

# » Implementing Adaptive Phased Management 2021 to 2025

**MARCH 2021**

The Nuclear Waste Management Organization (NWMO) welcomes all suggestions and ideas about our work and how we can help you learn more about Canada's plan for the safe, long-term management of used nuclear fuel.

Please share your thoughts on this plan by **June 11, 2021**. We look forward to hearing from you.

**Lisa Frizzell**





Vice-President, Communications

Nuclear Waste Management Organization  
22 St. Clair Avenue East, Fourth Floor  
Toronto, ON M4T 2S3, Canada

Fax: 647.259.3692

Email: [learnmore@nwmocanada.ca](mailto:learnmore@nwmocanada.ca)

Website: [www.nwmo.ca/contactus](http://www.nwmo.ca/contactus)

   @nwmocanada  
 /company/nwmocanada

# TABLE OF CONTENTS

Vision, mission and values .....	2
Welcome to <i>Implementing Adaptive Phased Management 2021 to 2025</i> .....	3
Committed to transparency .....	4
Introduction to the NWMO and Canada's plan .....	6
Planning timelines .....	8
Selecting a site .....	10
Key components of the repository .....	11
Centre of Expertise .....	12
Reconciliation and Indigenous Knowledge .....	13
Cost and funding .....	18
Keeping abreast of the external landscape and adapting to change .....	20
Planning priorities .....	21
■ PRIORITY: ENGINEERING .....	22
■ PRIORITY: SITE ASSESSMENT .....	24
■ PRIORITY: SAFETY .....	26
■ PRIORITY: MOBILIZATION .....	28
■ PRIORITY: PARTNERSHIP .....	30
■ PRIORITY: TRANSPORTATION .....	32
■ PRIORITY: LICENSING .....	34
Developing a Canadian Integrated Strategy for Radioactive Waste .....	37
Sound governance and accountability .....	38
Glossary .....	40
What we heard .....	42
Share your thoughts .....	47

# VISION, MISSION AND VALUES

## Vision

Our vision is the long-term management of Canada's nuclear waste in a manner that safeguards people and respects the environment, now and in the future.

## Mission

The purpose of the NWMO 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.

## Values

<p><b>SAFETY</b></p> <p>We place all aspects of public and employee safety – including environmental, conventional, nuclear, and radiological safety – first and foremost in everything we do.</p>	<p><b>INTEGRITY</b></p> <p>We act with openness, honesty and respect.</p>	<p><b>EXCELLENCE</b></p> <p>We use the best knowledge, understanding, and innovative thinking, and seek continuous improvement in all that we do in our pursuit of excellence.</p>
<p><b>COLLABORATION</b></p> <p>We engage in a manner that is inclusive, is responsive, and supports trust, constructive dialogue, and meaningful partnership.</p>	<p><b>ACCOUNTABILITY</b></p> <p>We take responsibility for our actions, including wise, prudent and efficient management of resources.</p>	<p><b>TRANSPARENCY</b></p> <p>We communicate openly and responsibly, providing information about our approach, processes and decision-making.</p>

# Welcome to *Implementing Adaptive Phased Management 2021 to 2025*

This is the five-year strategic plan for the NWMO as we implement Canada's plan for the safe, long-term management of used nuclear fuel.



# COMMITTED TO TRANSPARENCY

The NWMO is committed to transparency. In fact, it is one of our core values. Our annual implementation plan is one way we demonstrate that commitment. These plans are living documents. They evolve and grow over time. Each year, we update our plans to reflect progress in our work, input from communities and the public, advances in science and technology, insight from Indigenous Knowledge, evolving societal values and changes in public policy.

Throughout the global COVID-19 pandemic – which took hold in Canada in 2020 – the NWMO has remained focused on continuing to advance Canada’s plan for the safe, long-term management of used nuclear fuel while at the same time protecting both employees and members of the public with whom we work. The pandemic challenged us to adapt to evolving circumstances. Canada’s plan is designed to be adaptive, this principle is woven into the fabric of our organization, and we found innovative ways in 2020 to maintain our momentum.

At times we pivoted from in-person to virtual collaboration to maintain health and safety. We conducted a range of activities online, from environmental workshops and transportation engagement sessions in potential siting areas to knowledge-exchange meetings with international counterparts. Going forward, we will continue to expand the ways people interested in Canada’s plan can engage with us, including through virtual

platforms. Building on what we learned during the pandemic, we are better equipped than ever before to engage audiences at a distance.

Innovation during the pandemic extended beyond virtual work. For example, with key partners and vendors, we determined how to resume manufacturing physical prototypes of containers for used nuclear fuel while following health and safety guidelines.

Flexibility was key to our continued progress. We extended timelines for some of our fieldwork – like borehole drilling – due to the impact of the pandemic and based on community input. At the same time, we were able to bring forward other work by several months in order to maintain momentum.

We remain on track to meet our expected site selection date of 2023 – an important milestone in Canada’s plan. And while we’ve made some necessary adjustments to our long-term plans to gain ground in certain areas that were delayed due to the pandemic, long-term timelines for construction and moving our operations to the site also remain unchanged.

Late in the year, Natural Resources Canada asked us to lead an engagement process with Canadians and Indigenous peoples to inform the development of an Integrated Strategy for Radioactive Waste, which will include low- and intermediate-level waste. This work will run parallel to Canada’s plan but will be separate from it.

The 2021-25 planning period includes not only confirming a safe site with informed and willing hosts for a deep geological repository, but also embarking on the next phase of Canada's plan. The years following site selection will see a new series of activities, such as implementing partnership agreements with host communities; finalizing the safety case for the identified site; preparing to construct a Centre of Expertise; preparing for and participating in regulatory processes; and getting ready to move our operations to the site that is selected.

The activities outlined in this plan reflect our continuing efforts to work with communities to identify a preferred site, as well as preparations for all the activities that follow. Throughout this period, we will maintain our organizational commitment to a fair, transparent and dialogue-driven process.

Your input and feedback help inform our work, and now is an important time for us to hear from you. Included at the back of this document is a summary of the comments we received after publishing last year's plan in March 2020. We invited comments until Sept. 1, 2020, extending the timeline to accommodate the effect of the pandemic.

**Your feedback is essential to the implementation of Canada's plan. Every year, we ask Canadians for their input on our implementation plan to inform and guide our work. This year, we are moving our feedback form for the implementation plan online. We invite you to visit [www.nwmo.ca/implementationplan](http://www.nwmo.ca/implementationplan) and share your thoughts until **June 11, 2021**.**

**You may also email us at [learnmore@nwmo.ca](mailto:learnmore@nwmo.ca) or send us a letter. Please include your name, mailing address and contact information in any written response. Your response should be addressed to:**

**Lisa Frizzell  
Re: Implementation Plan 2021-25  
22 St. Clair Avenue East, Fourth Floor  
Toronto, ON M4T 2S3  
Canada**

# INTRODUCTION TO THE NWMO AND CANADA'S PLAN

Canada has been generating electricity from nuclear power to light our homes, businesses and towns for nearly 60 years. As the worldwide demand for energy grows and action on climate change intensifies, nuclear power is increasingly part of the conversation.

The NWMO plays an important role that completes the nuclear fuel cycle. We are the guardians who will be entrusted to ensure used nuclear fuel is safely managed in the very long term, in a manner that protects people and the environment.

In 2002, the Government of Canada, through the *Nuclear Fuel Waste Act (NFWA)*, assigned responsibility for the long-term management of Canada's used nuclear fuel to the NWMO. The organization was established in accordance with the *NFWA* by Canada's major nuclear fuel waste owners –

Ontario Power Generation, Hydro-Québec and New Brunswick Power Corporation – and operates as a not-for-profit organization.

The plan we are implementing, known as Adaptive Phased Management (APM), emerged through a three-year dialogue with Canadians, including Indigenous peoples. The outcome of these conversations was outlined in *Choosing a Way Forward – The Future Management of Canada's Used Nuclear Fuel (Final Study)*, issued in November 2005.

Canadians made clear they want to move forward now on managing used nuclear fuel – and not leave the burden for future generations. The NWMO is doing just that.

This plan is Canada's plan. It reflects the values and priorities citizens identified as important.



## Canada's plan: Adaptive Phased Management (APM)

### Technical method

- Centralized containment and isolation of used nuclear fuel in a deep geological repository
- Continuous monitoring
- Potential for retrievability
- *Optional* step of temporary storage (not included in current implementation plan)<sup>1</sup>

<sup>1</sup> We do not expect to need the optional step of temporary storage as used fuel will remain at interim storage facilities until the repository is operational.

### Management system

- Flexibility in pace and manner of implementation
- Phased and adaptive decision-making
- Responsive to advances in technology, research, Indigenous Knowledge, and societal values
- Open, inclusive and fair siting process to seek an informed and willing host
- Sustained engagement of people and communities throughout implementation

APM is both a technical method (what we plan to build) and management system (how we will work with people to get it done). The technical method involves developing a deep geological repository in a suitable rock formation to safely contain and isolate used nuclear fuel. The management system involves phased and adaptive decision-making, supported by public engagement and continuous learning.

A safe and secure transportation system will be developed to transport used nuclear fuel from facilities where it is currently stored on an interim basis to the repository site.

APM also includes plans for a Centre of Expertise, which will be established at or near the site. Initially it will support multi-year testing and assessment of the site, with a focus on safety and community well-being. Eventually it will become a hub for knowledge-sharing across Canada and internationally.

# PLANNING TIMELINES

Although the global COVID-19 pandemic has had an impact on our work, we remained focused and productive. Still, it was necessary to adjust some of the planned timelines associated with regulatory approvals and building the Centre of Expertise to fully address all the work required in these areas.

We remain on track to meet our expected site selection date of 2023 – an important milestone in Canada’s plan. Timelines for construction and moving our operations to the site also remain unchanged.



## Our timelines

The following graphic provides a glimpse at historic and future milestones of the project.

Developing Canada's plan	2002	The NWMO is created.
	2005	The NWMO completes three-year study with interested individuals, including specialists, Indigenous peoples and the Canadian public.
	2007	Government of Canada selects Adaptive Phased Management (APM) and mandates the NWMO to begin implementation.
Developing the siting process	2008 to 2009	Work takes place with citizens to design a process for selecting a central, preferred site for the deep geological repository and Centre of Expertise.
Identifying a site using the siting process	2010	The siting process is initiated, with a program to provide information, answer questions and build awareness.
	2010 to 2015	Twenty-two communities initially express interest. In collaboration with interested communities, the NWMO conducts initial screenings, followed by preliminary assessment desktop studies and community engagement. Areas with less potential to meet project requirements are eliminated from further consideration.
	2015 to 2023	The NWMO expands assessment to include field investigations. Areas with less potential are eliminated from further consideration as the narrowing down process continues.
	2023	A single, preferred site is identified. The transportation planning framework is finalized.
Towards construction	2024	Detailed site characterization begins. The project description is submitted, triggering the federal impact assessment. The Licence to Prepare Site application is submitted to the Canadian Nuclear Safety Commission (CNSC).
	2026	Impact assessment studies are submitted as part of the regulatory process.
	2027	The grand opening of the Centre of Expertise is held.
	2028	The impact assessment is approved (estimate). The Licence to Prepare Site is granted (estimate).
	2029	The Licence to Construct application is submitted to the CNSC.
	2032	The Licence to Construct is granted (estimate).
	2033	Design and construction begin.
Beginning operations	2040 to 2045	Operations of the deep geological repository begin. Transportation of used nuclear fuel to the repository begins.

# SELECTING A SITE

The NWMO has been engaged in a multi-year, community driven process to identify a site that will safely contain and isolate Canada's used nuclear fuel in a deep geological repository.

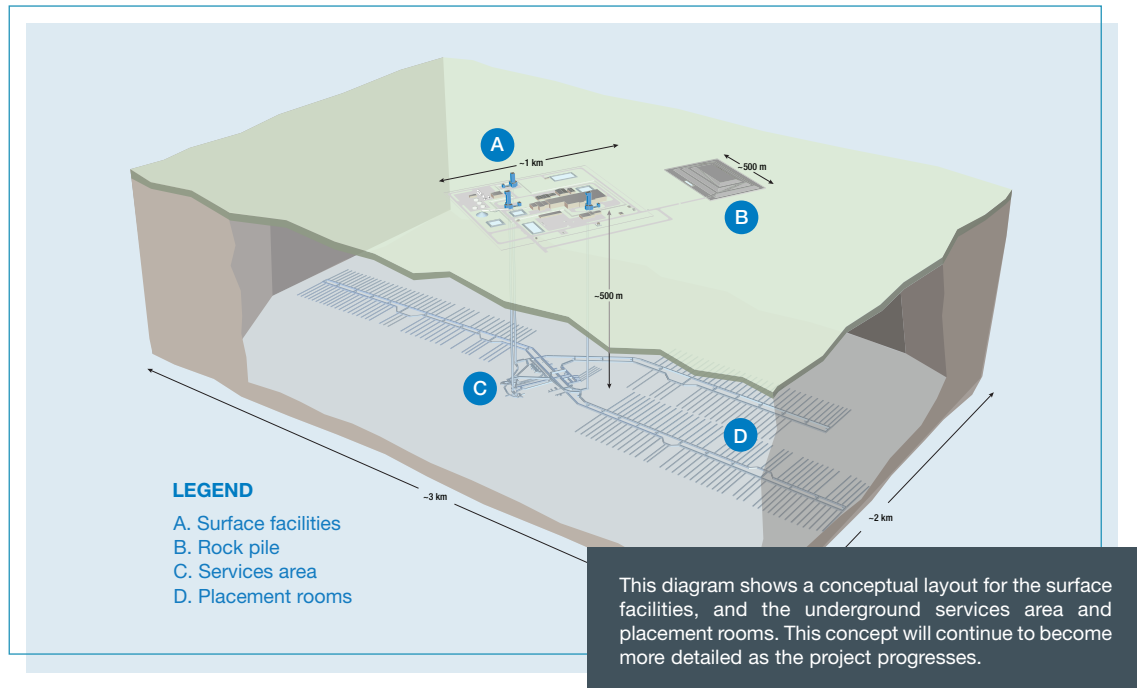
We initiated the site selection process in 2010, and over the next two years, 22 municipalities and Indigenous communities expressed interest in learning more and exploring their potential to host the project. Over time, we gradually narrowed our focus and in January 2020 announced that two potential sites – one near Ignace in northern Ontario and one in South Bruce – remain in the site selection process. This narrowing down process was achieved through extensive social engagement and technical site evaluations to assess safety and the potential to build supportive and resilient partnerships.

Moving forward, we will work with potential siting communities to conduct progressively more detailed technical site evaluations, continue meaningful discussions around partnerships, develop criteria to determine willingness, and explore how the project can be implemented in a manner that will enhance community well-being. We remain on track to identify a single, preferred site by 2023.

As we advance the siting process, we maintain a fundamental understanding that the project will only proceed with the involvement of the interested municipal, First Nation and Métis communities in the area and surrounding communities, working together to implement it.

More information about the site selection process is available at [www.nwmo.ca/sitingprocess](http://www.nwmo.ca/sitingprocess).

# KEY COMPONENTS OF THE REPOSITORY



The deep geological repository uses 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 consists of a network of placement rooms for the used nuclear fuel. This approach aligns with international best practices.

At the surface, there will be facilities where the used fuel is received, inspected and repackaged into purpose-built containers encased in a buffer box of bentonite clay before being transferred to the main shaft for underground placement.

The repository will include a centralized services area, which allows for ventilation underground through three shafts located within a single, secure area. The layout also includes multiple access tunnels that enable the placement rooms

to be situated in areas with the most suitable rock. The buffer boxes will be arranged in the horizontal placement rooms, and any spaces backfilled with bentonite pellets.

In preparation, the NWMO has begun work on site-specific conceptual designs of the underground repository layout for potential siting areas in Ontario based on information from geoscience assessments and initial borehole drilling. This will be an iterative process. As the NWMO acquires additional site-specific information, we will continue to evolve the design and layout of the repository.

For a more comprehensive description of the project, please see *Description of a Deep Geological Repository and Centre of Expertise for Canada's Used Nuclear Fuel* at [www.nwmo.ca/backgrounders](http://www.nwmo.ca/backgrounders).

# CENTRE OF EXPERTISE

A Centre of Expertise will be established at or near the repository location, after the host site has been selected. The design and use of the centre will be developed collaboratively with those living in the area, including First Nation and Métis communities.

Initially, the centre will support a multi-year program of technical testing and verification, and ongoing planning and discussion with the community. Working closely with our Indigenous partners, the centre may also serve as a hub

for sharing Indigenous Knowledge and culture. Later, the centre will support construction and operation of the deep geological repository.

Eventually, the centre will be home to an active technical and social research and technology demonstration program. Scientists and other specialists in a wide range of disciplines will contribute to the program. From its inception, the centre will be a hub for knowledge-sharing about Canada's plan across the country and internationally.



An artist's rendering portrays one example of how the Centre of Expertise could look. The final design will be developed collaboratively with those living in the area.

# RECONCILIATION AND INDIGENOUS KNOWLEDGE



Scientists and Indigenous Knowledge Keepers help build bridges of understanding.

The NWMO continues our commitment to understand, honour and interweave Indigenous Knowledge in all our work. This commitment is reflected in many ways – through oversight by our Indigenous Relations team, advice from the NWMO’s Council of Elders and Youth, Indigenous representation in our organization (including representation in our executive team and Board of Directors), meaningful policies to guide our work, and regular engagement with First Nation and Métis communities.

Over the next five years, the NWMO will work to implement our Reconciliation Policy, measure our progress, and continue to interweave Indigenous Knowledge into our work. This work affirms our commitment to acting on the Truth and Reconciliation Commission’s call to action #92, which calls upon the corporate sector to build respectful relationships with Indigenous peoples and provide education and management for staff on the history of Indigenous peoples.

## Reconciliation

In late 2019, the NWMO released our Reconciliation Policy, setting out how we will contribute to Reconciliation in all our work. Following the policy, the NWMO will continue to meaningfully engage with First Nation, Métis and municipal communities and organizations as we work to implement Canada's plan.

The NWMO will also continue to recognize the truth of the historic wrongs, the challenges we have today and seek opportunities to co-create a better future. The policy requires that the NWMO will build relationships with First Nation and Métis communities on a foundation of respect for languages and customs, culture, and institutions. Additionally, we will work with communities to support Reconciliation opportunities in their area.

The policy commits the NWMO to develop an annual plan to ensure that we are taking action on the policy. The plan will be measured and we will publicly report on our progress as an organization, beginning in 2021. The Indigenous Relations team has developed a Reconciliation baseline to evaluate our contributions to Reconciliation, identify gaps, and determine how we should move forward as an organization. The team has also created an assessment tool to look at corporate policies and procedures through a Reconciliation lens and identify opportunities for improvement. Measuring our progress will help instill Reconciliation as a core value, reflected in how we act as an organization.

The actions we take in implementing the policy will demonstrate our contribution to this important national movement towards change.



# NWMO RECONCILIATION STRATEGY

---

## 2021 and beyond

Develop an Indigenous youth strategy that includes a scholarship program and recruitment strategy

Continue to enhance Reconciliation training to include unconscious bias training

Include Indigenous Knowledge in water protection plans

Apply the Reconciliation assessment tool to regional engagement strategies

Embed Reconciliation within corporate culture

## 2020

Enhanced policies and procedures to address Reconciliation

Enhanced procurement program to include an Indigenous strategy

Assessed corporate Reconciliation baseline and developed a Reconciliation measurement matrix

## 2018

85 per cent of NWMO staff received cultural awareness training

Reconciliation Statement finalized through Indigenous ceremony

## 2019

Published Reconciliation Policy

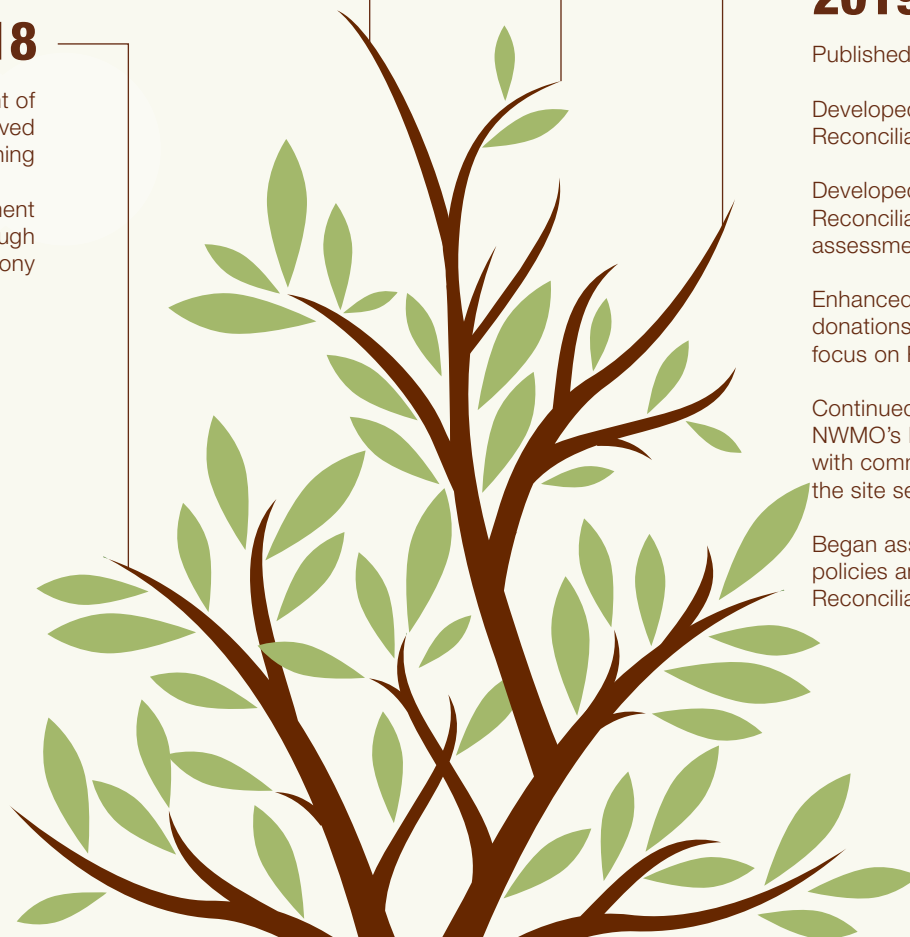
Developed and delivered Reconciliation training program

Developed a corporate Reconciliation baseline assessment tool

Enhanced sponsorships and donations program to include a focus on Reconciliation

Continued to communicate the NWMO's Reconciliation program with communities involved in the site selection process

Began assessment of NWMO's policies and procedures against Reconciliation assessment tool



## Indigenous Knowledge

The NWMO is committed to interweaving Indigenous Knowledge into all our work.

Important teachings from Indigenous Knowledge Keepers, such as the role and significance of spirit and ceremony, understanding natural laws, respecting Mother Earth, and creating space for Indigenous voices has guided our work.

When identifying a borehole location in the Ignace area, for example, Indigenous knowledge studies, which included ceremony, contributed

to the decision-making process, as well as the geoscientific studies and environment studies. Additionally, local Indigenous experts ensured Indigenous protocols guided field activities. This created a safe space for western scientists and Indigenous Knowledge Keepers to learn together on the land. Also in South Bruce, Saugeen Ojibway Nation has let us know that their Knowledge Keepers will be working with the NWMO as we proceed with our work.



Elder Fred Kelly shares Indigenous water symbolism with NWMO staff.

NWMO technical experts and research partners come together with Indigenous scientists and Knowledge Keepers each year (virtually in 2020) to explore how we can continue to interweave Indigenous knowledge into our technical research programs.

As well, we have interwoven the Indigenous perspective into presentations about water, a subject of vital importance to people. Several communities in our site selection process asked us to provide more information about how our project will protect water. We have developed three presentations that explore the relationship between water, clay, and copper, which are vital components of the multiple-barrier system in our proposed deep geological repository. Developed with input from Indigenous communities, the presentations incorporate Indigenous teachings about water, clay, and copper, and use oral tradition as part of how they are delivered.

There is often a misconception that Indigenous Knowledge is only applicable to knowledge of the land when in fact it includes things like resource management, science, governance and

**There is often a misconception that Indigenous Knowledge is only applicable to knowledge of the land when in fact it includes things like resource management, science, governance and much more.**

much more. For example, our Human Resources Department has taken steps to interweave Indigenous Knowledge into their work by coordinating with the Indigenous Relations team to offer sharing circles to support mental health during the global COVID-19 pandemic.

During the next five years, we will continue to find opportunities to interweave Indigenous Knowledge into everything we do, and create space to learn from ceremony and apply those teachings to how decisions are made at the NWMO.

# COST AND FUNDING

Canadians expect that the money necessary to pay for the long-term care of used nuclear fuel will be available when needed. This expectation is being met.

Canada's long-term plan for used nuclear fuel is funded by the waste owners in Canada: Ontario Power Generation (OPG), New Brunswick Power (NBP), Hydro-Québec (HQ), and Atomic Energy of Canada Limited (AECL). The *Nuclear Fuel Waste Act (NFWA)* 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.

Each company pays into the trust fund based on the number of fuel bundles it has and continues to create. The amounts cover estimated fixed costs for the NWMO to construct, operate, monitor, and decommission a deep geological repository, as well as variable costs associated with managing each fuel bundle. This process is designed to ensure Canada's plan is funded over the long term.

For more information on trust fund deposits, please refer to the 2020 NWMO Annual Report. In addition to these trust fund contributions, waste owners are also responsible for funding the NWMO's annual operating budget.

## Total trust fund deposits: Year 2021

Owner	Trust fund balance (\$ million)	Deposit to trust funds (committed and future bundles) (\$ million)*
	December 2020	2021
OPG	4,988	62.5
HQ	183	0
NBP	204	5.0
AECL	61	0.3
<b>Total</b>	<b>5,436</b>	<b>67.8</b>

\* Annual trust fund deposits are required to be made within 30 days of the submission of the annual report. A deposit date of April 30 is assumed for illustrative purposes.

The NWMO is responsible for determining what costs can reasonably be expected to arise over the life of the project, along with a contingency for unexpected events. We maintain a system to estimate funding requirements and communicate with waste owners to ensure they provide the required deposits to the trust funds.

Many factors will affect the long-term cost of Canada's plan: the volume of used nuclear fuel to be managed, the location of the facility, the surrounding infrastructure, rock type and characteristics, the design of the repository, and the length of time allocated to monitoring the site following fuel placement. The existing inventory of used nuclear fuel in Canada is approximately 3 million bundles, and more bundles are produced each year as nuclear reactors generate electricity.

The NWMO completed a full update of the cost estimate for APM in 2016, with the next update planned for 2021. These estimates provide the basis for financial planning and trust fund deposits for future years. For planning purposes, our cost estimate is based on an expected volume of about 5.2 million fuel bundles. With this expected volume, the total lifecycle cost of APM – from the beginning of site selection in 2010 to the completion of the project about 150 years from now – is approximately \$23 billion (in 2015 dollars). This figure covers many decades of lifecycle activity – stretching well into the next century.

# KEEPING ABREAST OF THE EXTERNAL LANDSCAPE AND ADAPTING TO CHANGE

The NWMO is committed to staying abreast of local, national and international developments that may either change the landscape in which we operate or impact our project directly. We continue to monitor advances in the energy sector, innovations in nuclear waste management, changes in energy and environmental policies, potential developments involving new nuclear reactor units, changes in society's expectations, values, and insights, as well as developments with other Canadian nuclear waste initiatives.

In Canada, there is an active research sector exploring new technologies such as small modular reactors (SMRs). The NWMO understands that we will also be responsible for the long-term management of nuclear fuel waste from advanced reactors such as SMRs. We encourage organizations developing new concepts to work with us to identify the types of fuel waste that may result. Once we have sufficient information about new types of fuel to be managed, we will determine potential impacts to repository designs and how our funding formulas can be adapted to include new entrants.

We monitor new developments in Canada and internationally, plus annually update a watching brief on used nuclear fuel reprocessing and alternative used nuclear fuel management technologies ([www.nwmo.ca/adaption](http://www.nwmo.ca/adaption)). We also monitor and report on potential inventories of CANDU used nuclear fuel quantities for implications to repository design ([www.nwmo.ca/howmuchfuel](http://www.nwmo.ca/howmuchfuel)).

A core principle of APM is the commitment to adapt plans in response to input obtained through engagement activities. By way of example, we adjusted timelines for heavy fieldwork in both the Ignace and South Bruce siting areas in 2020 based not only on limitations from the global COVID-19 pandemic but also community input. In another example, we developed a transportation planning framework based on what we heard from communities and those interested in Canada's plan. Beginning in 2020, we shared it publicly for broader engagement and will refine the framework again in 2021 based on feedback we receive. We also adapted our regulatory plans in response to changes in the *Impact Assessment Act* passed in 2019. The regulatory plan will be published in 2021.

# PLANNING PRIORITIES

At the NWMO, we structure our work plans around seven priorities – engineering, site assessment, safety, mobilization, licensing, partnership, and transportation. Our commitment to incorporate Indigenous Knowledge and Reconciliation will guide our efforts related to all priority areas.

These planning priorities reflect the many activities required during this transitional period, both to achieve site selection and prepare for the work that follows.

In this section, we will outline our plans within these seven work streams.





## PRIORITY: Engineering

### THE NWMO WILL:

- » Demonstrate the NWMO's engineered-barrier system meets safety requirements, and can be produced effectively and efficiently;
- » Complete conceptual site-specific facility designs to support regulatory approvals; and
- » Initiate preliminary repository design work.

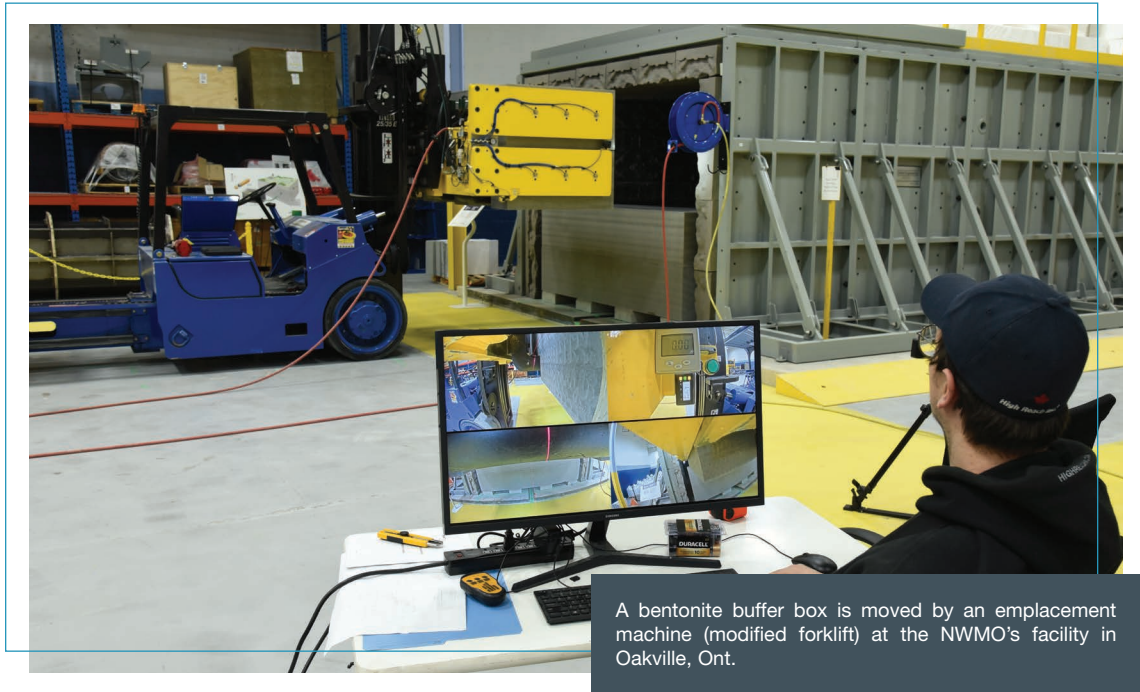
The deep geological repository is an internationally recognized approach, based on scientific consensus, for the safe, long-term management of used nuclear fuel. Multiple engineered barriers are emplaced in a stable rock formation deep underground.

Over the next five years, we will advance the site-specific repository designs in support of a site selection decision, and then progress the preliminary design at the preferred location. This information will also support the preparation of regulatory submissions and assessments.

While we encountered some delays in 2020 as a result of the COVID-19 pandemic, working closely with our key partners and vendors, we were able to restart manufacturing of physical prototypes of the long-lived repository containers. We also advanced the design, manufacture and commissioning of equipment necessary to demonstrate full-scale emplacement of the engineered barriers in the repository.

We will continue to optimize our processes and techniques in coming years to enhance confidence in the strength of the engineered barrier design and components. We also will continue to integrate the latest information from our on-going research and development activities into our designs through interdisciplinary reviews as part of our Technical Research Review Committee.





A bentonite buffer box is moved by an emplacement machine (modified forklift) at the NWMO's facility in Oakville, Ont.

**In the period from 2021 to 2025, the NWMO will also:**

- » Support site selection with conceptual site-specific repository designs that incorporate data collected through borehole drilling and preliminary environmental baseline investigations;
- » Complete the design, fabrication, and testing of prototype repository containers, buffer, and emplacement systems;
- » Maintain a prototype test and demonstration facility for engineered-barrier evaluations;
- » Complete full-scale engineered barrier system emplacement trials at our test and demonstration facility;
- » Update the conceptual designs and cost estimate for APM as required, and initiate design and development of used fuel handling systems;
- » Support the preparation of the project description and assessments needed for the regulatory process; and
- » Arrange independent peer reviews of specific aspects and features of the engineered-barrier design, and seek reviews of the engineered-barrier system testing program.



## PRIORITY:

# Site assessment

### THE NWMO WILL:

- » Complete sufficient geoscientific investigations and preliminary environmental baseline monitoring to inform site selection; and
- » Begin additional borehole drilling and baseline data collection at the preferred site.

The period 2021 to 2025 will see the NWMO identify a single preferred site and move into the licensing and regulatory process.

Although the NWMO had to suspend some site assessment activities in 2020 as a result of the global COVID-19 pandemic, we were able to re-initiate many activities by the end of the year. We have also prepared plans to recover the schedule to support a site selection decision by 2023.

In the next five years, site assessment activities will transition from preliminary assessment at the two remaining potential sites, to detailed site characterization at the selected site.

To ensure we appropriately incorporate Indigenous Knowledge, we seek guidance from local knowledge holders in planning and executing our studies. Activities have included cultural verification studies of potentially affected areas, the use of ceremony before work is carried out, having Indigenous guides and monitors on-site to observe our work, and conducting cultural awareness training for staff as well as contractors performing work in the field.

Between 2021 and 2025, as site assessment continues, we will work with interested municipalities, First Nation and Métis communities, and others in the area as they reflect on the potential environmental, social, cultural, and economic effects of hosting Canada's plan. Involving people in the broader area helps ensure that a wide range of potential benefits and impacts are recognized and considered as we move beyond site selection.



NWMO staff prepare for technical site assessments near Teeswater, Ont.

**In the period from 2021 to 2025,  
the NWMO will also:**

- » Create social conditions to support implementation of the project through engagement on specific topics such as safety of people and the environment, project benefits and stewardship of the land;
- » Continue field studies, including borehole drilling, and consider factors identified by Indigenous Knowledge holders to inform geoscientific, engineering, environmental, and safety assessments;
- » Support the process to select a site suitable for hosting the deep geological repository in a safe location through geoscientific studies in the vicinity of interested communities; and
- » Support regulatory approvals and initiate detailed site characterization studies to confirm the site is technically suitable for hosting the deep geological repository.



## PRIORITY: Safety

### THE NWMO WILL:

- » Develop preliminary site-specific safety assessments;
- » Develop updated safety assessment models for the selected site that will be the basis for regulatory approvals; and
- » Continue research to support safety cases, and build expertise to support the regulatory phase.

The NWMO is committed to keeping people and the environment safe. We place all aspects of public and employee safety – including environmental, conventional, nuclear, and radiological safety – first and foremost in everything we do.

The preferred site for the deep geological repository will be in a rock formation that supports the safe, long-term containment of used nuclear fuel. Repository performance must also meet or exceed the regulatory expectations of the Canadian Nuclear Safety Commission (CNSC).

The NWMO has initiated the development of site-specific safety case studies for the two potential sites that remain in the site selection process. We are applying our preclosure and postclosure safety assessment methodologies to these site assessments. This work includes examining features of the repository system, testing key safety parameters, and confirming that people and the environment will be protected in the long-term under a range of scenarios.

During this period, we will also develop plans for nuclear material safeguards, commensurate with the increasing design detail.

We continue to conduct joint research projects with international organizations and counterparts in other countries, including Sweden, Switzerland, Finland, France, Korea, Japan, and the United Kingdom. Partnering with other radioactive waste management organizations allows the NWMO to foster international co-operation on technology research and development, learn from other countries' experience, and keep abreast of developments in geoscience and safety cases for various host rock formations.

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

Safety is an important subject of discussion for communities, which continue to identify new and ask more detailed questions about topics, such as: the multiple barrier system, safety assessments, water management during construction and repository operations.

To advance understanding of safety topics, we identify NWMO specialists and independent speakers with whom people can engage with in discussion, and industry-related conferences they can attend. We organize presentations in potential siting area communities that address frequently asked safety-related questions.

Within the organization, the NWMO is continuing to build a strong safety culture among our employees as we prepare for the licensing phase of our project. We are also working to create and sustain an environment where employees take responsibility for their safety and that of their colleagues in all activities.



In the period from 2021 to 2025, the NWMO will also:

- » Maintain active technical research programs through partnerships with industry, academia and international organizations;
- » Maintain collaboration agreements with technical counterparts in other countries and participate in joint international efforts as appropriate;
- » Continue to participate in national and international projects, including underground experiments, with other waste management organizations and international agencies; and
- » Continue to host an annual Geoscience Seminar to bring together researchers from academia and industry.



## PRIORITY: Mobilization

### THE NWMO WILL:

- » Develop a human resources strategy, implement IT systems and other support infrastructure to prepare for the next phases of work following site selection; and
- » Begin planning, design and tendering for construction of the Centre of Expertise.

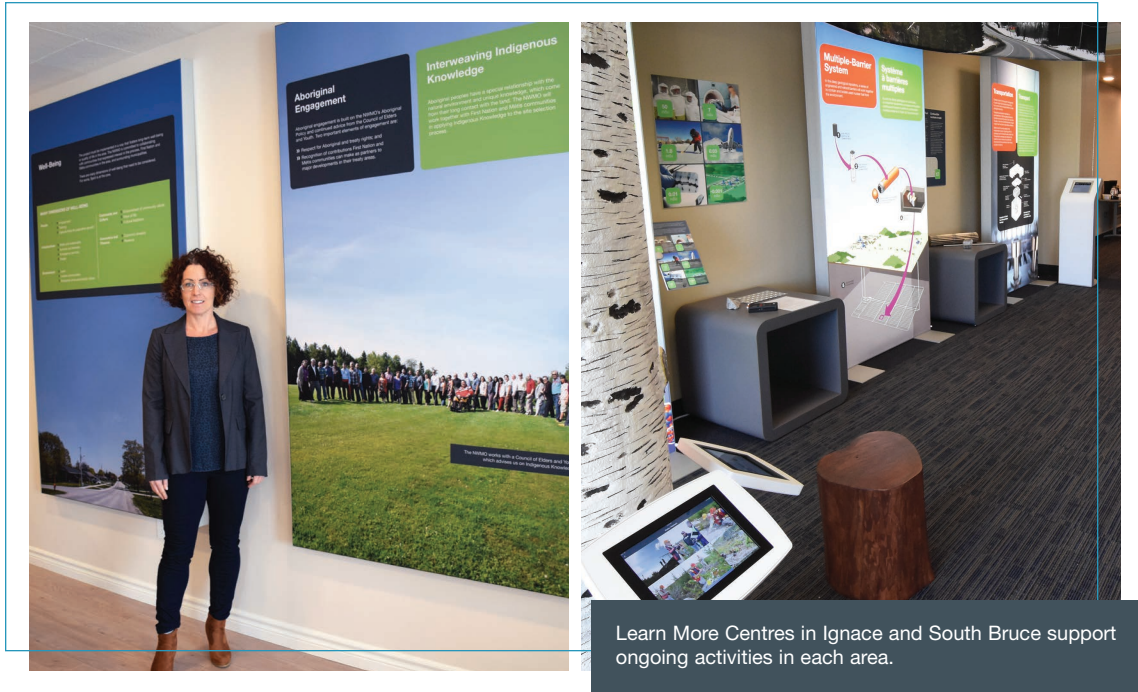
Planning is now underway for how to implement Canada's plan following site selection. In 2023, we expect to select and announce the preferred site for the project.

Once a preferred site is selected there will be increased activity in the local and regional area. This large national infrastructure project will result in significant economic benefits. The number of jobs sourced from the siting area will depend in part on the location of the repository. The impact will include direct jobs at or near the

repository site, indirect jobs created by suppliers and contractors working on the project, and induced jobs created by expenditures of people employed in the area. The NWMO will seek to maximize job opportunities in the local area – the municipality and surrounding region, including First Nation and Métis communities – and to build capacity in communities through investments in training and education.

Site selection will also mark the beginning of a multi-phase organizational transformation for the NWMO. As we focus on one area, we will need to increase resources within the region, ensure we have the technology in place to support Canada's plan, and secure land for NWMO facilities and the Centre of Expertise. We will also move our operations to be based in whichever community is selected to host the repository.

Internally, we will prepare for this increased activity by putting in place over time the human, organizational and information resources needed to undertake detailed site characterization, make regulatory submissions, and construct and operate the deep geological repository.



**In the period from 2021 to 2025, the NWMO will also:**

- » Develop work plans and assess resource requirements to advance detailed site characterization, environmental assessments, engineering designs, and safety case development for the selected siting area in support of the licensing application;
- » Continue to build a strong local staffing presence in potential siting areas and provide local contracting opportunities for the project;
- » Deepen our safety culture and build a learning organization, encouraging and supporting continuous employee learning;
- » Invest in building skills and capacity of youth and community members in the municipalities, and First Nation and Métis communities engaged in the site selection process to help position them to secure jobs related to Canada's plan;
- » Continue to use IT tools and technology to automate processes, support strategic initiatives, and digitize information, content and records. We will also use artificial intelligence, business intelligence, and data analytics to drive operational efficiencies and aid in critical decision-making; and
- » Continue to strengthen our corporate culture through appropriate management behaviours, standards and tools, including the use of technology platforms. This includes striving for excellence in project management, achieving meaningful partnership, embracing diversity and inclusion, committing to Reconciliation and interweaving Indigenous practices into all our work.



## PRIORITY: Partnership

### THE NWMO WILL:

- » Build supportive and resilient partnerships with communities leading to mutually agreeable partnership agreements;
- » Develop project implementation plans compatible with the well-being of communities; and
- » Select the preferred site for the deep geological repository in an area with informed and willing hosts.

The NWMO will work with siting communities to build the sustainable and resilient partnerships required to implement the project. From 2021 to 2023, we will continue to work with municipal and Indigenous communities in each siting area to explore the potential for partnership.

Together with communities, we are following a partnership road map that outlines a sequence of partnership-building topics to explore. Communities will build on the values and principles they have identified to guide discussions. Work will include developing area-specific visions and identifying partnerships that are required for the project.

As the exploration of partnership deepens, municipalities in the siting process continue to express interest in enhancing relationships with their Indigenous neighbours. The NWMO

supports learning through cultural awareness and Reconciliation training, and provides support where appropriate in establishing formal lines of communication.

As the site selection process progresses, we have seen increased engagement and heard a diversity of views. Comments, questions and concerns help inform our work. For example, people want clarity around the challenges and opportunities the project will bring and how benefits can be realized. We will work with the communities to address these questions and concerns.

In southern Ontario, we also continue to hear questions about potential impacts on property values. The NWMO has committed to develop, in consultation with the Municipality of South Bruce, a program to compensate certain property owners in the vicinity of the deep geological repository if their property values are adversely affected by the project, should it be sited in South Bruce.

Following site selection in 2023, we will shift focus from exploring the potential for partnerships to implementing partnership agreements. Youth engagement will remain a priority, given the long-term nature of the project and the need for intergenerational transfer of knowledge to support implementation.

Ultimately, only one site can be selected for the deep geological repository, and as communities exit the siting process, the NWMO remains committed to ensuring they are better off for having participated. We take great pride in feedback to date from local leaders who maintain their communities benefited from their involvement in the process.



## Road map to partnership

### ALIGNED PARTNERSHIPS

Through a schedule developed and agreed upon with partners

### INVESTMENTS

Identify and deliver investments that drive capability and economic prosperity for partners

### IDENTIFY REQUIRED PARTNERSHIPS

Identify required partnerships with whom, at what level, in what combination, and when

### DEVELOP VISION FOR THE PROJECT

Develop the project vision that will meet the NWMO's and community's interests, and potential partners as well

### VALUES AND PRINCIPLES TO GUIDE PARTNERSHIP DISCUSSIONS

Agree on common values and principles to guide partnership discussions

Starting from the bottom and moving upwards, the road map guides our discussions about partnership with communities.

In the period from 2021 to 2025, the NWMO will also:

- » Continue engaging municipalities, First Nation and Métis communities in the siting areas and surrounding communities to build awareness of the project and develop and sustain relationships – taking into account traditional laws, practices and use of land;
- » Conduct socio-economic studies to further assess potential impacts and benefits associated with the project;
- » Outline an approach to assessing willingness to inform the final site selection and an approach to build, measure and monitor conditions for willingness over time;
- » Work with the siting communities to build awareness of the project in the region and identify the required partners to build supportive and resilient partnerships;
- » Ensure communities engaged in the siting process have the resources and information they need to fully participate in siting activities, reflect on their interests, and make an informed decision; and
- » Develop mutually agreeable hosting agreements in each siting area, and after a site is selected, begin implementing the agreements in the siting area that is continuing into the regulatory process.



## PRIORITY: Transportation

### THE NWMO WILL:

- » Demonstrate potential for a socially acceptable transportation plan through dialogue on the transportation planning framework; and
- » Continue refinement of the used fuel transportation system.

The NWMO is developing safe, secure and socially acceptable plans for transporting used nuclear fuel from the current interim storage sites to the deep geological repository.

As part of the site selection process, an acceptable transportation route must be identified or have the potential to be developed. Transportation planning and evaluations will fully address regulatory requirements for safely transporting used nuclear fuel through different provinces. Site-specific technical and social planning activities will continue after site selection in 2023.

From a technical perspective, used nuclear fuel can be transported safely and securely through the use of robust transportation packages. The NWMO continues to conduct technical assessments to help define potential routes. We plan to start transporting used fuel to the deep geological repository site in the 2040s, once the repository is operational.

In addition to technical requirements, social considerations are important in the planning process. We understand that transportation of used nuclear fuel is an important topic to Canadians and Indigenous peoples, and we are taking a collaborative approach that includes shared decision-making.

The NWMO has developed a draft transportation planning framework that will form the foundation for developing a socially acceptable transportation plan. Engagement on this framework, along with updates to the used fuel transportation system design description to be published in 2021, will provide confidence that a socially acceptable transportation plan can be developed and will support a site selection decision in 2023. Beyond 2023, the NWMO will continue to seek feedback on the transportation framework to ensure our planning remains reflective of Canadian and Indigenous peoples' perspectives.

The NWMO recognizes that a wide range of individuals and groups have an interest in transportation planning, and we are working to understand their interests so that we can continue to address questions and concerns.

Indigenous peoples are one very important group that must be involved in planning for transportation. Applying a Reconciliation lens to all our work enables us to recognize that given our country's history of past and continuing wrongs, it is imperative that we build positive and respectful relationships based on trust, rights and equity.



Senior Transportation Engineer Ulf Stahmer (right) talks to a guest at our proof test facility in Oakville, Ont., about transportation of used nuclear fuel.

**In the period from 2021 to 2025, the NWMO will also:**

- » Continue transportation planning that is reflective of citizens' values, principles and objectives;
- » Release a revised version of the transportation framework in 2021 based on public input;
- » Undertake transportation logistics studies and risk assessments;
- » Seek CNSC design approval certificates for road and rail transport packages as appropriate;
- » Establish key requirements for emergency management and transportation security for planning purposes;
- » Continue to expand engagement to include municipalities and Indigenous communities along potential transportation routes, as well as interested individuals and groups; and
- » Brief Canada's nuclear host communities about our progress, including planning for eventual transportation of used nuclear fuel from their communities to the deep geological repository.



## PRIORITY: Licensing

### THE NWMO WILL:

- » Prepare with community input the submissions to commence the regulatory approvals process; and
- » Start the regulatory approvals process with partner communities.

The NWMO's overriding objective in implementing Canada's plan is protecting people and the environment for generations to come. We will have to demonstrate that the project meets or exceeds strict regulatory requirements to protect the health, safety, and security of people and

the environment, while also respecting Canada's international commitments.

Our site investigations and associated technical studies will adhere to relevant municipal, provincial and federal requirements. We keep abreast of all regulatory changes that are pertinent to the project. For example, the NWMO has already begun, and will continue over the next five years, to conduct studies consistent with the *Impact Assessment Act* passed in 2019. We have adapted our plans to this change in legislation and will release our regulatory plan in 2021. We expect to formally begin the regulatory process in 2024.

We will continue to interact with the CNSC, consistent with the terms of a special project arrangement in place, prior to submission of a licence application.



Input and feedback from online engagement sessions will inform the NWMO's environmental baseline program design, including future fieldwork.

**In the period from 2021 to 2025, the NWMO will also:**

- » Develop impact assessment methodologies in collaboration with municipal and Indigenous siting area communities, in preparation to formally launch the regulatory approvals process;
- » Working with communities and others, identify opportunities to enhance understanding of current local and regional conditions. This includes collaboration with Indigenous communities to interweave local Traditional Knowledge into this understanding, as a foundation for the environment, social, health, and economic assessments;
- » Establish environmental monitoring programs in potential siting areas in close collaboration with community members and Indigenous Knowledge Keepers;
- » Work with the CNSC and other regulatory authorities to obtain certainty regarding the requirements and implementation of the *Impact Assessment Act*;
- » Prepare materials required to initiate the federal impact assessment and regulatory approvals process;
- » Work with potential host communities to define their role in the regulatory process and then facilitate their participation;
- » Submit the project description required to initiate the impact assessment process; and
- » Following the receipt of the Site-Specific Impact Assessment Guidelines and Permitting Plan from the IA Agency of Canada and the CNSC, begin the impact assessment process and prepare the necessary reports for licensing.



## NUCLEAR REGULATORY OVERSIGHT

Implementation of a deep geological repository 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's mandate also includes the dissemination of objective scientific, technical and regulatory information to the public.

Under section 26 of the *NSCA*, activities associated with a nuclear facility can occur only in accordance with a licence issued by the CNSC. The repository for Canada's used nuclear fuel will be subject to the CNSC's comprehensive licensing system, which covers the entire life cycle of the repository, from site preparation to construction, operation, decommissioning (closure and postclosure), and abandonment (release from CNSC licensing).

This stepwise approach will require a licence for each phase of the repository life cycle. The process for obtaining a "site preparation" licence will be initiated by the NWMO. The NWMO would submit an application for a Licence to Prepare Site to the CNSC. A licensing decision under the *NSCA* on a repository can be taken only after the successful completion of an impact assessment, following the process established under the *Impact Assessment Act*. More information about the CNSC's licensing process is available at [www.nuclearsafety.gc.ca](http://www.nuclearsafety.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, it 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.

# DEVELOPING A CANADIAN INTEGRATED STRATEGY FOR RADIOACTIVE WASTE

In 2020, the Minister of Natural Resources announced that the federal government will complete a Radioactive Waste Policy Review ([www.radwastereview.ca](http://www.radwastereview.ca)). The objective is to elaborate on the existing policy in order to provide greater leadership on radioactive waste management and ensure that Canada continues to meet international best practices.

In November 2020, the Minister of Natural Resources Canada asked the NWMO to lead discussions about an integrated strategy for the safe, long-term management of all Canada's radioactive waste. We have been selected in part to leverage our almost 20 years of recognized expertise in the engagement of Canadians and Indigenous peoples on plans for the safe, long-term management of used nuclear fuel. This work will run in parallel with the APM project, but will be separate from it.

We will make informed and practical recommendations to the Canadian government on an Integrated Strategy for Radioactive Waste.

All Canada's radioactive waste is safely managed today in interim storage. An integrated strategy will ensure the material continues to be managed in accordance with international best practice over the longer term. Building on previous work, this strategy represents a next step to identify and address any gaps in radioactive waste management planning, while looking further into the future.

Interested individuals and organizations will have a variety of ways to participate and can sign up for updates at [radwasteplanning.ca](http://radwasteplanning.ca).

# SOUND GOVERNANCE AND ACCOUNTABILITY

The NWMO will maintain an accountable governance structure that provides confidence to the Canadian public in the conduct of our work.

Our governance structure comprises the member organizations, Board of Directors and Advisory Council. The NWMO is subject to the requirements of the *NFWA* and oversight by the Minister of Natural Resources.

## MEMBERS

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

## BOARD OF DIRECTORS

The Board of Directors is responsible for oversight and taking a leadership role in developing the corporation's strategic direction. The member organizations elect the Board of Directors. There are currently nine directors on the Board, representing a range of perspectives from both within and outside the nuclear industry, including capabilities in Indigenous culture and financial management.

## ADVISORY COUNCIL

The *NFWA* requires that the Board of Directors appoints an Advisory Council to review and comment on the NWMO's work. The Council meets regularly with the NWMO's senior management, closely following the organization's plans and activities, and providing ongoing counsel and advice.

Advisory Council members represent a broad range of expertise, including engineering, community engagement, public affairs, environment, sustainable development, Indigenous relations, Indigenous Knowledge, and community-based research. Members of the Council are knowledgeable in a range of topics, including nuclear waste management issues and experienced in working with citizens and communities on a range of public policy issues.

## COUNCIL OF ELDERS AND YOUTH

The Council of Elders and Youth is an independent advisory body made up of First Nation and Métis Elders and Youth. It meets regularly throughout the year and provides counsel to the NWMO on how to apply Indigenous Knowledge in implementing APM. In addition, the Council provides advice on issues that could enhance the development and maintenance of good relations with First Nation and Métis communities and organizations.



## INTEGRATED MANAGEMENT SYSTEM

The NWMO continues to operate our integrated management system for activities supporting the long-term management of nuclear waste. To sustain excellence in governance, accountability and safety, the organization maintains certifications to Canadian and international standards, including:

- ISO 9001:2015 for quality;
- ISO 14001:2015 for environment; and
- CSA Z1000:2014 for health and safety management.

In addition to complying with these standards, we have augmented our management system to satisfy the CSA N286-12 Management System Requirements for Nuclear Facilities, which includes nuclear waste facilities. Our integrated management system is regularly reviewed and enhanced to ensure it continues to support our key planning priorities and provides a strong foundation on which to implement our mission and values. The focus on protecting people and the environment fully aligns with the CSA N286-12 management principle that safety is the paramount consideration guiding decisions and actions.

## INDEPENDENT REVIEWS

Consistent with recommendations from our Advisory Council, the NWMO will continue to seek external expert review of and comment on our technical program. As the program continues to move from research into design, fabrication, and demonstration, the reviews are increasingly focused on specific design aspects and features. These reviews ensure the science is sound, contribute to design and quality, and help to enhance public confidence in the NWMO's implementation plan and decision-making.

## REPORTING

The NWMO maintains high standards of reporting to demonstrate safety, integrity, excellence, collaboration, accountability, and transparency in the implementation of APM. We report regularly on our progress, especially in response to the advice of Canadians and the evolving environment.

The *NFWA* requires us to issue annual and triennial reports. In each case, reports must be submitted to the Minister of Natural Resources and to the public at the same time. The minister tables each report in Parliament and issues a statement on it.

## TRANSPARENCY

The NWMO is committed to being open and transparent in our processes, communications, and decision-making so that the approach we are implementing is clear to Canadians and Indigenous peoples. To demonstrate this commitment, we maintain a Transparency Policy. Sharing information and encouraging an exchange of perspectives are fundamental to our mandate, and we strive to ensure our practices are aligned with the spirit of the NWMO Reconciliation Policy and all relevant freedom of information, access to information and privacy legislation.

# 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.

**Land access** is a process the NWMO initiated in 2019 to reach agreements with landowners in South Bruce, Ont., to allow sufficient access to land for studies at a potential deep geological repository location and to confirm a potential repository site could be identified. The agreements include a combination of option and purchase arrangements that enable the NWMO to conduct studies while allowing the landowners to continue using the land.

**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 per cent of its initial value after one year, decreases to about 0.1 per cent after 10 years, and decreases to about 0.01 per cent after 100 years. After approximately one million years, the radioactivity in used nuclear fuel approaches that of natural uranium.

**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 not included in the implementation plan as used fuel will remain at interim storage facilities until the repository is operational.

**Property value protection** is a program the NWMO has committed to develop, in consultation with the Municipality of South Bruce, to compensate certain property owners in the vicinity of the deep geological repository if their property values are adversely affected by the project. This program will be developed as part of a series of well-being studies that the NWMO plans to complete with the involvement of the community.

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

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

**Small modular reactors (SMRs)** provide an alternative to large-scale nuclear reactors. SMRs can be purchased and constructed in a modular way. The NWMO would be responsible for the long-term management of used nuclear fuel created through new or emerging technology if it is implemented in Canada.

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

**Willingness** is fundamental to the siting process. From the very beginning, the NWMO outlined a number of principles regarding willingness. These include a commitment to only site the project in a community that is informed and willing, time and resources for communities to learn about the project before making a decision, and a compelling demonstration of community willingness. Community residents, at the grassroots level, must be involved in that demonstration of willingness.

Beyond the demonstration from the community, the NWMO also needs to ensure the other requirements and commitments outlined in the siting process can be met in order to implement the project in an area.

**Note about terminology:** In this document, we use the terms Indigenous, First Nation, and Métis. Our intention in the writing is to honour and respect people, nations and communities, as well as historical and contemporary understanding.

# WHAT WE HEARD

In March 2020, the NWMO published *Implementing Adaptive Phased Management 2020 to 2024* – the previous five-year version of this plan – and invited public review and comment.

We received responses from across the country, from individuals and organizations, some from government agencies and Indigenous communities and others from private citizens. This type of public input informs and guides our work and comments received have helped us update this plan.

Several themes emerged. This is a summary of what we heard.

## Transportation

The safe and secure transportation of used nuclear fuel is an important component of Canada's plan. A number of respondents had questions about this aspect of our plan.

Transportation to a central repository site is expected to begin in the 2040s, but now is the time to build confidence that a socially acceptable plan can be developed to move the used fuel to the repository site we select. The NWMO has started working with communities, Canadians and Indigenous Peoples to determine what the plan will look like while adhering to national and international safety standards. In 2020, we released our draft Transportation Planning Framework, a responsive document to address the questions and concerns we are hearing from Canadians.

The framework describes planning objectives, issues to be addressed and factors to be considered as the NWMO continues to plan for transportation. The NWMO will continue to seek input on this framework and on this plan as it moves towards the safe and secure transportation of used nuclear fuel in the coming decades. More information on the transportation plan can be found in the [Transportation](#) section of this report.

## Indigenous Relations

Canadians wrote to us to comment on our work towards Reconciliation and ask about how the NWMO works with Indigenous communities.

The NWMO is collaborating with Indigenous communities and organizations across the country, and they are frequently involved in both our engagement and technical activities. We are committed to respecting and valuing Indigenous Knowledge in all its forms and interweaving it into all our work.

The NWMO is also committed to working towards Reconciliation and released a Reconciliation Strategy in 2019 that informs the activities outlined in this plan.

We will continue to meaningfully engage with First Nation and Métis communities and organizations as we work to implement Canada's plan. More information on our work towards Reconciliation and Indigenous engagement can be found in the [Reconciliation and Indigenous Knowledge](#) section of this report.

### **Future technologies and a central site for a deep geological repository**

The NWMO also heard questions about how future technologies will affect Canada's plan.

We were asked how we plan to include warnings on the repository once it's built to ensure future generations understand it contains potentially hazardous materials. A number of controls, including building the repository away from any natural resources and deep underground, are built into the design to help prevent future accidental intrusion. In the medium term, through operation and decommissioning, institutional controls, which could include active controls

continued surveillance and monitoring and passive controls like above-ground markers or record keeping, will be in place. Over the very long-term, the NWMO joined experts around the world to discuss the complex issue as part of the Nuclear Energy Agency's international collaboration initiative on Preservation of Records, Knowledge and Memory Across Generations, which explored various topics such as markers, archives and key information files that would include for information transferred across generations. The NWMO has not decided on our specific strategy. We continue to monitor for relevant developments and international initiatives.

Growing interest in the use of small modular nuclear reactors (SMRs) has raised questions about any resulting fuel waste. Although no SMRs are currently approved for construction in Canada, if they move ahead the NWMO will be responsible for managing resulting fuel waste. Future waste owners would be responsible for the costs associated with this increased waste. More information can be found in the [Keeping abreast of the external landscape and adapting to change](#) section of the report.

Others asked about alternatives to a deep geological repository at a central location. While multiple options were considered as part of the dialogues from which APM emerged, conversations with Canadians, Indigenous peoples and technical specialists led us to propose the plan for a single, central repository site. This is the plan the federal government accepted and directed the NWMO to implement.

Canada's plan is also based on international best practices. Countries around the world are working to build their own deep geological repositories for used nuclear fuel. The multiple-barrier system, which is designed for the long-term storage of used nuclear fuel, will protect people and the environment for generations to come. Canadians have told us they want to ensure future generations are not left to deal with our used nuclear fuel and, through consultation, told us they want it stored in a deep geological repository in a central location. Canada's plan follows international and national best practices and regulatory standards to ensure used nuclear fuel is safely isolated and contained for hundreds of thousands of years. On-site storage has proven a safe interim solution for used nuclear fuel, but it is not suitable as a long-term approach. A deep geological repository in a central location will ensure safety for the long-term.

### **Funding Canada's plan**

The NWMO was asked to provide clearer language about who is responsible for paying for Canada's Plan. We updated the description to clarify that waste owners, not taxpayers, are responsible for funding the planning, design, construction and maintenance of Canada's Plan. In response to feedback we received, we also updated

how we describe our funding model in the Implementation Plan, and this can be found in the [Cost and funding](#) section of this report. Further information about funding and Trust Funds can be found in our Annual Report.

### **Security and safety**

We received comments about engineering, security and safety planning that will be required to implement Canada's plan. Safety and protecting people and the environment guides all our work at the NWMO. We were asked about our research and development activities, and in this report we integrate the latest information from our ongoing research and development activities, including interdisciplinary reviews. In response to specific feedback about nuclear security, we have adapted this document to reflect that we are planning for nuclear material safeguards in the implementation of Canada's plan, including our plan to account for nuclear material safeguards, in the [Safety](#) section of this report.

### **Environment**

Respondents told us they share the NWMO's priority that Canada's plan must protect people and the environment for generations to come. This report provides information about how we plan to work with

communities to design our environmental baseline monitoring programs and integrate their priorities and knowledge into our work. We know that local communities, including Indigenous communities, have important knowledge to share with us and we are committed to understanding and integrating that insight.

### Site selection

As the NWMO works towards selecting a site for Canada's plan, we continue to hear from citizens about our approach to ensuring we work in an area with informed and willing hosts.

We employ Adaptive Phased Management in our approach to Canada's plan, as such, this plan and all our work is constantly being adapt to reflect our missions and values as well as the priorities of our siting communities.

We now have two siting areas remaining in our site selection process, Ignace in northwestern Ontario and South Bruce in southern Ontario. In 2020, in Ignace we began analyzing geological samples from boreholes already drilled and prepared for additional borehole studies to be undertaken in 2021, while technical activities in South Bruce focused on preparing for upcoming borehole drilling. Further site assessments, environmental, social and technical work in both areas will continue over the next few years, as described throughout this report.

This report also provides information about how we plan to leave a positive legacy in communities

we work with and ensure any costs of learning more about Canada's plan are covered by the NWMO. While some comments asked about our intentions behind these monetary agreements, the NWMO has been clear that our financial support is intended to ensure taxpayers are not funding municipal engagement in Canada's plan, and to ensure we are helping communities enhance their well-being and capacity in ways they identify as priorities and that would support the implementation of Canada's plan. More details about this work are included throughout this report.

We also heard concerns about whether we are treating the two potential siting areas equally. Canada's plan is about working with everyone who has an interest. Together with communities in both of the remaining siting regions, we are committed to defining what partnership will look like and developing criteria for determining willingness, as described in the [Selecting a site](#) section of this plan. In many ways the two areas require different approaches. Each community has different needs, priorities and aspirations. Differences in geology mean even some of the technical assessment work required is not exactly the same.

Throughout this report you can read how the NWMO is working with communities to learn how to ensure Canada's plan respects the unique character of the future repository site. The project will only proceed with the involvement of the interested municipal, First Nation and Métis communities in the area and surrounding communities, working together to implement it.





# Share your thoughts on Implementing Adaptive Phased Management 2021 to 2025

Your feedback is essential to the implementation of Canada's plan for the safe, long-term management of used nuclear fuel.

Every year, we ask Canadians and Indigenous peoples for their input on our implementation plan to inform and guide our work. We then take that feedback into account in our planning activities, and in each year's implementation plan we report on what we heard from Canadians about the previous year's plan.

This year, we are moving our feedback form for the implementation plan online. We invite you to visit [www.nwmo.ca/implementationplan](http://www.nwmo.ca/implementationplan) and share your thoughts.

**The deadline to submit your feedback is June 11, 2021.**

We will also continue to accept written comments by mail, email and fax. Some questions you may consider when drafting a written response include:

- » Are the priorities that we have identified appropriate? Have we missed key areas?
- » The 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?
- » Other comments or suggestions?

Please include your name, mailing address and contact information in any written response.

Your response should be addressed to:

Lisa Frizzell  
Re: Implementation Plan 2021-25  
22 St. Clair Avenue East, Fourth Floor  
Toronto, ON M4T 2S3  
Canada

Please reply by  
June 11, 2021, to:  
**Lisa Frizzell**  
Vice-President,  
Communications

**By mail** 22 St. Clair Avenue East, Fourth Floor  
Toronto, ON M4T 2S3, Canada

**By email** [learnmore@nwmo.ca](mailto:learnmore@nwmo.ca)

**By fax** 647.259.3692

**Through website**  
[www.nwmo.ca/contactus](http://www.nwmo.ca/contactus)

**Through social media**  
   @nwmocanada  
 /company/nwmocanada

# Implementing Adaptive Phased Management 2021 to 2025

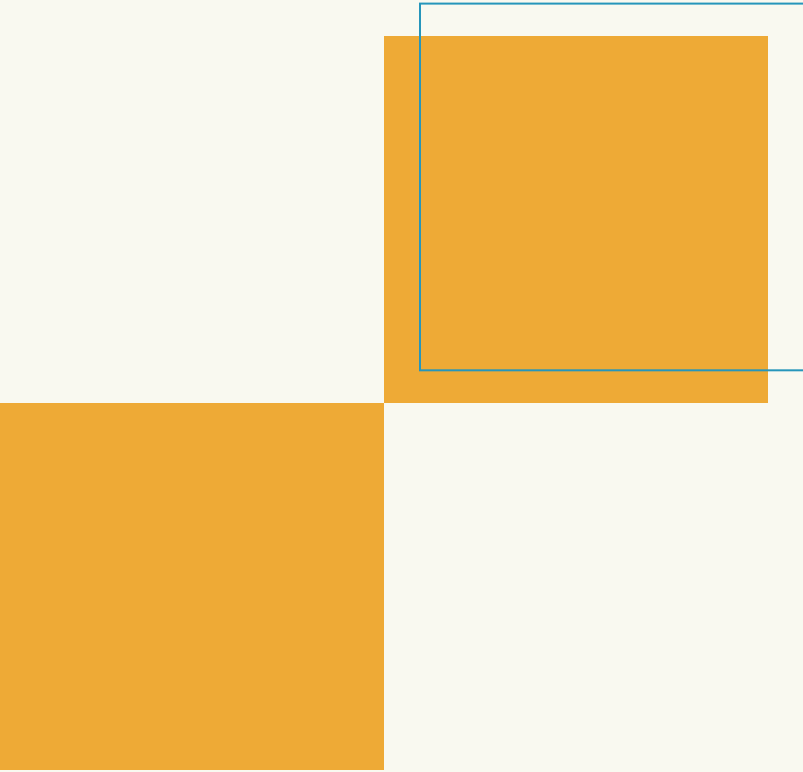
For more information,  
please contact:

**Nuclear Waste Management Organization**  
22 St. Clair Avenue East, Fourth Floor  
Toronto, Ontario M4T 2S3, Canada  
Tel.: 416.934.9814 Toll Free: 1.866.249.6966  
Email: [contactus@nwmocanada.ca](mailto:contactus@nwmocanada.ca)  
Website: [www.nwmocanada.ca](http://www.nwmocanada.ca)

   @nwmocanada  
 /company/nwmocanada

© 2021 Nuclear Waste Management Organization





**nwmo**

NUCLEAR WASTE  
MANAGEMENT  
ORGANIZATION

SOCIÉTÉ DE GESTION  
DES DÉCHETS  
NUCLÉAIRES