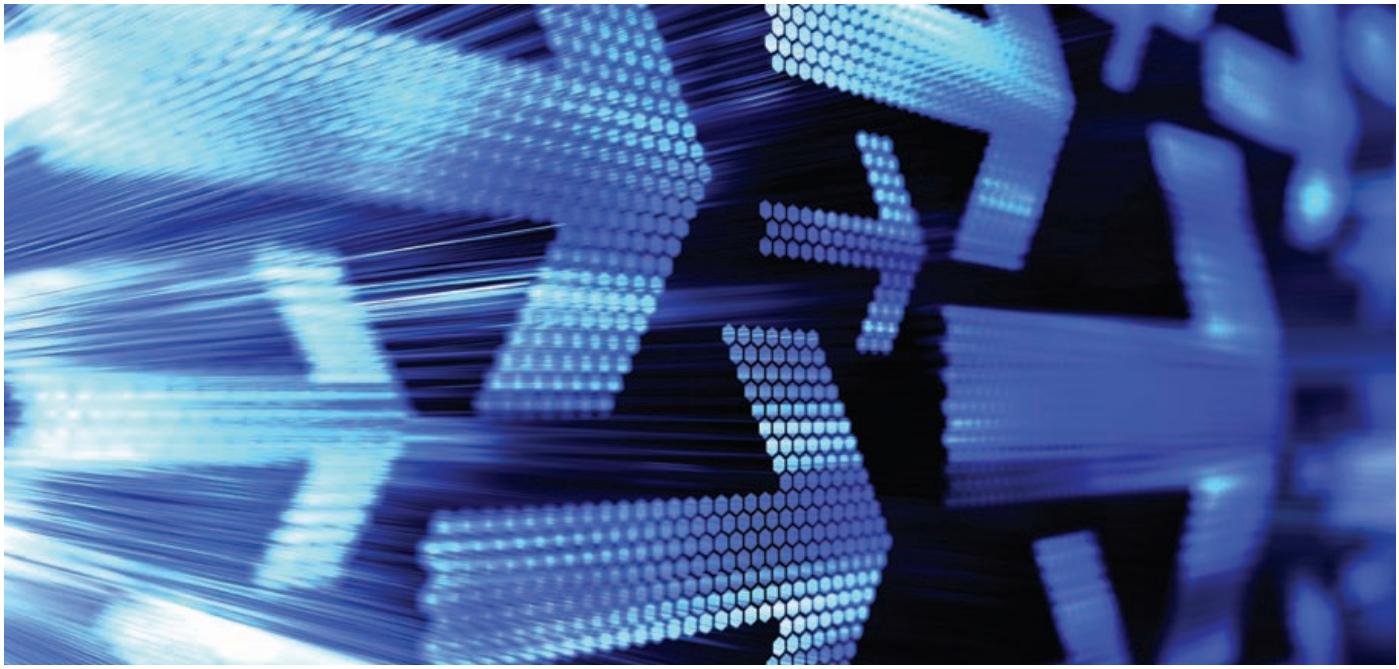

Implementing Adaptive Phased Management 2010 to 2014

DRAFT FOR REVIEW

November 2009

nwmo
NUCLEAR WASTE MANAGEMENT ORGANIZATION
SOCIÉTÉ DE GESTION DES DÉCHETS NUCLÉAIRES

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.

Contents

Preface

In June 2007, the Nuclear Waste Management Organization (NWMO) was given responsibility for implementing Adaptive Phased Management (APM), Canada's plan for the safe, long-term care of used nuclear fuel. The NWMO invites all Canadians and Aboriginal peoples of Canada to 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 business 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. We report our progress in the NWMO's Annual Report published every March.

In response to last year's Plan, *Implementing Adaptive Phased Management 2009 to 2013* (January 2009), the NWMO received many submissions and suggestions. Overall, the NWMO was acknowledged for transparency in its annual reporting and commitment to regular review and update of its plans for the implementation of APM. An overview of the comments received and how they were applied to this Plan will be posted on the NWMO website.

We would like to hear from you about our draft Implementation Plan for 2010-2014.

This Plan is released in draft for public comment until January 29, 2010. We welcome all suggestions and ideas about the Plan and how we can help you learn more about APM. We will publish the final version of the Plan once comments received have been considered.

PLEASE SEND US YOUR COMMENTS AT THE NWMO

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OR THROUGH OUR WEBSITE AT

www.nwmo.ca

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 2010 to 2014 (Draft)* describes our five-year work program.

Adaptive Phased Management (APM), Canada's long-term plan for used nuclear fuel, is a management system and a technical method. The management system is based on phased and adaptive decision-making supported by public engagement and continuous learning. The end point of the technical method is a repository deep underground in a suitable rock formation. 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.

In the period 2002 to 2005, the NWMO led a study that created the foundation for the safe, long-term care of used nuclear fuel. Beginning in 2007, when the NWMO received the mandate from the Government of Canada to implement APM, the NWMO has worked on transitioning from a small study group to a sustainable implementing organization. From 2007 through 2009, the NWMO has built the organization, putting in place a comprehensive governance structure and expanding staff resources with the technical and social research expertise that is key to implementing APM. Much activity has also been directed to engaging interested Canadians and Aboriginal peoples in the development of our plans, including the principles and process to guide selection of a site for the underground repository for used fuel. By year-end 2009, this two-year collaboration is expected to produce a process to select an informed, willing host community that is fair and transparent, and meets the expectations of citizens.

The Plan is organized along seven strategic objectives. The objectives and initiatives in each area reflect our priorities for the next five years.

The period 2010-2014 marks a significant phase in the continued implementation of APM. An important focus of this five-year period will be the initiation of the process for site selection. The NWMO will begin to work with communities interested in APM as they consider their potential interest in hosting the used fuel repository. As communities come forward to learn more and proceed with initial screenings and assessments of site suitability, the NWMO will be ready to support the process. Work will continue to ensure readiness for future phases of site selection, including detailed site investigations and refinement of the generic designs and safety cases for a repository in both crystalline and sedimentary rock formations. Throughout the planning period, engagement and 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.

This update confirms the Plan as a living document that is regularly assessed, strengthened and redirected in the face of new information, advances in science and technology, changes in societal values and evolving public policy. APM will only proceed as quickly as Canadians, successful technology development and demonstration, and the regulatory authorities allow.

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.
- Implement collaboratively with Canadians the process for siting a deep geological repository for the safe, long-term management of used nuclear fuel in an informed, willing host community.
- Refine and further develop the generic designs and safety cases for a repository for used nuclear fuel in both crystalline and sedimentary rock formations, and conduct technical research and development to ensure continuous improvement, consistent with best practices.
- Ensure funds are available to pay for the safe, long-term management of Canada's used nuclear fuel.
- Adapt plans for the management of used nuclear fuel in response to new knowledge, international best practices, advances in technical learning, evolving societal expectations and values, and changes in public policies.
- Maintain an accountable governance structure that provides confidence to the Canadian public in the conduct of the NWMO's work.
- Build and sustain an effective organization with the social, environmental, technical and financial capabilities for the safe, long-term management of Canada's used nuclear fuel.

The 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. Established to operate on a not-for-profit basis by Canada's major nuclear fuel waste owners, Ontario Power Generation, Hydro-Québec and NB Power Nuclear,[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 led 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 gave the NWMO the mandate to implement APM. Implementation of APM will be regulated by the Canadian Nuclear Safety Commission (CNSC) under the *Nuclear Safety and Control Act* and many associated regulations.

The NWMO is now building a multidisciplinary team with a range of experience in the fields of social research, technical research and development, public engagement, 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.

REGULATORY OVERSIGHT OF ADAPTIVE PHASED MANAGEMENT

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.

Implementation of APM falls within federal jurisdiction and is regulated under the *Nuclear Safety and Control Act* (*NSCA*) and many associated regulations. Under the *Act*, licences must be obtained from the Canadian Nuclear Safety Commission (CNSC) to prepare a site for, construct, operate, decommission or abandon a nuclear facility. A licensing decision by the CNSC for the implementation of APM will only be made after the environmental assessment process has been completed under the *Canadian Environmental Assessment Act*.

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

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.

Canada's Plan for Used Nuclear Fuel

Canada's plan for the long-term care of used nuclear fuel is known as Adaptive Phased Management (APM).

A Technical Method

- Centralized containment and isolation of used nuclear fuel in deep geological repository
- Continuous monitoring
- Potential for retrievability
- Optional step of shallow underground storage

A Management System

- Flexibility in pace and manner of implementation
- Phased and adaptive decision-making
- Responsive to advances in technology, research, Aboriginal Traditional Knowledge, societal values
- Open, inclusive, fair siting process – seek informed, willing host community
- Public engagement and site selection focused in four nuclear provinces (NB, ON, QC, SK)

APM 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. Collaboration with Canadians and adaptability to changes in technology and science, societal values and public policy underpin implementation. The end point of the technical method is containment and isolation of used nuclear fuel in a repository constructed deep underground in an appropriate rock formation.

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. Interested Canadians from across the country participated in a two-year dialogue to design the process to select a site.

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

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 temporary storage at nuclear reactor sites in Ontario, Québec, New Brunswick and at Atomic Energy of Canada Limited's nuclear research site in Manitoba.

Canadian nuclear power plants are fuelled by uranium pellets in the form of a fuel bundle about the size and shape of a fireplace log and weighing approximately 24 kilograms. Once the fuel bundle has been used to generate electricity, it is removed from the reactor and considered waste. Physically, the bundle looks the same as when it was placed in the reactor. The bundle that is removed from the reactor is, however, radioactive and continues to generate heat at a steadily decreasing power level for a long time. If improperly managed, used nuclear fuel is hazardous to humans and the environment.

When a fuel bundle is removed from a reactor, 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 containers have a design life of 50 years.

About 85,000 used nuclear fuel bundles are generated in Canada each year. Over 40 years, Canada's nuclear power program has produced just over two million used fuel bundles. If the entire inventory of used fuel bundles could be stacked end-to-end like cordwood, it would fit into a space the size of six hockey rinks from the ice surface to the top of the boards.

The NWMO has the 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.

CANADIANS' OBJECTIVES FOR THE LONG-TERM MANAGEMENT OF USED NUCLEAR FUEL, IDENTIFIED DURING THE STUDY PHASE, CONTINUE TO GUIDE THE IMPLEMENTATION OF APM

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.

FAIRNESS » To ensure fairness (in substance and process) in the distribution of costs, benefits, risks and responsibilities, within this generation and across generations.

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 waste management system, while simultaneously contributing positively to the local economy.

ADAPTABILITY » To ensure a capacity to adapt to changing knowledge and conditions over time.

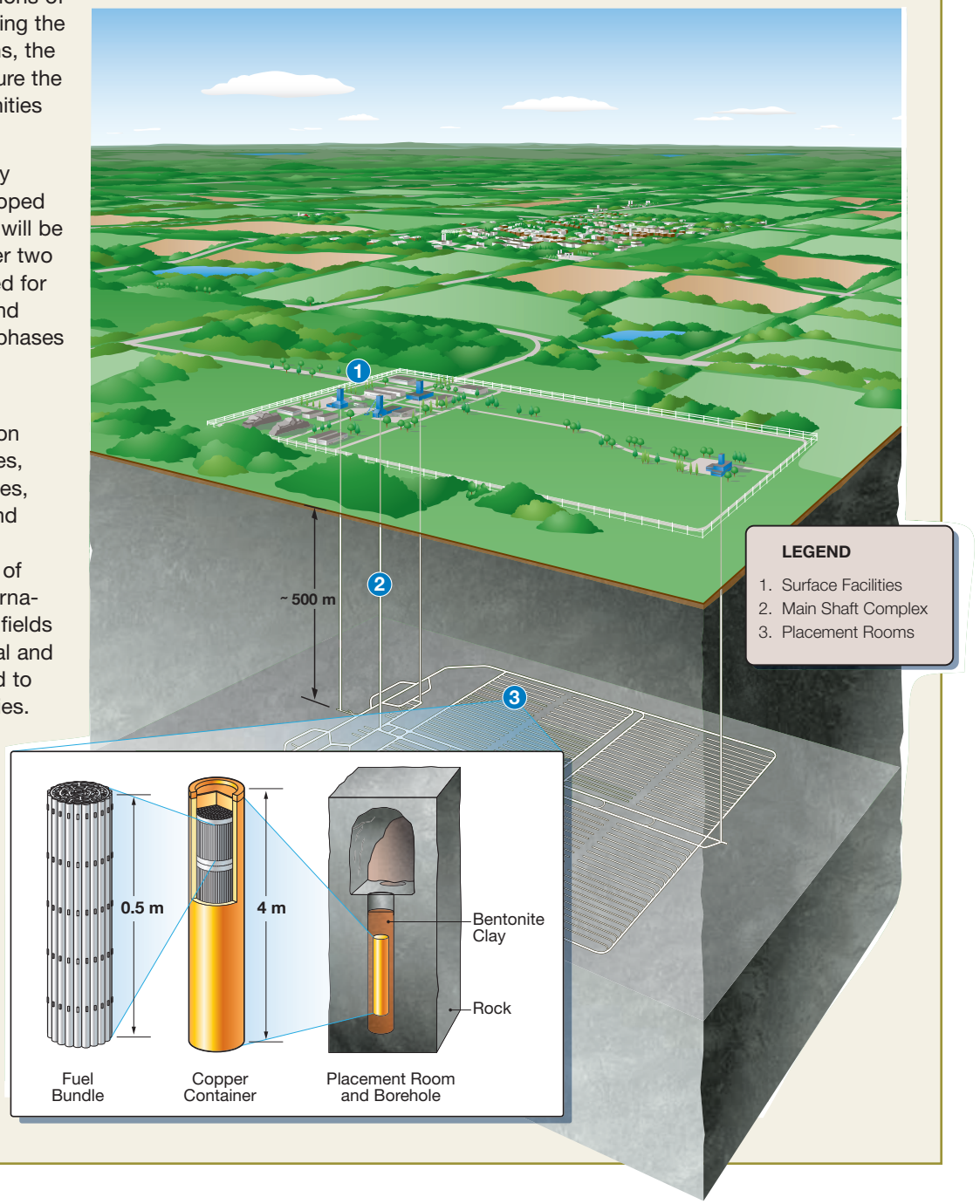
THE PROJECT

DEVELOPMENT OF THE FACILITY for the long-term management of Canada's used nuclear fuel is a $16- to $24-billion project. It includes the construction of a repository deep underground and creation of a centre of expertise. The used fuel will be safely contained and isolated by engineered barriers in the repository and the surrounding geology. The design of the repository will allow the waste to be retrievable for an extended period. Consistent with best practice and the expectations of Canadians as defined during the three-year study of options, the facility will be built to ensure the safety of people, communities and the environment.

The project will span many generations and be developed in phases. The repository will be sited and constructed over two or three decades, operated for three decades or more, and monitored throughout all phases of implementation.

The site will host an underground demonstration facility and surface facilities, such as laboratories, offices, public viewing galleries and exhibits. The project will become a national centre of expertise and hub for international collaboration in the fields of technical, environmental and community studies related to deep geological repositories.

Implementation of the project will involve scientists, engineers, tradespeople and many others. The project will provide significant economic benefits, including direct employment for hundreds of people at the facility for many decades and many more indirect jobs.



Priorities for 2010 to 2014

Over the period 2010 to 2014, implementation of the process for deciding where to contain and isolate Canada's used nuclear fuel for the long term will begin. The site selection process will seek an informed, willing host community.

The proposed process is described in *Moving Forward Together: Designing the Process for Selecting a Site – Invitation to Review a Proposed Process for Selecting a Site*, May 2009, available on the NWMO website at **www.nwmo.ca**.

The NWMO will assist communities interested in learning about APM and the site selection process. As communities come forward to consider their potential interest and suitability for hosting the used fuel repository, the NWMO will be ready to support the community and the many potentially affected surrounding regions, governments, organizations and Aboriginal peoples so that they may fully engage in the process of site selection.

The NWMO will prepare for the future phases of site selection, including detailed site investigations, and development of generic designs and safety cases for a repository in both crystalline and sedimentary rock formations.

The NWMO is not establishing firm timelines for moving through the siting process. The process of site selection will be community-driven – communities will determine if and when they wish to work with the NWMO. Activities set out in this Plan represent the NWMO's preparations to be ready to respond in a timely way and work together with communities.

The NWMO will continue to build the organization to strengthen internal resources and capabilities, and support technical and social research programs to ensure continuous improvement and adaptation to new knowledge, consistent with best practices. The NWMO will continue to engage Canadians meaningfully in these activities.

To guide the implementation of APM in a coordinated and systematic way and to reflect the evolving priorities of the five-year work plan, the Strategic Objectives have been updated. The addition of an objective specific to the generic design and safety case for a deep geological repository reflects progress and the importance of this work. Changes to the governance objective reflect the maturity of the organization.

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.
- Implement collaboratively with Canadians the process for siting a deep geological repository for the safe, long-term management of used nuclear fuel in an informed, willing host community.
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- Adapt plans for the management of used nuclear fuel in response to new knowledge, international best practices, advances in technical learning, evolving societal expectations and values, and changes in public policies.
- Maintain an accountable governance structure that provides confidence to the Canadian public in the conduct of the NWMO's work.
- Build and sustain an effective organization with the social, environmental, technical and financial capabilities for the safe, long-term management of Canada's used nuclear fuel.

Strategic Objectives

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.

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 associated with the long-term management of used nuclear fuel. Through open, transparent and inclusive engagement processes, the NWMO will continue to build awareness and understanding for APM. We believe that such processes and joint decision-making will help ensure that APM continues to respond to the values and concerns of Canadians.

The NWMO will seek and respond to a diversity of views and perspectives. The interweaving of Aboriginal and western worldviews and knowledge systems will strengthen the implementation of APM.

During the period 2010 to 2014, engagement will focus on strengthening established relationships to sustain program momentum and build the foundation for future regulatory approvals. This includes engagement activities, such as information sessions, briefings, joint projects and partnerships, which will be undertaken with municipal, provincial, federal and Aboriginal governments, and interested individuals and organizations. The NWMO will also continue to establish relations with a broader audience and expand its outreach to organizations through the dissemination of communications materials.

ENGAGEMENT WITH ABORIGINAL PEOPLES OF CANADA

THE NWMO RECOGNIZES that there are Aboriginal peoples in all areas of Canada where the NWMO's work will take place. The NWMO acknowledges, respects and honours that Aboriginal peoples – Indian, Métis and Inuit peoples of Canada – have unique status and rights as recognized and affirmed in S.35 of the *Constitution Act* (1982). Understanding the nature of any impacts from the implementation of APM 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.

Going Forward » In the period 2010 to 2014, the NWMO will:

- Continue work to increase awareness among Canadians and Aboriginal peoples of Canada about the long-term care of used nuclear fuel, the siting process and the NWMO;
- Implement the NWMO communications and media relations program to help interested individuals and organizations understand APM;
- Develop and maintain relationships with the federal government and with provincial and local governments in nuclear provinces to support their roles in the implementation of APM;
- Develop relationships with municipal associations to better understand local points of view and work with them to implement APM;

"Involving Canadians and Aboriginal peoples of Canada at all stages and in key decisions is critical to meeting the challenges associated with the long-term management of used nuclear fuel."

- Develop and maintain relationships with national, provincial and regional Aboriginal governments in nuclear provinces to keep them apprised of the implementation of APM and with local communities as the site selection process evolves;
- Continue to seek the advice of the NWMO Aboriginal working group Niigani and the NWMO Elders Forum on interweaving of Aboriginal Traditional Knowledge and western science, and respectful engagement of Aboriginal peoples;
- 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;
- Implement activities to engage young people in the NWMO's work;
- Regularly assess the value of engagement activities and identify opportunities to improve future initiatives; and
- Continue to report publicly on the input that the NWMO receives and how this advice is considered.

In 2010, the NWMO will:

- Continue to engage governments in nuclear provinces to prepare for the site selection process, specifically to ensure they have the necessary internal processes in place to position themselves to take inquiries from communities and to manage issues and communications associated with the initiation of the site selection process;
- Enhance relationships with the municipal sector through regular meetings of the NWMO Municipal Forum and joint research projects;
- Further develop relations with Aboriginal peoples through work with Niigani and the NWMO Elders Forum, and joint projects with Aboriginal organizations;
- Continue to develop communications materials, exhibits, DVDs and information kits to support the siting process and respond to the needs of the Municipal Forum, Niigani, youth and potentially interested communities; and
- Continue to seek citizen points of view from across Canada with the use of web-based dialogues and surveys.

Collaboratively Implement Siting Process

The NWMO will implement collaboratively with Canadians the process for siting a deep geological repository for the safe, long-term management of used nuclear fuel in an informed, willing host community.

The NWMO is working with Canadians to design and implement a siting process to seek an informed, willing community to host the deep geological repository. The proposed process is described in *Moving Forward Together: Designing the Process for Selecting a Site – Invitation to Review a Proposed Process for Selecting a Site*, May 2009, available on the NWMO website at **www.nwmo.ca**.

The proposed process is the product of a two-year dialogue with Canadians. The NWMO initiated discussions in 2008 to collaboratively design a process for identifying an informed and willing community to host a site for a deep geological repository. We used a variety of engagement techniques to help ensure that a broad diversity of perspectives was heard. Throughout 2009, a draft proposal for the process was the subject of public dialogue. In early 2010, the NWMO will refine the siting process with the comments received during the 2009 public dialogues.

Siting will begin only after the NWMO is confident that the design of the process meets the needs and concerns of Canadians. Over time, refinements to the siting process may be necessary as experience is gained, and the process is designed to respond to change.

Both the design of the site selection process and the process itself must be inclusive, fair and transparent, and meet the expectations of Canadians. Collaboration, shared decision-making and willingness underpin the siting process (see *Designing a Process for Selecting a Site*). Screening and feasibility studies of potential sites will be done in partnership with communities as they come forward and express interest. The NWMO is also developing the institutional policies, practices and structures required to support the siting process.

Workplans proposed for the 2010–2014 period will ensure the NWMO is prepared to support all aspects of the site selection process. The NWMO seeks to be ready to work with interested communities as they come forward to learn about site selection and the project. The NWMO will be prepared to conduct initial screenings of potential sites at the request of communities and deliver detailed briefings about the findings. For communities that continue to be interested, the NWMO would facilitate engagement of surrounding communities, the region, and provincial and Aboriginal governments, in a regional study of social, economic and cultural effects and detailed site investigations.

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

Technical work will focus on assessing the suitability of the site through geoscientific characterization and evaluation studies in crystalline and sedimentary rock formations. This work will be complemented by a phased and progressively more detailed assessment of the suitability of a site in terms of social, cultural and economic factors. By 2013, the NWMO expects to be ready to begin feasibility studies on one or more sites, including geological investigations, safety assessments, and social and economic impact assessments, all in collaboration with the interested communities. Studies on the logistics and options for the transportation of used fuel will also contribute to the overall assessment of candidate sites.

DESIGNING A PROCESS FOR SELECTING A SITE

THE PROPOSED PROCESS is designed to address the broad range of issues and protections that people told us are important for any appropriate siting process in Canada. It draws from experiences and lessons learned from past work and processes developed in Canada to site facilities for the management of hazardous material. It also draws from projects to develop deep geological repositories in other countries.

The proposed site selection process is designed to use a partnership-based approach to:

- Help ensure that any community that is selected to host this facility is both informed about the project and willing to host it;
- Help ensure that any site that is selected to host this facility will safely contain and isolate used nuclear fuel for a very long period of time in an appropriate geological formation and that there is an acceptable way of transporting used fuel to the site;
- Assist the potentially interested host community to consider carefully and thoroughly the project's potential benefits and risks when deciding whether to express interest, and ultimately, willingness to host the project;
- Involve surrounding communities, regions and other jurisdictional levels potentially affected by the project and the transportation of used fuel in the identification and assessment of public health, environmental, social, economic and cultural effects of the project as part of a broader regional assessment;
- Involve First Nations, Métis and Inuit who are potentially affected by the implementation of this project; and
- Help foster an ongoing public conversation on questions to be answered and issues to be addressed throughout the site selection process.

Going Forward » In the period 2010 to 2014, the NWMO will:

- Be ready to respond to invitations from communities to conduct initial screening of potential sites and preliminary feasibility studies;
- Deliver engagement and communications activities to build awareness of the siting process and support communities and others who are interested in learning more about APM and the project;
- Seek advice of municipal associations on materials and tools to assist communities interested in the siting process;
- Prepare generic options for transport of used fuel from interim storage sites to a long-term management facility for use in the assessment of potential sites and transportation routes;

- Refine tools and methods for conducting geoscientific assessments at candidate sites in both crystalline and sedimentary settings;
- Be ready to begin detailed investigations of proposed sites;
- Provide engineering design and preliminary safety assessments to evaluate candidate sites; and
- Refine tools and methods for assessing the suitability of a site in terms of social, cultural and economic factors.

In 2010, the NWMO will:

- Refine the *Proposed Process for Selecting a Site* in response to public input collected in 2009;
- Issue the *Process for Selecting a Site*;
- Initiate site selection, subject to confirmation of the NWMO's readiness to proceed;
- Implement activities to build awareness of the project, the siting process and opportunities for communities to learn more;
- Provide briefings as requested by communities or organizations on the APM site selection process; and
- Develop tools and methods for conducting geoscientific studies of candidate sites in crystalline and sedimentary settings, and assessment of social, economic and cultural factors.

Refine Conceptual Designs for a Deep Geological Repository

The NWMO will refine and further develop the generic designs and safety cases for a repository for used nuclear fuel in both crystalline and sedimentary rock formations, and conduct technical research and development to ensure continuous improvement, consistent with best practices.

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 are consistent with the expectations of the Canadian Nuclear Safety Commission (CNSC), the guidance of the International Atomic Energy Agency and experience in other countries with nuclear waste management programs.

The NWMO's technical program supports APM in three key areas: siting, conceptual engineering design and costing, and safety assessment. A strong technical program will ensure that APM benefits from knowledge and innovation in the long-term care of used nuclear fuel from Canada and abroad, and will ensure that the NWMO maintains adequate human resources to manage implementation.

A strong technical program will ensure that APM benefits from knowledge and innovation in the long-term care of used nuclear fuel from Canada and abroad, and will ensure that the NWMO maintains adequate human resources to manage implementation.

Going Forward » In the period 2010 to 2014, work in the fields of repository engineering, geoscience and safety assessment will focus on updating reference designs and safety cases, and improving understanding of repository system components. Study of processes, such as glaciation and climate change, and geosphere stability, as well as modelling of groundwater flow and thermal-hydraulic-mechanical processes in both crystalline and sedimentary rock, will improve assessment of the long-term safety of a used fuel repository. Specific work program activities are listed below:

- Prepare updated conceptual design for APM by 2011;
- Establish updated "licensable" reference designs, safety cases and cost estimates in 2012;
- Demonstrate full-scale shaft seal and monitoring instrumentation by 2011;
- Complete CNSC pre-licensing review of used fuel deep geological repository designs and safety cases in 2012;
- Develop, evaluate and demonstrate copper used fuel container technologies by 2014;
- Maintain and improve performance assessment models, including groundwater flow, containment release and transport, and coupled thermal-hydraulic-mechanical processes;
- Improve the system level safety assessment model with respect to capabilities, speed and validation;
- Further increase confidence in the deep geological repository safety cases; and
- Continue the NWMO's involvement in joint research activities and international programs at the Äspö Hard Rock Laboratory in crystalline rock in Sweden and at the Mont Terri Laboratory in sedimentary rock in Switzerland.

In 2010, the NWMO will:

- Complete SKB International Consultants (IC) review and update of copper used fuel container and used fuel packaging plant designs;
- Agree with CNSC on the APM Design Review Process;
- Issue report *NWMO Technical Program Activities for the Period 2011 to 2015*;
- Issue draft Conceptual Design Report for a Used Fuel Transportation System;

- Issue draft Conceptual Design Report for a Deep Geological Repository in Crystalline Rock;
- Issue draft Conceptual Design Report for a Deep Geological Repository in Sedimentary Rock;
- Complete annual review of NWMO's Technical Program by the Independent Technical Review Group (ITRG);
- Complete computer model runs for the postclosure safety assessment of a deep geological repository in crystalline rock;
- Issue preliminary package of supporting APM conceptual design material to CNSC; and
- Complete 2010 improvement actions in response to ITRG recommendations.

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. Financial surety 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 and protects enough money to ensure that the entire cost can be covered under a variety of social and economic circumstances, and within a required timeframe.

As APM is implemented, the NWMO must ensure that the cost estimates remain updated and that the funding formula will finance all aspects of APM. Contributions will be adjusted periodically to reflect updated projections of overall costs and the number of fuel bundles expected to be produced by each used fuel owner.

A particular emphasis during the planning period will be to initiate discussions and research on further developing the funding formula to incorporate new reactors and new owners of used nuclear fuel.

THE *NUCLEAR FUEL WASTE ACT*

THE *NUCLEAR FUEL WASTE ACT* assigns responsibility to the major owners of used nuclear fuel to make financial provisions for its long-term management. The *Act* required each of the four waste owners to make annual deposits to trust funds established for this purpose.

The waste owners will share the cost of development, licensing, construction and operation of the facility. The cost to each waste owner will generally be proportional to the number of fuel bundles to be stored in the facility, with special adjustments for factors such as differences in timing of shipping, transportation, fuel characteristics, etc.

Going Forward » In 2010 and through to 2014, the NWMO will:

- » Incorporate revised baseline cost estimate for APM into the funding formula by 2011;
- » Update the total cost estimate for APM no later than 2012;
- » Initiate a study to identify key issues associated with the update of the funding formula to accommodate new build and new waste owners; the timeline for finalizing the funding formula will depend on the outcomes of the review phase; progress will be reported in the Annual Report published every March;
- » 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; and
- » Estimate and publish the financial implications of potential future scenarios of varying volumes of used fuel, when available.

Adapt Plans

The NWMO will adapt plans for the management of used nuclear fuel in response to new knowledge, international best practices, advances in technical learning, evolving societal expectations and values, and changes in public policies.

A fundamental tenet of APM is the ongoing incorporation of new learning and knowledge to guide decision-making. We are committed to re-evaluating decisions where warranted, maintaining the option to change course and being prepared to act on new knowledge. Developments throughout the implementation of APM may pose technical and ethical challenges. The NWMO's approach and response to these challenges will be critical to the success of APM.

The Strategic Objectives, the NWMO's values and the framework of objectives developed with Canadians during the study phase provide a starting point for evaluating the challenges of APM. In addition, by regularly engaging citizens, specialists and potentially affected communities, the NWMO benefits from many opportunities to monitor, review, report and discuss changes in the management of used nuclear fuel, especially in the areas of technology development, societal expectations, and energy and environmental policy.

A program that is implemented over a long time will have many opportunities to improve safety and performance, enhance effectiveness, build understanding, reduce uncertainty and address societal concerns. One of the strengths of APM is the incorporation of new learning and knowledge. The NWMO is prepared to act on new knowledge, re-evaluate decisions and to change course as appropriate.

"The NWMO is committed to re-evaluating decisions where warranted, maintaining the option to change course and being prepared to act on new knowledge."

Developments in energy policy are particularly relevant to APM. For example, nuclear reactor refurbishment projects and new nuclear reactor units would produce new quantities of used fuel with potentially different characteristics. The NWMO has a process for ongoing monitoring, review and discussion of the potential implications of these developments on the volumes of used 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 APM and especially in response to the advice of Canadians and the changing external environment.

The NWMO also seeks formal opportunities, such as House of Commons Standing Committees, for open and transparent review of the implementation of APM at key milestones and decision points.

Going Forward » In the period 2010 to 2014, the NWMO will:

- » Support the siting process by improving understanding of best practices in engagement, capacity building, impact assessment and sustaining community well-being;
- » Support interested individuals and organizations in learning more and participating in the implementation of APM;
- » Collaborate with interested academics in Canada and internationally about best practices in social and community-based processes;
- » Continue to research citizen priorities and concerns relating to APM, including an annual survey of public attitudes about APM;
- » Build understanding of the interweaving of Aboriginal Traditional Knowledge and other assessment approaches into implementation;
- » Post research papers and the results of engagement activities on the NWMO website, including comments received during the public review of the proposed site selection process;
- » Publish an annual review of developments in used fuel reprocessing and alternative used nuclear fuel management technologies;
- » Publish an annual update on current and future potential inventories of used fuel volumes and types;
- » Seek the input of Canadians on how the implementation of APM should be adapted in response to current and projected inventories of used fuel; and
- » Continue to monitor, assess and discuss the impact of potential new nuclear reactor units on the long-term management of used nuclear fuel.

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* and oversight by the Minister of Natural Resources Canada. The NWMO's activities will also be subject to regulatory oversight through the *Nuclear Safety and Control Act* and 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 Nuclear and Hydro-Québec are the founding Members of the NWMO. The 2007 Membership Agreement and by-law set out Member roles and responsibilities in furtherance of the objectives of the *Nuclear Fuel Waste Act* and the NWMO's implementation mandate.

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 *Nuclear Fuel Waste Act* requires that the governing body of the NWMO appoints an Advisory Council to review and comment on its study, and following the Government's selection of a long-term management approach for used nuclear fuel, on its triennial reports. The Board of Directors appointed the Advisory Council in 2002, with membership renewed in 2008. In addition to meeting its statutory obligations, it provides independent guidance and advice to the NWMO. Current membership of the Advisory Council represents a broad range of expertise, including geosciences, strategic communications, environment, medicine, political science 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.

"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."

POLICIES AND PROCEDURES

The NWMO has been developing its internal governance since its inception. In 2007, a framework for update and expansion of necessary policies and procedures was established, and in 2008, the NWMO examined internationally accepted management system standards. A process framework based on the ISO 9001 and ISO 14001 management systems standards was subsequently adopted. Over the course of 2009, essential policies, procedures and internal standards have been developed and implemented with the intent of achieving full conformance to the ISO 9001:2008 standard. Certification to the ISO 9001:2008 management system is planned for 2010. Work on the integrated internal governance will continue with the development and implementation of additional policies and procedures to enable full compliance to ISO 14001 management system requirements in early 2012.

INDEPENDENT TECHNICAL REVIEW GROUP

The Board of Directors established the Independent Technical Review Group (ITRG) in 2008 to regularly review the NWMO's technical research program on used nuclear fuel. The ITRG conducts annual reviews to inform the Board and Advisory Council whether the NWMO technical program is based on credible scientific and technical approaches and methodologies; is consistent with international practices; and will broaden and advance the NWMO's technical knowledge to adequately support implementation of APM. The four members bring extensive internationally recognized expertise in the technologies associated with nuclear waste geological repository projects acquired through experience in Canada, U.K., Sweden and Switzerland. Members of the ITRG are appointed by the NWMO Board on a three-year basis and may be reappointed. The members are profiled on the NWMO website. Reports of the group will be published on the NWMO website.

PEER REVIEWS

The NWMO will continue to seek opportunities for peer review of its work and to invite independent comment. This will benefit program design and delivery, and help to enhance public confidence in the NWMO's implementation plans and decision-making.

REPORTING

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

The *Nuclear Fuel Waste Act* 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 statements on each report.

TRIENNIAL REPORT

THE *NUCLEAR FUEL WASTE ACT* sets out very specific reporting requirements for the triennial reports, issued in the third fiscal year after the fiscal year in which a decision is made by the Governor in Council and for every third fiscal year after that. These must 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 2010 and annually through to 2014, the NWMO will:

- Convene regular meetings of NWMO Members, Board, Board Committees and Advisory Council;
- Coordinate annual review of the NWMO's technical program by the Independent Technical Review Group (ITRG);
- Interact with the Canadian Nuclear Safety Commission (CNSC) on APM in the pre-licensing period consistent with the terms of the special project arrangement relating to provision of regulatory information and reviews;
- Report to Canadians on its progress in implementing APM; the NWMO will publish its Annual Report to the Minister of Natural Resources Canada and the public in the first quarter each year, including its first triennial report in 2011;
- Publish its five-year Implementation Plans; and
- Publish the minutes of the meetings of the Board of Directors, the Advisory Council, and the Independent Technical Review Group and any reports.

Build and Sustain a High-Performing Organization

The NWMO will build and sustain an effective organization with the social, environmental, technical and financial capabilities for the safe, long-term management of Canada's used nuclear fuel.

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. The NWMO must have access to a sufficient and sustainable number of trained and skilled personnel. This requires investment in the organization to ensure resource capacity, capability, expertise, and sound administrative and management policies and practices that provide a foundation for operations and demonstrate commitment to staff development.

Going Forward » In the period 2010 to 2014, the NWMO will continue to grow and develop its staffing and contractor capability. We will acquire expertise and capabilities in a range of fields; including, but not limited to, repository design and construction, environmental assessment, socio-economics, ethics, finance, public engagement, Aboriginal Traditional Knowledge, siting and waste management technology. These experts will be critical to implementing the siting process, developing host community interest and partnerships, and undertaking the technical and socio-economic site investigations.

The NWMO has a strong set of skills and competencies resident in its current staff. It will be important to ensure this expertise is retained and further developed over the years to come. This will be accomplished through initiatives, such as focused recruitment campaigns when appropriate, establishing alliances with appropriate educational institutions, developing and relying on third-party expertise, training and development programmes, and succession planning.

To support the growing organization, investment in business systems and processes will continue throughout the business planning period.

"The NWMO will require expertise and capabilities in a range of fields; including, but not limited to, repository design and construction, environmental assessment, socio-economics, ethics, finance, public engagement, Aboriginal Traditional Knowledge, siting and waste management technology."

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 2010 to 2014 is updated annually to guide the five-year planning period ahead. As such, the Plan is regularly assessed, strengthened and redirected as appropriate in the face of new information.

APM will proceed as expeditiously as Canadians, successful technology development and demonstration, and the regulatory authorities allow. We welcome all suggestions and comments. Please write to us or submit comments to our website at **www.nwmo.ca**.

Glossary

Deep geological repository is a facility for the placement of used nuclear fuel deep underground where both natural and engineered barriers shield it from humans and the environment. While placed in a deep geological repository, there is the potential for retrieving the used nuclear fuel.

Dialogue brings people from all walks of life together and encourages them to work through difficult issues, learning from one another as they listen to and understand perspectives that are different from their own. Participants examine their own thinking, and through talking with one another, identify areas on which they can agree, while acknowledging differences.

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. The Zircaloy parts of the fuel bundle are collectively known as the cladding. The bundles are then inserted into CANDU reactors where nuclear fission reactions in the fuel are used to generate electricity.

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 maximum hazard from used nuclear fuel exists in the short term, and the hazard diminishes over time. For practical purposes some hazards remain for an indefinite period. The total radioactivity in a CANDU used fuel bundle approaches the radioactivity level of natural uranium ore around one million years after discharge from a reactor.

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.

Retrievability is the ability to remove waste from where it has been placed.

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.

Storage is a method of maintaining used nuclear fuel in a manner that allows access, under controlled conditions, for retrieval or future activities.

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.

Nuclear Waste Management Organization

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