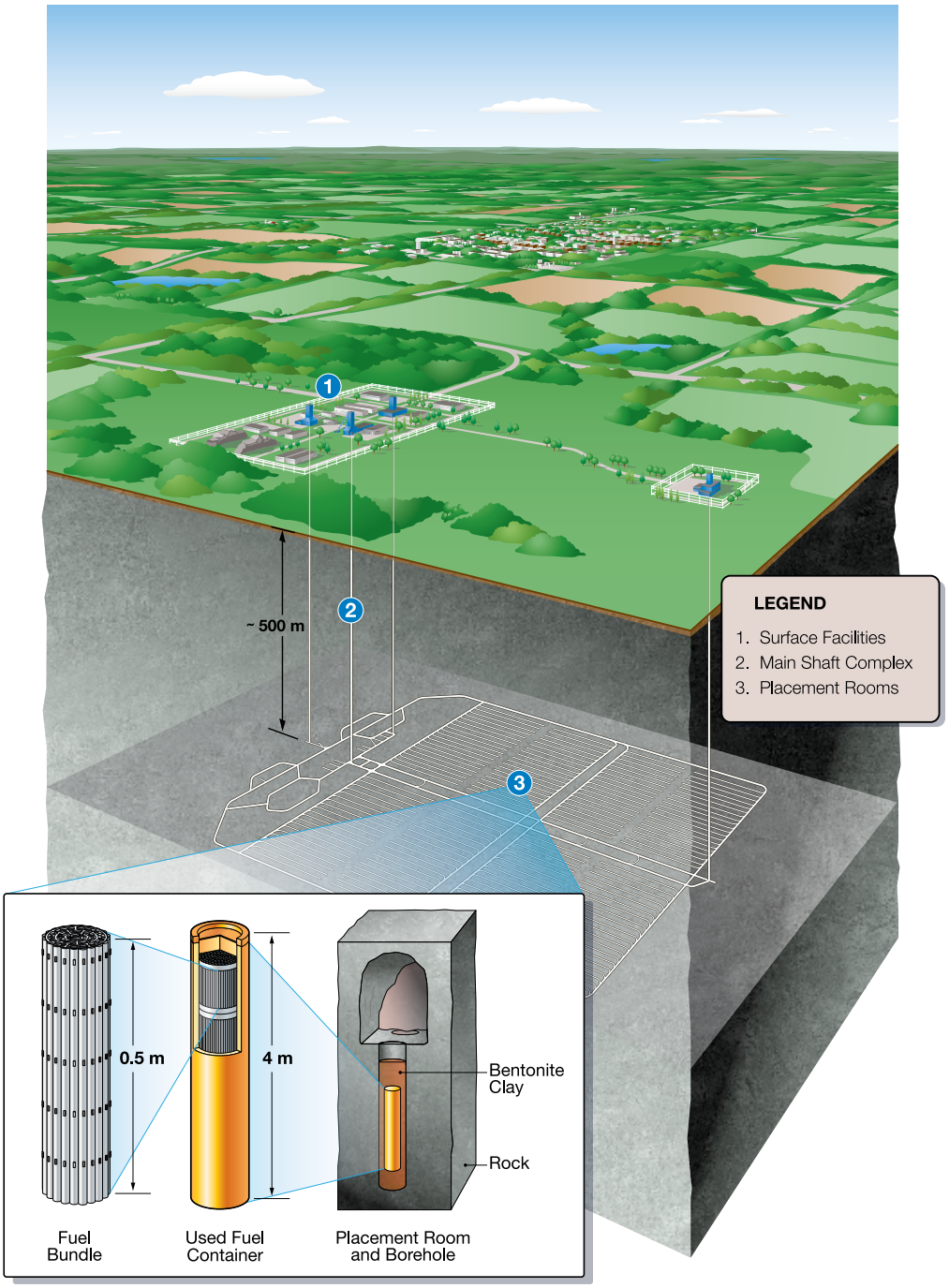
### Why is this plan needed?

For decades, Canadians have been using electricity generated by nuclear power reactors in Ontario, New Brunswick and Quebec. When used nuclear fuel is removed from a reactor, it remains a potential health risk for many hundreds of thousands of years and must be safely isolated from people and the environment essentially indefinitely.

Today, Canada's used nuclear fuel is safely stored on an interim basis at licensed facilities located where it is produced. Like many other countries with nuclear power programs, Canada is planning for the future. Ensuring the long-term, safe and secure management of used nuclear fuel is an important responsibility we as Canadians share. Canadians have emphasized that safety and security are the top priority now and in the future, and that this generation must assume active responsibility for putting in place a plan for the long-term stewardship of used nuclear fuel.

### How was this plan developed?

Adaptive Phased Management is the plan that emerged from a three-year study led by the NWMO from 2002 to 2005. The study engaged thousands of citizens, specialists and Aboriginal peoples in every province and territory as a range of management options were assessed. The plan draws on more than 30 years of research, development and demonstration of technologies and techniques in Canada and elsewhere. It is in line with best international practice and has been designed to meet the expectations expressed by Canadians throughout the study.




Deep Geological Repository in Adaptive Phased Management

## Do Canadians support Adaptive Phased Management? How do you know?

The Adaptive Phased Management approach emerged from the three-year dialogue the NWMO had with Canadians and is responsive to the priorities they said were important. In dialogues after the recommendation was published in draft, most participants – except those who feel no long-term management approach is appropriate without first phasing out nuclear power – told us that on the overall, Adaptive Phased Management is a reasonable and appropriate approach for Canada.

During the study, individuals and groups with diverse perspectives proposed values and objectives to guide the NWMO's decision-making. The majority of those we engaged recognized the need to move forward and begin the process of implementing a long-term management approach for used nuclear fuel. Adaptive Phased Management has a clear direction with flexibility built in to explore areas where citizens wish to gain greater confidence.

## What facilities will be constructed?

This is a national infrastructure project that will involve the development of a deep geological repository with placement rooms for used nuclear fuel, approximately 500 metres underground. Supporting the repository will be an underground demonstration facility, surface buildings and a centre of expertise that will become a hub for national and international scientific collaboration.

## How will people and the environment be protected?

A multiple-barrier system will safely contain and isolate the used nuclear fuel. The repository and containers for used fuel are designed to provide multiple engineered barriers using robust, corrosion-resistant materials. A further barrier is provided by the host rock in which the repository is built. The geology provides the principle barrier between the used fuel containers and the surface environment. Many years of investigation will be involved in demonstrating that the geology in that location meets strict technical safety requirements. Once placed in the repository, the used nuclear fuel will be monitored and retrievable.

## How will the project be regulated?

The project will be subject to a thorough and comprehensive regulatory review process to ensure that it is implemented in a manner that protects people and the environment, now and in the future. The site selected will need to meet or exceed regulatory requirements.

The Canadian Nuclear Safety Commission (CNSC) will review and assess the project and site locations, and ultimately, it will be responsible for issuing licences authorizing the project to proceed to different phases of its life cycle development. An environmental assessment will be required under the *Canadian Environmental Assessment Act* to ensure the project will not cause significant adverse environmental effects. Various aspects of transportation will also need to be approved.

The Government of Canada, through Natural Resources Canada, monitors the NWMO on an ongoing basis to ensure compliance with the *Nuclear Fuel Waste Act.*

Provincial legislation will cover many aspects of the project, including emergency preparedness, public and occupational health and safety, and environment. Municipal requirements will also need to be addressed.

In addition, a number of international treaties and agreements will apply. Canada is a signatory to the *Treaty on the Non-Proliferation of Nuclear Weapons* and the *Canada/IAEA Safeguards Agreement*. Operating under the jurisdiction of the CNSC, the NWMO will be required to manage itself in accordance with the *Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management*.

## Where will the repository be located?

The process for selecting a central site has been developed collaboratively with Canadians. The deep geological repository will be located in an informed and willing host community at a site that meets rigorous technical and safety criteria. The project will not be imposed on any community.

## What are the transportation requirements?

Used nuclear fuel will be transported from the interim storage facilities, where it is produced and safely managed now, to the centralized site of the deep geological repository. Depending on the location of the site, this may involve the use of road, rail or water transport, or a combination of these modes, which are used widely today internationally. The NWMO will need to demonstrate the safety and security of the transportation system to regulatory authorities and citizens before transportation of used nuclear fuel to the repository can begin. Transportation of the material will need to meet stringent requirements set out by Transport Canada and the Canadian Nuclear Safety Commission.

## Can used nuclear fuel be transported safely?

Canadians can be confident that the material will be safely transported. There is a great deal of experience, both domestically and around the world, in the safe movement of used nuclear fuel.

Packages designed to transport used nuclear fuel are based on international standards and Canadian regulations. They are extremely robust and are tested to provide protection against the impact of a collision and the effects of fire and immersion in water.

Transporting radioactive materials is also a highly regulated activity. The NWMO will need to demonstrate the safety of any transportation system to the satisfaction of citizens and regulatory authorities before transportation of used fuel to the repository can begin. Transportation will need to meet stringent requirements laid out by Transport Canada and the Canadian Nuclear Safety Commission.

The NWMO will need to demonstrate the safety of any transportation system prior to its implementation. Our research and discussions with authorities in Canada and abroad suggest that used nuclear fuel can be transported safely. Internationally, many nations have been regularly transporting used fuel for decades. Robust transport containers are designed to withstand severe accidents and transport conditions, and must meet high standards that are continually reviewed by regulatory and licensing bodies.

Rail car with a transportation cask used in Europe (top-left); package and trailer for road transport of used nuclear fuel (top-right). Photos from Areva. Ship for used nuclear fuel transport in Sweden (left). Photo from SKB.

## How much will the long-term management of used nuclear fuel cost?

Over the life of the project, the long-term management of Canada's used nuclear fuel will cost $16 billion to $24 billion. As at January 1, 2010, the estimated present value cost is in the range of $7 billion to $8 billion. These estimates include costs for reactor site storage, which are carried out and funded by the individual waste owners; and costs to develop, construct and operate a central long-term facility, including a deep geological repository and transportation of the used nuclear fuel to the repository, which will be carried out and funded by the NWMO. The next generation of baseline cost estimates is expected to be completed in 2012.

## Who will pay for it?

The used fuel owners are responsible for all the costs. The *Nuclear Fuel Waste Act* requires that the planning, development and implementation of the project are 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* also requires each of these four companies to establish independently managed trust funds and make annual deposits to ensure the money to fund the project will be available when needed.

The NWMO has the responsibility for maintaining a funding formula and establishing the amount of deposits to trust funds required by each company on an annual basis. The funding formula was approved by the Minister of Natural Resources Canada in April 2009. Audited financial statements of each of the nuclear fuel waste trust funds are posted on the NWMO website annually.

The NWMO may access the trust funds only for the purpose of implementing Adaptive Phased Management once a construction or operating licence has been issued under the *Nuclear Safety and Control Act*.

### Will this facility manage foreign waste?

No. The *Nuclear Fuel Waste Act* establishes a mandate for the NWMO to manage Canada's used nuclear fuel. Adaptive Phased Management was developed collaboratively with Canadians to meet this mandate. The plan was recommended by the NWMO and approved by the Government of Canada on this basis.

### Does this plan legitimize new nuclear build?

The NWMO does not advocate one energy source over another. Used nuclear fuel exists and must be managed. Adaptive Phased Management addresses the need expressed by Canadians for safety, security and protection of the environment. The NWMO is committed to protecting both this and future generations in this regard. The organization has no view on energy choices.

### How does Adaptive Phased Management compare with what others are doing?

Internationally, countries are at different stages of designing or implementing their long-term management plans for used nuclear fuel. Canada's plan for a multiple-barrier system based on a deep geological repository is consistent with programs that have been developed in many other countries with nuclear power programs such as Sweden, Finland, France and the United Kingdom.

### Is Canada's plan adaptable to new learning?

Yes. By design, the plan builds in flexibility to act on new knowledge and adjust the way forward as necessary. In engaging with the NWMO, Canadians have underscored the importance of providing flexibility for future generations to shape decisions as the plan is designed and implemented over several decades. Many emphasized the importance of designing the repository in a way that allows for retrieval of the used fuel for an extended period, in order to provide future societies with access to the used fuel to take advantage of new technologies that may developed. Over this period of time, we may see changes in the priorities and preferences of the Canadian society, evolution in public policy or advances in technology. The NWMO is committed to continuous learning to inform decision-making at each step along the way.

## What are the NWMO's next steps?

Adaptive Phased Management is a long-term program that will be conducted in an open and transparent manner. The path forward will involve:

- Implementing the community-driven site selection process;
- Continuing to engage Canadians in formulating detailed plans and in making decisions;
- Advancing technical and social research in Canada and through international partnerships and collaboration;
- Continually updating our plans to align with ongoing technical and social developments;
- Building an organization with capabilities to implement Adaptive Phased Management; and
- Ensuring program costs and the funding formula remain updated.

## How can I follow the NWMO's progress in implementing Adaptive Phased Management?

On an annual basis, the NWMO publishes a five-year Implementation Plan that establishes the objectives and milestone activities for the next five years.

In each Annual Report, published and submitted to the Minister of Natural Resources Canada, the NWMO reports on its progress over the previous year.

These reports are available on the NWMO website at www.nwmo.ca, along with other material supporting the implementation of Canada's plan for managing used nuclear fuel over the long term.

## Site Selection Process

### How was the site selection process developed?

The process for selecting a site for the deep geological repository reflects the ideas, experience and best advice of a broad cross-section of Canadians who participated in dialogues conducted over a two-year period. Interested individuals and organizations shared their thoughts with the NWMO on what an open, transparent, fair and inclusive process for making this decision would include. The NWMO has also drawn on experiences and lessons learned in site selection processes in Canada and other countries.

### Why did it take two years to develop the site selection process?

The NWMO is committed to taking into account the views of all interested Canadians at each stage as we plan, design and implement Adaptive Phased Management. An important first step was the collaborative development of the site selection process.

In 2008, we invited interested organizations and individuals to contribute their suggestions and expectations for the principles, objectives and key elements that should guide the development of a fair and inclusive site selection process. With this input, we developed a proposed process.

Then in 2009, the NWMO invited public review and comment on the proposed site selection process that was published in a discussion document. The comments received enabled the NWMO to refine and finalize the process.

The NWMO believes it is important to take the time required to ensure that an appropriate process that meets the expectations of Canadians is in place to guide decision-making on a location for this important national initiative.

Reports from the 2008 and 2009 dialogues are available at www.nwmo.ca/what_we_heard.

### What are some of the features of the site selection process?

The site selection process is designed to ensure, above all, that the site which is selected is safe and secure and meets the highest scientific, professional and ethical standards. The process contains a number of steps identified by a broad cross-section of Canadians who participated in a two-year dialogue on what an open, transparent, fair and inclusive process for decision-making on siting would include. It is built on a set of principles that reflect the values and priorities of Canadians on this issue, including a commitment to locate this national infrastructure initiative in a community that is informed and has demonstrated its willingness to host the project.

The process provides a road map for communities considering hosting the project to explore and understand how their well-being could be affected, including what challenges they might face, how they might benefit, and what commitments they will have to make before deciding if they wish to be considered to host the facility. The site selection process is available at www.nwmo.ca/sitingprocess.

### What facilities will be constructed?

This is a national infrastructure project that will involve the development of a deep geological repository with placement rooms for used nuclear fuel, approximately 500 metres underground. Supporting the repository will be an underground demonstration facility, surface buildings and a centre of expertise that will become a hub for national and international scientific collaboration.

### How much land is required?

The project will require a dedicated surface area of about 100 hectares (250 acres) for the surface buildings and associated facilities. The underground repository itself will occupy a subsurface area in suitable host rock of approximately 2.5 kilometres by 1.5 kilometres (375 hectares/930 acres) at a depth of about 500 metres.

The NWMO would need to have rights to the land above the underground repository, although alternative uses would be considered, with the community, for portions of this land. There may be a need to limit activities in the immediate area surrounding the surface facilities in order to meet regulatory or other requirements.

### What are the transportation requirements?

Used nuclear fuel will be transported from the interim storage facilities, where it is produced and safely managed now, to the centralized site of the deep geological repository. Depending on the location of the site, this may involve the use of road, rail or water transport, or a combination of these modes, which are used widely today internationally. The NWMO will need to demonstrate the safety and security of the transportation system to regulatory authorities and citizens before transportation of used nuclear fuel to the repository can begin. Transportation of the material will need to meet stringent requirements set out by Transport Canada and the Canadian Nuclear Safety Commission.

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### How long will it take to confirm a site for the deep geological repository?

The process of site selection will be community-driven. Communities will determine if and when they wish to explore their potential interest with the NWMO. The nature, pace and manner of progressing through the phases of the site selection process will be determined in partnership with communities. The NWMO anticipates it may take 10 years before a specific site can be proposed. This is based on experiences with similar projects in other jurisdictions and the several years required to confirm all aspects of technical safety; understand potential social, economic, cultural and environmental effects of the project; and demonstrate community willingness.

### Has the NWMO identified some communities as potential hosts for the project?

No. The NWMO will be seeking an informed and willing community to host the project. The project will not be imposed on any community. Communities that are interested in learning more about the NWMO, Adaptive Phased Management and the deep geological repository for used nuclear fuel are invited to contact the NWMO. Communities that express interest in learning more are not obliged to participate in the site selection process.

### Has the NWMO ruled out certain areas?

No. Many areas in Canada have geological formations with the potential to safely and securely contain used nuclear fuel. However, detailed surface and subsurface investigations will be needed to confirm whether a specific site is in fact suitable. These detailed assessments will be undertaken on sites in communities that come forward with potential interest in hosting the project.

### What are the benefits for a community and region that host the project?

The project will be implemented through a long-term partnership involving the community, the larger region in which it is located and the NWMO. It is important that it be implemented in a way that will help foster long-term well-being and sustainability. The development and operations of the facilities will generate thousands of jobs in the host region and potentially hundreds of jobs in a host community for many decades.

### How can I learn more about Canada's plan for the long-term management of used nuclear fuel?

The NWMO is providing opportunities for interested individuals, organizations and communities to learn more about Canada's plan for the long-term management of used nuclear fuel, the activities of the NWMO, and the process it will use to select an informed and willing community to host this project. Communities that express interest in learning more are not obliged to participate in the site selection process.

For more information, please contact:

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