PEOPLE. SCIENCE. INDIGENOUS KNOWLEDGE.

Moving towards partnership

Triennial Report 2017 to 2019

nwmo

NUCLEAR WASTE MANAGEMENT ORGANIZATION

SOCIÉTÉ DE GESTION DES DÉCHETS NUCLÉAIRES

HOW WE GOT HERE

2002

The NWMO is created

The NWMO is established to manage used nuclear fuel for the long term, as per the *Nuclear Fuel Waste Act*.

2005

Canada's plan is developed

The plan emerges through a three-year dialogue with a broad cross-section of Canadians.

2007

Adaptive Phased Management is selected

The Government of Canada adopts the NWMO's recommended approach to managing used nuclear fuel.

2008-09

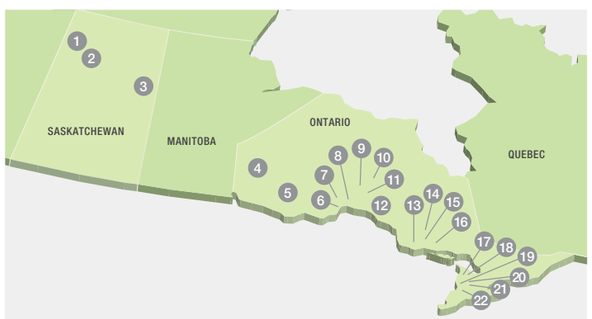
Public engagement on the site selection process is undertaken

The NWMO and citizens collaboratively design a process for selecting a preferred repository site.

2010-12

Site selection process begins

Twenty-two communities express interest in learning about and potentially hosting the project.



2014

Design concept for the engineered-barrier system (EBS) is completed

The EBS design is optimized specifically for used CANDU fuel.

2015

Multi-year proof testing plan begins

Testing on the EBS is initiated to demonstrate its safety performance.

Field and subsurface studies begin

Studies in potential siting areas help determine suitability to meet project requirements.

2017

First borehole is drilled in the Ignace-Wabigoon Lake area

The NWMO obtains initial core samples and accesses rock at a depth for further investigations.

2018

Reconciliation Statement is issued

The statement acknowledges historical wrongs in Canada's past and the need to co-create a better future.

2019

Reconciliation Policy is formalized

The policy sets out how the NWMO will contribute to Reconciliation in all our work.

Two areas remain in the siting process

Since 2012, the NWMO has narrowed our focus to two areas of study in the site selection process.

NUCLEAR WASTE MANAGEMENT ORGANIZATION
SOCIÉTÉ DE GESTION DES DÉCHETS NUCLÉAIRES

The Honourable Seamus O'Regan
Minister, Natural Resources Canada
Ottawa, ON K1A 0A6

March 2020

Dear Minister,

We are pleased to submit to you the triennial report of the Nuclear Waste Management Organization (NWMO) for fiscal years 2017 to 2019.

We submit this report in compliance with sections 16(1), 16(2), 18, and 23(1) of the *Nuclear Fuel Waste Act*.

In fulfilment of our obligations under section 24 of the Act, we are also making this report available to the public.

Respectfully submitted,

Wayne Robbins
Chairman

Laurie Swami
President and CEO

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1 Messages

Wayne Robbins, Chairman

I am honoured to continue to serve as the Board Chair for the NWMO, which is taking great care with implementing Canada's plan to safely manage used nuclear fuel in a way that protects people and the environment. It is rare to be given the opportunity to steward with an organization whose work will affect not only the current generation, but also those to come. It is also a great responsibility.

The Board endeavours to provide oversight in the context of an evolving business and social landscape. Over the past three years, we have continued to monitor such things as emerging technologies, and the social and political changes that could impact Canada's plan.

It has been very rewarding to work with the highly capable executive team at the NWMO as we navigate our way through changes in the energy sector, developments in nuclear waste management, the complexities of identifying a single, preferred site, and preparing the organization for all the work that will follow.

The NWMO has continued to chart a steady forward course and is on track to meet the major milestone of selecting a single, preferred site for a deep geological repository by 2023. This will be a significant accomplishment and will mark the transition to the regulatory phase of the project.

Once a site is selected, there will be an escalation of activity; the NWMO's drive for excellence in project management will help ensure we have the human, organizational and information technology capacity in place for continued success.

During the past three years, the Board has also experienced a refresh, as some members completed their terms and new members joined. New members have contributed fresh insight and experience as the project continues to advance towards selection of a single, preferred site for a used fuel repository.

These changes are balanced by the continuity of longer-serving Board members and the excellent advice we receive each year from both the Advisory Council and Council of Elders and Youth.

Board members are fully supportive of Canada's plan and take their role very seriously. One of the ways we, as Board members, keep abreast of developments is through gaining insight first-hand. During the past three years, the Board has attended industry conferences and events, met with a number of community leaders, and participated in Indigenous ceremonies to formalize our Reconciliation Statement and Policy. We are also tracking developments regarding the management of used nuclear fuel internationally, in countries such as Finland and Sweden.

As part of overseeing the strategic direction of the NWMO's work, we hold strategy sessions with the executive team each year. These strategy sessions focus on identifying opportunities and challenges for the short- and long-term success of the project.

The Board's governance duties include approving the NWMO's business plans, performance objectives and budgets. Fiscal responsibility is of the utmost importance, especially with a project of this size and duration. We are committed to ensuring that the NWMO maintains the necessary financial resources to successfully implement it in a way that is technically sound, socially acceptable and economically feasible.

Canada has a plan for used nuclear fuel, and the NWMO, working together with partners, continues to make good progress on its implementation. I invite you to dig deeper into the pages of this report. It demonstrates why you can have confidence in Canada's plan to safely manage used nuclear fuel.

Wayne Robbins

Chairman

Laurie Swami, President and Chief Executive Officer

With bold steps, we continue to build momentum. During the last three years, the NWMO has made great strides in implementing Canada's plan. Identifying a single, preferred location for a deep geological repository for used nuclear fuel is now coming into view. Our organization, like the communities with which we work, has demonstrated great dedication and resilience as we progress towards this significant milestone.

Our goals are ambitious; our ideas forward-looking. The protection of both people and the environment is too important for half measures. Throughout this reporting period, you will find examples of steadfast commitment, insightful innovation, and most of all, the capacity to take bold steps. These bold steps are evident across all our work: in advancing site selection, in validating our technical solutions, and in leading by example with our Reconciliation journey.

With Canada's plan, we committed to a collaborative process to select a site for the long-term management of Canada's used nuclear fuel. As the process bears out, we see it was the right choice. The progress we have made together with the communities fills me with pride.

To advance the site selection process, we narrowed our focus to fewer study areas between 2017 and 2019: from nine to two. Municipal, First Nation and Métis communities have actively engaged and helped shape the process.

The communities that have participated in the process have demonstrated tremendous leadership, investing their time and effort on behalf of Canadians. Those remaining in the process have already begun exploring the kinds of long-term, sustainable partnerships that will be needed to continue our march forward, not only towards the milestone of site selection, but also for generations to come.

As Canada's plan advances, our technical program has as well. During the reporting period, our specialists have focused on demonstrating the safety and effectiveness of the multiple-barrier system, learning more about the rock at potential siting locations through borehole drilling, and optimizing the repository layout for potential host sites.

Our technical solutions are based on international best practices and Canadian innovation. During the reporting period, we renewed seven agreements with international counterparts and established a new one. From 2017 to 2019, the NWMO supported research at more than 15 universities across Canada.

Our progress has enabled us to begin the initial work for the regulatory phase of Canada's plan, ahead of our original schedule. For example, we are already working with municipal and Indigenous communities to design environmental assessment methods we can use when it comes time to launch our impact assessment activity.

We have also made progress in our Reconciliation journey. I am particularly proud of the manner in which the NWMO team has embraced Reconciliation. Through ceremony with our Council of Elders and Youth, in 2018, we issued a Reconciliation Statement to acknowledge historical

wrongs and commit to co-create a better future. In 2019, also through ceremony, we formalized a Reconciliation Policy that commits us to measuring and reporting on our progress annually. These commitments build on initiatives already underway to interweave Indigenous Knowledge into our work across disciplines. We are motivated to contribute to an essential Canadian conversation and adapt to the evolving needs of our society.

Similarly, we are responding to other matters that are important to Canadians such as climate change. As nuclear energy becomes an increasingly important part of the clean energy discussion, there is growing interest in new nuclear technologies such as small modular reactors. Our project, adaptive by nature, monitors industry developments. We encourage organizations developing new concepts to work with us to identify the types of fuel that may result. Early planning will ensure we are prepared to manage all Canada's used nuclear fuel when the repository begins operating.

This triennial report provides a closer look at the bold steps we have taken during the past three years and the progress we have made. We know it will take ongoing commitment and resilience to achieve our ambitious goals. By continuing to work collaboratively, we will be successful in implementing Canada's plan. The protection of people and the environment demands it.

Laurie Swami

President and CEO

2 Introduction to the NWMO

Welcome

Welcome to the Nuclear Waste Management Organization's (NWMO) triennial report for the period covering 2017-19. The theme of the report, "Moving towards partnership," carries forward from the previous two annual reports. It reflects our momentum during the past three years in advancing both technical and social elements of Canada's plan, and in creating a foundation for partnerships of many kinds. With communities. With Canadians. With scientists. With universities. With other countries. With employees.

In the following pages, we outline our activities in advancing Canada's plan during the past three years, introduce you to some of the specialists working on this project, preview some planned future activities, and provide an update on our financial position.

Submitting this report to Canada's Minister of Natural Resources – and making it available to the public – fulfils one of our obligations under the *Nuclear Fuel Waste Act* (*NFWA*) (2002).

In keeping with our adaptive approach and based on public feedback, the triennial report is now more concise and accessible. We hope the new format serves to more easily inform you about who we are and what we are doing.

Our place in the nuclear cycle

For nearly 60 years, Canada has been exploring the potential for nuclear innovation as a reliable energy source to power our homes, businesses, schools, and hospitals.

As worldwide demand for energy grows and action on climate change intensifies, nuclear power is increasingly part of the conversation.

The NWMO has an important role that completes the 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.

We must get this right. It is important for industry, for the environment, for Canadians, and for other nuclear countries embarking on similar projects.

Canada's plan

Used nuclear fuel is stored on an interim basis near or at sites where it was produced in facilities licensed by the national regulator – the Canadian Nuclear Safety Commission. This current storage method is safe, but not permanent.

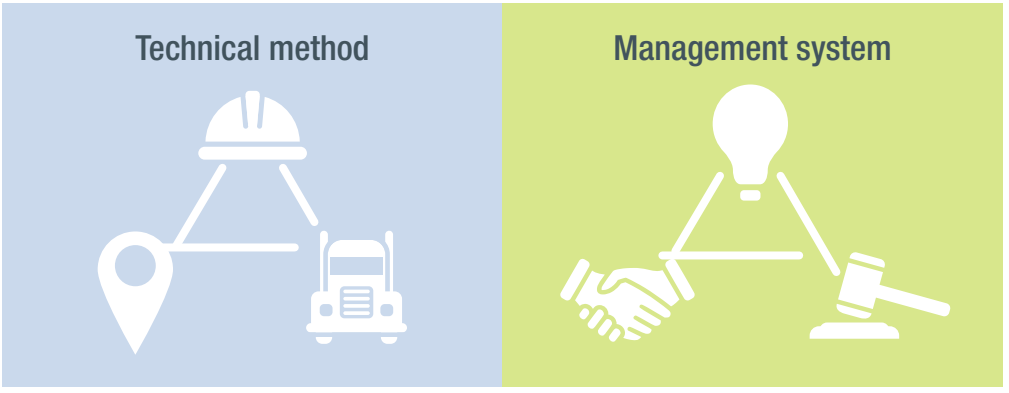
Canadians have made clear that it is important to develop a long-term approach for managing used nuclear fuel – and not leave it for future generations.

In 2002, the Government of Canada, through the *NFWA*, assigned this responsibility to the NWMO. The organization operates as a not-for-profit and was established in accordance with the *NFWA* by Canada's nuclear fuel waste owners – Ontario Power Generation, Hydro-Québec and New Brunswick Power Corporation.

Adaptive Phased Management (APM) emerged through a three-year dialogue with both specialists and the public. It is based on the values and objectives that Canadians identified as important. 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.

In June 2007, the Government of Canada selected APM as Canada's plan for the long-term management of used nuclear fuel.

Adaptive Phased Management



APM involves both a technical plan, and a phased and flexible implementation plan.

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.

During the past three years, we have continued to take an adaptive approach in all our work – in terms of technical repository design, field testing, interweaving Indigenous Knowledge, and engagement activities around partnership and community well-being, to name a few examples.

Informing and guiding our work

The NWMO's values, safety, and Ethical and Social Framework, all inform our work.

Values

Six fundamental values guide our work.

SAFETY

We place all aspects of public and employee safety – including environmental, conventional, nuclear, and radiological safety – first and foremost in everything we do.

INTEGRITY

We act with openness, honesty and respect.

EXCELLENCE

We use the best knowledge, understanding, and innovative thinking, and seek continuous improvement in all that we do in our pursuit of excellence.

COLLABORATION

We engage in a manner that is inclusive, is responsive, and supports trust, constructive dialogue, and meaningful partnership.

ACCOUNTABILITY

We take responsibility for our actions, including wise, prudent and efficient management of resources.

TRANSPARENCY

We communicate openly and responsibly, providing information about our approach, processes and decision-making.

In 2017, we updated our statement of values to make them more clear and direct, and to better reflect who we are as an organization today and as we proceed to the next phase of work.

An Ethical and Social Framework

We are guided by an Ethical and Social Framework that was developed with the involvement of leading ethicists in Canada during the study phase of our work. It was first published in 2004. We continue to use the framework and build on it as we advance the project.

The ethical principles incorporated in the framework are:

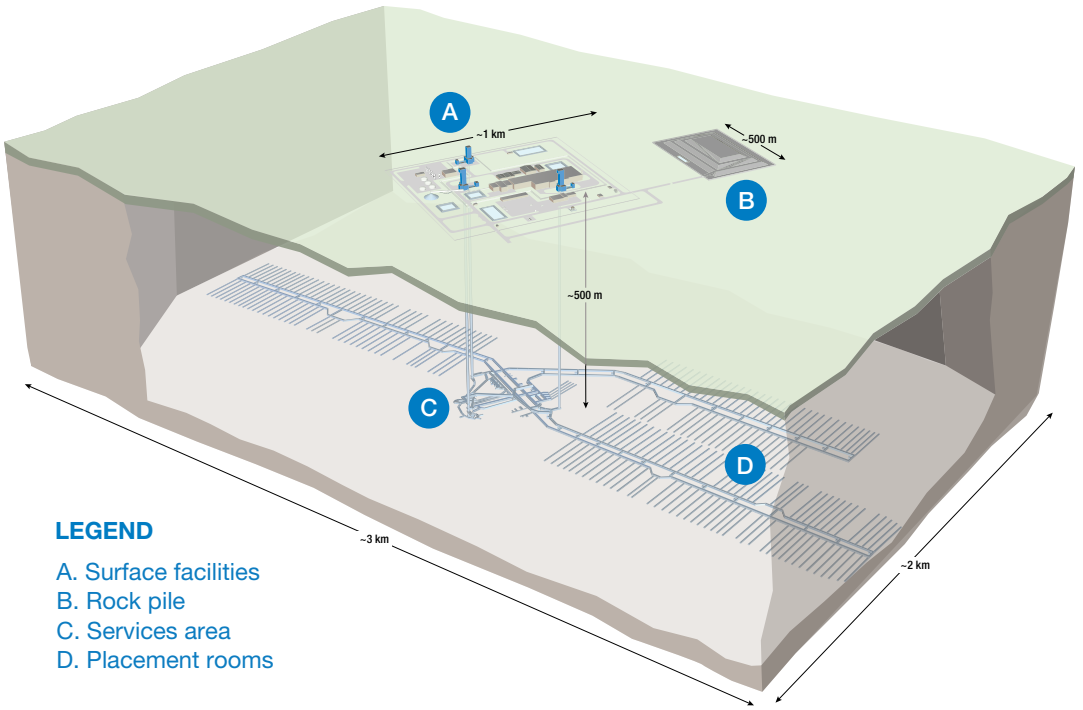
- Respect for life in all its forms, including minimization of harm to human beings and other sentient creatures;
- Respect for future generations of human beings, other species, and the biosphere as a whole;
- Respect for peoples and cultures;
- Justice (across groups, regions and generations);
- Fairness (to everyone affected, and particularly to minorities and marginalized groups); and
- Sensitivity to the differences of values and interpretation that different individuals and groups bring to the dialogue.

In 2018, we updated the framework in discussion with communities involved in the site selection process and others who expressed an interest. The updates ensure alignment with the current phase of our work and advancement of the site selection process. For more detail, please see www.nwmo.ca/ethicalandsocial.

Public engagement and continuous learning are integral to implementing Canada's plan.

Safe storage of used nuclear fuel

Safety comes first in every aspect of our work. The project is governed by stringent safety standards, and we have committed to meet or exceed applicable federal and provincial regulatory requirements to protect the health, safety and security of people and the environment.



LEGEND

A. Surface facilities
B. Rock pile
C. Services area
D. Placement rooms

This diagram shows a conceptual layout for the surface facilities, and the underground services area and placement rooms in the deep geological repository in a site with sedimentary rock. The design will continue to become more detailed as the project progresses.

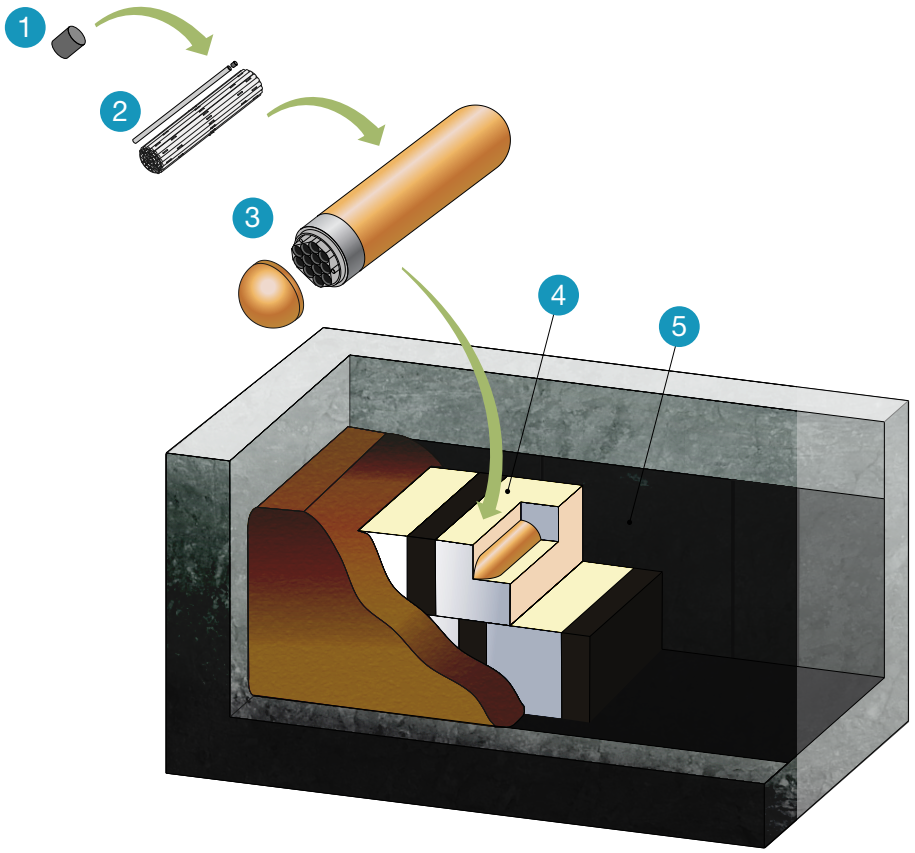
The deep geological repository

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 on the geology, and consists of a network of placement rooms for the used nuclear fuel.

At the surface, there will be facilities where the used fuel is received, inspected and repackaged into purpose-built containers before being transferred to the main shaft for underground placement. There will also be facilities for administration, quality, security, processing of sealing material, and ongoing operation of the site.

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 tunnel arms that enable technical specialists to situate placement rooms in areas with the most suitable rock.

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 of the repository.



This diagram shows the multiple-barrier system that will contain and isolate the used nuclear fuel.

The engineered-barrier system

Inside the deep geological repository, five barriers will work together to safely contain and isolate the used nuclear fuel from people and the environment.

1. The first barrier is the fuel pellet. Fuel pellets are ceramic, made from highly durable baked uranium dioxide powder; they are stored end-to-end in long tubes made of a strong corrosion-resistant metal.
2. The second barrier is the fuel bundle, made from Zircaloy, which contains a number of these tubes.
3. The third barrier is a copper-coated, steel container. The containers are engineered to resist corrosion, and strong enough to keep the used nuclear fuel completely isolated until its radioactivity decreases to safe levels.
4. The fourth barrier is a buffer box made of highly compacted bentonite clay, which encases each container. Bentonite clay is a natural material proven to be a powerful barrier to water flow. It is also very stable, as observed in natural formations that are hundreds of millions of years old. Buffer boxes will be placed in emplacement rooms deep within the repository.
5. The fifth barrier is the rock itself, which will protect the repository from disruptive natural events, water flow and human intrusion.

The project also involves the development of a Centre of Expertise for technical, environmental and community studies.

Our timelines

The NWMO expects to select a single, preferred site for the repository by about 2023. 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 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 2013	Twenty-two communities initially express interest. In collaboration with interested communities, the NWMO conducts initial screenings.
	2012 to 2015	Preliminary desktop studies are initiated to further assess suitability. 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. The impact assessment project description is submitted. The Licence to Prepare Site application is submitted.
Towards construction	2024	Detailed site characterization begins. Impact assessment studies are submitted. The federal regulatory process is triggered. The application to begin construction of the Centre of Expertise is submitted.
	2026	The impact assessment is approved (estimate). The Licence to Prepare Site is granted (estimate).
	2028	The construction licence application is submitted.
	2032	The construction licence is granted (estimate).
	2033	Design and construction begin.
Beginning operations	2040 to 2045	Operations of the deep geological repository begin.

The NWMO by the numbers

The NWMO is
17
years old.

We expect to select a single, preferred site for the deep geological repository by
2023.

There are
2
areas remaining in the site selection process.

We have knowledge-sharing agreements with waste management organizations in
8
other countries.

The NWMO has research projects underway with
18
universities.

The NWMO has Learn More agreements with
35
communities and organizations.

In 2019, our Mobile Learn More Centre made
23
visits across Ontario.

In 2019,
80%
of NWMO staff received Reconciliation training.

In 2019, we received
45,745
kilograms of steel to manufacture 20 used fuel containers.

Number of potential **siting areas** from the beginning to the end of the year

2017	9 siting areas narrowed down to 5
2018	5 siting areas
2019	5 siting areas narrowed down to 2

2017	not tracked
2018	14,000
2019	20,000

Number of **young people** reached through a variety of programs and outreach

Number of **tours** our technical staff hosted at our proof test facility

2017	22
2018	32
2019	46

2017	3,014
2018	27,476
2019	113,118

Number of **social media engagements** (reactions, comments, shares, and clicks)

Number of **metres drilled** in boreholes

2017	772
2018	229
2019	2,102

2017	156
2018	163
2019	188

Number of **employees**

Number of **core (rock) samples** taken from the boreholes to characterize the rock and porewater

2017	115
2018	20
2019	236

2017	not applicable
2018	85%
2019	97%

Percentage of staff that received **Indigenous cultural training**

3 Understanding and honouring Indigenous perspectives

Since our inception in 2002, we have been striving to understand, honour and interweave Indigenous world view into all aspects of our work.

The NWMO's commitment to understand and include the perspectives of Indigenous peoples continues to be incorporated into the fabric of our organization. The NWMO has Indigenous representation on our executive team, Board of Directors and Advisory Council to ensure there is a strong Indigenous voice present within the organization. Our Indigenous Relations team has developed meaningful policies to guide our work, including our Reconciliation journey. Our Indigenous Engagement team builds respectful relationships with First Nation and Métis communities.

We listen to the First Nation and Métis communities with which we are working, and also receive ongoing guidance and advice from the Council of Elders and Youth, an independent advisory body made up of First Nation and Métis Elders and youth.

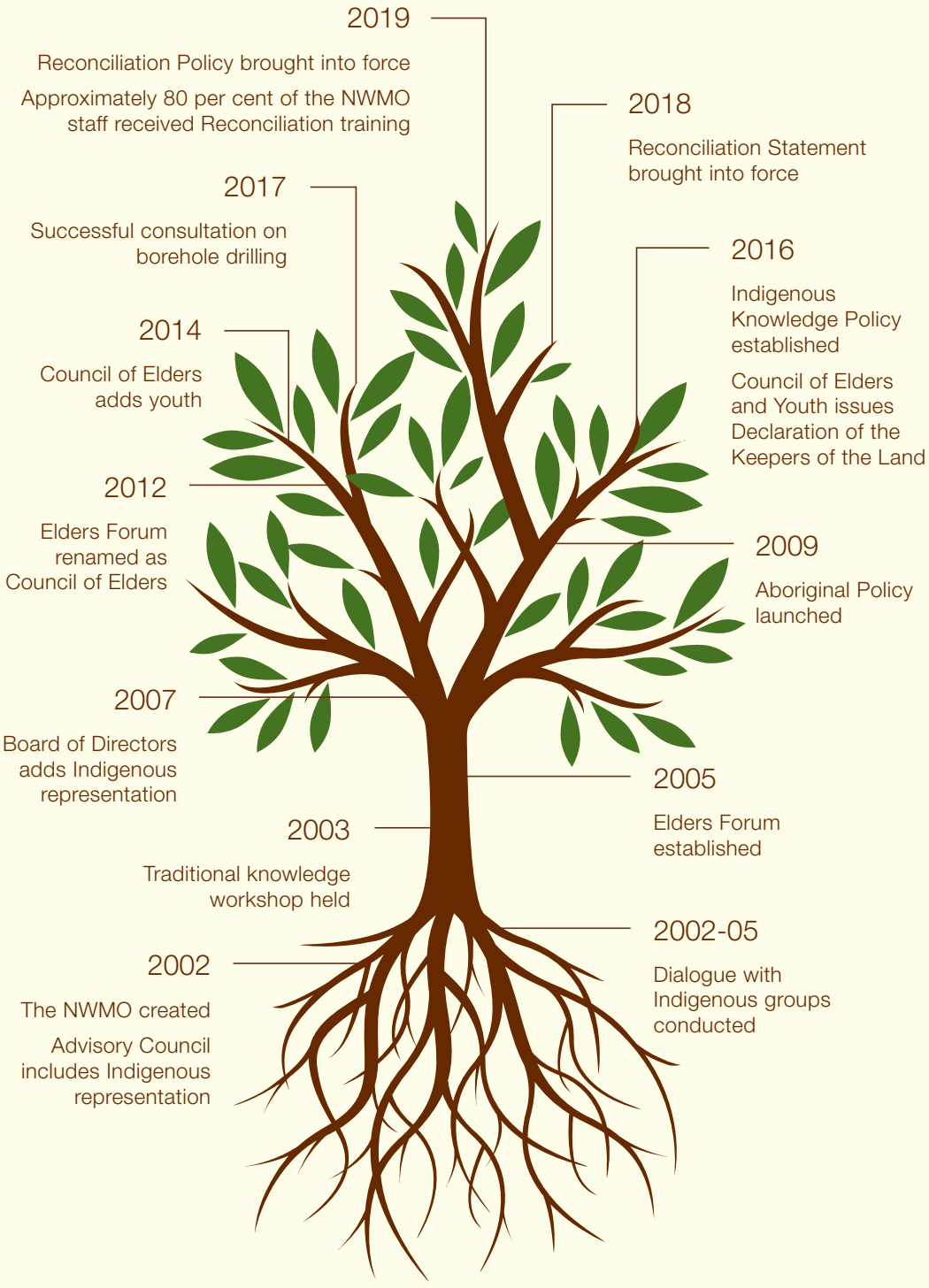
Throughout 2017 to 2019, we have continued to incorporate previously established practices into our daily activities. These include marking important corporate occasions and milestones through Indigenous ceremony, adhering to our Indigenous Knowledge Policy, and implementing our commitment to interweave Indigenous Knowledge into all aspects of our work.

Reconciliation

In 2015, the Truth and Reconciliation Commission of Canada released its calls to action, including # 92, which calls upon the corporate sector to build respectful relationships with Indigenous peoples, and provide education for management and staff on the history of Indigenous peoples, including the history and legacy of residential schools.

Donna Augustine, Chair of the Council of Elders and Youth, offers an eagle feather to the sacred bundle at the ceremony formalizing the NWMO's Reconciliation Policy.

NWMO MILESTONES
in Indigenous Relations



3 Understanding and honouring Indigenous perspectives

Reconciliation Statement

In 2018, we took an important step in our journey towards Reconciliation by acknowledging historical wrongs in Canada's past and the need to create a better future by addressing the challenges of today.

The NWMO issued a Reconciliation Statement, which was finalized through an Indigenous Pipe Ceremony, attended by members of the Council of Elders and Youth, our Board of Directors and our executive team. The statement recognizes the NWMO's ongoing involvement, collaboration and discussions with Indigenous communities.

The NWMO's Reconciliation Statement

In the context of Reconciliation, the Nuclear Waste Management Organization (NWMO) recognizes historical wrongs in Canada's past and the need to create a better future by addressing the challenges of today. The NWMO Council of Elders and Youth speaks of this journey as a new era for humanity – a time of Reconciliation with First Nation, Métis and Inuit peoples.

The NWMO is committed to contribute to Reconciliation in all its work by co-creating a shared future built on rights, equity and well-being. In addition, the NWMO will establish a Reconciliation Policy with an implementation strategy that will be measured annually and publicly reported to contribute to the Truth and Reconciliation Commission's calls to action.

The NWMO's executive team and Board of Directors signed our Reconciliation Statement in 2018.

The NWMO's Reconciliation Policy was formalized and blessed through a Traditional Sunrise Ceremony in King City, Ont., in October 2019.

Reconciliation Policy

The NWMO took the next step and formalized a Reconciliation Policy in 2019, setting out how we will contribute to Reconciliation in all our work. As defined in the Truth and Reconciliation Commission of Canada's final report, Reconciliation is an ongoing process of establishing and maintaining respectful relationships.

The NWMO will continue to honour our commitments to work in partnership with First Nation, Métis and municipal communities to develop and implement a management approach for the long-term care of Canada's used nuclear fuel.

The policy was blessed through a Traditional Sunrise Ceremony in King City, Ont., that included members of the NWMO's executive team and Board of Directors, the NWMO Council of Elders and Youth, as well as a number of special guests.

The policy commits the NWMO to develop an annual implementation plan to measure and publicly report on our progress as an organization. The actions we take in implementing the policy will demonstrate our commitment to contribute to this important national process.

To enable us to measure our progress, the NWMO completed a Reconciliation assessment tool in December 2019 that will assist us in ensuring our policies and procedures align with the NWMO's commitment to contribute to Reconciliation.

The NWMO's Reconciliation Policy

The NWMO commits that Indigenous Knowledge will inform all work and activities.

The NWMO acknowledges, respects and honours that First Nation and Métis peoples of Canada have unique status and rights as recognized and affirmed in s.35 of the *Constitution Act* (1982). The NWMO is committed to respecting the Aboriginal rights and treaties of First Nation and Métis peoples. The NWMO also recognizes that there may be unresolved claims between First Nation and Métis communities and the Crown to be considered in relation to a proposed site.

The NWMO will build relationships with First Nation and Métis communities and municipalities, groups and peoples on a foundation of respect for languages and customs, cultural protocols, and political, social, economic, and cultural institutions.

The NWMO commits to meaningful engagement, including consultation as required, building respectful relationships, and seeking the free, prior, and informed consent of impacted Indigenous peoples before proceeding with development of a deep geological repository.

The NWMO will provide impacted First Nation and Métis peoples equitable access to jobs, business opportunities, training, and education opportunities in our work, and ensure their communities gain long-term sustainable benefits from the development of a deep geological repository.

The NWMO commits to providing education for management and staff on the history of Indigenous peoples, including the history and legacy of residential schools, the United Nations Declaration on the Rights of Indigenous Peoples, treaties and Aboriginal rights, Indigenous law, and Aboriginal-Crown relations, which will require skills-based training in intercultural competency, conflict resolution, human rights, and anti-racism as stated in the Truth and Reconciliation Commission call to action #92.

The NWMO will work with affected Indigenous communities in implementing our mandate under the *Nuclear Fuel Waste Act* (*NFWA*) and in the selection of a site as required by Adaptive Phased Management, which was selected as Canada's plan for the long-term management of used nuclear fuel by the Government of Canada in 2007. The selection of a site must be informed by the best available knowledge, including science, social science, Indigenous Knowledge, and ethics.

The NWMO will work with the Crown regarding the Crown's duty to consult and accommodate as guided by decisions of the Supreme Court of Canada in fulfilling the NWMO's obligations under the *NFWA*. All our work with respect to the duty to consult will be guided by Reconciliation.

The NWMO will work with First Nation and Métis communities and municipalities that wish to share their knowledge and advice in the implementation of the site selection process, and in the design, construction, operation, and monitoring of the deep geological repository.

The NWMO commits to respecting and following local First Nation and Métis protocols related to burial sites found on work sites.

The NWMO will develop an annual Reconciliation implementation plan that will be measured and publicly reported.

The NWMO will communicate clearly with new potential employees about who we are as an organization with regards to our commitment to interweaving Indigenous Knowledge, building partnerships with Indigenous communities and our commitment to Reconciliation.

Creating a Reconciliation culture

The NWMO employs a multi-pronged Reconciliation program. We have made it a regular practice to open major seminars, workshops and meetings (including international meetings we host) with traditional Indigenous ceremony and land recognition statements. The NWMO arranges staff activities and participates in events such as National Indigenous Peoples Day and Orange Shirt Day to enhance learning and promote meaningful discussion about Indigenous world view and history.

Cultural awareness training and Reconciliation training is mandatory for staff. At the end of 2019, 97 per cent of staff had received cultural awareness training and 80 per cent of staff had received Reconciliation training. We also provided this training to the Advisory Council and Board of Directors.

Our program increasingly includes outreach to other interested individuals and organizations. For example, in 2018, we started providing cultural awareness training to communities in potential siting areas.

In 2019, we launched a video series, titled *Voices of Reconciliation*, that was published on our website and promoted through social media. At conferences in 2019, such as those of the International Association for Impact Assessment and the Canadian Nuclear Society, we also delivered presentations on Reconciliation. We also sponsored the Canadian Chamber of Commerce roundtable on Reconciliation.

NWMO employees participate in Orange Shirt Day to create meaningful discussion about the effects of residential schools and the legacy they have left behind.

Sponsorship of the Gord Downie & Chanie Wenjack Fund Legacy Schools program

The NWMO also supports Reconciliation activities through sponsorships. For example, in 2019, we were one of the sponsors of the Gord Downie & Chanie Wenjack Fund Legacy Schools program. This program provides tool kits to teachers in schools across Canada – including in our siting area communities – that include educational support and resources to help students learn about the history and impact of the residential school system on Indigenous peoples. As part of the program, legacy schools are encouraged to take meaningful actions to move Reconciliation forward.

The next page outlines the NWMO's Reconciliation strategy.

WHAT WAS SAID

"It is encouraging to see the NWMO taking such meaningful steps to support the journey towards reconciliation. The NWMO has also committed to supporting the Legacy Schools program, enabling educators across Canada to teach about residential schools and support reconciliACTIONs in the school community."

– Sarah Midanik, President and CEO, Gord Downie & Chanie Wenjack Fund

NWMO
RECONCILIATION STRATEGY

2020 and beyond

Assess corporate Reconciliation baseline and develop additional activities

Enhance human resources practices and procedures to address Reconciliation

Develop an Indigenous youth strategy to include a scholarship program and recruitment strategy

Enhance procurement program to include an Indigenous strategy

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 the NWMO's policies and procedures against Reconciliation assessment tool

2018

85 per cent of NWMO staff received cultural awareness training

Reconciliation Statement finalized through Indigenous ceremony

3 Understanding and honouring Indigenous perspectives

Interweaving Indigenous Knowledge into our work

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

In 2018 and 2019, we held workshops to bring together Indigenous Knowledge keepers and scientists to bridge the gap that exists among scientists about Indigenous Knowledge and explore ways of working together. Attendees focused on elements of the multiple-barrier system – copper, clay and rock. They discussed how Indigenous Knowledge that includes advice and guidance received through ceremony can be combined with digital data collection and laboratory analysis to understand an area of land from multiple dimensions.

As part of our 17th annual Geoscience Seminar in 2019, attended by approximately 100 scientists from around the world, we reiterated our commitment to interweave Indigenous Knowledge into our work and discussed its relevance to geoscience.

As part of the first Ontario Research Fund annual meeting hosted by the Ontario government, we provided an introduction to Indigenous world view, and presented on how the NWMO is interweaving Indigenous Knowledge and playing a role in Reconciliation as part of corporate Canada.

The journey of water

Several communities in our site selection process, particularly Indigenous communities, identified water as a subject of vital importance. They wanted to know how our project will safeguard water.

Between 2017 and 2019, the NWMO worked closely with these communities to develop three presentations about water's role in the environment and what it can tell us as part of our ongoing studies. The presentations include water's relationship with both clay and copper. They incorporate Indigenous teachings about water, clay, and copper, and use oral tradition in their delivery.

In 2019, we also published a story about Indigenous water symbolism on our website and in our quarterly newsletter. The web story was based on a lunch and learn seminar the NWMO hosted for employees as part of National Indigenous History Month.

We continue to reach out to Indigenous peoples to gather their views and questions on water and other subjects.

Duty to consult: First, second and third boreholes in Ignace

During 2017 and 2018, our Indigenous Relations team undertook consulting activities regarding plans to drill our first, second and third boreholes in the Ignace and Wabigoon Lake Ojibway Nation area. After successful consultation with five First Nations and one Métis community, the NWMO received permission to drill from the Ontario Ministry of Natural Resources and Forestry.

We collaborated with a nearby Indigenous community to provide guides to help with fieldwork and conduct cultural verification studies of the proposed sites and access routes. Drilling commenced on the first borehole in 2017, and the second and third borehole in 2019.

John Harrison and other Indigenous guides work with the NWMO out in the field.

POWERED BY PEOPLE

Rebekah Wilson, Indigenous Relations Associate, serves as a liaison with the Council of Elders and Youth.

Although Rebekah joined the NWMO in March 2019, she already had a long history with us. For 10 years, she was a member of the Council of Elders and Youth, an advisory body made up of First Nation and Métis Elders and youth. (Rebekah is a member of the Métis Nation of Ontario.) Now she serves as an NWMO liaison with the Council.

She also supports the NWMO's work in interweaving Indigenous Knowledge systems with western science and spends time building relationships with communities involved in the site selection process.

"It is an honour to be part of an organization that has genuine conversations with Indigenous communities and to apply the skills I learned by being on the Council," she says.

Rebekah, who grew up in Markdale, Ont., discovered her Métis roots at 16 years old when her grandmother looked into the family's heritage. The journey led to her career and life's passion: supporting Indigenous communities.

"My heritage is a strong part of my identity," she says.

Before joining the NWMO, Rebekah worked as a Research Coordinator at Leaders International, an organization that places executive-level staff within organizations looking for Indigenous employees. She holds a diploma in Print Journalism from Sheridan College.

When not working, Rebekah enjoys reading and writing. In 2014, she teamed up with her father to create a children's book on Métis history, called *The Tiny Voyageur*. She did the writing, and he did the illustrations.

"It was great working on a book with my dad – a learning journey for both of us," she said. She is now working on her second book, which will be about the significance of the different colours of the Métis sash.

4 Social engagement

Working together to advance Canada's plan

Dialogue with communities and a range of interested individuals and organizations is central to the work we do to advance Canada's plan. As the siting process advances, we have broadened and deepened engagement activities with municipal, First Nation and Métis communities, as well as surrounding communities in each area. The NWMO has also maintained relationships with national and provincial Indigenous organizations, as well as municipal associations.

Municipal engagement activities

In 2017, we engaged with nine communities and surrounding areas in the siting process. After narrowing our focus at the end of 2017, engagement activities continued in five siting areas remaining in the process, namely in Hornepayne and area, Huron-Kinloss, Ignace and area, Manitouwadge and area, and South Bruce. During the reporting period, we supported more than 800 engagement activities. A full list of engagement activities is published as a separate document and posted on our website at www.nwmo.ca/reports.

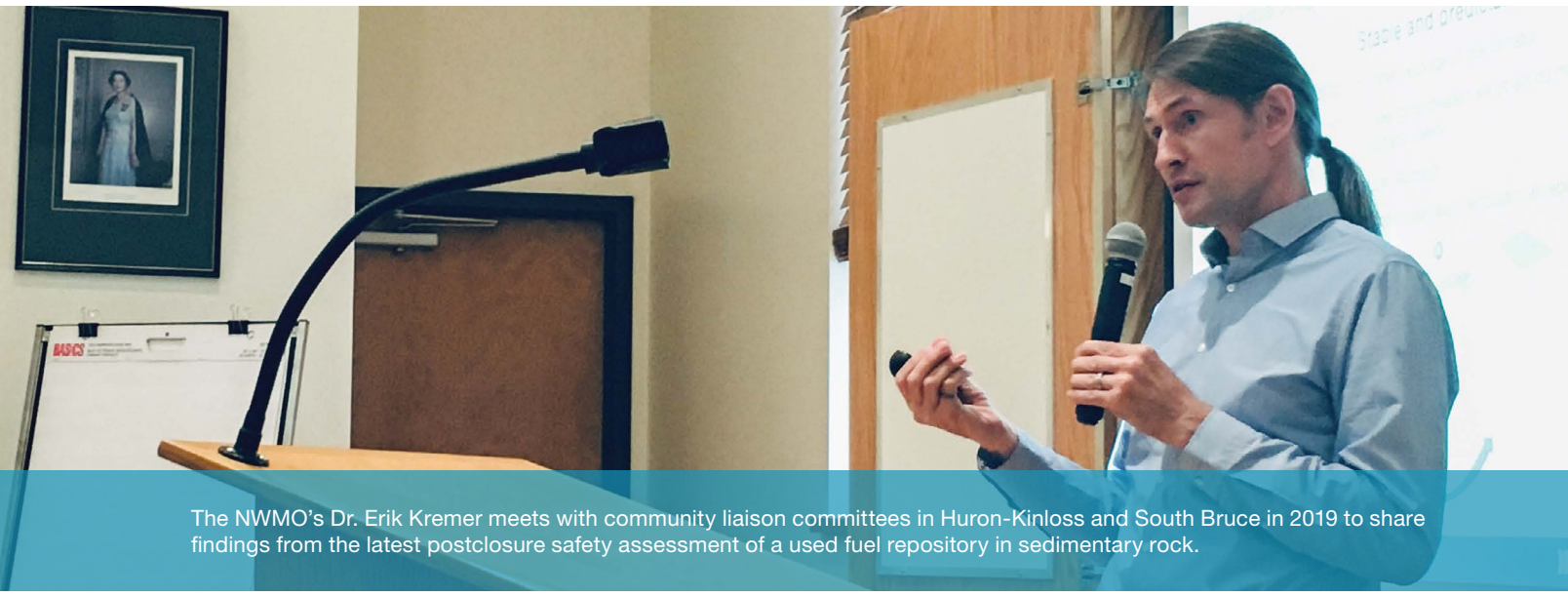
Rachelle Davenport, NWMO Relationship Manager, shares information with a resident of Ignace at an open house in 2018.

Manitouwadge residents speak with Dr. Jeff Binns, a corrosion scientist at the NWMO, at our proof test facility in Oakville, Ont.

We held one-on-one conversations and conducted presentations and discussions with groups. We engaged through meetings and briefings, conferences, tours of interim storage facilities and the NWMO's proof test facility, monthly meetings of community liaison committees (CLC), community open houses, symposiums, drop-ins to local community offices, and community festivals and events. We maintained a municipal conference program and meetings of the NWMO's Municipal Forum. The NWMO also continued to hear from citizens via our website, email and social media platforms.

Safety and learning about the project remain of primary interest among communities and groups new to the project. Each year, CLCs identify a variety of safety-related topics, and arrange for presentations by NWMO technical specialists, followed by discussion sessions. We have held in-depth conversations with communities in the siting process to explore additional aspects of safety, preliminary borehole drilling and the path to partnership.

To better understand awareness and continue to improve the way we communicate, the NWMO initiated in fall 2019 community surveys in the five municipal communities still involved in the siting process. The survey results will provide insight into community awareness about Canada's plan, as well as how communities would like to receive information in the future.



The NWMO's Dr. Erik Kremer meets with community liaison committees in Huron-Kinloss and South Bruce in 2019 to share findings from the latest postclosure safety assessment of a used fuel repository in sedimentary rock.

4 Social engagement

Engaging First Nation and Métis communities

During the last three years, the NWMO continued to build sustainable relationships with First Nation and Métis peoples in and near potential siting areas, while maintaining ongoing engagement with national, provincial and treaty Indigenous organizations. These engagements include more than 23 separate groups and communities across Ontario and New Brunswick.

The NWMO actively engaged with Elders, youth and community members, as well as Chiefs and Councils or leadership, providing information on the Adaptive Phased Management (APM) Project, and borehole drilling in the Ignace-Wabigoon area. Technical specialists also shared insight into their fields of expertise.

From 2017 to 2019, we attended more than 100 community events, powwows, open houses, learning and sharing gatherings, cultural awareness workshops, assemblies, conferences, and special occasions in the area. The NWMO also facilitated community members attending dry storage tours at interim storage facilities, as well as visiting our proof test facility in Oakville. Many communities accessed the NWMO's community sponsorships and donations programs for a variety of activities such as robotics programs, rangers' camps, cultural verification, youth gatherings, wellness camps, language classes, hockey tournaments, and science camps.

Voyageur canoes carrying leadership, dignitaries, and NWMO Vice-President of Site Selection Mahrez Ben Belfadhel signalled the start of the Métis Nation of Ontario's Annual General Assembly.

Rachelle Davenport, NWMO Relationship Manager, and residents of Ignace examine the model of the surface facilities of the NWMO's deep geological repository in 2019.

Mobile exhibit

The NWMO has Learn More Centres in potential siting areas, and invites individuals and groups to visit and learn more about Canada's plan. Building on that idea, in 2019, the NWMO launched a mobile exhibit that travelled to many communities and events (such as fairs and conferences) and bring our story to a wider audience.

The rolling engagement vehicle allows visitors to experience all aspects of our story in a tangible way – from interacting with a surface facility model, to touching a section of a used fuel container, to watching videos about our field studies and journey towards Reconciliation.

Engaging youth

Given the long time frames associated with the implementation of APM, engaging people across multiple generations is an important consideration of our work. Our activities and outreach programs enable young people to learn about and be involved in the implementation of Canada's plan.

Both the NWMO and communities engaged in the process place importance on involving young people in learning and decision-making. Communities have said they want to ensure that current and future generations can access future benefits from the project. Reflecting this, the NWMO's youth engagement program has three strategic goals in siting area communities:

- Building youth awareness of the NWMO and APM Project;
- Building youth understanding and confidence in the project; and
- Building youth capacity for future decision-making regarding APM (in siting area communities and more broadly).

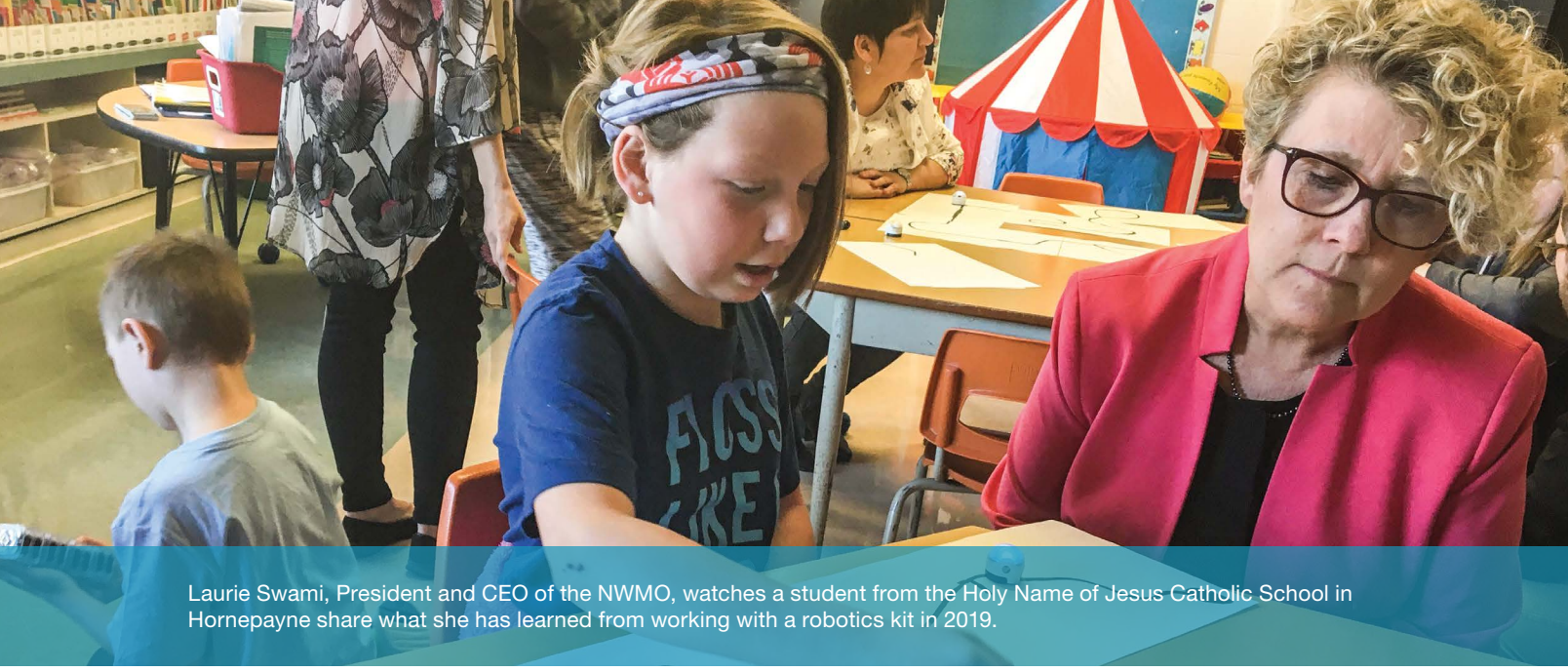
Between 2017 and 2019, the NWMO together with communities have implemented a variety of programs to engage youth.

Our Learn More resource program and agreements ensure communities have the resources they need to participate in the siting process, including a portion of funding dedicated to youth. The Learn More program reached more than 1,000 young people in 2019. Through this program and the agreements, young people participated in school visits to local Learn More Centres and open houses, the NWMO proof test facility, interim storage facilities, and our Toronto office to learn about the project.

WHAT WAS SAID

"Thanks to @NWMOCanada's passion for building a better future for all children in Canada, we're able to provide thousands of students across Bruce and Huron counties with hands-on STEM workshops that will spark their curiosity, and inspire them to become change-makers. Thank you, NWMO!"

– Tweet from Cindy Adams, Executive Director, Scientists in School



Laurie Swami, President and CEO of the NWMO, watches a student from the Holy Name of Jesus Catholic School in Hornepayne share what she has learned from working with a robotics kit in 2019.

We also actively promoted opportunities for direct youth engagement through participation in the Council of Elders and Youth and CLCs. In this way, youth perspectives are considered in APM activities, policies and processes.

Additionally, we conducted outreach to youth and post-secondary institutions to foster science education and career pathways. Students participated in NWMO-sponsored school-based STEM (science, technology, engineering, and mathematics) programs in the siting areas. We also created opportunities for summer student employment and co-op work terms in fields related to APM in siting areas and at our Toronto office.

We released an NWMO youth engagement scorecard for the first time in 2018 in the report *Engaging youth: A report on NWMO youth engagement activities*, which is available on our website at www.nwmo.ca/reports. The scorecard provides an at-a-glance view of how we are doing against our youth engagement goals. Over time, it will provide year-over-year indicators that we can review with communities and modify as needed.

Early Investments in Education and Skills

The NWMO is committed to equipping youth with the skills to prepare them for careers related to the APM Project and transferable skills that could be applied to other related projects.

In 2016, we launched a funding program, Early Investments in Education and Skills, to support training, education and other capacity-building initiatives for both young people and community members. In 2019, we funded 70 youth-focused activities related to STEM education, job readiness training, leadership, graduation, and science awards.

Teachers and school administrators have been a driving force behind introducing robotics and coding for students. They have sought support for robotics materials and kits, and playrooms, as well as for hosting or participating in robotics tournaments.

In 2019, the NWMO, two siting area communities and local school boards funded a mobile learning lab to promote STEM and skilled trades in the region. Youth from Grade 7 and up at more than 50 participating elementary and high schools will be guided through simulation software and technology to help them explore and consider a future career in STEM fields.

Giving back through sponsorships

Another way we give back to communities is through our sponsorships and donations. In 2019 alone, we sponsored 78 youth-related initiatives.

We support a variety of youth-related initiatives – from education to summer cultural camps to sports activities to community well-being. Of note, we provide funding to three organizations that promote exploration and passion for STEM – Science North, Scientists in School and SHAD.

SHAD is a four-week science and technology summer enrichment program for high-achieving students in Grades 10 to 12. Our specialists conducted interactive presentations and workshops at university campuses – from Mount Allison and Lakehead to McGill and McMaster. We reached more than 500 students in 2017, 650 students in 2018, and 800 students in 2019.

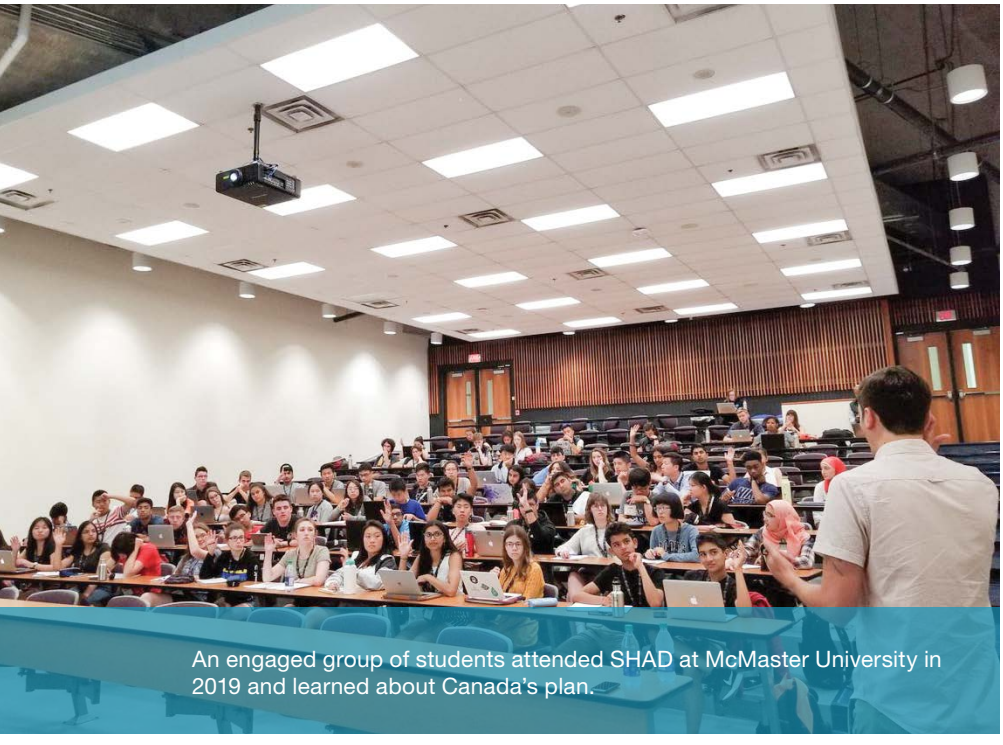
Science North is a fun and interactive program for elementary students in northern Ontario that incorporates games and activities to encourage interest in science among elementary students. During the past three school years, Science North reached thousands of students (5,035 in the 2016-17 school year, 3,729 in 2017-18, and 1,708 in 2018-19) in northern communities with the NWMO's support.

Scientists in School is a science education charity providing hands-on STEM workshops for students in kindergarten to Grade 8, encouraging them to discover science in the world around them. Thanks to our support, Scientists in School reached eager young scientists in the Bruce, Grey, Huron, and Perth Counties (2,889 in the 2016-17 school year, 4,455 in 2017-18, and 5,238 in 2018-19).

Campers watch a Science North staff member conduct a science demonstration in 2019.

Strengthening relationships with governments

Since the initiation of the site selection process in 2010, NWMO staff have routinely engaged with representatives of federal and provincial governments to provide information about the project and our progress in implementing it. We remain connected on topics of shared interest such as transportation, fieldwork, the duty to consult Indigenous peoples, and access to Crown land. The NWMO works with lead ministries within the federal and provincial governments as our primary points of contact, and in addition to meeting with government officials, the NWMO staff also briefs provincial and federal elected representatives.



An engaged group of students attended SHAD at McMaster University in 2019 and learned about Canada's plan.

POWERED BY PEOPLE

Mark Knell, Social Research Associate, supports the design and implementation of community-based engagement and assessment initiatives.

As part of the municipal engagement group at the NWMO, Mark gathers and analyzes data from municipalities in the siting process about topics such as building confidence in safety, how communities may be affected by APM, and communities' potential for partnership. This analysis helps to advance social assessment and consideration of the social acceptability of the APM Project in each potential siting area.

Mark finds his role rewarding. "My interests lie in developing methods to enhance meaningful dialogue with communities on social and environmental issues as part of impact assessment and decision-making processes," he says.

Although he has a PhD in Chemistry from the University of Durham in the United Kingdom, Mark wanted to be around people to work on issues that matter to them; he also wanted to use his science background to share technical information and effectively address complex concerns.

After graduate school, Mark returned to Ontario in 2006 and began a career that shifted towards social research. He managed environmental and social impact assessment studies at a consulting company, and rights-based consultation programs on projects and policy initiatives for an Indigenous organization. He joined the NWMO in April 2018.

When he is not at work, Mark enjoys growing food and cooking, as well as camping and canoeing with his wife, son and daughter. He is keen on travelling as well, especially to visit family; his brother still lives in the United Kingdom.

Incidentally, the fact that Mark moved with his family to the United Kingdom in high school and lived there for 10 years isn't obvious. He didn't retain a British accent. "Well, I am originally from *Ontario*," he offers as an explanation. Still a proud Canadian, eh?

5 Site assessment

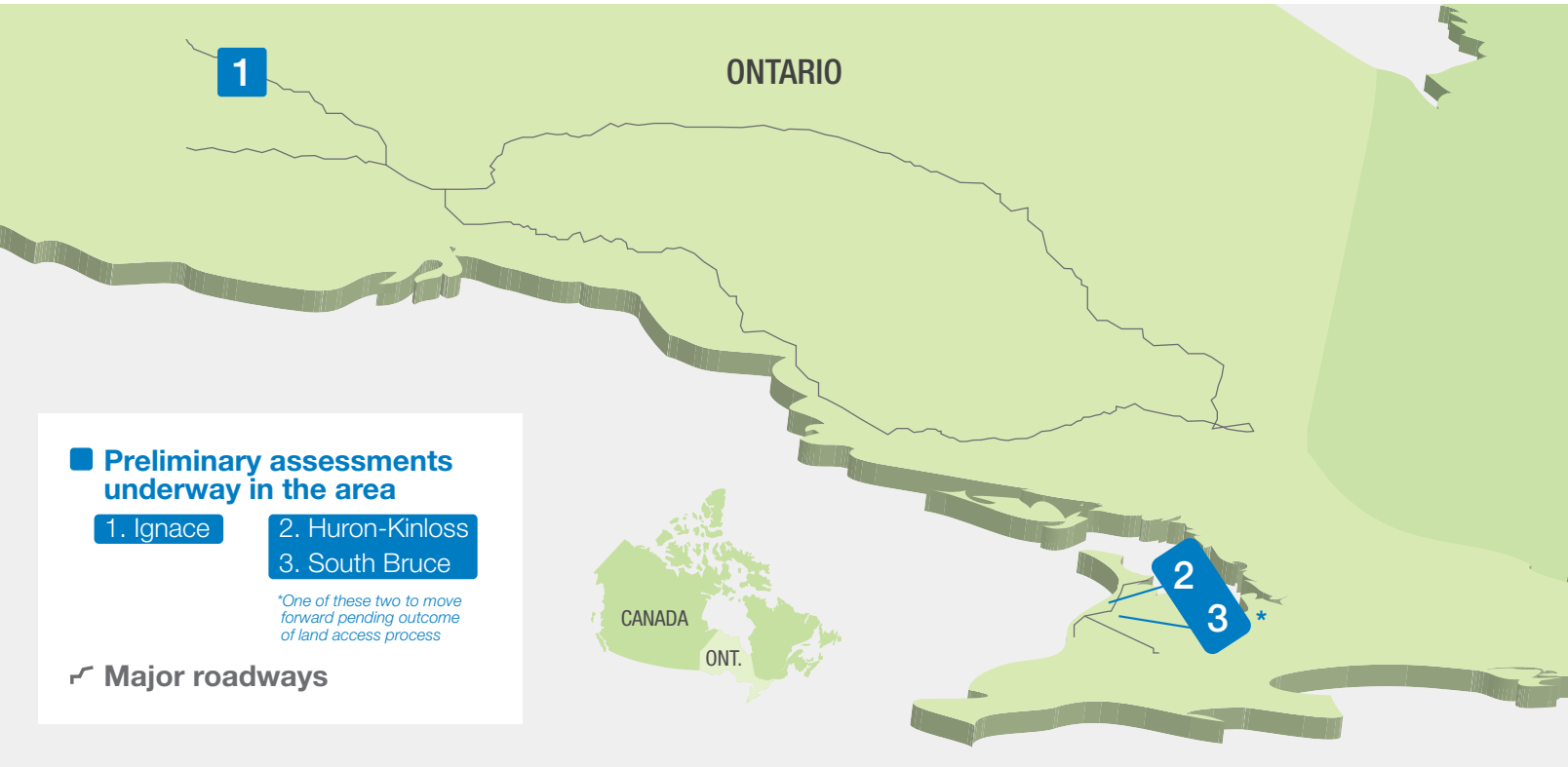
Supporting site selection through engagement activities and geoscientific evaluations

Narrowing down potential siting areas

In 2010, the NWMO launched a siting process to identify an informed and willing host for a deep geological repository for Canada's used nuclear fuel. Initially, 22 communities expressed interest in learning about the project and entered the siting process.

Over time, a series of progressively more detailed scientific, technical and social assessments resulted in narrowing our focus to fewer potential sites.

We narrowed down twice in 2017, from nine to seven potential siting areas and then to five. In 2019, the process advanced, and in November, we narrowed down once again, this time to two potential siting areas.



As of year-end 2019, Ignace in northwestern Ontario, and in southern Ontario either Huron-Kinloss or South Bruce continue to be considered potential host areas for the project.

As of year-end 2019, Ignace in northwestern Ontario, and in southern Ontario either Huron-Kinloss or South Bruce continue to be considered potential host areas for the project. In Huron-Kinloss and South Bruce, one of these communities will move forward in the site selection process once a potential repository site is located in the area through an ongoing process with local landowners. Throughout this process, our work has continued to include neighbouring First Nation and Métis communities and municipalities.

Next steps include working with municipal and Indigenous communities to conduct progressively more detailed technical site evaluations and social studies. The work will further assess safety, continue meaningful discussions around partnerships, and explore how the project can be implemented in a manner that will enhance the well-being of municipal and Indigenous communities in each area. We remain on track to identify a single, preferred site by 2023.

WHAT WAS SAID

"We have very qualified, knowledgeable experts with international experience on the APM-GRG who are actively engaged in reviewing and guiding the work of the geoscience team at the NWMO. We've found the NWMO to be very responsive to our group's questions and recommendations. Overall, the review group is pleased with the progress of the APM Project and is looking forward to continuing our active participation in future site selection activities by the NWMO."

– Dr. Peter K. Kaiser, Chairman, Adaptive Phased Management Geoscientific Review Group

Conversations about partnership and fostering community well-being

Engagement activities have increasingly become centred on partnership, willingness and how the project could contribute to community well-being to support the implementation of Canada's plan for the safe, long-term management of used nuclear fuel.

Late in 2017 and early in 2018, we shared our partnership road map to guide these discussions with communities in the siting process and to begin to create a framework to implement the project if a preferred site were identified in the area.

In 2018, each community created a set of values and principles to guide future discussions with the NWMO to explore partnership and to consider the project in more detail.

Among municipalities, safety emerged as a pre-eminent principle. Other commonly held values included working together, transparency and honouring commitments. Communities also highlighted the importance of working regionally with other municipalities and Indigenous communities.

In 2019, communities and the NWMO began working together to develop a shared vision of the project for each area. This shared vision reflects on how the project might best fit with the community and area, and its potential to help advance towards a future envisioned by those who live there.

Road map to partnership (2017-22)

Starting from the bottom and moving upwards, the roadmap guides our discussions about partnership.

NWMO staff supported engagement efforts during an open house in Ignace in 2018.

Initial borehole drilling was conducted in 2018 in the Ignace-Wabigoon area.

Site investigations

A key part of the site selection process is studying and identifying a site that can safely house the underground repository and its surface-level facilities. That involves activities such as borehole drilling, environmental monitoring and other site investigation work, including Indigenous cultural verification.

In 2017 and 2018, the NWMO integrated findings from preliminary site assessments in the Ignace-Wabigoon, Hornepayne, and Manitouwadge siting areas, and analyzed the data to support the identification of potential repository sites in each area. We identified preferred locations based on a wide range of technical studies and through extensive engagement activities with people in the siting areas, including First Nation and Métis communities.

During the reporting period, the NWMO drilled three initial boreholes to a depth of about a kilometre to study the geological conditions at a potential repository site in the Ignace-Wabigoon area. Borehole studies included a series of down-hole tests in the field and analysis of core samples in laboratories. We constructed temporary access routes and field sites to support the drilling and testing activities. Boreholes were not drilled in Hornepayne or Manitouwadge before the areas were screened out of the process.

Indigenous Knowledge keepers and guides supported technical fieldwork; they guided technical specialists as they walked the land, and cultural monitors were present at drill sites. Engagement is ongoing to plan more studies and drill additional boreholes.

During the same period, we introduced a community well-being investment program for siting communities where borehole drilling activities were planned. It complements the Learn More resource programs to advance learning about the project.

This picture shows the third borehole location in the Ignace-Wabigoon area.

This picture shows an overview of the third borehole location in the Ignace-Wabigoon area.

Accessing land

In the Ignace-Wabigoon area, the potential repository site is located on Crown land, and we have worked with appropriate government bodies to secure access for studies. In Huron-Kinloss and South Bruce, potential repository sites would be located on privately owned land. As a result, the process for accessing a potential site in this area is different.

Under the Land Access Process initiated in 2019, the NWMO asked landowners in Huron-Kinloss and South Bruce to consider signing option agreements with the NWMO that will allow us to conduct site investigation, and if the site is later selected, to purchase the land.

In total, the NWMO is looking to aggregate approximately 1,500 acres (607 hectares), which would accommodate the size of the underground and surface facilities. We expect to identify a potential site in either Huron-Kinloss or South Bruce in 2020.

To prepare for next steps, we have developed plans and established the required support contracts for drilling initial boreholes in the area. While the NWMO continues to work with the Saugeen Ojibway Nation, other Indigenous communities and local municipalities in this area, the Land Access Process does not indicate they have provided their support for the siting of the repository in this area. The project will only proceed with interested municipalities, First Nation and Métis communities, and surrounding communities working in partnership to implement it.

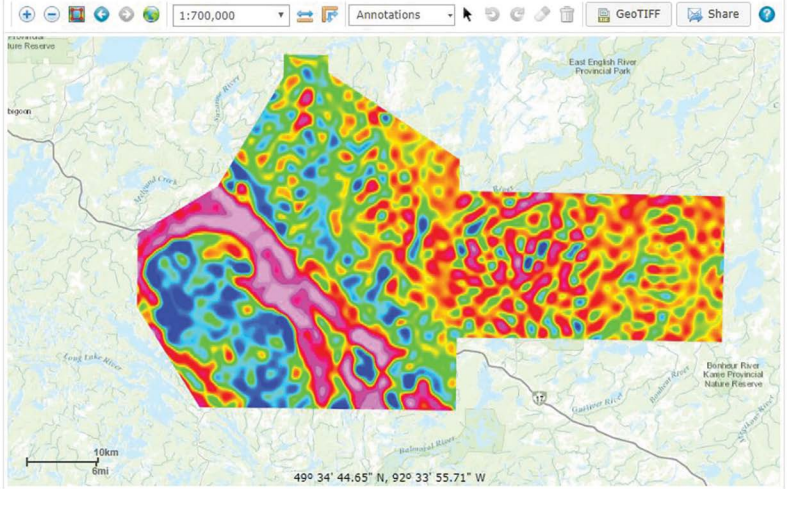
Data analysis and testing

Borehole drilling is an important advancement for the NWMO in obtaining more complete knowledge of the characteristics of the rock and water that lie deep beneath the surface. The NWMO works closely with industry and academic partners to complete analysis and laboratory testing of the information and samples retrieved from boreholes such as core (rock and porewater) and water samples.

These are core samples from borehole drilling near Ignace.

Our multidisciplinary geoscience and data management teams have developed state-of-the-art systems to receive and manage information from borehole drilling and other activities such as airborne surveys and surface-based mapping activities. The geoscience team has the capabilities and tools to generate 3D geological models of the sites, and the processes to begin interpreting and integrating the information received from field programs. The NWMO together with external experts will interpret and model the data collected.

We also share all technical aspects of the geological assessments of potential siting areas, from planning to data interpretation to modelling, with the Adaptive Phased Management Geoscientific Review Group (APM-GRG), an expert group established in 2012 to review the NWMO's geoscience siting plans, approaches and findings.



This is a screenshot showing an example of the NWMO's airborne gravity data stored within the geoscientific data management system.

POWERED BY PEOPLE

Sarah Hirschorn, Director of Geoscience, heads a team that studies the rock in potential siting areas.

For Sarah, the unique challenges of implementing Canada's plan is what attracted her to the NWMO more than a decade ago.

After finishing her doctorate in geology in 2007, she knew she wanted to work somewhere that fell between academia and practical application, and Canada's plan presented a unique project.

"You do not often see that in geoscience," Sarah said. "This is a project where geoscience is involved from planning through desktop and field studies, and on into regulation and construction."

Her team at the NWMO is in charge of studying and understanding whether the rock in possible siting areas is suitable to host a deep geological repository for the safe, long-term management of used nuclear fuel. They work with specialists across the company, in communities and around the world.

"That multidisciplinary approach is one of the things I enjoy the most about working at the NWMO," Sarah added. "We get to work with all these incredible experts, but we also get to drill down into the minutia of problems and really think deeply about our science. Who else gets to contemplate their project based on timelines of ice ages, and look millions of years into the past or future?"

In addition to her promotion at the NWMO in April 2019, Sarah was named an adjunct professor in the Department of Earth Sciences at the University of Toronto.

She lives in Toronto with her three kids and husband, with whom she recently began karate lessons. When not in the field for the NWMO, Sarah and her family love to go on walks around their city and camping on the weekends.

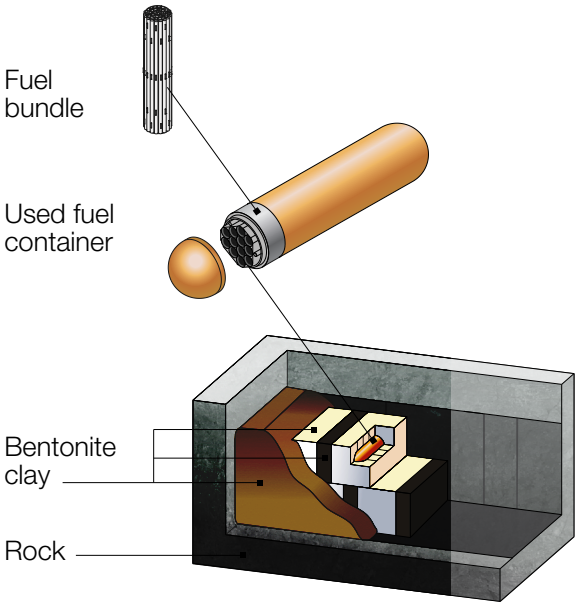
6 Engineering, safety and technical research

Demonstrating effectiveness and safety of technical aspects of the project

Engineering

From 2017 through 2019, the NWMO's engineering program has been focused on proof testing activities to demonstrate the performance of the NWMO's engineered-barrier system (EBS) design. This includes manufacturing various components of the EBS – notably the copper-coated used fuel container (UFC), the highly compacted bentonite clay buffer box and the granular bentonite gapfill.

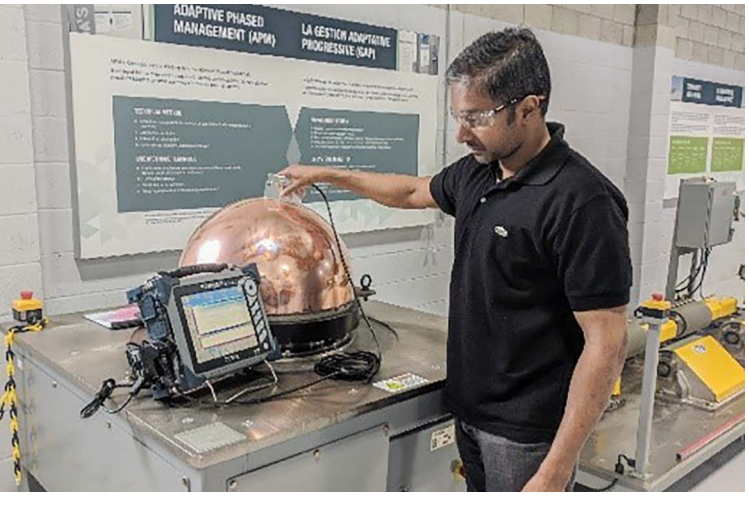
We will conduct a full-scale trial using a mock-up of the emplacement room at our proof test facility in Oakville, Ont., from 2021 through 2022. This will enable us to test our ability to fabricate and demonstrate the emplacement of the EBS to meet our design requirements. During the past three years, we have been preparing for these activities by procuring raw materials, and designing, fabricating, installing, and commissioning equipment to support the serial fabrication of UFCs and buffer boxes, as well as the placement of the components into the emplacement room. Much of this equipment is first-of-a-kind.

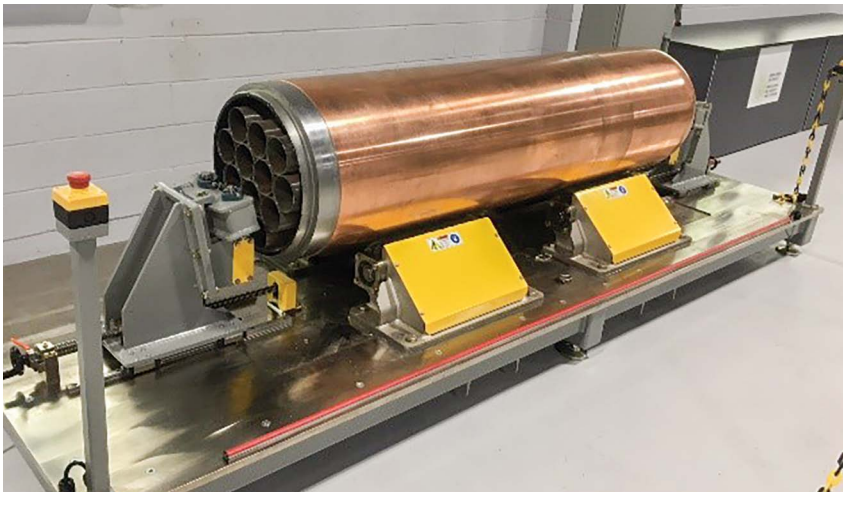


This is a cross-section diagram of the engineered-barrier system in an emplacement room in the deep geological repository (left); this is a prototype used fuel container in half of a highly compacted bentonite clay buffer box (right).

These pictures show advances to the copper-coating plating technology: The Nanovate™ Tank Plating System and supporting systems (left), and a prototype copper-coated container component produced in the plating system (right).

The NWMO is also developing non-destructive examination techniques and custom equipment to inspect the UFCs following the various stages of fabrication such as welding, copper coating and machining. These inspections will ensure the UFC meets the required specifications. As with container fabrication, we have adapted standard methods currently used in the nuclear industry to our specific needs.





These pictures show a non-destructive examination (NDE) of the used fuel container (UFC) components: An NWMO technical specialist inspects the copper coating (left); and NDE test bench equipment is used to rotate the UFC container during inspection (right).

6 Engineering, safety and technical research

The NWMO has also supported site assessments through beginning work on developing conceptual site-specific designs of the surface infrastructure and underground repository layouts. These designs are based on the latest information from geoscience assessments and initial borehole drilling. Advancing these concepts will be an iterative process as more information becomes available. The designs will eventually be used in the development of preliminary site-specific safety assessments.

While the proof test facility supports the development of the EBS design, it also provides an opportunity to engage with others about our technical activities. From 2017 to 2019, we have given 100 tours to a variety of interested groups from the communities in which we work, schools, academia, and industry. People have the opportunity to see the physical prototypes, speak with the technical experts conducting the work, and better understand how the EBS will function within the repository.

Technical engagement is carried out at the NWMO's proof test facility.

Safety and technical research

Safety assessment

Repository safety is of paramount importance. The site, the facility's robust design, and the way it is built, operated and monitored will all ensure safety. The NWMO develops detailed safety assessments, which we often refer to as case studies, to demonstrate that the regulatory requirements for safety will be met. The case studies address safety in both the near term (during facility operations) and the long term (postclosure after the repository has been filled, sealed off and closed).

In the near term, safety assessments evaluate the potential impact on people and the environment due to facility operation under normal and abnormal operating conditions and for credible accident scenarios. In 2018, a preliminary analysis of accidents was completed for a generic site. A study was initiated in 2019 to review the anticipated climate change impacts on precipitation, and update the estimates of the flood potential for the regional areas under consideration as potential siting areas. These results will help improve the design basis.

WHAT WAS SAID

"The National Research Council and the NWMO have had a long-standing, mutually beneficial relationship developing cold spray copper coatings for used fuel containers. The innovative approach to research and development has led to advances in the technology, while building partnerships that reach across the coating and manufacturing industries. We have been pleased to present our work at technical conferences and publish in books and peer-reviewed journals with the NWMO."

– Dr. Dominique Poirier, Research Officer, National Research Council

Postclosure safety assessments are simulations that calculate repository performance for a million years or longer. A postclosure safety assessment will be submitted in support of a licence application once a site is selected. From 2017 to 2019, the NWMO published updated postclosure safety case studies for both a hypothetical crystalline rock repository and a hypothetical sedimentary rock repository at www.nwmo.ca/reports. These updated safety case studies incorporate the NWMO's EBS design and emplacement room layout.

In 2019, the NWMO started to develop the next safety assessment model to support site-specific safety assessments. This model will take advantage of current developments in computers and computer models to provide a more complete representation of the repository system.

In 2019, we also began a preliminary site-specific safety assessment for a potential repository location in the Ignace-Wabigoon area. This iterative assessment will build on the methodologies developed in latest case studies and incorporate information from current site investigation work. We will extend this work to the second potential siting area in southern Ontario and update each area's case study as field data is made available.

Fuel and radionuclide inventory

From 2017 to 2019, the NWMO updated our used fuel and radionuclide inventory database. This included the characterization of fuels and fuel bundle material, such as measurements of the radionuclide content of the Zircaloy structure on an irradiated fuel bundle. We also updated information related to the current number of used fuel bundles and their burn-up (how much energy was extracted from the fuel bundle) through reviewing historical records for CANDU fuel produced by Canadian nuclear power reactors. This information (which includes radiological and physical properties of the used fuel) is important to the development of the safety assessment, as well as the EBS and repository designs.

Research and development

The NWMO continues to advance our understanding of many elements of the Adaptive Phased Management Project through our research and development (R&D) program. In 2018, we reorganized our technical research activities and established an internal Technical Research Review Committee to provide an information-sharing forum within the NWMO.

In 2018 and 2019, we assessed the R&D requirements across all phases of the project, from current state through detailed characterization, construction, operations, decommissioning, and closure. The goal was to better understand how current R&D activities support our technical knowledge of repository performance and safety, and identify future R&D activities. This work will culminate in an integrated R&D program report, focusing on technical research in the areas of the safety case, engineered barriers and geoscience.

Canadian university research

Over the period of 2017 to 2019, the NWMO supported research at more than 15 universities, with the majority here in Canada. Research partnerships with universities play an important role in ensuring the NWMO's technical work is scientifically rigorous. We have also, together with the Natural Sciences and Engineering Research Council, established Industrial Research Chairs, collaborative R&D grants with a variety of universities.

In 2018, with the NWMO collaborating as industrial partner, Western University, the University of Toronto, the University of Waterloo, and York University were awarded a $4-million Ontario Research Fund grant to support the next five years of UFC integrity research. The goal of the research is to understand the complex interactions that will take place in the repository over hundreds of thousands of years.

From 2017 to 2019, our scientists continued to publish technical reports, peer-reviewed journal articles and abstracts for presentation at Canadian and international conferences on radioactive waste management.

Dr. Jeff Binns, a corrosion scientist at the NWMO, examines a robot used in underwater research, conducted in partnership with Ocean Networks Canada (of the University of Victoria).

POWERED BY PEOPLE

Mehran Behazin focuses on the non-corroding copper coating of the NWMO's used fuel container.

"When I was a child, I dreamed of being able to make a positive, meaningful impact on societal issues," says Mehran, a Corrosion/Microbiology Scientist at the NWMO. Now she is getting to do just that. Canada's plan to safely manage used nuclear fuel will protect people and the environment.

Working in the engineered barrier science group at the NWMO, Mehran's role focuses on the longevity of copper coating of the used fuel container (UFC). She collaborates with experts in the corrosion field in Canada and internationally to ensure the NWMO is using the most advanced science and technology to build confidence in our UFC – from both a safety and design perspective.

As part of her work, Mehran also gives presentations on the multiple-barrier system to people in potential siting areas. "One of the most fulfilling things about the NWMO is that I have been able to engage with people in our communities and hear their perspectives. It has been personally quite impactful for me," she says.

Originally from Tehran, Mehran decided to move to Ontario 10 years ago to do her PhD at Western University. Her thesis topic addressed corrosion of metals under radiation environment. She also completed a post-doctoral fellowship at Western; the work was focused on the NWMO's project regarding copper coating of our UFC. Mehran joined the NWMO in 2017.

With a passion for fashion, Mehran likes to dress well for work. It is a creative outlet to express her individual style. And when not at work, she likes to do yoga to relax and enjoys cooking delicious meals for friends. "I am definitely a foodie. I like mixing ingredients together. It must be my chemistry background," she says.

7 Collaborating internationally for a safe future

The NWMO partners with organizations around the world responsible for the safe management of used nuclear fuel to learn from their experiences and knowledge and to share Canadian research and learning.

During the reporting period, we fostered international co-operation on developing and demonstrating technology innovations, kept abreast of developments in repository design and safety cases for various host rock formations, and discussed aspects of social acceptance.

Derek Wilson, Chief Engineer and Vice-President of Contract Management at the NWMO, and Dr. Sung-Soo Cha, President and CEO of KORAD (Korea Radioactive Waste Agency), renewed a co-operation agreement in 2019.

Agreements with international counterparts

Since 2017, the NWMO renewed co-operation agreements with international counterparts, including Belgium, France, Finland, Sweden, South Korea, Switzerland, and the United Kingdom. We also entered into a new agreement with Japan in 2017. The agreements help to ensure we are considering best international practices as we implement Canada's plan. They also provide an opportunity to share our experiences from the implementation of Adaptive Phased Management.

Top left: Derek Wilson, Chief Engineer and Vice-President of Contract Management at the NWMO, presents at the 6th International Symposium on Safety Improvement & Stakeholder Confidence in Radioactive Waste Management, hosted by KORAD in South Korea in 2019.

Top right: Shunsuke Kondo (centre), President of NUMO in Japan, and Satoru Suzuki (left), Manager of Repository Engineering at NUMO, visit the NWMO's proof test facility in 2017.

Bottom left: Samantha King, Head of Requirements and Programme at Radioactive Waste Management in the United Kingdom, and Dan Woloshyn, Senior Production Engineer at Integran, inspect a copper-coated hemispherical head prototype of the NWMO's used fuel container.

7 Collaborating internationally for a safe future

Exchanging technical knowledge with other countries

Over the reporting period, the NWMO participated in a variety of international activities, forums and projects.

In 2018, the NWMO played a key role in Canada's delegation to the International Atomic Energy Agency (IAEA)'s Sixth Review Meeting of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, which occurs every three years. The Joint Convention commits all 78 ratifying countries, including Canada, to demonstrate they are safely managing used nuclear fuel. It also promotes open discussion on the safety of waste management programs, with the goal of identifying and sharing best practices.

Over the period of 2017 to 2019, the NWMO also maintained participation in underground research laboratory experiments at the Mont Terri Project and Grimsel Test Site in Switzerland. Projects include studies of corrosion and sealing system performance under natural underground conditions.

WHAT WAS SAID

"Just back from a fantastic week visiting the Nuclear Waste Management Organization (NWMO) in Canada learning more about their programme for implementing Adaptive Phased Management of used nuclear fuel. Wish I could have stayed longer as so much to learn and share on the Canadian and UK programmes for managing radioactive waste. Very grateful to openness and generosity all of those that I met this week as we identified lots of opportunities to strengthen collaborations."

– Samantha King, Head of Requirements and Programme, Radioactive Waste Management, United Kingdom

The NWMO's Chris Boyle (left), Director of Engineering, and Mark Gobien (right), Safety Assessment Models Section Manager, tour Posiva's Full-Scale In-Situ System Test project in Finland.

Specialists at the NWMO contributed to international projects, including the Effective Rock Properties and the POST Projects (with SKB of Sweden), the Nuclear Energy Agency (NEA) Clay Club annual meeting, NEA Integration Group for the Safety Case annual meeting, and DECOVALEX modelling workshops.

As well, the NWMO participated in Posiva's Full-Scale In-Situ System Test (FISST) project at Posiva's ONKALO facility in Finland. Taking part in the FISST experiment has provided the NWMO with insight into potential construction challenges and what type of technologies are working in the underground environment.

7 Collaborating internationally for a safe future

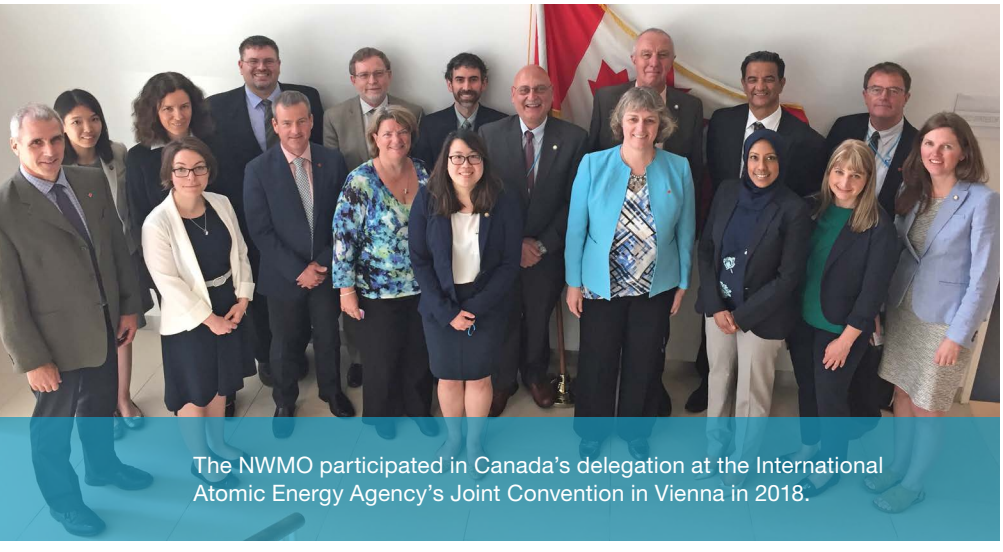
Sharing our engagement experience

As we approach the milestone of identifying a preferred site, discussions with communities in siting areas are becoming increasingly focused on partnership, willingness and community well-being. Other countries are looking to the NWMO's collaborative engagement activities as an example of best practices.

The NWMO and members of the communities in which we work participate in international forums to share our engagement experience. During the reporting period, the NWMO has presented at the NEA's Forum on Stakeholder Confidence in Paris, the IAEA's Sixth Review Meeting of the Joint Convention in Vienna, and the International Workshop on Deepening Comprehension on Safety Case on Deep Geological Repository and Public Confidence in Tokyo.

Lisa Frizzell, Vice-President of Stakeholder Relations at the NWMO, addresses the audience at the signing ceremony for new or renewed co-operation agreements with counterparts from five countries.

We have attended IAEA meetings in Vienna throughout the reporting period. In both 2017 and 2018, we participated in the Technical Meeting on Learning from the Experiences of Local Communities on Stakeholder Involvement in Radioactive Waste Management Programmes. In 2019, we attended the International Conference on the Management of Spent Fuel from Nuclear Power Reactors: Learning from the Past, Enabling the Future. At these meetings, the NWMO participated in panel discussions about keeping communities engaged over long time frames. We shared stories about building trust in communities, forging sustainable relationships and generating confidence in safety.



The NWMO participated in Canada's delegation at the International Atomic Energy Agency's Joint Convention in Vienna in 2018.

POWERED BY PEOPLE

Thomas Reilly, Inventory Manager at Radioactive Waste Management, is responsible for managing the United Kingdom's radioactive waste inventory.

Thomas was on secondment for six months as a Technology Transfer and Innovation Officer at the NWMO. Radioactive Waste Management (RWM), our counterpart from the United Kingdom, is at the beginning of its search for a site to locate a deep geological repository and looking to learn from the NWMO.

Thomas was at the NWMO to identify knowledge transfer opportunities, and aspects of our project that are applicable to the United Kingdom's program. "Working at the NWMO has put into perspective how advanced its used fuel container development is," he says.

Thomas comes from a small town near Birmingham, England, called Walsall, and obtained a master's degree in Theoretical Physics from Durham University. His love for physics came from playing snooker. "My grandad taught me how to play, and that is how I became good at math. I wanted to be a world snooker champion, but I couldn't, so I became a scientist instead."

He wanted to work for an ethical organization that made an environmental impact. This led him to work as a consultant for a nuclear engineering company before joining RWM in 2016.

At RWM, he manages the United Kingdom's nuclear waste inventory, which he describes as "complex because of its large number of different waste forms." He works with the nuclear industry across the United Kingdom to characterize each waste type's origin, chemical composition, packaging, radioactivity, heat output, and volume.

Thomas is a big sports enthusiast – and maybe a lucky charm too. While in Toronto, he attended seven Blue Jays games that the team won. And during the 2019 NBA playoffs, Thomas attended game seven of the quarter finals when Toronto narrowly defeated the Philadelphia 76ers with "the shot." The Toronto Raptors then went on to win the NBA championship on Thomas' birthday.

8 Transportation

Developing transportation plans

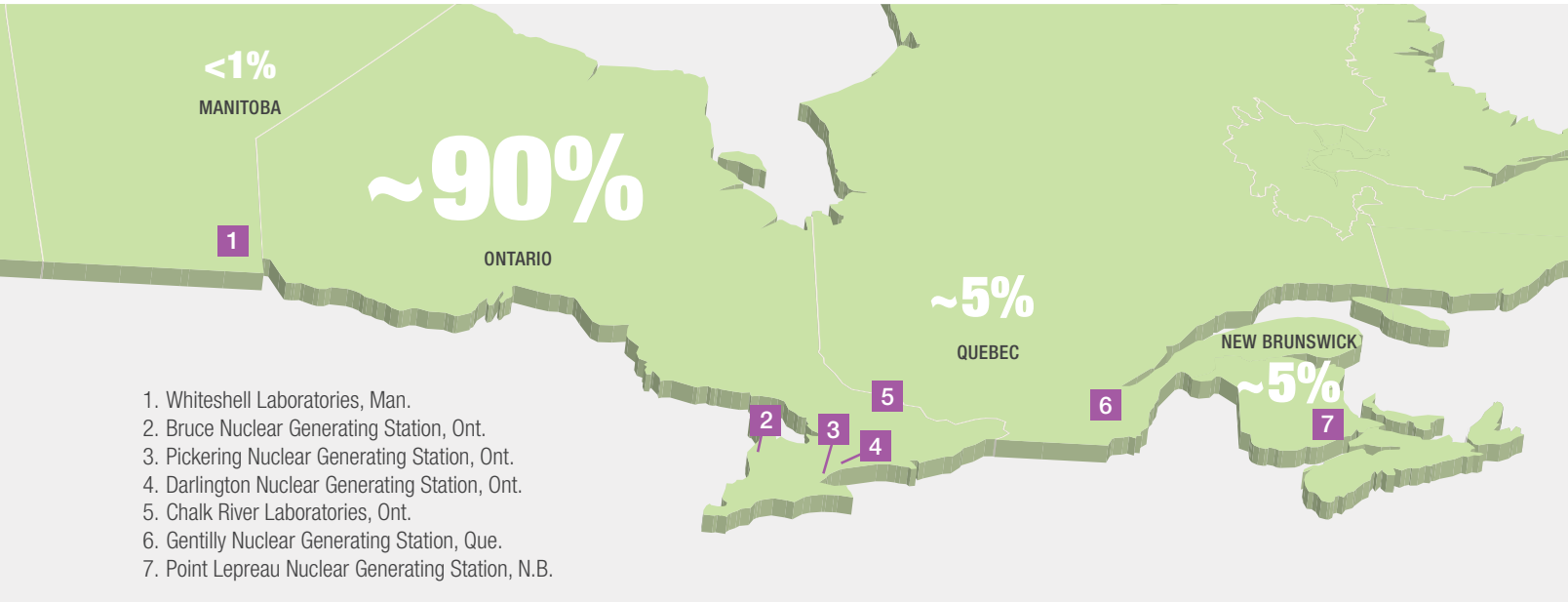
Overview

Canada's used nuclear fuel is safely stored on an interim basis at seven licensed facilities. Current locations include four in Ontario (Bruce, Pickering and Darlington Nuclear Generating Stations, as well as Chalk River Laboratories), and one in each of Manitoba (Whiteshell Laboratories), Quebec (Gentilly Nuclear Generating Station), and New Brunswick (Point Lepreau Nuclear Generating Station).

The used fuel will eventually be transported to the selected repository site. The NWMO is responsible for ensuring our transportation activities are conducted safely and securely. We are studying both road and rail as potential transportation modes.

Used nuclear fuel will be transported in specially designed transportation packages, which are certified by the Canadian Nuclear Safety Commission (CNSC) to meet stringent testing and regulatory requirements.

While transportation is not expected to begin until about 2040, work is underway to ensure it will be safe and secure, with a plan that reflects public priorities and concerns.



1. Whiteshell Laboratories, Man.
2. Bruce Nuclear Generating Station, Ont.
3. Pickering Nuclear Generating Station, Ont.
4. Darlington Nuclear Generating Station, Ont.
5. Chalk River Laboratories, Ont.
6. Gentilly Nuclear Generating Station, Que.
7. Point Lepreau Nuclear Generating Station, N.B.

Canada's used nuclear fuel is safely stored on an interim basis at seven licensed facilities.

Caitlin Burley, Manager of Transportation Engagement at the NWMO, discusses used nuclear fuel transportation planning with members of Red Sky Métis Independent Nation in Thunder Bay in 2019.

Social considerations

From 2017 to 2019, the NWMO has expanded our engagement with communities, and interested individuals and groups to enhance our understanding of social priorities and concerns that need to be addressed as we plan the Adaptive Phased Management (APM) transportation program. These activities have provided communities with information about the NWMO's transportation program and encouraged people to raise questions and concerns.

Dialogue

During the past three years, our transportation and engagement specialists have held information briefings and conversations with a range of communities and groups, including municipal, First Nation and Métis communities in potential siting areas, surrounding communities, and broader-reaching municipal and Indigenous organizations. These conversations aimed to share information about safety and discuss requirements of a socially acceptable transportation plan.

We continue to inform governments about our plans as they are developed through one-on-one updates with federal and provincial representatives, as requested. In addition, we provide information to an interjurisdictional working group made up of public servants from Transport Canada, the CNSC, and respective provincial transportation ministries of Ontario, Quebec, and New Brunswick.

8 Transportation

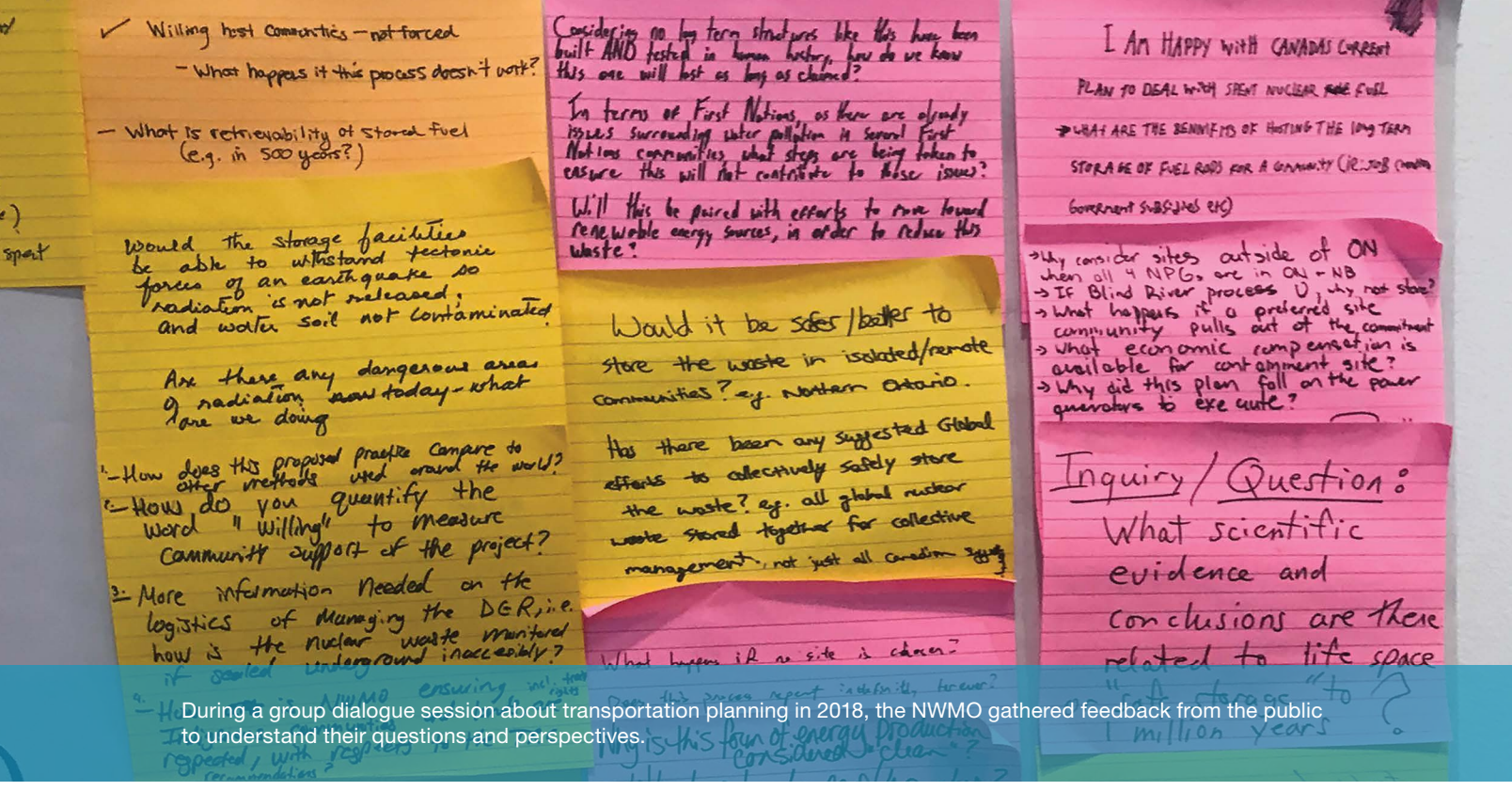
Participation in municipal association and Indigenous trade shows and conferences is another way that the NWMO facilitates learning and dialogue with interested groups. Engagement and transportation specialists attended the Ontario Good Roads Association and Association of Ontario Road Supervisors conferences, and heard from Indigenous groups at events such as the Métis Nation of Ontario and Ontario Coalition of Indigenous Peoples Annual General Assemblies. In the last three years, we expanded outreach to participate in first responder and nuclear industry conferences.

Through ongoing engagement, people have identified areas of interest, which we have incorporated into our engagement materials, briefings and conversations. Specific topics include design and testing of the Used Fuel Transportation Package (UFTP), consideration of accident scenarios, international track record for transporting used nuclear fuel, and regulatory oversight. This type of responsive engagement helps to lay the foundation for earning broad confidence in safety.

Additionally, the NWMO has conducted public attitude research with a cross-section of people in Ontario, Quebec and New Brunswick to get a broader perspective about used fuel transportation. The research has involved focus groups, workshops, larger group sessions, and Indigenous dialogue sessions.

These discussions have helped increase understanding of social sensitivities and questions that will need to be addressed in APM transportation program planning and the requirements for a socially acceptable transportation plan.

NWMO Manager of Transportation Caitlin Burley discusses the basis for confidence in safety for used nuclear fuel transportation with Randy Barnes, Deputy Fire Chief of Manitouwadge, at FireCon 2019.



During a group dialogue session about transportation planning in 2018, the NWMO gathered feedback from the public to understand their questions and perspectives.

Publications

A summary of conversations about transportation are reported annually in *Transportation themes 2014 to 2019: What we heard about transportation planning*. A brochure, *Working together to develop a transportation planning framework: What we are hearing*, was released in 2018. Both are available at www.nwmo.ca/transportation. Additionally, public attitude research reports are available on our website at www.nwmo.ca/reports.

Transportation framework

Our engagement and research will culminate in the development of a transportation planning framework, which will help guide our work going forward. We will seek further public input in 2020.

Technical transportation program highlights

From 2017 to 2019, technical work has focused on exploring design concepts and key components of the used fuel transportation system, as well as conducting assessments of transportation modes, logistics and routing options for the remaining areas in the site selection process.

This work focuses on both road and rail modes of transport, and considers the use of various transportation packages, in particular: the NWMO's UFTP and the Dry Storage Container Transportation Package for transport of used fuel from Ontario Power Generation; and the Basket Transportation Package for transport of used fuel from Hydro-Québec, New Brunswick Power and Atomic Energy of Canada Limited.

WHAT WAS SAID

"I applaud the NWMO transportation program for engaging the first responder agencies as part of the Learn More Process and look forward to working with them as we stay engaged with the project. I encourage other emergency service leaders to contact the NWMO to learn more about their transportation program."

– Owen Cranney, Fire Chief, Township of Manitouwadge

In 2018, the CNSC re-certified our UFTP. The re-certification demonstrates that the package meets the applicable requirements of the *Packaging and Transport of Nuclear Substances Regulations* (2015) and the International Atomic Energy Agency *Regulations for the Safe Transport of Radioactive Material* (IAEA SSR-6, 2012 Edition).

To further support the development of transportation packages, the NWMO undertook studies to test the material performance of stainless steels and compressible foams that may be used in their manufacture.

We have simulated and studied impact analyses of transportation packages under various regulatory test conditions and other scenarios. We have also completed further work on fire modelling of transportation packages under hypothetical accident conditions.

Thirty-two bolts are incorporated into the Used Fuel Transportation Package that could be used to transport the used nuclear fuel from the interim storage facilities to the deep geological repository.

POWERED BY PEOPLE

Ulf Stahmer, Senior Transportation Engineer, supports the NWMO used fuel transportation program.

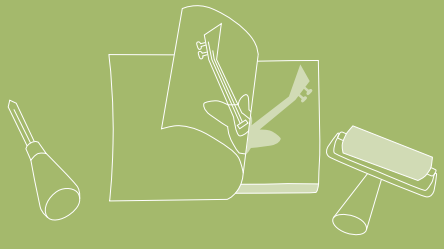
As a Senior Transportation Engineer at the NWMO, Ulf is passionate about his role. It is a varied one with a focus on logistics, risk assessment, radiological dose assessment, and costing. As he explains, “Transportation work is critical to our success because eventually we will be going through communities. We have to make sure we do this in a safe and socially acceptable way.”

Using end-to-end system costs for various transportation scenarios, Ulf has recently built a model that allows the NWMO to cost out a variety of different transportation options and scenarios, and compare them.

Ulf also travels to siting area communities and delivers presentations about how used nuclear fuel will be transported safely. One of the challenges he enjoys is making the data he shares easy to understand and relatable. For example, he explains that nine nuclear fuel pellets equivalent in size to three AA batteries can power a typical Canadian household for a year.

With a lengthy background as a transportation engineer, previously working in the area of transportation design, and a Bachelor of Applied Science in Mechanical Engineering from the University of Waterloo, Ulf joined the NWMO 12 years ago. He loves working with his colleagues whom he describes as a group of committed and safety conscious people.

Ulf grew up in Toronto and still resides in the city with his wife and three sons. When not working, he enjoys watching his wife act in theatre productions, building electronic musical instruments, and printmaking (silkscreen and linocuts). What he is particularly happy about: “One of my sons has now taken up printmaking.” Said as only a proud dad can.



9 Organizational readiness

Preparing for the future

Throughout 2017 to 2019, the NWMO has been preparing for phases of the project that will begin after a preferred site for a deep geological repository has been selected.

Building a learning organization and stronger safety culture

As future operations come into closer view, we are building a learning organization and deepening our safety culture. Over the past couple of years, we have invested resources to further both of these aspects of our culture.

Public and employee safety is first and foremost in everything we do. In 2018, we hired a Health and Safety Manager to amplify our safety culture and further embed it in operations. Ensuring the long-term safety of people and the environment is an ongoing commitment at all levels of the organization.

As we build a learning organization, we have been focused on developing employee resilience, and encouraging and supporting continuous employee learning and critical thinking.

NWMO employees all work together to accomplish goals. Our annual all-staff meeting is an opportunity to prepare for the upcoming year.

Human resources

As our work continues to evolve, we need to continually ensure the right people are in the right jobs at the right time, supported by the right technology. In 2017, we created succession and development plans for key positions within the NWMO.

Our human resources team partners with the many diverse departments within the organization to understand the business, bring in talent, and prepare for future needs.

We are also investing in internal systems to make us more effective and efficient. The first phase of our new Enterprise Resource Planning System was implemented in 2018 to improve workflow processes and integrate electronic systems. In 2019, we initiated the second phase – Human Capital Management. This will provide the NWMO with tools to effectively manage employee-related information and support staff working inside and outside our Toronto headquarters.

Mobilization

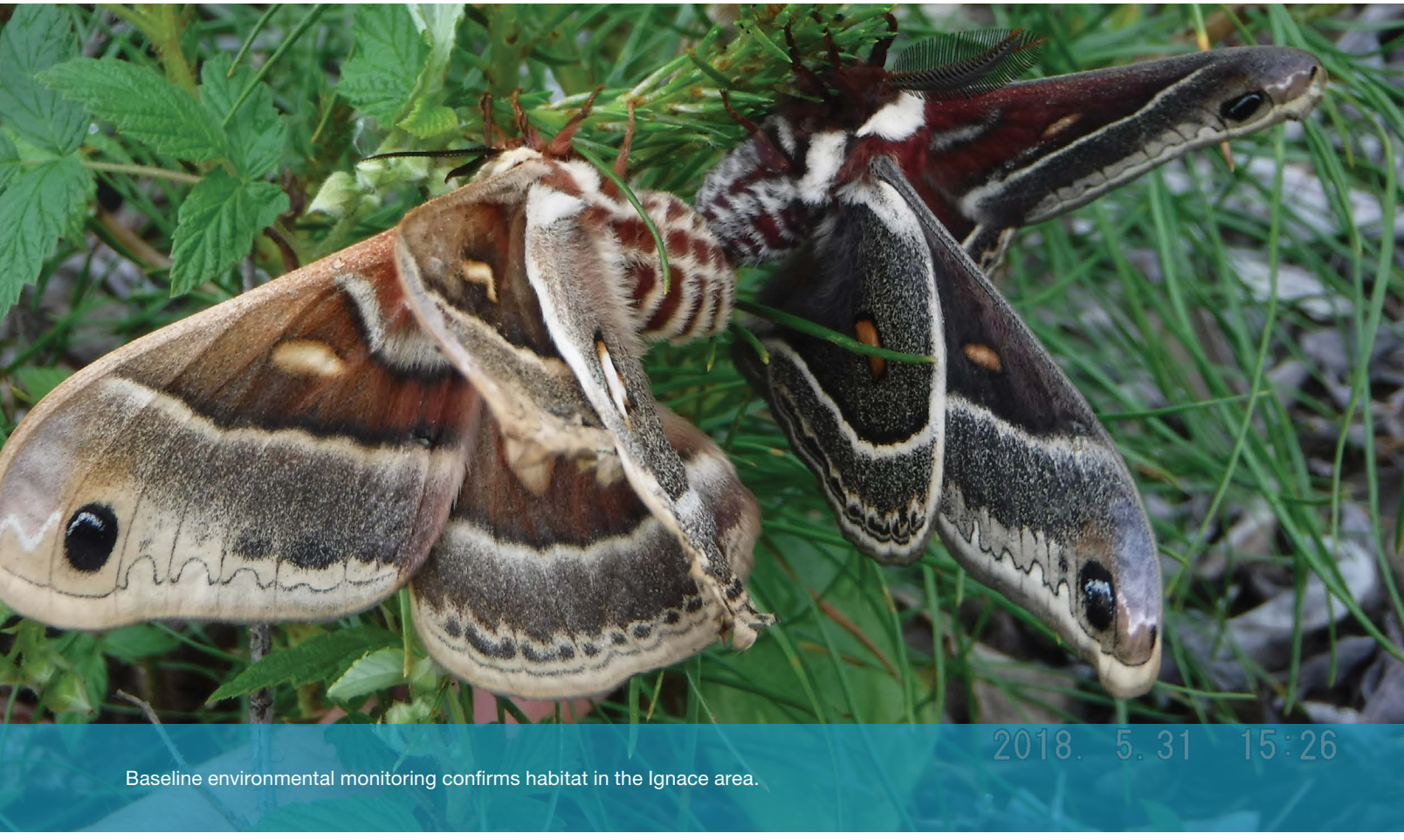
In 2018, the NWMO began to develop the organization's mobilization resource strategy to ensure we are prepared to transition to the selected site. The strategy encompasses many logistical, partnership and people-related factors. We are creating an execution plan that can adapt to the site eventually selected and partnership agreements developed with host communities.

9 Organizational readiness

Preparing for licensing applications

In 2018, the NWMO started actively planning for initiating the regulatory phase of Adaptive Phased Management (APM), to begin after site selection. This work will involve conducting detailed analyses of the environmental impact of the project, completing a formal impact assessment, submitting an application for a Licence to Prepare Site, and developing the materials for a construction licence.

We closely monitored progress and discussions across Canada regarding the *Impact Assessment Act* (one of the pieces of legislation contained in Bill C-69). This legislation, which is now in force, establishes the requirements and process for the approval of the preferred site by the Government of Canada. We note a close alignment between the requirements in the *Impact Assessment Act* for pre-submission engagement with communities (especially Indigenous peoples), and the discussions the NWMO has been having since the site selection process was launched in 2010.



Baseline environmental monitoring confirms habitat in the Ignace area.

A consultant from Tulloch Engineering measures tree width for potential bat roost habitat in the Ignace area in 2018.

We are working with communities, both Indigenous and non-Indigenous, on designing both baseline and assessment methods that we can use in preparing to formally launch the regulatory approvals processes. Baseline environmental monitoring in potential siting areas is underway, in close collaboration with community members, as well as Indigenous Knowledge keepers. The information we develop will help the NWMO and communities engaged in the process make good decisions.

The NWMO continues to interact with the Canadian Nuclear Safety Commission (CNSC), consistent with the terms of a special project arrangement prior to submission of a licence application. These activities include providing briefings to the CNSC on the progress of APM implementation. This special project arrangement was renewed in March 2019 and will continue until the NWMO applies for our first licence.

We also began to engage with the CNSC to obtain guidance on regulatory requirements for first-of-a-kind elements of the facility's design. Our initial discussions focused on design requirements for the used fuel containers that will be stored in the deep geological repository. We anticipate seeking additional guidance as we further begin to prepare for licence applications.

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 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.

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.

Joanne Jacyk, Section Manager of Environmental Assessment at the NWMO, conducted field studies in Ignace in 2018 to confirm habitat.

Environmental responsibility

At the suggestion of the Advisory Council in 2016, the NWMO began developing an Environmental Responsibility Statement that outlines our commitment to environmental sustainability as we move forward with implementing Canada's plan. Municipalities and Indigenous rights-holding groups have raised the topic of environmental protection a number of times over the years, and the topic has been highlighted through public comments on our annual implementation plan. In 2018, we created a draft statement that was reviewed by the Advisory Council, the Council of Elders and Youth, and NWMO staff. We incorporated their input and finalized the statement in 2019.

The statement articulates how we are going to protect the environment and support sustainability in our daily practices. It builds on environmental principles we already put into practice and also defines our vision of what can be achieved. The NWMO will incorporate the Environmental Responsibility Statement into our plans as we look ahead to the implementation of the project at a selected site.

Environmental Responsibility Statement

Environmental responsibility is embedded in the core values that guide the NWMO in everything we do. Protecting people and the environment is a key objective in implementing Canada's plan for the long-term management of used nuclear fuel, known as Adaptive Phased Management. We are continually looking for ways to advance our mission consistent with our values, and aspire to balance our effects on the environment such that ecosystem integrity is maintained, and enhanced where possible. Consistent with this goal, we recognize:

- The desire to protect and respect the air, land, fire, water, plants, medicines, animals, and people is a way to bring communities together with a common purpose;
- There are inseparable linkages between the environment and people of past, current and future generations, which are essential to fostering many dimensions of well-being;
- Interconnections within the natural world, including with humanity, are complex and dynamic in time and space, and the decisions we make should account for uncertainty; and
- We all have a role to play in protecting and respecting the environment.

As we continue on our path, we commit to the following principles in the regions we are working:

- Learning and obtaining guidance about ecosystems by interweaving Indigenous Knowledge, western science, and lessons from local land users, including nature's patterns and strategies;
- Seeking traditional and innovative approaches that strive to promote biodiversity and reinforce our relationship with nature;
- Cultivating environmental responsibility by encouraging actions that reduce the ecological footprint of our day-to-day workplace activities; and
- Pursuing and offering opportunities to partner with others on actions that support sustainability.

Monitoring new nuclear technologies

Canada has an active research sector exploring new technologies such as small modular reactors (SMRs). SMRs would generate used fuel requiring safe, long-term management.

In 2019, the first licence application to prepare a site for a SMR in Canada was submitted to the CNSC. Subsequently, the notice of commencement of an environmental assessment for the SMR project was posted.

A fundamental tenet of APM is that we will adapt our plans in response to technical advances and new knowledge. We encourage organizations developing new concepts to work with us to identify fuel waste characteristics and ensure their wastes are compatible with the repository safety case. Once we have sufficient information about new types of fuel to be managed, we would determine potential impacts to repository designs and how our funding formulas can be adapted to include new entrants.

The NWMO has agreements in place with several SMR proponents to allow these discussions to be conducted, but has not yet actively assessed SMR waste streams. We continue to monitor the development of new reactors and new owners of used nuclear fuel to ensure we are prepared to safely manage all Canada's used nuclear fuel.

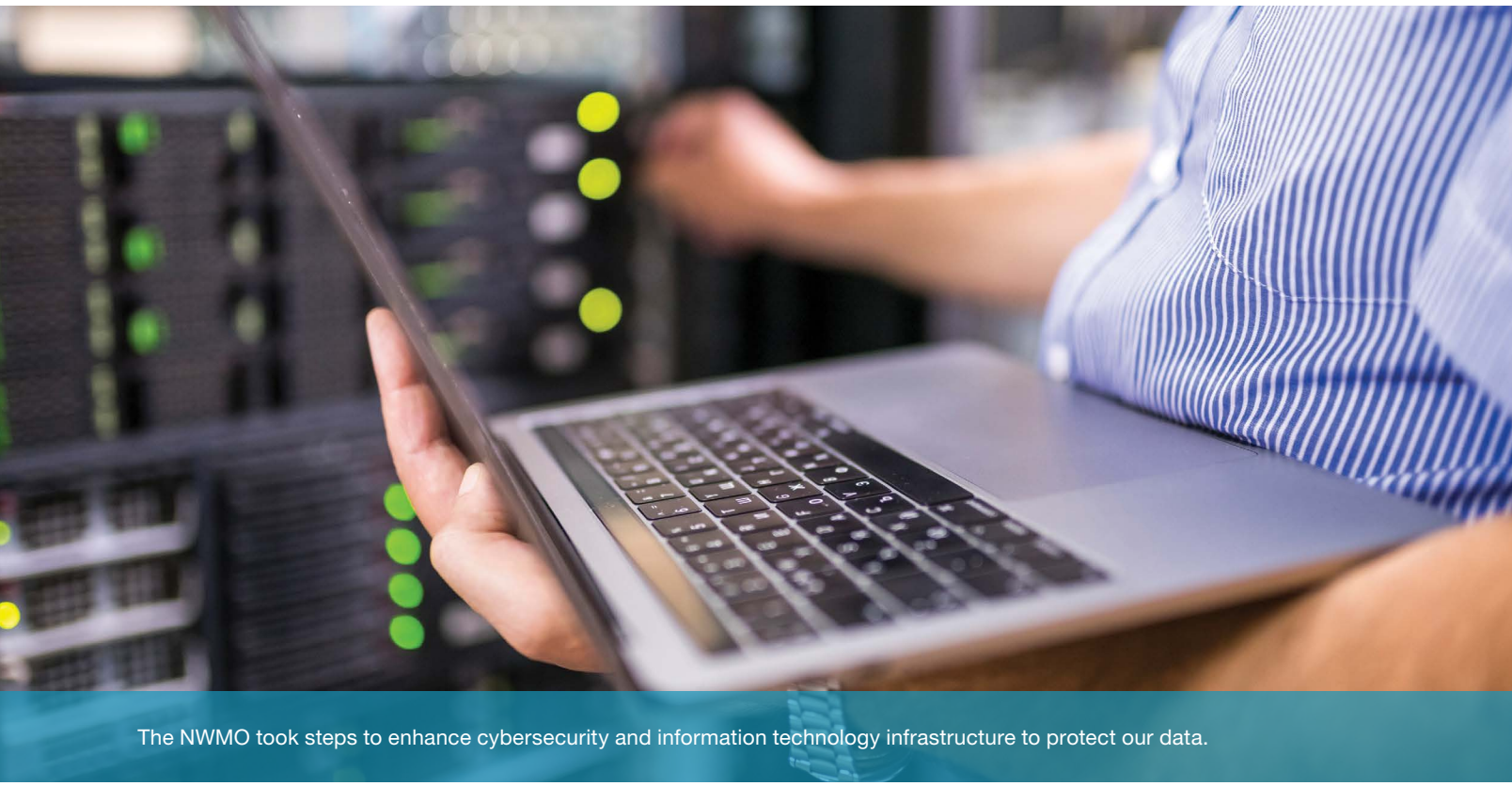
Managing risk

Risk management involves identifying events that may affect the NWMO, assessing their likelihood, implementing mitigation strategies, and managing any resulting risks to help ensure that we meet our objectives. Our governance requires that risks be considered and managed in a manner that is consistent across the organization and appropriate to their severity. We have a process in place to regularly monitor, manage and report to our Board of Directors all risks in different areas such as operational, financial, social, and technical. Senior management and the Board of Directors review risks and mitigate actions on a regular basis.

9 Organizational readiness

Enhancing cybersecurity posture and information technology infrastructure

In 2019, the NWMO took additional steps to enhance our cybersecurity posture and information technology (IT) infrastructure. We added an IT Director to lead this effort, and have tools and processes in place to safeguard the NWMO's information systems against malware and other malicious attacks. We continuously improve our organizational resilience through regular identification of vulnerabilities, monitoring of our digital environment and planning for disaster recovery. The NWMO is planning to implement an IT security awareness program to educate employees regarding IT security and increase awareness of the emerging IT security and related issues.



The NWMO took steps to enhance cybersecurity and information technology infrastructure to protect our data.

Managing our profile

In the last three years, our communications activities have evolved significantly as we have sought to increase awareness across a wide range of audiences about Canada's plan and our progress in implementing it. Consistent with our commitment to transparency, we have provided a growing stream of user-friendly, plain language materials, exhibits and audiovisual media to communicate about our work.

During the reporting period, we established and continue to build our presence on a range of social media platforms: Facebook, Twitter, LinkedIn, Instagram, and YouTube. We also frequently posted new information on our website (www.nwmo.ca) to share updates about our progress towards identifying a safe site, community engagement activities, environmental stewardship, technical programs, and our journey towards Reconciliation.

Other activities to raise awareness of our work to implement Canada's plan have included increased advertising, and expanding our presence at public and industry events such as fairs, conferences and trade shows.

The NWMO actively posts across a variety of social media channels.

POWERED BY PEOPLE

Alicia Flynn, Human Resources Manager, provides human resources (HR) support for internal business units at the NWMO.

As a Human Resources Manager, one of Alicia's responsibilities is recruiting staff to the NWMO – specifically for the Stakeholder Relations, Indigenous Relations, and Site Selection groups. She is effective at recruitment not only because of her HR skills, but also because she is an ambassador for the organization. Her enthusiasm for the NWMO clearly shines through: "I work with a great HR team and others who are dedicated to what they do, and I like that the NWMO's project will be good for Canada," Alicia explains.

Alicia's work also encompasses benefits, compensation, responding to general HR questions, supporting the implementation of HR programs and policies, co-ordinating training, and ensuring compliance with legislation and collective agreements.

When Alicia joined the NWMO 3½ years ago, she had held a number of previous HR roles, and already had a background in benefits and significant experience in recruitment. However, she was attracted to the challenge of a new industry.

While holding an Honours Bachelor of Science degree in Archeological Science from the University of Toronto might be unexpected, understanding a little about geology from some undergraduate courses has a tie-in with the NWMO's work. She also holds an HR certificate from Centennial College and a number of professional designations. "I wanted to do a postgraduate program and considered HR because it is related to anthropology – understanding people, which interested me," she explains.

When Alicia is not at work, she is focused on her family. She enjoys taking her five-year-old son and four-year-old daughter to a park overlooking a beach in Toronto. The family also hosts relatives from Ireland and travels there to visit friends and family.

10 Governance and accountability

The pursuit of excellence

Canadians can trust that the organization responsible for managing our country's used nuclear fuel has a strong governance structure in place. The NWMO is federally mandated under the *Nuclear Fuel Waste Act* (*NFWA*). Our members are provincially owned Crown corporations that produce used nuclear fuel. We are governed by a nine-member Board of Directors and are accountable to Canada's Minister of Natural Resources.

As a not-for-profit corporation, the NWMO falls under the *Canada Not-for-Profit Corporations Act*. We receive ongoing advice from the Advisory Council, an independent advisory body established under the *NFWA*. We receive additional guidance and review on technical, social and Indigenous matters through other independent expert bodies, assuring the organization is continuously pursuing excellence.

The NWMO's integrated management system ensures we are well equipped to implement our vision while protecting people and the environment.

The NWMO's executive committee works as a strong team to implement Canada's plan.

The NWMO's executive committee brings together its diverse areas of expertise to lead our organization.

Annual and triennial reporting to Minister

The annual report to the Minister of Natural Resources is required by the *NFWA*. It is made public on our website and tabled in Parliament, and the Minister issues a statement on it each year. The Minister's full statement can be viewed online at www.nrcan.gc.ca. Every third year, an expanded version of the annual report, which reports on the previous three years and includes comments of the Advisory Council, is required under the *NFWA*. The previous triennial report was published in March 2017.

Reporting to member organizations

Ontario Power Generation (OPG), 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.

10 Governance and accountability

Board of Directors

Chair of the Board: Wayne Robbins

President and CEO: Laurie Swami

Directors: Mark Elliott, Lesley Gallinger, Sean Granville, Michael G. Hare, Ronald L. Jamieson, Josée Pilon, Beth Summers

The Board of Directors is responsible for oversight of the NWMO and taking a leadership role in developing the corporation's strategic direction. The Board is elected by member organizations, and represents a range of perspectives from both within and outside the nuclear industry, including capabilities in Indigenous culture and financial management.

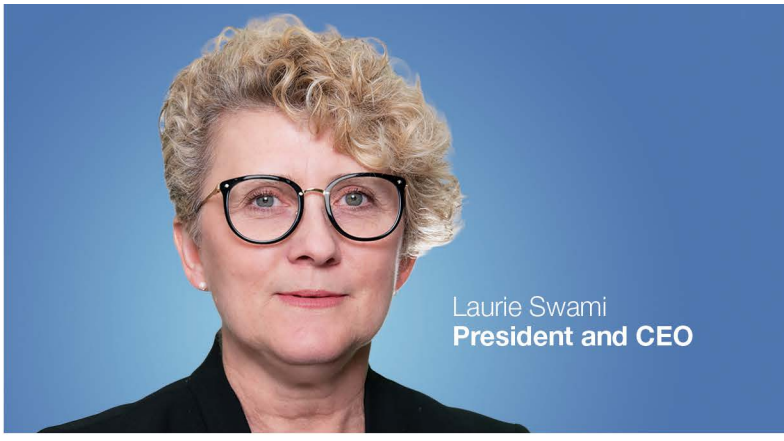
The Board of Directors convened 16 formal meetings between 2017 and 2019. The minutes can be viewed online at www.nwmo.ca/board.

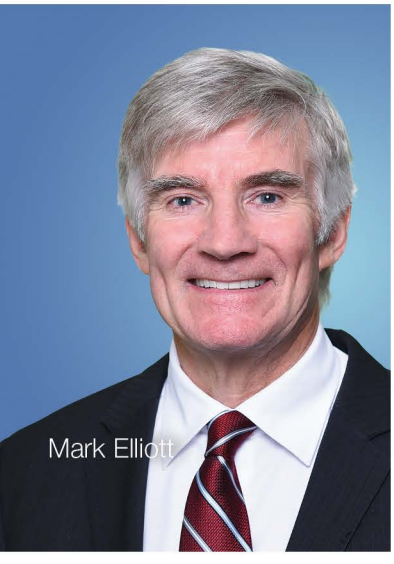
In addition to its regular meetings, the Board holds a strategy session each year with the NWMO's executive team to consider long-term challenges and opportunities as the siting process continues to progress. Discussions focused on strategic oversight of the NWMO's work to reach site selection while maintaining high performance in delivering on strategic goals.

The Board meets annually with the Council of Elders and Youth to exchange ideas and understand decision-making that reflects upon and respects the traditions, customs and values of Indigenous peoples. In October 2019, the Board participated, along with senior management of the NWMO and the Council of Elders and Youth, in an Indigenous ceremony to formalize the NWMO's Reconciliation Policy.

The Board receives regular reports from the Advisory Council and also held annual meetings with the Council to discuss relevant topics of importance.

Board of Directors





Committees of the Board

Audit, Finance and Risk (AFR) committee

The AFR committee is responsible for monitoring the integrity of the NWMO's internal control and management information systems, approving annual financial plans, ensuring the integrity of the NWMO's reported financial performance, and providing oversight of the NWMO's pension fund. The AFR committee met five times in 2019, plus one joint AFR-Human Resources, Compensation and Governance (HRCG) committee meeting.

As of Dec. 31, 2019, the committee had five directors: Beth Summers (Chair), Lesley Gallinger, Ronald L. Jamieson, Josée Pilon, and Wayne Robbins.

Human Resources, Compensation and Governance (HRCG) committee

The HRCG committee is responsible for overseeing the NWMO's human resources functions, including compensation practices, human resources policy, organization design, labour relations, and the pension plan. The HRCG committee met four times in 2019, plus one joint AFR-HRCG committee meeting. The committee had governance added to its mandate in 2018.

As of Dec. 31, 2019, the committee had five directors: Lesley Gallinger (Chair), Sean Granville, Josée Pilon, Beth Summers, and Wayne Robbins.

Siting committee

Through the Siting committee, the Board maintains oversight of the site selection process and manages any identified risks associated with its execution. The committee met four times in 2019.

As of Dec. 31, 2019, the committee had five directors: Ronald L. Jamieson (Chair), Mark Elliott, Sean Granville, Michael G. Hare, and Wayne Robbins.

Technical committee

The Technical committee has oversight responsibilities for the NWMO's technical program as it relates to the implementation of Adaptive Phased Management (APM) and technical support to OPG's low- and intermediate-level waste deep geologic repository. It is responsible for monitoring to ensure the NWMO has a robust technical program to support our objectives and meet regulatory requirements, has an appropriate research and development program, and has appropriate technical staff and governance capabilities. The committee met four times in 2019.

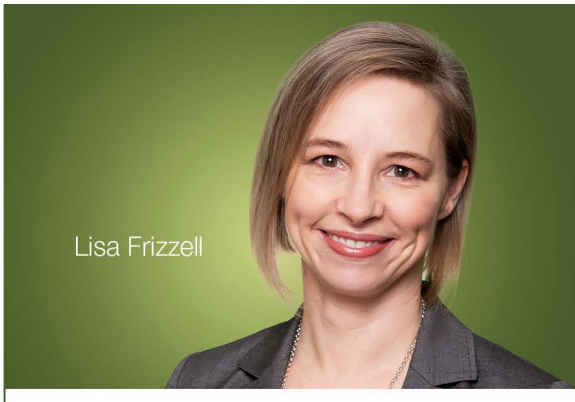
As of Dec. 31, 2019, the committee had six members: Mark Elliott (Chair), Lesley Gallinger, Michael G. Hare, and Laurie Swami. Brad Curle and Lawrence Johnson participate as non-director members on the committee.

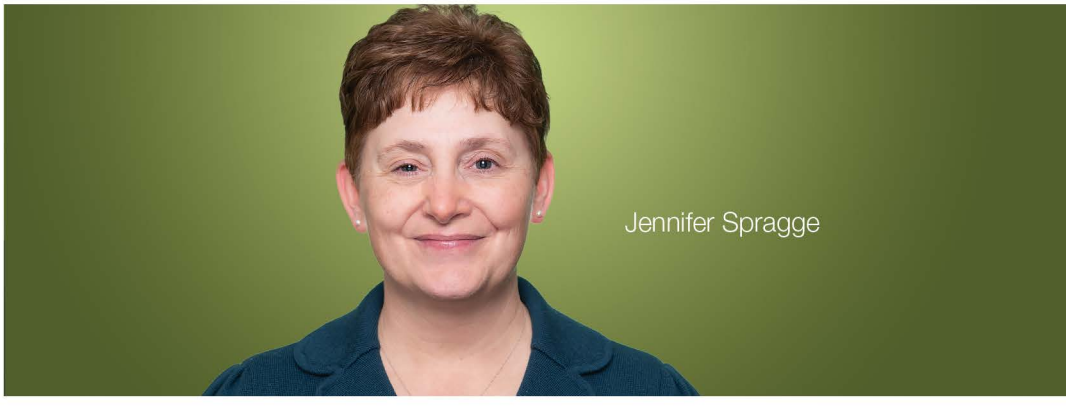
10 Governance and accountability

Officers

Chair of the Board:	Wayne Robbins
President and CEO:	Laurie Swami
Vice-President, Site Selection:	Mahrez Ben Belfadhel
Vice-President, Stakeholder Relations:	Lisa Frizzell
Chief Risk Officer and Vice-President of Strategic Initiatives:	Michael Hung
Chief Financial Officer:	Georgina Kossivas
Vice-President, Human Resources, and Chief Ethics Officer:	Jennifer Spragge
Vice-President and General Counsel:	Doug Taylor
Vice-President, Indigenous Relations:	Bob Watts
Chief Engineer and Vice-President, Contract Management:	Derek Wilson
Board Secretary:	Gillian Morris

Executive Committee





Advisory Council

The Advisory Council reviews and comments on the NWMO's work, as a requirement of the *NFWA*. The Council's reports appear in the NWMO's triennial reports, published every three years.

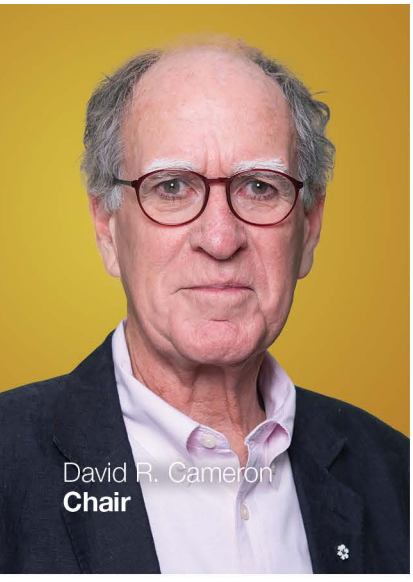
There are 10 Advisory Council members. Member expertise includes nuclear engineering, geotechnical engineering, nuclear waste management, engagement, public affairs, nuclear community relations, environment, sustainable development, political science, municipal affairs and government relations, financial management, Indigenous Knowledge, Indigenous relations, and community-based research.

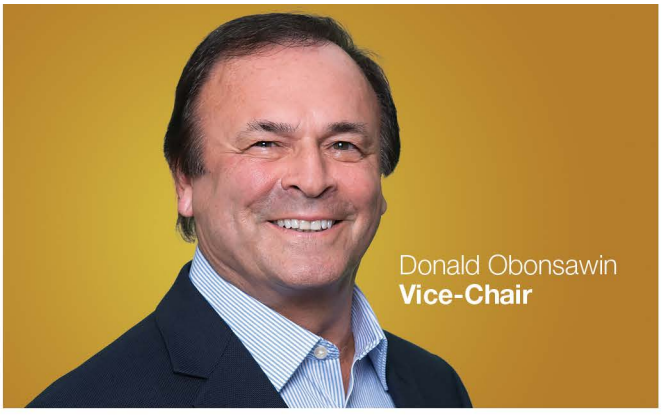
The full Advisory Council membership is profiled online at www.nwmo.ca/advisorycouncil.

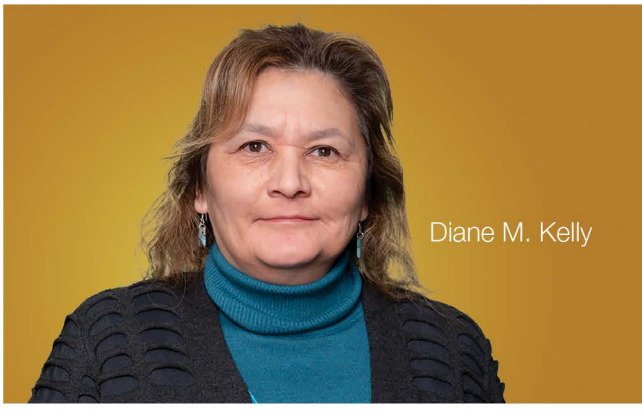
In 2019, the Advisory Council focused on providing the NWMO with advice in these key areas:

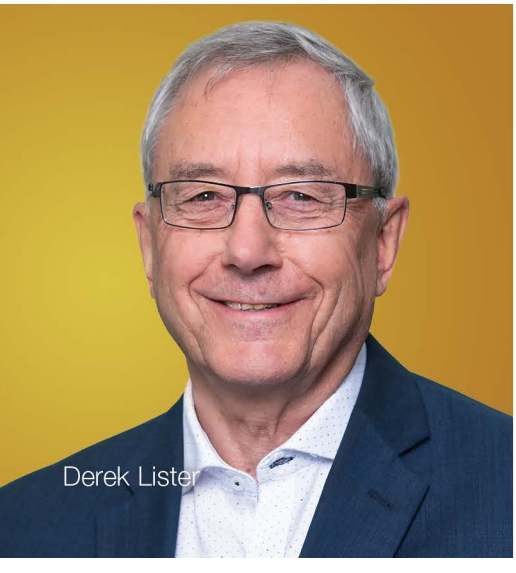
- Site assessment activities;
- Plans for narrowing down the number of communities in the siting process;
- A fair and ethical plan for recognition of communities exiting the siting process;
- Partnership development and community well-being funding to support building partnership agreements;
- Assessments of risks related to the NWMO's work;
- Development of the Reconciliation Policy;
- Business planning activities;
- Topics related to used fuel transportation;
- Technical matters related to long-term safety; and
- Plans for accessing land.

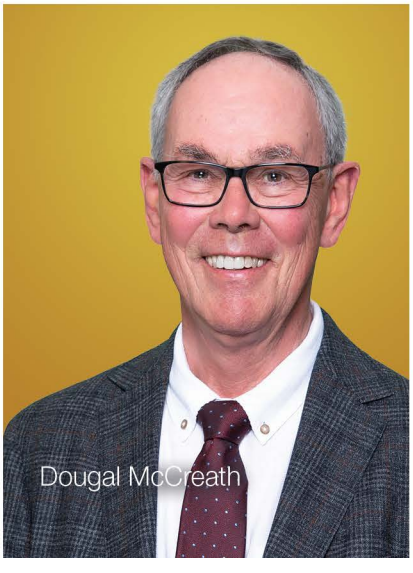
Advisory Council











Peer reviews

From 2017 through 2019, the NWMO has continued to co-ordinate peer review of technical work and to invite independent comment. These external reviews help ensure high technical standards are met, as well as consistency with international best practice.

For example, in an exercise similar to the 2016 expert technical panel review of our copper coating corrosion program, we had experts review our underground microbial research program in 2018. The reviewers' report was favourable regarding the technical program and also provided direction for future research.

The NWMO also regularly seeks peer review of key technical reports. These are often requested at the draft report stage and used to improve the final report.

Additionally, we publish in peer-reviewed journals in our technical fields, collaborating with partners at universities, national laboratories, and international organizations.

WHAT WAS SAID

"As a non-emitting power source, Nuclear plays an important role in our country's energy mix. Our industry is leading in innovation and – through the NWMO – advancing a community-driven process for the safe disposal of waste."

– The Honourable Seamus O'Regan, Minister, Natural Resources Canada

Adaptive Phased Management Geoscientific Review Group (APM-GRG)

The APM-GRG is a group of internationally recognized experts in geoscience disciplines that reviews the NWMO's geoscience siting plans and findings. The group plays an important role in ensuring our technical work consistently meets or exceeds international best practices.

During the past three years, the APM-GRG's reviews included plans for geological fieldwork such as borehole drilling from the Revell Batholith, modelling and interpretation of geoscientific data.

Each year, the APM-GRG produces an annual report, which is posted on the NWMO's website at www.nwmo.ca/apmgrg.

The APM-GRG was able to use its annual in-person meetings as opportunities to visit some of the communities engaged in the site selection process, to attend one of the NWMO's annual Geoscience Seminars, and to visit the NWMO's proof test facility.

The Adaptive Phased Management Geoscientific Review Group is made up of five internationally recognized experts from Canada, Sweden, Switzerland, and Australia. They possess extensive multidisciplinary experience relevant to the siting of a deep geological repository.

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.

From 2017 to 2019, the Council met with the NWMO three to four times each year. Significant themes of discussion included harmonizing policies and frameworks that guide Indigenous relations, developing a Reconciliation agenda, finalizing the Reconciliation Statement and Policy, and providing input towards 2020 Reconciliation implementation plans.

Members of the Council engaged with people in communities that may be impacted by APM, and attended open houses, trade shows and cultural events, as well as First Nation and Métis community meetings. These activities received positive feedback from communities.

Municipal Forum

The Municipal Forum is an assembly of municipal association representatives with experience and expertise on municipal issues and challenges. It was established in 2009, and provides advice on municipal perspectives and processes to help guide the NWMO's engagement and outreach.

The forum helps the NWMO to incorporate best practices when communicating with local governments and associations, and understand the needs and practices of municipalities that are considering hosting the project.

Membership has been refreshed during the past three years as former members retired or moved on to new roles. Members visited the proof test facility in Oakville and participated in the 2019 Canadian Nuclear Society Conference in Ottawa to learn more about nuclear waste management in Canada and around the world.

Members of the Municipal Forum visit the NWMO's proof test facility in Oakville.

Environmental Review Group

In 2018, the NWMO established an Environmental Review Group (ERG) to provide independent expert advice and guidance on environmental programs and impact assessment planning.

The ERG has advised the NWMO on developing an effective impact assessment process – one that includes early engagement and impact assessment studies as a best practice.

The group connects quarterly (once a year in person) to discuss strategic issues relating to assessing potential impacts of the APM Project on the natural environment. In April 2019, the ERG, along with Wabigoon Lake Ojibway Nation, participated in a workshop focused on the NWMO's baseline studies and biodiversity programs. They also visited the Revell Batholith in northern Ontario, where the NWMO has worked with the community to initiate borehole drilling investigations.

The NWMO's integrated management system

The NWMO continues to operate our integrated management system for activities supporting the long-term management of nuclear waste. To sustain governance excellence, 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, the NWMO has augmented our management system to satisfy the CSA N286-12 Management System Requirements for Nuclear Facilities, which includes nuclear waste facilities.

The NWMO's integrated management system ensures the organization has 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.

POWERED BY PEOPLE

Brittany Misurec, Legal Counsel, has worked on the consultation record necessary for borehole drilling.

Brittany's role at the NWMO is multi-faceted. Since joining the organization in April 2019, she has advised on a broad range of government, regulatory and compliance matters, including identifying areas of risk and making recommendations; drafting funding agreements with municipal and Indigenous communities; and providing legal advice for various internal departments.

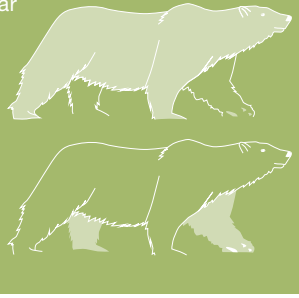
However, the biggest project she has taken on is producing a concise consultation record for boreholes four through six in Ignace that the NWMO submitted to the Ministry of Natural Resources and Forestry. This record fulfils a legal duty to consult with Indigenous communities before drilling can commence.

"The work allows me to assist the NWMO team in carrying out our site selection process while honouring Reconciliation and building meaningful relationships with Indigenous communities," she explains.

The job is a great fit given her background. Brittany has a Juris Doctor degree from Osgoode Hall Law School in Toronto. While in school, Brittany was part of an Indigenous students association that led initiatives that supported Osgoode Hall Law School in fulfilling its Truth and Reconciliation duties.

"I am from Six Nations myself, and I used school as a way to explore my culture and heritage," she says. This exploration led Brittany to realize her passion in helping Indigenous peoples and communities build sustainability, capacity and wealth creation.

Growing up in Ancaster, Ont., Brittany now makes Toronto her home, and keeps busy outside work by travelling and serving as a board member for the Toronto Zoo. When asked what her favourite animal is, the lawyer pauses, giving a lawyer's measured consideration before responding, "The polar bear."



11 What we heard on implementing Canada's plan

From 2017 to 2019, the NWMO continued to engage in dialogue with communities, organizations and interested individuals about the implementation of Canada's plan. We shared our knowledge, learned together and addressed concerns.

As the siting process advanced, we have narrowed our areas of focus. At the same time, we continue to expand our engagement beyond potential siting communities to surrounding regional communities.

General topics of interest have remained largely similar from year to year. These topics include:

- Safety;
- Transportation of used nuclear fuel;
- Canada's plan and the site selection process;
- Community well-being; and
- Interweaving Indigenous Knowledge with science.

People who are learning about Adaptive Phased Management (APM) for the first time have different questions from those who have been involved for a longer period. People in siting communities have developed a deep understanding of the project, which has led to more informed conversations and new topics that we explore together.

Also, we have undertaken new or additional activities during the past three years, as Canada's plan continues to advance. For instance, increasingly, engagement has centred around exploring the potential for partnership. As a result, our conversations have evolved to mirror this progression. Newer areas of focus that have emerged include:

- Exploring the potential for partnership;
- Reconciliation; and
- Choosing sites for borehole studies and land access.

We work with a diverse range of communities and have provided a wide variety of ways for people to engage with us. These include one-on-one conversations, group discussions, community symposia, interim storage facility and proof test facility tours, a mobile exhibit, presentations to community groups, participation in conferences, monthly meetings and briefings, community open houses, digital channels, and more.

The feedback we have received has helped us understand what is important to communities in potential siting areas, as well as a wider range of audiences.

Safety

Safety is our foremost priority. People learning about Canada's plan want to know how the project will keep people and the environment safe. They asked about the nature of used nuclear fuel, the long-term safety of the deep geological repository, the health effects of radiation exposure, and how the project will protect water and the environment.

People in siting areas that have been in the process for a longer time were interested in taking a more in-depth look at safety topics such as the NWMO engineered-barrier system, geological studies, safety assessments, water management during construction and operations of the repository, and the safety features of the on-site surface facilities. We developed new presentations and informational materials to address topics of interest.

To meet community requests, in 2019, NWMO specialists presented findings from a study that focused on the safety of the repository after operations cease and the facility is decommissioned. NWMO technical specialists also gave presentations on the safety of borehole drilling, our corrosion program, and clay as an engineered barrier.

In addition, as the issue of climate change has increasingly become a focus of public discourse, it has also become a frequent topic of conversation, and a common introduction to the broader issue of managing Canada's used nuclear fuel. There is greater awareness about the potential of nuclear electricity production as a means of reducing greenhouse gas emissions, and people are interested in knowing how the fuel cycle is completed safely and securely through APM.

As the NWMO moves into the next phase of the project and begins to prepare for regulatory processes, in 2019, people in siting area communities shared ideas about what they would want to see in an environmental monitoring program. Some ideas include publicly accessible data, consideration of local communities' input and knowledge, and potential impacts on air, water, soil quality, fish, vegetation, and wildlife.

Transportation of used nuclear fuel

Although the transportation of used nuclear fuel is not expected to begin before 2043, it is a key topic of interest.

With broadened engagement, people had questions about the Used Fuel Transportation Package and various regulations the NWMO must adhere to in order to transport used fuel. Meanwhile, people in potential siting communities who understand the safety case well wanted to learn about our risk assessment studies, including accident scenarios raised by the public.

Also, people in potential siting communities and broader audiences identified common themes that need to guide transportation planning. These include safety as the primary consideration, protecting the environment (including watersheds), creating strong procedures to secure shipments from threats, developing emergency response plans, fully covering costs so they do not fall on the communities, clearly articulating and understanding jurisdictional roles and responsibilities, and providing education to address concerns and misconceptions.

11 What we heard on implementing Canada's plan

Canada's plan and the site selection process

While we have focused our studies on fewer siting areas, we have also continued to broaden engagement to include regional communities and others with an interest in the project. For people who were new to the project during this reporting period, initial learning evoked a common set of questions such as "Who owns the NWMO?", "How much does the project cost, and who is paying for it?", "What kind of site and/or rock are we looking for?", "What is the community role in the site selection process?"

People in siting areas familiar with the project were interested in learning more about topics such as narrowing down decision-making, how APM compares with the management of used nuclear fuel in other nuclear countries, and lessons learned from other nations.

Prompted by media stories during the past two years about small modular reactors (SMRs), people notably expressed an interest in how the NWMO will adapt to new and emerging technologies, especially the development of SMRs and the management of used fuel from these reactors. In 2018, the NWMO created the backgrounder *Small Modular Reactors: Managing Used Fuel*, exploring how SMRs relate to our work; we also annually produce a *Watching brief on advanced fuel cycles*.

Community well-being

People in potential siting communities and the surrounding areas were interested in the economic benefits of the project and how these benefits will be shared equitably in a region. They wanted to know about job opportunities and how small- and medium-sized local businesses could benefit during early stage activities. People also called on the NWMO to help young people consider careers that would position them to be part of the APM Project in the future. Starting in 2017, the NWMO began to identify opportunities for local procurement and employment associated with social and technical studies. We heard about the need to learn from approaches to apprenticeships and local hiring that are already working in communities.

People also explored other aspects of community well-being. They highlighted the importance of stewardship of the land (including agricultural land), and the need to manage change and undertake long-term sustainability planning. As well, people expressed a desire to retain community values such as family feel.

Communities in the siting process increasingly pursued capacity-building opportunities in 2019 as partnership discussions intensified and they considered a future that may include the project. We heard they would like support to evolve from funding learning to full community participation in partnership activities.

Interweaving Indigenous Knowledge and science

We heard from First Nation and Métis communities about the need to continue incorporating Indigenous Knowledge and world views into our processes, approaches and presentations.

In 2017 and 2018, the NWMO together with communities created two presentations that integrated Indigenous Knowledge – *The Journey of Water* and *Teachings from Mother Earth* – about water's role in the environment and what it can tell us as part of our ongoing studies.

In 2019, the NWMO collaboratively developed the third presentation in the series, which focuses on water's relationship with copper. We also worked with communities to develop a program in which Indigenous Knowledge keepers and guides supported fieldwork.

Exploring the potential for partnership

Increasingly through engagement, the NWMO has explored the potential for partnership with siting area communities.

In late 2017 and through 2019, municipalities took the first steps in the partnership road map by identifying and refining a set of values and principles to guide future conversations on partnership, and starting to envision how the project could help attain community goals such as diversifying the local economy or retaining young people.

During the last two years, conversations with communities in the site selection process have intensified on the topic of who needs to be involved in an area for the project to proceed. Strong relationships between neighbours will be required to co-ordinate planning and advance the project. Municipalities have reiterated the importance of working regionally, and the desire to get to know Indigenous neighbours continues to grow.

As neighouring communities begin to learn about the project and Canada's plan, we are hearing from them common questions about the safety of the project, the fit of the project in the area, the nature of local benefits or risks the project may entail, and their place in a collaboratively designed decision-making process for selecting a preferred site.

11 What we heard on implementing Canada's plan

Reconciliation

During the reporting period, the NWMO took significant steps in our Reconciliation journey. We issued a Reconciliation Statement and Policy in 2018 and 2019, respectively.

As we progress, municipalities in the siting process have expressed a deepening interest in our Reconciliation journey, as well as in enhancing relationships with their Indigenous neighbours. We heard from municipal leadership that communities wanted to learn through NWMO-supported cultural awareness training. The training was initially provided to community liaison committee members, councillors and senior staff in 2018, and then offered to the broader community in 2019.

People in siting areas have also requested the NWMO's advice on local protocols and how best to establish formal lines of communications.

There continues to be a keen interest to understand Aboriginal rights laid out in Canadian law and how these must be respected. People in siting areas sometimes ask or share knowledge about traditional land claims.

Choosing sites for borehole studies and land access

For the past three years, we engaged with people in the siting areas (including people in First Nation and Métis communities) to learn about the social conditions with respect to borehole drilling. In 2017, we had conversations with people in the Ignace area, while in 2018, we initiated conversations in the areas of Manitouwadge and Hornepayne (which were still in the siting process at the time). These conversations involved sharing a range of sites with the potential to be technically suitable and exploring with people which of these sites should be the focus of borehole studies. The goal of these engagement activities was to identify socially acceptable sites for borehole drilling in siting areas.

The large majority of people expressed interest about the proposed borehole locations and drilling activities. People who use the land in proximity to proposed boreholes asked how we would manage drilling so it would not interfere with hunting, fishing and trapping activities. A few individuals asked for further information about potential impacts to the environment, in particular, on water quality in surrounding water bodies.

People in siting area communities also expressed a preference to use existing roads or trails to access borehole locations, where possible, and the need to minimize disturbance with new or improved access roads. They also stated the importance of protecting fish and wildlife habitat, as well as water management.

As borehole drilling in the Ignace area commenced in late 2017 and continued through 2019, people in this siting area have expressed interest in the analysis of core (rock and porewater) obtained from the boreholes, and they are continuing to follow the process.

In 2019, conversations in the Huron-Kinloss and South Bruce siting areas largely revolved around the NWMO's newly launched Land Access Process, which involved the NWMO seeking to sign agreements to access sufficient land to conduct site investigations such as borehole drilling. People in these communities generally had a positive response to the program and shared stories that emphasized deep family and historical connections to the land. Some people said if the project goes ahead in their area, they would like to stay and farm the land for as long as possible, while others said they would like to remain in the area to contribute to the local economy or move closer to be near children who had moved out of the community.

Social media and online conversations

From 2017 through 2019, the NWMO continued to hear from people via our website, email and social media channels. Generally, people were supportive of our mission. The public is interested in educational content, especially content to demystify used nuclear fuel. People's questions and comments tend to focus on safety-related topics; there is a desire for expert verification of the NWMO's work. Our audience responds positively to addressing common concerns with facts. Additionally, quizzes and polls provided an opportunity to learn about APM.

We also learned that social media users in potential siting areas like to see their communities featured in NWMO content, through updates about the progress of site selection, as well as early capacity-building activities.

Throughout 2019, we steadily increased our social media presence, resulting in increased engagement. In particular, the NWMO's social media audience demonstrated a strong interest in Indigenous-related content, particularly the #VoicesOfReconciliation video series, focusing on the NWMO's Reconciliation journey.

Implementation plan

The NWMO received comment and direction from interested individuals and groups on our annually updated strategic plan, *Implementing Adaptive Phased Management*.

People requested a document that was easier to read, a more streamlined review process and more time to provide comments. Over 2017 and 2018, we revised the document and timelines for input based on this feedback.

We received mostly positive comments on the APM process, along with some suggestions to help strengthen the plan. In 2017, comments highlighted the challenge of obtaining social acceptance, the importance of sustained engagement, and the need for careful transportation planning. In 2018, some respondents asked for clarification on terms and concepts used, why multiple boreholes were required in each siting area, and why some potential siting communities are located at a considerable distance from operating nuclear reactors. In 2019, we received questions and comments around increasing awareness about APM and transportation planning beyond the siting areas, managing risks related to site selection, and the need to be prepared to adapt to new developments such as SMRs.

We continue to invite comments and suggestions about our work programs and plans, and acknowledge the communities, individuals and organizations that lend their thoughts to the implementation of Canada's plan.

12 Social, economic and cultural considerations

During the past three years, the NWMO continued preliminary assessments for communities and areas in the site selection process. The communities and areas of focus were those that had shown strong potential to meet the requirements of the Adaptive Phased Management Project based on earlier assessments. After safety considerations had been addressed, social, economic and cultural considerations factored into these assessments.

Earlier assessments examined the potential for the project to be implemented in a manner that fosters each community's and area's well-being as they define it. Building further on this, during the past three years, assessments focused on the potential to develop the durable and resilient partnerships the project will require. (See box that follows for more information.) Throughout these assessments, the NWMO explored the potential to:

- Develop a strong level of confidence in the safety of the project among community members (social safety);
- Develop support for the project;
- Align the project with long-term community and area vision; and
- Identify a socially acceptable repository site.

Here is what we learned through the assessments:

Social confidence in the safety of the project increased substantially in all communities and areas during the past three years. Communities received information and engaged in dialogue about the project's safety over an extended period. This led to increased community capacity to engage in discussion and ask more detailed questions, and also a growing confidence in the multiple-barrier technology to contain and isolate used nuclear fuel for the long term required.

As we get into more detailed discussions, alignment of the project with community and area vision comes into sharper focus. In each area, the project demonstrated the potential to substantially address challenges and advance towards key community priorities such as providing opportunities for youth and supporting local businesses, helping to diversify the economy, and enhancing stewardship of the environment.

However, the alignment of the project with community aspirations is stronger in some areas than others and is influenced by the strength of the shared vision within the community. Strong project alignment affects interest in the project, engagement in learning, and ultimately, the potential for willingness and support for hosting the project in the area.

Beyond support for the project, some areas had stronger potential to identify a socially acceptable repository site than others. This is an important step in the siting process and one of the factors considered as part of narrowing down decisions. Once potential repository sites are identified, the NWMO and community members proceed to collaboratively plan field studies, including borehole studies, to learn more about the technical suitability of the site.

Addressing social, economic and cultural objectives of communities will continue to be essential to demonstrating project fit and to laying the foundation for the sustainable and resilient partnerships needed for the implementation of the project. These assessments have highlighted the strong potential to achieve this fit and needed partnerships in the remaining siting areas. Work also needs to continue to build confidence in the safety of the project among area residents, including addressing their questions and concerns about any potential effects on people's health, the land, drinking water, infrastructure, and services.

Social, economic and cultural considerations

The framework for assessing ***potential for partnership*** includes social, economic and cultural considerations:

a. Support for the project (willingness) at multiple levels, including leadership, grassroots and neighbouring communities: The degree to which community leaders, community interests and neighbours express support and desire for the project.

b. Confidence in the safety of the project: The degree to which communities understand the safety assessment, and their degree of confidence and acceptance of the safety case for the project.

c. Support for field investigations to identify a potentially acceptable repository site: The degree to which communities express support for planned and ongoing field studies, the potential to identify a socially acceptable repository site, and one or more potential repository sites in the area.

d. Potential alignment of project well-being opportunities with community vision and strategies: The degree to which well-being opportunities that can be fostered by the project are recognized, understood, and responsive to the priorities and objectives of communities.

The selection of ***borehole drilling sites*** includes social, economic and cultural considerations. For example, working with the NWMO, people in the Ignace siting area identified the factors that make a site socially acceptable and assessed potentially technically suitable sites against them. These include:

- Economic: Proximity to the community, presence of existing infrastructure, and impact on local business;
- Cultural: Proximity to recreational land uses, private property impacts, and First Nations cultural considerations; and
- Natural environment and resources: Water impacts, animal impacts, and lands and resource impacts.

12 Social, economic and cultural considerations

Working within an Ethical and Social Framework

From our inception, the NWMO has committed to the highest ethical standards both in our procedures and in our decision-making. To guide us in this matter, a Roundtable on Ethics established an Ethical and Social Framework, and the NWMO adopted it. First published in 2004, the framework was confirmed through dialogue with Canadians conducted during the study phase of work.

In its 2016 report, the Advisory Council recommended the NWMO update the Ethical and Social Framework to increase its relevance to the site selection phase of work; engage communities involved in the siting process more actively to help refine and apply the framework; ensure the framework includes ethical and social values embodied in the Indigenous communities in the siting study areas; and continue to refine the framework to reflect the needs of each stage of work. With this guidance, during the last three years, the NWMO initiated a dialogue to review and refine the framework.

Framework refined

In 2018, we reviewed the framework for its applicability to the current phase of work. This review included discussion with the Advisory Council, the Council of Elders and Youth, the Municipal Forum, NWMO expert consultants working with us to conduct social studies, and the communities involved in the siting process through their community liaison committees and working groups. We made minor refinements to better align the framework with the kinds of activities and decisions that are the current focus of our work. This includes selecting a single site for a deep geological repository with informed and willing hosts, building supportive and sustainable partnerships with communities in siting areas, as well as developing a program to transport used nuclear fuel from interim storage facilities to the deep geological repository once sited.

Following the direction of the Advisory Council, we also added detail to the framework to provide more context and discuss how we have built on it in our subsequent work.

The refined framework was published on the NWMO website and as a stand-alone pamphlet that was broadly distributed to municipal and Indigenous communities involved in the site selection process. It was also shared at conferences and trade shows.

Activities to build on the framework

Over the course of our work, the NWMO has built on and operationalized the original framework in a number of ways. In the last three years, the NWMO worked with communities involved in the site selection process to develop a shared set of values and principles to guide more detailed conversations about the project and future partnerships as part of the partnership road map. The Ethical and Social Framework provides broad context for these discussions.

The framework also provides important context for the NWMO's work to develop a program to support Reconciliation, and the respect and understanding this will bring into the process and decision-making.

It informs ongoing work to explore partnership, willingness and consent.

13 Budget forecast 2020 to 2024

The NWMO's annual budget process

The NWMO's business planning process begins with senior management discussing and confirming proposed strategic directions and objectives for the five-year planning period. The development of each five-year plan takes into account the input received through public reviews of implementation plans and engagement activities. Each year, the five-year business plan is presented to the Board of Directors for review and discussion. Each fall, the Board approves the budget for the upcoming fiscal year. The 2020-24 strategic plan for Adaptive Phased Management (APM) is presented in chapter 15, *Implementing Adaptive Phased Management 2020 to 2024*.

In addition to managing the implementation of APM, the NWMO has been under contract since 2009 to Ontario Power Generation (OPG) to help develop a deep geologic repository (DGR) for the long-term management of low- and intermediate-level waste (L&ILW) at the Bruce nuclear site in the Municipality of Kincardine. In late 2017, the NWMO was informed by OPG that it will assume responsibility for the L&ILW repository, across the regulatory, design and construction phases of the project by the end of 2020.

The total projected costs for the NWMO's activities in these two program areas for the period 2020 to 2024 are presented below.

Total projected costs ($ million)

Program	2020	2021	2022	2023	2024
APM	136.3	128.2	132	146.3	172.5
OPG DGR for L&ILW	1.5	0	0	0	0
Proposed plan	137.8	128.2	132	146.3	172.5

Adaptive Phased Management budget forecast 2020 to 2024

The budget forecast supports the major APM work program objectives described in the five-year strategic plan. A summary of the costs in each of the seven work program areas, and staffing and administration is provided in the table below.

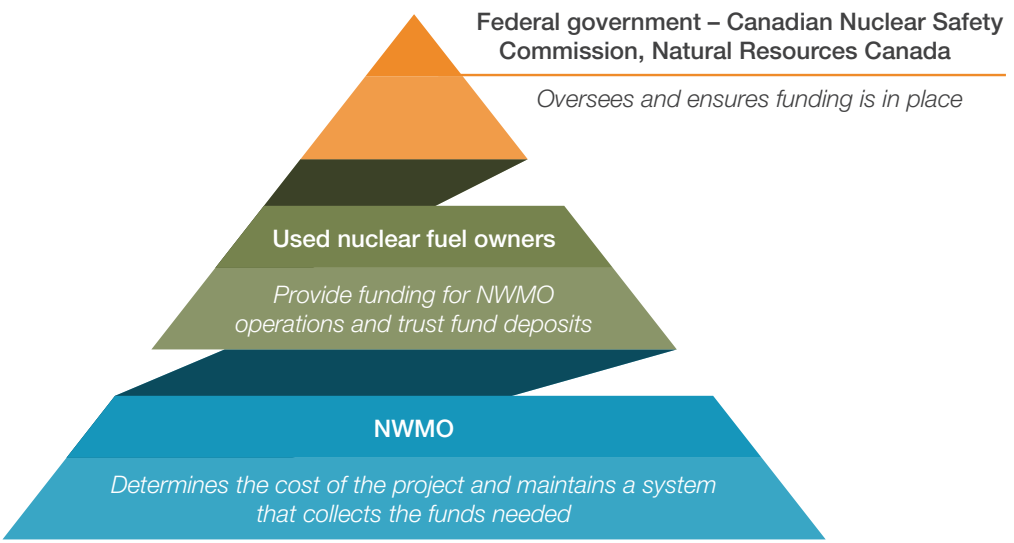
APM projected costs ($ million)

Program	2020	2021	2022	2023	2024
Engineering	12.1	13.6	11.9	10.6	14.1
Site assessment	30.8	19.7	5.5	22	30.5
Safety	5.4	5.4	4.4	4.3	4.4
Regulatory approvals	5.8	6.7	6.3	6.1	8.2
Engagement	31.7	26.6	44.4	44	50.7
Transportation	1.1	6.1	7.9	5.9	7.1
Stakeholder relations	4.5	4.2	5.2	4.9	5
Staffing and administration	44.9	46	46.4	48.5	52.5
Proposed plan	136.3	128.2	132	146.3	172.5

14 Ensuring funding is in place

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

The roles and responsibilities of financial surety can be summarized in the diagram below.



Factors that influence cost

Adaptive Phased Management (APM) cost estimates include costs to develop, construct, operate, monitor, and decommission a long-term facility, including a deep geological repository and Centre of Expertise, and to transport the used nuclear fuel to the repository.

The eventual cost of the project is impacted by many factors. This includes 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 2.9 million bundles. The eventual number of bundles to be managed is impacted by factors such as the longevity and productivity of nuclear reactors, and decisions on refurbishments. If new reactors are built, the potential volume could rise to as many as 7.2 million bundles. For planning purposes, our cost estimate is based on an expected volume of about 5.2 million fuel bundles.

On an annual basis, we perform assessments of the factors that impact APM cost estimates and funding requirements. We then determine the trust fund contribution requirements for the following year, while ensuring resources are used prudently.

Financial reporting requirements

The *Nuclear Fuel Waste Act* (*NFWA*) specifically addresses the future financial obligations expected for managing used fuel over the long term. The requirements of the Act are described in the box below. The following section of this triennial report is structured to be consistent with requirements defined in subsection 16(2) of the *NFWA*.

Requirements of the *NFWA* (2002)

The NWMO is required to provide a range of financial information in each of our annual reports following the government's decision, as defined in subsection 16(2) of the *NFWA*.

16(2) Each annual report after the date of the decision of the Governor in Council under section 15 must include:

(a) the form and amount of any financial guarantees that have been provided during that fiscal year by the nuclear energy corporations and Atomic Energy of Canada Limited under the *Nuclear Safety and Control Act* and relate to implementing the approach that the Governor in Council selects under section 15 or approves under subsection 20(5);

(b) the updated estimated total cost of the management of nuclear fuel waste;

(c) the budget forecast for the next fiscal year;

(d) the proposed formula for the next fiscal year to calculate the amount required to finance the management of nuclear fuel waste and an explanation of the assumptions behind each term of the formula; and

(e) the amount of the deposit required to be paid during the next fiscal year by each of the nuclear energy corporations and Atomic Energy of Canada Limited, and the rationale by which those respective amounts were arrived at.

The NWMO is responsible for determining the cost of the project and designing a system that collects the funds needed.

14 Ensuring funding is in place

The *NFWA* requires the establishment of trust funds by each waste owner. The funds were established in 2002, and annual contributions have been made by each waste owner since. The total value of these funds, including investment income, was approximately $4.8 billion as of the end of 2019. This money is in addition to other segregated funds and financial guarantees the companies have set aside for nuclear waste management and decommissioning.

Owner	Trust fund balance ($ million) December 2019
OPG	4,399
HQ	158
NBP	183
AECL	55
Total	4,795

Experience in other countries has demonstrated the importance of safeguarding these funds so that they will be preserved for their intended purpose. The *NFWA* built in explicit provisions to ensure the trust funds are maintained securely and used only for their intended purpose. The NWMO may have access to these funds only for the purpose of implementing the management approach selected by the government once a construction or operating licence has been issued under the *Nuclear Safety and Control Act* (*NSCA*).

As required by the *NFWA*, the NWMO makes public the audited financial statements of the trust funds when they are provided by the financial institutions annually. They are posted at www.nwmo.ca/trustfunds.

Reporting of the Canadian Nuclear Safety Commission (CNSC) financial guarantees

As mandated under the *NSCA*, the CNSC requires waste producers to provide financial guarantees to cover the cost (in present value terms) associated with decommissioning, interim storage and the long-term management of radioactive waste (including used nuclear fuel) produced to date.

These financial guarantees available for year 2020 total $19 billion. They are reviewed independently by the CNSC as part of the waste owner licence requirements and are satisfied by segregated funds that are dedicated to nuclear waste management and decommissioning (totalling approximately $22 billion as of year-end 2019), and in the form of Provincial Guarantees.

Details of the status of these guarantees are presented in Attachment 1.

Total cost estimate

The NWMO completed a full update of the cost estimates 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.

On the basis of an expected volume of 5.2 million fuel bundles, the total lifecycle cost of APM – from the beginning of site selection in 2010 to the completion of the project – is approximately $23 billion (in 2015 dollars). This figure covers many decades of lifecycle activity.

It is also important to determine the amount that is required, in today's dollars, in order to have the necessary funds in place when needed in the future. We know that the funds in place today will grow based on continued additional payments from the funders of the project and through expected investment income that will also grow over time.

The funding required (using Jan. 1, 2020, present value) to manage 5.2 million fuel bundles from 2020 onwards is $9.6 billion.

Pre- and post-construction costs

Included in the $9.6 billion funding requirement is $2.8 billion to select a site for the repository, complete a detailed design, develop the Centre of Expertise, acquire the site, evaluate environmental impacts, and obtain a site preparation and construction licence under the *NSCA*. These pre-construction costs are paid for by the waste owners based on the annual NWMO budget as approved by the Board of Directors.

Also included is $6.8 billion to complete construction, transport the fuel to the repository, and operate, close, and monitor the repository. The *NFWA* requires that these post-construction costs must be funded through contributions to the *NFWA* trust funds established by Ontario Power Generation (OPG), Hydro-Québec (HQ), New Brunswick Power (NBP), and Atomic Energy of Canada Limited (AECL). As of December 2019, the total value of these funds, including investment income, was approximately $4.8 billion. This is enough money to cover post-licensing costs of APM for the country's existing inventory of used nuclear fuel.

The costs of interim storage at the reactor sites and retrieval of the used fuel from storage are not funded through the NWMO because they are the responsibility of the waste owners.

Budget forecast for 2020

For 2020, the NWMO Board of Directors approved a budget envelope of $136.3 million. Annual costs beyond 2020 are subject to further review. Sharing of these costs will be in accordance with the percentages defined in the Membership Agreement, as amended from time to time. The 2020 cost-sharing percentages among the waste owners are: OPG: 93.32%, HQ: 2.20%, NBP: 3.73%, and AECL: 0.75%.

Funding formula

The NWMO funding formula has been in place since its approval by the Minister of Natural Resources in April 2009. The formula, based partly on projections of used fuel to be generated by each waste owner, allocates liabilities and trust fund contribution requirements to each waste owner. Costs common to all waste owners are shared based on a cost-sharing percentage agreed to by the members. Costs specific to a nuclear fuel waste owner, such as special fuel and special transportation costs that are owner specific, are attributed to the owner.

Possible future reactors

With the recent development in small modular reactors, the NWMO has begun initial reviews of the funding formula and its application to this new fuel waste form. Previous discussions with a number of stakeholders on this topic resulted in the following conclusions:

- The principles used in the approved funding formula are reasonable and should also apply to new owners and new reactors.
- Fixed and variable costs and investments made to date need to be considered in any new funding formula for new owners and new reactors.
- The characteristics of new nuclear fuel types must be considered.
- The existing funding formula should be revised when specific circumstances are clear for new reactors and new owners.
- The changes in funding formula for new owners of new reactors may be different than the changes for an existing owner with new reactors.

The NWMO has proposed to apply the above principles to specific circumstances related to new owners and new reactors when they arise.

Trust fund deposits for 2020

Beginning in 2002, used nuclear fuel owners have been making annual contributions to the *NFWA* trust funds.

The 2020 *NFWA* trust fund deposit requirements stated herein have been developed based on the APM cost estimate completed in 2016. This estimate reflects an updated engineered-barrier system design and planning assumptions for the duration needed to select a single site.

Under the approved funding formula, the funding for the post-construction licence costs is divided into two parts:

1. Funding for historical used fuel bundles (committed liability); and
2. Funding for used fuel to be produced each year (future liability).

Committed liability represents all costs that will be incurred regardless of whether any further used fuel bundles are generated in the future. This liability includes all fixed costs for the facility and variable costs attributed to the historical used fuel bundles. Contributions for the committed liability are to be amortized to the year 2043 in equal present value payments. The rationale for this amortization period is that 2043 is consistent with the earliest planned date when the deep geological repository would be available. This funding method has the advantage of distributing the funding obligations evenly to each year, while taking into account the time value of money.

Future liability represents the incremental cost of transferring to the repository, facility expansion, and additional operating and monitoring costs of used fuel bundles to be produced each year. Each future used fuel bundle would incur the same cost in present value terms taking into account the time value of money.

The 2020 trust fund deposit requirements are shown in the table below.

Total trust fund deposits: Year 2020

Owner	Trust fund balance ($ million)	Deposits to trust funds (committed and future bundles) ($ million)*
	December 2019	2020
OPG	4,399	63.9
HQ	158	0
NBP	183	4.5
AECL	55	0.7
Total	4,795	69.1

* 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.

POWERED BY PEOPLE

Krista Sohaj, Director of Business Planning and Performance Reporting, develops strategy and the business plan for the NWMO.

Krista has an adventurous spirit. She loves to go hiking, white water rafting and zip lining with her partner, family and friends; she has even tried doing yoga with goats.

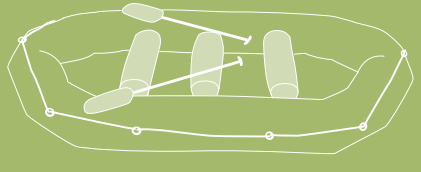
This may seem unexpected from someone who works in a structured finance role. At the NWMO, Krista manages business planning and performance reporting, and supports strategic planning with the executive leadership team. However, as she explains it, “Strategy is comparable to charting a course to where we are going and how we are going to get there. Then there is great satisfaction in being able to track and achieve results. It is like climbing a mountain.”

Krista joined the NWMO in April 2019, being drawn to work on a project that has an important societal impact on Canadians. She finds connecting with colleagues across the organization particularly rewarding. “I enjoy working with the talented, professional and fun team,” she says.

For her role, she draws on her previous experience in the areas of risk management, procurement, financial reporting, auditing, and cost management. Notably, Krista previously managed more than $1 billion in annual costs for a publicly traded food processing company.

Growing up in Hamilton, Ont., Krista decided to attend university in her hometown. She completed an Honours Bachelor of Commerce, specializing in Finance/Accounting with a minor in Economics from Degroote School of Business at McMaster University. She then obtained a chartered accountant designation (CPA, CA) while completing her practical experience hours at PricewaterhouseCoopers.

Now Krista is based in Toronto, but ever the adventurer, she travels often. She has been everywhere from Pompeii and Athens to the Grand Canyon and Swiss Alps. Historical sites and natural wonders await.



Attachment 1

Financial guarantee status – Used fuel owners

Hydro-Québec (HQ)

The HQ *NFWA* Trust Fund contained $158 million as of Dec. 31, 2019, and the fair value is estimated at $173 million.

In addition to the trust fund, HQ has provided the CNSC with a Decommissioning Financial Guarantee of $685 million that includes a guarantee associated with used fuel arising from the operation of Gentilly-2 and the cost of station decommissioning, including the long-term management of low- and intermediate-level radioactive waste. The guarantee is in the form of an expressed commitment of the Province of Quebec to HQ that provides a guarantee of payment.

The *NFWA* Trust Fund and the Financial Guarantee provided by the Province of Quebec covered the future financial obligations as follows:

- $507 million for decommissioning and long-term management of low- and intermediate-level radioactive waste; and
- $269 million for used fuel.

Ontario Power Generation (OPG)

In accordance with the *NSCA*, the CNSC requires OPG to have sufficient funds available to discharge its existing nuclear waste management and nuclear decommissioning obligations. The CNSC process requires the CNSC Financial Guarantee requirement to be updated once every five years, and OPG to provide an annual report to the CNSC on the assumptions, asset values, and resulting financial guarantee requirements. The CNSC Financial Guarantee requirement calculation takes into account nuclear waste expected to be generated to the end of each year.

The CNSC Financial Guarantee requirement continued to be satisfied, in part, by the forecast fair market value of the federally mandated Ontario *NFWA* Trust, and remainder by the two segregated funds governed by the *Ontario Nuclear Funds Agreement* (*ONFA*) between OPG and the Province of Ontario (collectively, the "Nuclear Funds") without the requirement of a Provincial Guarantee for the 2020-22 period. As provided for by the terms of the *ONFA*, the province is committed to provide a Provincial Guarantee to the CNSC as required, on behalf of OPG, should there be a shortfall between the CNSC Financial Guarantee requirement and the fair market value of the Nuclear Funds during the 2020-22 period, as it has done in the past.

The CNSC Financial Guarantee requirement for 2020 is $17,885 million (Jan. 1, 2020, present value). This will be satisfied by the 2019 year-end fair market value of the Nuclear Funds of $20,784 million without the requirement of a Provincial Guarantee.

NB Power (NBP)

NBP has provided the CNSC with a Decommissioning Financial Guarantee that covers the costs associated with the long-term management of used fuel projected to be produced from the Point Lepreau Generating Station and the cost of station decommissioning, including the long-term management of low- and intermediate-level radioactive waste.

- The Financial Guarantee requirement is based on the present value of future costs to manage used fuel produced to the end of 2019 and present value of future estimated costs for station decommissioning.
- The Financial Guarantee requirement is satisfied by three separate funds: a Used Fuel Fund, a Station Decommissioning Fund, and the *NFWA* Trust Fund.
- The total market value of the funds at Dec. 31, 2019, was approximately $800 million and was comprised of the following:
  - Used Fuel Fund – $221 million;
  - Station Decommissioning Fund – $396 million; and
  - *NFWA* Trust Fund – $183 million.

Atomic Energy of Canada Limited (AECL)

AECL is not a member of the NWMO. Its Financial Guarantee is in the form of an expressed commitment by the Government of Canada to the CNSC, combined with supporting estimates of the financial liability and the basis for same. The AECL *NFWA* Trust Fund contained approximately $55 million as of Dec. 31, 2019.

15 Implementing Adaptive Phased Management 2020 to 2024

Implementing Adaptive Phased Management 2020 to 2024

MARCH 2020

nwmo

NUCLEAR WASTE MANAGEMENT ORGANIZATION
SOCIÉTÉ DE GESTION DES DÉCHETS NUCLÉAIRES

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 10, 2020. We look forward to hearing from you.

Lisa Frizzell
Vice-President, Stakeholder Relations

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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

SAFETY

We place all aspects of public and employee safety – including environmental, conventional, nuclear, and radiological safety – first and foremost in everything we do.

INTEGRITY

We act with openness, honesty and respect.

EXCELLENCE

We use the best knowledge, understanding, and innovative thinking, and seek continuous improvement in all that we do in our pursuit of excellence.

COLLABORATION

We engage in a manner that is inclusive, is responsive, and supports trust, constructive dialogue, and meaningful partnership.

ACCOUNTABILITY

We take responsibility for our actions, including wise, prudent and efficient management of resources.

TRANSPARENCY

We communicate openly and responsibly, providing information about our approach, processes and decision-making.

Welcome

Welcome to *Implementing Adaptive Phased Management 2020 to 2024*. This is the five-year strategic plan for the NWMO.

Committed to transparency

The NWMO is committed to transparency, and our annual implementation plans are 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, advances in science and technology, insight from Indigenous Knowledge, and evolving societal values and public policy.

This planning period is the first to look beyond our expected site selection date of 2023. Identifying a single, preferred site for used nuclear fuel represents a transformative milestone for the NWMO. This decision will bring to an end the site selection process we initiated in 2010. It will also mark the beginning of a new series of activities, such as implementing partnership agreements with host communities; furthering the safety case for the identified site; constructing 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 work outlined in this plan covers this important transition. We have updated our work plans to reflect our continuing efforts to identify a preferred site, as well as the preparation we are beginning to undertake to ensure readiness for all activities that follow. While we navigate this change, we will maintain our organizational commitment to fairness, transparency and a 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 2019. We invited comments until July 12, 2019.

If you would like to comment on the latest plan as outlined in these pages, please get in touch with us by mail, email, or fax, or through our website or social media platforms, any time through to June 10, 2020. To help you share your thoughts with us, we have included a questionnaire on the last page.

This is Canada's plan. This is your plan. We welcome your suggestions and ideas.

Introduction to the NWMO and Canada's plan

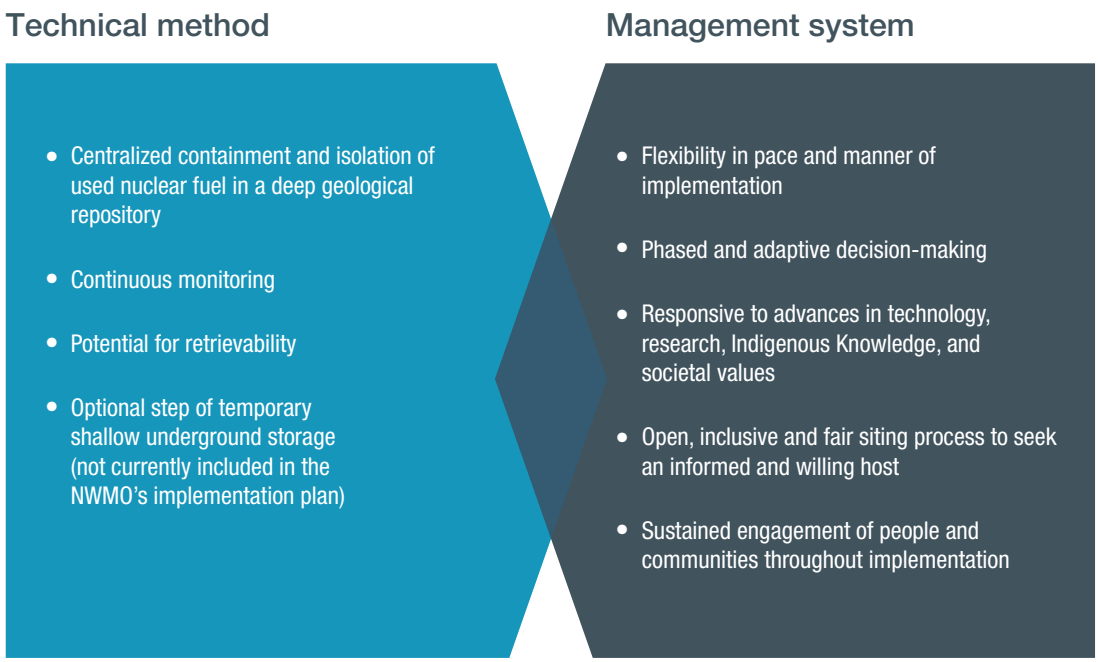
Canada has been generating electricity from nuclear power – to light our homes, businesses and towns – for more than half a century. A byproduct of this process is used nuclear fuel, which remains radioactive for hundreds of thousands of years, and is a potential health and safety hazard unless properly managed.

The NWMO has an important role that completes the 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 on a not-for-profit basis.

The plan we are implementing emerged through a three-year dialogue with Canadians (2002 to 2005), including Indigenous peoples. Details of those conversations were outlined in *Choosing a Way Forward – The Future Management of Canada's Used Nuclear Fuel (Final Study)*, issued in November 2005.

Canadians told us they want to move forward now on managing used nuclear fuel – and not leave it as a burden for future generations. The NWMO was created to do just that. Our plan is Canada's plan. It reflects the values and priorities citizens identified as important.



Known as Adaptive Phased Management (APM), Canada's plan involves both a technical method (what we plan to build) and a 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. The project also involves developing a Centre of Expertise on or near that site, where the NWMO will continue technical, environmental and community studies.

Planning timelines

The following graphic provides a snapshot of milestones achieved to date, as well as estimated planning timelines for the future.

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 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 2013	Twenty-two communities initially express interest. In collaboration with interested communities, the NWMO conducts initial screenings.
	2012 to 2015	Preliminary desktop studies are initiated to further assess suitability. 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. The impact assessment project description is submitted. The Licence to Prepare Site application is submitted.
Towards construction	2024	Detailed site characterization begins. Impact assessment studies are submitted. The federal regulatory process is triggered. The application to begin construction of the Centre of Expertise is submitted.
	2026	The impact assessment is approved (estimate). The Licence to Prepare Site is granted (estimate).
	2028	The construction licence application is submitted.
	2032	The construction licence is granted (estimate).
	2033	Design and construction begin.
Beginning operations	2040 to 2045	Operations of the deep geological repository begin.

Selecting a site

The NWMO site selection process is community-driven, and underpinned by safety, fairness, collaboration, and shared decision-making. Fundamental to the process is the understanding that the APM Project will only proceed with the involvement of the interested community, First Nation and Métis communities in the area, and surrounding communities, working together to implement it.

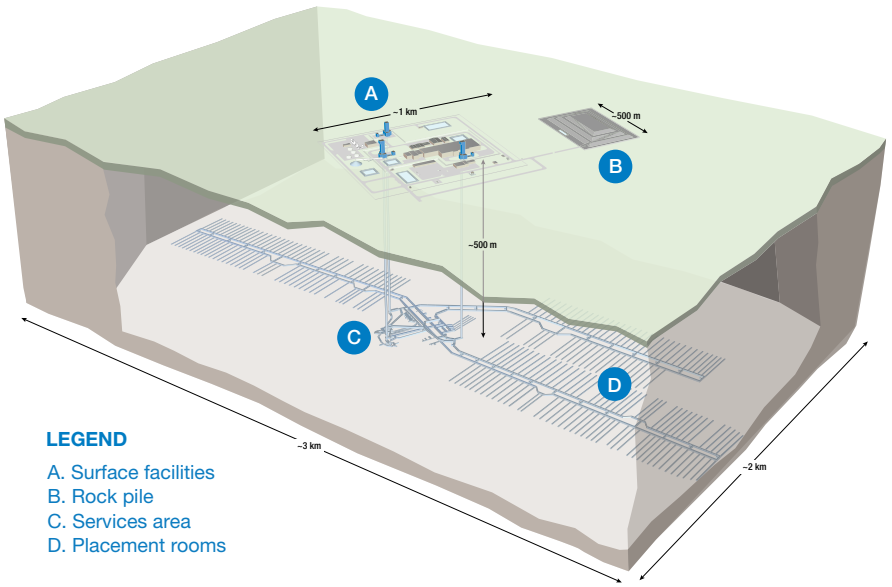
When we initiated the site selection process in 2010, 22 municipalities and Indigenous communities expressed interest in learning more and exploring their potential to host the project. As of January 2020, we had gradually narrowed our focus to two areas (Ignace and South Bruce) through technical site evaluations and social engagement to assess safety and the potential to build supportive and resilient partnerships, key criteria to evaluate the suitability of each area. At the same time, we have expanded learning and engagement activities beyond each of the communities that expressed interest, also involving their Indigenous and municipal neighbours. We remain on track to identify a single, preferred site by 2023.

Once the site is selected, we will move forward together with host communities to implement partnership agreements, develop the Centre of Expertise, finalize the safety case, and prepare for the regulatory processes we must complete before construction and operations can begin.

More information about the site selection process is available at www.nwmo.ca/sitingprocess.

Key components of the repository

The deep geological repository is a multiple-barrier system designed to safely contain and isolate used nuclear fuel over the long term. It will be constructed at a depth of approximately 500 metres, depending upon the geology of the site, and consists of a series of tunnels leading to a network of placement rooms where the used nuclear fuel will be contained using a multiple-barrier system. This approach aligns with international best practices.



This diagram reflects the latest conceptual layout for the surface facilities, and the underground services area and placement rooms. This concept will continue to become more detailed as the project progresses.

Surface facilities will provide processes and equipment for receiving, inspecting, repackaging, and moving used fuel to the main shaft to transfer underground, as well as for emplacement in the repository.

Before being transported underground to the repository, the used fuel will be placed into specialized, long-lived containers and encased in a buffer box made of bentonite clay. Once underground, these buffer boxes are to be arranged (e.g., two high) in the horizontal placement room, and any spaces backfilled with bentonite pellets. The current conceptual design of the underground layout assumes a footprint of about two kilometres by three kilometres, but the actual required footprint will be influenced by factors such as the geological setting and the ultimate number of fuel bundles to be managed.

By the time construction begins, a robust safety case will have been developed to demonstrate the project can be safely implemented, including transportation, and that it meets or exceeds the requirements of regulatory authorities.

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.

Centre of Expertise

A Centre of Expertise will be established on the surface, in or near the area selected to host the deep geological repository. The design and use of the centre will be developed collaboratively with those living in the area, including First Nation and Métis communities. The centre's key purpose initially will be to support a multi-year program of technical testing and verification, and to support ongoing planning and discussion with community members. It would later be expanded to support construction and operation of the deep geological repository. If appropriate and based on feedback and input, the centre may also serve as a hub for sharing Indigenous culture, history, traditions, and knowledge.

The Centre of Expertise will be home to an active technical and social research and technology demonstration program. It will involve scientists and other specialists in a wide variety of disciplines, including geoscience, engineering, and environmental, socio-economic, and cultural impact assessment. The centre will become a hub for knowledge sharing across Canada and internationally, both about Canada's plan, and possibly, about the local area. It could also, for example, highlight the area's unique history or characteristics or serve to sustain or enhance the natural environment.

The design and use of the centre will be developed collaboratively with those living in the area as the NWMO works to draft partnership agreements with potential host communities in the coming years. The NWMO plans to select a single, preferred site for the repository by 2023 and begin construction of the Centre of Expertise at or near this location in 2024.

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

The NWMO has been committed to working with First Nation and Métis communities since our founding. This commitment is reflected in Canada's plan in many ways, from oversight by our Indigenous Relations team, advice from the NWMO's Council of Elders and Youth, cultural awareness training for all NWMO staff and contractors, to guidance drawn from the NWMO's groundbreaking Indigenous Knowledge Policy and new Reconciliation Policy, and regular engagement with First Nation and Métis communities.

Over the next five years, the NWMO will work to implement our new Reconciliation Policy and continue to incorporate Indigenous Knowledge into our work. This policy affirms our commitment to acting on the Truth and Reconciliation Commission's call to action #92.

Truth and Reconciliation Commission's call to action #92

We call upon the corporate sector in Canada to adopt the United Nations Declaration on the Rights of Indigenous Peoples as a reconciliation framework and to apply its principles, norms, and standards to corporate policy and core operational activities involving Indigenous peoples and their lands and resources. This would include, but not be limited to, the following:

i. Commit to meaningful consultation, building respectful relationships, and obtaining the free, prior, and informed consent of Indigenous peoples before proceeding with economic development projects.

ii. Ensure that Aboriginal peoples have equitable access to jobs, training, and education opportunities in the corporate sector, and that Aboriginal communities gain long-term sustainable benefits from economic development projects.

iii. Provide education for management and staff on the history of Aboriginal peoples, including the history and legacy of residential schools, the United Nations Declaration on the Rights of Indigenous Peoples, Treaties and Aboriginal rights, Indigenous law, and Aboriginal–Crown relations. This will require skills-based training in intercultural competency, conflict resolution, human rights, and anti-racism.

Reconciliation

In late 2019, the NWMO released our Reconciliation Policy, a concrete series of commitments that will see the words in our Reconciliation Statement put into action. Based on advice from the Council of Elders and Youth, and First Nation and Métis communities, the policy commits to an implementation strategy to measure annually the organization's progress on Reconciliation. It mandates that the NWMO, including our Board of Directors, move forward in the spirit of Reconciliation and hold staff accountable for their actions under the policy.

The policy ensures the NWMO will continue to recognize the truth of the historic wrongs that brought us to Reconciliation and seek to move forward together. The NWMO recognizes that protection of Mother Earth for future generations is, in itself, a foundational commitment to Reconciliation and is a responsibility of all people.

The formal policy also requires that all NWMO staff receive both cultural awareness and Reconciliation training, in addition to education about Indigenous history, the United Nations Declaration on the Rights of Indigenous Peoples, Treaties, and Aboriginal rights, and other topics. Over the next five years, the NWMO will continue to work with communities to offer more Reconciliation events in their area. We will continue our work to meaningfully engage with First Nation and Métis communities and organizations as we work to implement Canada's plan.

NWMO
RECONCILIATION STRATEGY

2020 and beyond

Assess corporate Reconciliation baseline and develop additional activities

Enhance human resources practices and procedures to address Reconciliation

Develop an Indigenous youth strategy to include a scholarship program and recruitment strategy

Enhance procurement program to include an Indigenous strategy

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

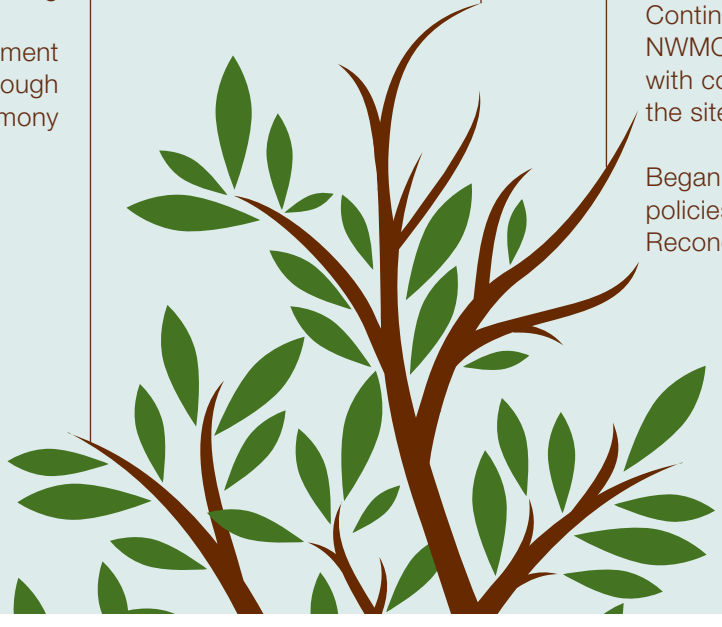
Continued to communicate the NWMO's Reconciliation program with communities involved in the site selection process

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

2018

85 per cent of NWMO staff received cultural awareness training

Reconciliation Statement finalized through Indigenous ceremony



Indigenous Knowledge

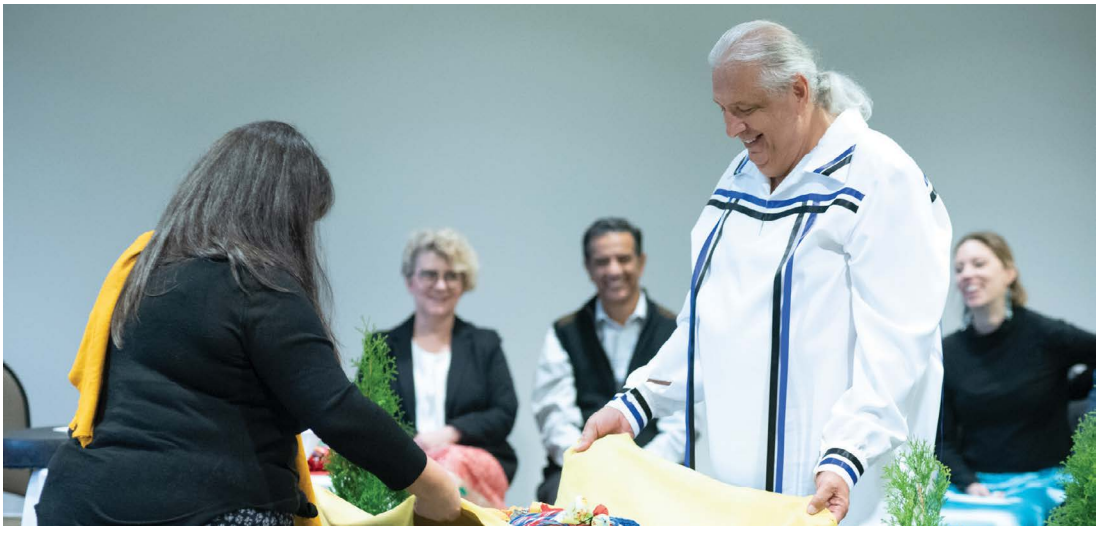
Respectful inclusion of Indigenous Knowledge is an essential element of the NWMO's work.

Through these conduits, we learn to see with fresh eyes, respecting Indigenous peoples' spiritual connection with and responsibility to protect the natural environment. This includes air, land, fire, water, plants, medicines, animals, and humans.

Over the next five years, we will continue to interweave Indigenous Knowledge, and reflect on what we learn from ceremony and traditional teachings. For example, water is a subject of vital importance to people. Several communities in our site selection process, particularly Indigenous communities, asked us to provide more information about how our project will protect water. In response, we have initiated a series of presentations to do just that. The water presentations have evolved into water's relationship with the deep underground, clay and copper, which are vital components of the multiple-barrier system. The water presentations incorporate Indigenous teachings about water, clay, and copper, and use oral tradition as part of how the presentations are delivered. Over the next five years, we will continue to work with Indigenous communities and knowledge keepers to ensure Canada's plan respects and protects water and the environment.

We will continue to reach out to Indigenous peoples to gather their views and questions on water, rock, clay, and other subjects. This ongoing feedback is crucial as Indigenous and other communities consider the project in the context of their long-term interests and well-being.

We will also continue to work with our research partners to incorporate Indigenous perspectives into all our work. Over the next five years, that will include continuing to offer cultural awareness training or access to knowledge keepers to both internal and external specialists.



The NWMO's Jessica Perritt, Section Manager for Indigenous Knowledge and Reconciliation, and Bob Watts, Vice-President of Indigenous Relations, gather the sacred bundle at the ceremony formalizing the NWMO's Reconciliation Policy.

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.

The NWMO is responsible for determining the cost of the project and designing a system that collects the funds needed. Both Canada's plan and the NWMO are funded by the waste owners. Federal law requires waste owners to pay into trust funds each year.

These funds cover the future cost of constructing and maintaining a deep geological repository for used nuclear fuel well into the future. The federal *NFWA* requires Ontario Power Generation, New Brunswick Power, Hydro-Québec, and Atomic Energy of Canada Limited 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 its trust fund based on the amount of used nuclear fuel it has and/or continues to create. This process is designed to ensure Canada's plan is funded over the long term.

These four companies are also responsible for funding the day-to-day operations of the NWMO. 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, and for designing a system that collects the funds needed. We also monitor these funds to ensure that the entire cost can be covered under a variety of social and economic circumstances and within the required time frame.

Many factors will affect that long-term cost, including the volume of used nuclear fuel to be managed, location of the deep geological repository, surrounding infrastructure, rock type and characteristics, design of the repository, and length of time allocated to monitoring the site following fuel placement. The existing inventory of used nuclear fuel in Canada is approximately 2.9 million bundles, and more bundles are produced each year as nuclear reactors generate electricity.

Based on the expected volume of 5.2 million fuel bundles, the total lifecycle cost of Canada's plan – from the beginning of site selection in 2010 to the completion of the project decades from now – is approximately $23 billion (in 2015 dollars) over the course of the about 150-year timeline of the project. This figure covers many decades of lifecycle activity – stretching well into the next century. That does not mean, however, that we need $23 billion today. Instead, we must calculate how much money needs to be in trust today so that it can continue to generate enough income over time to cover the costs of Canada's plan. We know these funds will grow over time as waste owners pay into trusts and investment income provides returns. So how much do we need in trust today to cover the project's costs tomorrow and decades from now? Based on best estimates in 2020 present value, the funding required to manage 5.2 million bundles from 2020 onwards is $9.6 billion – a sum that will grow and compound as the project advances so it is always available to cover the costs of Canada's plan.

Included in the $9.6 billion funding requirement is $2.8 billion for work to select a site for the repository, complete a detailed design, develop the Centre of Expertise, acquire the site, evaluate environmental impacts, and obtain a site preparation and construction licence under the *Nuclear Safety and Control Act* (*NSCA*). This planning period will see increased spending as our activities become more intensive. These pre-construction costs are paid for by the waste owners based on the annual budget as approved by the Board of Directors.

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 policy, 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.

We regularly report on new developments. We maintain a watching brief on used nuclear fuel reprocessing and alternative used nuclear fuel management technologies, and update it annually (www.nwmo.ca/adaption). We also monitor and report on potential inventories of used nuclear fuel quantities and types for implications to repository design (www.nwmo.ca/howmuchfuel).

In Canada, there is an active research sector exploring new technologies such as small modular reactors (SMRs), fuel reprocessing and other types of advanced reactors. The NWMO understands that we will also be responsible for the long-term management of nuclear fuel waste from advanced reactors and 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.

A core principle of APM is the commitment to adapt plans in response to input obtained through engagement activities. By way of example, we are continuing to respond to interest from stakeholders on the subjects of how water behaves in the underground environment, and how our plans can be adapted to include fuel waste that may be generated in the future as new technologies emerge.

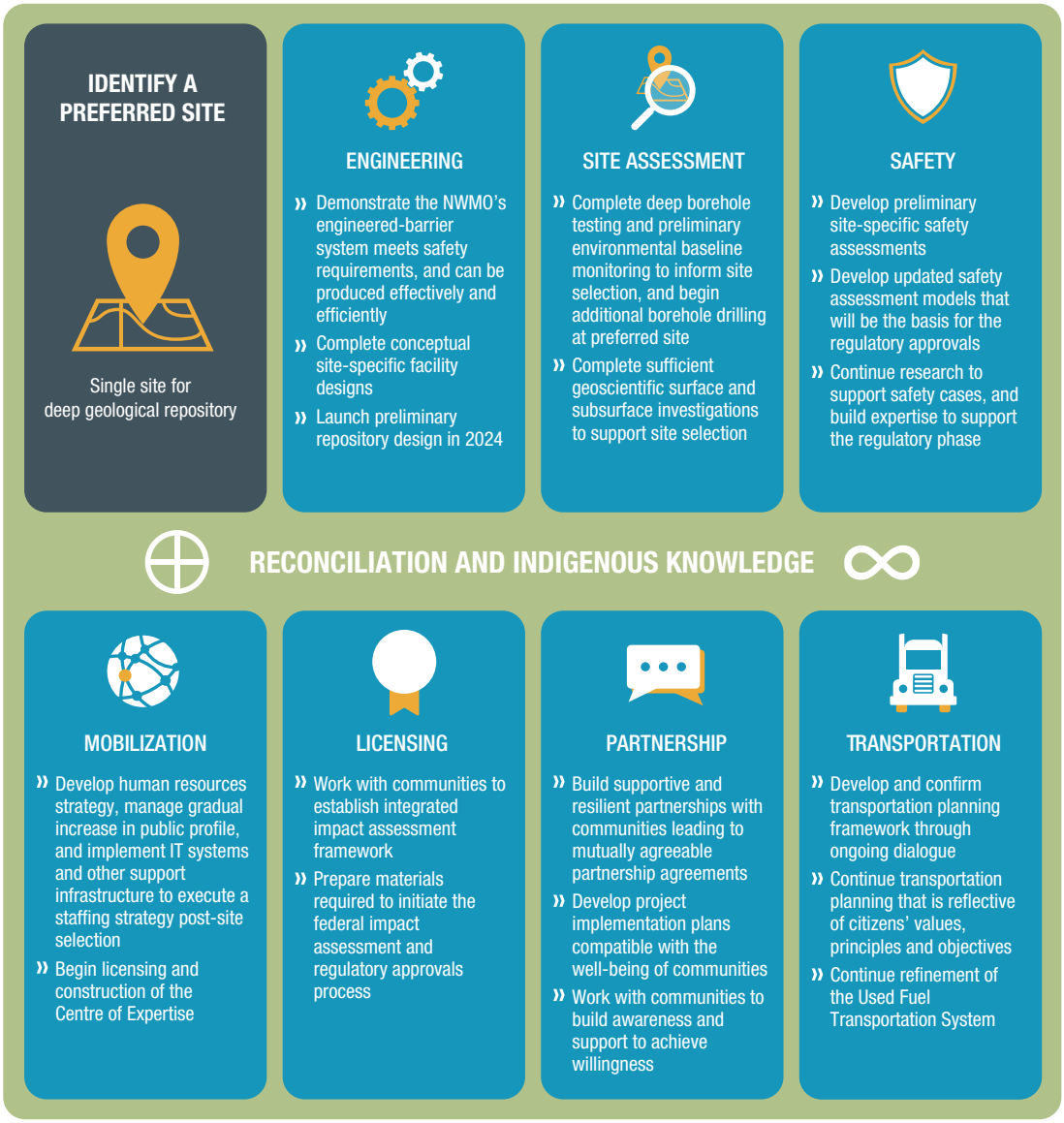
New federal legislation passed in 2019 has also required us to adapt our plans. The *Impact Assessment Act* has altered the licensing and regulatory landscape for Canada's plan. The NWMO has responded by adjusting our timelines for submitting reports and licensing applications as we continue to monitor the implementation of the bill. The NWMO has begun to use this new framework as the basis of our work in the regulatory approval phase. By 2024, we expect to begin submitting applications and studies as required.

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; and
- Launch preliminary repository design in 2024.

The deep geological repository is an effective way to safely contain and isolate used nuclear fuel because of the engineered barriers placed around it and the natural barrier provided by the rock formation in which the repository will be located.

Over the next five years, our technical program will further develop engineering designs and demonstrate their effectiveness. We will also continue to prepare site-specific preliminary designs as we progress towards a single preferred location. Physical prototypes of the long-lived repository containers will be manufactured and tested. This work will incorporate robust design practices and proven manufacturing technologies, and demonstrate the NWMO's ability to meet the rigorous requirements of the repository environment. Specialists will continue to investigate manufacturing and prototype testing technologies.

We are actively encouraging organizations developing new reactor concepts such as SMRs to work with us to identify the types of fuel waste that may result. The planning to accommodate this material will take time, and starting early will ensure we are prepared to manage all Canada's used nuclear fuel when the repository begins operating.

Following site selection, the NWMO will launch the preliminary design for a deep geological repository.

In the period 2020 to 2024, 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;
- Update the conceptual designs and cost estimate for APM as required, and initiate design and development of used fuel handling systems; 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.

Engineers from the NWMO tour the Posiva project in Finland. Posiva is the Finnish counterpart to the NWMO, and both organizations learn from each other. The Posiva project is in the construction phase of its repository for used nuclear fuel at its ONKALO site.

PRIORITY: SITE ASSESSMENT

The NWMO will:

- Complete initial borehole testing and preliminary environmental baseline monitoring to inform site selection, and begin additional borehole drilling and detailed site characterization at preferred site; and
- Complete sufficient geoscientific surface and subsurface investigations to support site selection.

The period 2020 to 2024 will see the NWMO complete the process of identifying a single preferred site and move into the licensing and regulatory process.

In the technical realm, work will focus on assessing the suitability of potential sites through geoscientific and environmental evaluation studies. The NWMO has worked collaboratively with municipal and Indigenous communities in identifying potential repository sites where additional studies such as borehole drilling and environmental baseline studies could begin. The results from these studies will allow us to progress to more detailed site characterization work.

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, Indigenous guides and monitors employed on-site to observe our work, and cultural awareness training for contractors performing work at potential sites.

Between 2020 and 2023, as site investigations continue, we will continue to 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 effects, some that are positive and some that may be areas of concern, are recognized and considered as we move through site selection.

In the period 2020 to 2024, the NWMO will also:

- Continue engagement with communities in the siting process, exploring the potential for a sustainable partnership and how the project could support community well-being;
- Complete borehole drilling and field studies to inform the assessment of geoscientific, engineering, environmental, and safety factors, as well as factors identified by Indigenous Knowledge holders and communities in areas with strong potential to meet the requirements of the project;
- Support the process to select a site suitable for locating the deep geological repository in a safe location through geoscientific studies in the vicinity of interested communities; and
- To support regulatory approvals, confirm through detailed site characterization studies that the selected site is technically suitable for hosting the deep geological repository.

Ignace is one area where we are continuing investigation work to collect geoscientific data, information and knowledge as we advance Canada's plan for the safe, long-term management of used nuclear fuel.

PRIORITY: SAFETY

The NWMO will:

- Develop preliminary site-specific safety assessments;
- Develop updated safety assessment models that will be the basis for the regulatory approvals;
- Continue research to support safety cases, and build expertise to support the regulatory phase;
- Maintain active technical research programs through partnerships with industry, academia and international organizations; and
- Maintain collaboration agreements, and participate in joint international efforts as appropriate.

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 with characteristics (geological, hydrogeological, chemical, and mechanical) that support the safe, long-term containment of used nuclear fuel. Repository performance must meet or exceed the regulatory expectations of the Canadian Nuclear Safety Commission (CNSC).

The NWMO has prepared generic safety case studies for crystalline and sedimentary settings by applying our preclosure and postclosure safety assessment methodology. These assessments examine features of the repository system, test key safety parameters, and confirm that people and the environment will be safe in the long term under various scenarios.

In the period 2020 to 2024, the NWMO will develop preliminary site-specific safety assessments for the remaining sites. These assessments will help inform our site selection process. Following site selection, we will also develop updated safety assessment models that will be the basis for regulatory approvals. The NWMO will also continuously improve technical knowledge in collaboration with international partners. We will continue to participate in the Nuclear Energy Agency (NEA) of the Organisation for Economic Co-operation and Development to exchange information in such areas as safety case development.

We are continuing 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.

The NWMO's Dr. Erik Kremer discusses findings from a case study that assesses the long-term safety of a deep geological repository in sedimentary rock formations, similar to those found in southern Bruce County.

Safety continues to be an important subject of discussion for communities, and they continue to drive the focus and shape of that discussion. They have identified questions they want to see addressed and safety-related topics they want to learn more about, such as safety assessments, the engineered-barrier system, and water management during construction and repository operations. They have also identified the NWMO specialists and independent experts they want to engage in discussion, and the independent conferences they will attend, to advance their understanding of these topics.

In response, the NWMO has organized presentations, such as *The Journey of Water*, which take a more community and culturally responsive approach to conveying information, telling a story, and using relevant and meaningful references to communities. These types of presentations aim to bring together technical knowledge and understanding with traditional knowledge, local knowledge and the lived experience of communities to explore important safety topics in new ways. The forum for these presentations, set by communities, continue to evolve to include learning and sharing gatherings and learning symposia hosted by communities.

Increasingly, the NWMO is incorporating Indigenous Knowledge in scientific workshops and seminars we host. For example, scientists are exploring how guidance received through ceremony can be combined with digital data collection and laboratory analysis to understand the land from multiple dimensions.

Within the organization, the NWMO is continuing to build a strong safety culture among our employees as we prepare for the licensing phase. We are focused on continuously improving and introducing new safety measures. We are working to create and sustain an environment where employees proactively take responsibility for their safety and that of their fellow employees in all occupational activities.

In the period 2020 to 2024, the NWMO will also:

- Conduct preliminary site-based safety assessments;
- Conduct research to enhance our understanding of key processes relevant to repository safety, and expertise to support the regulatory phase;
- Continue to participate in national and international projects, including underground experiments, with other waste management organizations and international agencies such as the NEA and International Atomic Energy Agency;
- Continue to host an annual Geoscience Seminar to bring together researchers from academia and industry; and
- Support and build discussion to increase the understanding of safety among community members.

PRIORITY: MOBILIZATION

The NWMO will:

- Develop a human resources strategy to prepare for the next phases of work following site selection;
- Increase awareness of the project among key stakeholder groups;
- Implement information technology systems and other support infrastructure; and
- Advance the licensing and construction process for the Centre of Expertise.

As the completion of the site selection process nears, the NWMO is beginning to look towards how we implement Canada's plan following site selection. This planning period is the first to go beyond our 2023 milestone of selecting and announcing the final site for our project.

Once a preferred site is selected for Canada's plan, there will be an escalation of activity on many fronts in the local and regional area. As a large national infrastructure project, it will result in significant economic benefits to the area. This includes jobs for the initiating community and region, as well as First Nation and Métis communities in the area and beyond. It will also mark the beginning of a multi-phase organizational transformation for the NWMO. Focusing our efforts in one area will require everything from adding more resources to the region, to ensuring we have the technology in place to support Canada's plan, through to sourcing land for NWMO facilities and the Centre of Expertise.

To prepare for this increased activity, internally, we will ensure we have the human, organizational and information capital in place to proceed in conducting detailed site characterization, making regulatory submissions, and constructing and operating the deep geological repository. We will also be prepared to manage the opportunities and challenges that arise from an increase in public scrutiny.

The number of jobs sourced from the siting area will depend in part on the location of the repository, and the capacity of communities in the immediate vicinity and economic region. The NWMO will seek to maximize job opportunities in the local area and to build capacity in communities to secure jobs on the project.

In the period 2020 to 2024, 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;
- Deepen our safety culture and build a learning organization, encouraging and supporting continuous employee learning;
- Continue to leverage the technology provided by our Enterprise Resource Planning System to improve workflow processes, and integrate electronic systems and effectively manage employee information;
- Continue to strengthen our corporate culture through appropriate management behaviours, standards and corporate tools, including appropriate technology platforms. This includes our safety culture, excellence in project management and commitment to interweaving Indigenous practices;
- Continue to build a stronger local staffing presence in potential siting areas and provide local contracting opportunities for the project; and
- 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 position them to secure jobs related to Canada's plan.

PRIORITY: LICENSING

The NWMO will:

- Work with communities to establish an integrated impact assessment framework;
- Prepare materials required to initiate the federal impact assessment and regulatory approvals process; and
- Begin the impact assessment process and the drafting of necessary reports for licensing.

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.

As a result, our site investigations and associated technical studies will adhere to relevant municipal, provincial and federal requirements for the project. 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 our studies consistent with the *Impact Assessment Act* passed in 2019. We have adapted our plans to this change in legislation and expect to formally begin the regulatory processes in 2024.

We will continue to interact with the CNSC, consistent with the terms of a special project arrangement, prior to submission of a licence application. These activities include providing briefings to the CNSC on the progress of Canada's plan. (The CNSC explains its role in the *Nuclear regulatory oversight* box that follows.)

In the period 2020 to 2024, the NWMO will also:

- Develop impact assessment methodologies in collaboration with siting communities, both Indigenous and non-Indigenous, in preparation to formally launch the regulatory approvals process;
- Establish environmental monitoring programs in potential siting areas in close collaboration with community members, as well as Indigenous Knowledge keepers;
- Work with the CNSC and other regulatory authorities to obtain certainty regarding the requirements and implementation of the new *Impact Assessment Act* so that we can account for them in our plans;
- Work with potential host communities to define their role in the regulatory process and then facilitate their participation; and
- Working with communities and others, identify opportunities to enhance understanding of the current local and regional conditions, including collaboration with Indigenous communities to interweave local traditional knowledge into this understanding, as a foundation for the environment, social, health, and economic assessments.

NUCLEAR REGULATORY OVERSIGHT

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

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.

PRIORITY: PARTNERSHIP

The NWMO will:

- Build supportive and resilient partnerships with communities leading to mutually agreeable partnership agreements, and begin implementing those agreements;
- Develop project implementation plans compatible with the well-being of communities, including a vision for a Centre of Expertise at or near the repository location; and
- Work with communities to build awareness and support to achieve willingness.

The NWMO will, over the next five years, work with siting communities to build the supportive and resilient partnerships required to implement the project. During the period 2020 to 2023, the NWMO will continue to work with municipal and Indigenous communities in each siting area to explore the potential for partnership.

Following a partnership road map that outlines a sequence of topics and milestones to explore the potential for partnership, communities will build on the values and principles they identified to guide discussions. Work will include developing area-specific visions for the project and engagement of communities in concrete discussions to explore how the project can be implemented in a manner that is consistent with community well-being objectives and aspirations.

As exploration of partnership deepens, municipalities in the siting process are increasingly expressing interest in enhancing relationships with their Indigenous neighbours. The NWMO supports learning through cultural awareness training and provides support where appropriate in establishing formal lines of communication.

Following site selection in 2023, we will shift focus from building partnerships to implementing partnership agreements.

Funding and resources will be provided to support communities as they build their capacity and understanding of the project, engage in discussions with community members and neighbours, reflect on their interest in the project, and participate in discussions with the NWMO to reach mutually agreeable partnership agreements.

Ultimately, only one site can be selected as the location where Canada's plan will be implemented, 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, even though they were screened out as potential siting areas.

We will continue to work with the Council of Elders and Youth and the Municipal Forum. We will also work with and learn from Indigenous Knowledge holders, and provide opportunities for them to share their knowledge with us. Youth engagement will remain a priority after a site is selected, given the long-term nature of the project and need for intergenerational transfer of knowledge to support project implementation.

The NWMO has a number of policies and plans in place that guide our work, including an Ethical and Social Framework. Importantly, a Reconciliation Policy was developed and released in 2019. Across the NWMO, we recognize that there are Indigenous peoples in all areas of Canada where our work will take place. We acknowledge, respect and honour that Aboriginal peoples – Indian, Métis and Inuit peoples of Canada – have unique status and rights as recognized and affirmed in section 35 of the *Constitution Act* (1982). Through the Reconciliation Policy, we commit to contribute to Reconciliation through the implementation of our work.

In the period 2020 to 2024, the NWMO will also:

- Ensure communities have the resources they need to fully participate in siting activities, reflect on their interests, and incrementally improve their well-being while exploring the project;
- Complete social impact and baseline studies as a component of the impact assessment;
- 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;
- Continue to develop and sustain relationships with:
  - Interested communities that chose to engage in the site selection process, First Nation and Métis communities in the area, and surrounding communities;
  - National, provincial and regional Indigenous organizations to keep them apprised of progress in implementing APM and the site selection process;
  - A range of municipal associations across provinces, in order to better understand local governments' points of view, and work with them to implement APM;
  - Federal, provincial and local governments; and
  - Non-governmental organizations and civil society at large.
- Continue to work with potentially affected Indigenous peoples, including Indigenous Knowledge holders, in recognizing the diversity of cultures and languages, practices, and approaches within Indigenous communities; in identifying sacred areas; in understanding traditional laws, practices, and use of land; and in protecting the environment to sustain community life;
- Implement the NWMO's Reconciliation Policy released in 2019. It commits to a strategy to annually measure the organization's progress in contributing to Reconciliation;
- Develop a willingness assessment plan and employ it to inform the final site selection decision;
- More specifically define the terms "social acceptance" and "willing host," and work in collaboration with municipalities, communities, and Indigenous peoples involved in the site selection process to understand how they can be demonstrated;
- Continue work to increase awareness among – and consider comments from – Canadians and Indigenous peoples of Canada about Canada's plan, including young people; and
- Continue to develop plain-language exhibits, communication products and multimedia to share the details of Canada's plan, and expand online engagement through our website and social media platforms.

PRIORITY: TRANSPORTATION

The NWMO will:

- Develop and confirm transportation planning framework through ongoing dialogue;
- Continue transportation planning that is reflective of citizens' values, principles and objectives; and
- Continue refinement of the Used Fuel Transportation System materials, including transportation of nuclear waste in Canada and internationally, to identify lessons that apply to APM.

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 process of selecting a site, an acceptable transportation route must be identified or have the potential to be developed. Transportation planning and evaluations must fully address regulatory requirements for safely transporting used nuclear fuel through different provinces. From a technical perspective, used nuclear fuel can be transported safely and securely with radiological safety assured through the use of robust transportation packages. As such, the timeline for transportation planning is longer than the site selection timeline to allow time for on-site and detailed technical perspectives to help define routes. The NWMO does not plan to transport used fuel to the deep geological repository site before 2040.

In addition to technical requirements, social considerations and community concerns are important considerations in identifying transportation routes. The NWMO has progressively broadened and deepened our engagement with communities and interested individuals and groups to enhance our understanding of social priorities and concerns that need to be addressed. We have also conducted public attitude research with a cross-section of people in Ontario, Quebec and New Brunswick. These activities have supported the development of a draft transportation planning framework, which will be the focus of further discussion in 2020, and once confirmed, will help guide APM transportation planning.

The NWMO will need to demonstrate the safety and security of any transportation system to regulatory authorities and citizens, including Indigenous communities, before transportation to the repository can begin.

Transportation is an important focus of public engagement, leading to a better understanding of social considerations.

In the period 2020 to 2024, the NWMO will also:

- Undertake transportation logistics studies and risk assessments;
- Conduct public attitude research and continue dialogue to explore public perception, questions and concerns about the transportation of used nuclear fuel;
- Continue ongoing dialogue about planning for the safe and secure transportation of used nuclear fuel with municipalities, and First Nation and Métis communities, and with municipal associations and Indigenous organizations;
- 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 review of experience and best practices with transportation of hazardous materials, including transportation of nuclear waste in Canada and internationally, to identify lessons that apply to APM; and
- Share the draft transportation planning framework with communities for further discussion, and to refine and confirm.

Ensuring strong 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 members 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, law, Indigenous relations, Indigenous Knowledge, and community-based research. This group of individuals is knowledgeable in nuclear waste management issues and experienced in working with citizens and communities on a range of public policy issues.

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 governance excellence, 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, the NWMO has augmented our management system to satisfy the CSA N286-12 Management System Requirements for Nuclear Facilities, which includes nuclear waste facilities. The NWMO's integrated management system ensures the organization has 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

As recommended by 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 nature of the reviews is increasingly focused on specific design aspects and features. These reviews benefit program design and delivery, contribute to overall program quality, and help to enhance public confidence in the NWMO's implementation plans and decision-making.

REPORTING

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

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

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.

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 included in APM as an option. This option is not expected to be needed and is not included in the current implementation plan.

Retrievability is the ability to remove the used nuclear fuel from where it has been placed. Retrievability is an important component of APM and was included on the direction of Canadians. It is part of a risk management approach to allow corrective action to be taken if the repository does not perform as expected or if new technologies emerge in the future that could significantly improve the safety of used 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.

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

Note about terminology: In this document, we use the terms Aboriginal, 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 2019, the NWMO published *Implementing Adaptive Phased Management 2019 to 2023* – the previous version of this five-year strategic plan. The document outlined Canada's approach for the safe, long-term management of the country's used nuclear fuel, and how the NWMO intends to proceed over that time period.

To encourage public review and comment, the plan was distributed by mail and email to more than 3,800 people and organizations that had expressed interest in the APM Project. It was also used by our staff and contractors as a discussion point in communities, at events, and with people involved in the siting process. To increase reach, we also posted it on our website (www.nwmo.ca) and on our social media platforms, with an invitation to comment by making a submission, sending a letter or email, or filling out the comment form.

We received responses from a range of people – some representing government agencies or businesses, and others as individuals. This input helps inform our plans and work activity. We have used the comments we received to help inform the updated plan.

Several themes emerged from the suggestions and comments received – below is a summary of what we heard.

Continuing local engagement and communicating clearly

A number of respondents commented on the strength of the NWMO's ongoing engagement program and plans going forward. It was acknowledged that a project of this size and with such long time frames will have a significant impact wherever it is implemented, and therefore, both local involvement and clear, honest communication about the project and its potential effects are particularly important.

Canada's plan is a major infrastructure project that will last generations, and the NWMO recognizes that social factors must be considered alongside the economic factors. We are working with communities to develop partnership frameworks that consider how the project will fit into each area's vision for itself. In the *Partnership* section of this plan, it is also noted that a willingness assessment plan will be developed and used to inform the final site selection.

To better understand how potential siting communities would like to receive information at this point in the site selection process, in 2019, the NWMO conducted surveys among local residents. The results of the survey, which was conducted by an independent Canadian research firm on behalf of the NWMO, will be shared with communities and published online in 2020. We will use the findings to continue to improve the way we communicate and engage with the public.

Some commenters shared specific suggestions for improving communications materials. For example, in 2019, the NWMO released updated conceptual designs for the deep geological repository for both sedimentary and crystalline rock formations. This new working concept was included in the 2019-23 implementation plan. Commenters advised us to indicate potential dimensions of the above and below ground facilities and the excavated rock pile. In response, we have added labels to diagrams included in this year's plan, as well as other NWMO publications. To further help people visualize what a repository and associated facilities might look like, we introduced a three-dimensional conceptual model as part of a travelling exhibit launched in 2019.

We were also asked why the NWMO often notes in our communications materials the optional step of temporary shallow underground storage of used nuclear fuel, even though it is not expected to be required. Shallow storage is not currently being considered for implementation, as the used fuel is safely stored on an interim basis at facilities that are expected to operate until the deep geological repository is available for long-term management. In the interest of transparency, we continue to note it as an option should future needs change.

Increasing public awareness about the project and transportation planning

Commenters encouraged us to expand communications and engagement about the overall project and transportation planning specifically in areas beyond potential siting communities. This includes the broader regions in which these communities are located, along potential transportation routes and in current nuclear host communities where interim storage facilities are located.

In the *Partnership* section of this plan, we note our commitment to engaging with nuclear host communities, including planning for eventual transportation of used nuclear fuel from their communities to the deep geological repository site. We also note our commitment to continue to increase awareness about Canada's plan. We continue to expand our outreach beyond siting areas through regional engagement, as well as media and social media campaigns.

We also are continuing to extend our engagement efforts to include communities and groups that may be affected by or have expressed an interest in transportation. The *Transportation* section of the plan notes that we have progressively broadened and deepened our engagement with communities, and conducted public attitude research to help inform a transportation planning framework.

The framework will outline transportation planning objectives, issues to be addressed, factors to be considered in making decisions, and how we will ensure transportation planning includes best practice and aligns with the values and priorities of citizens. We will use the framework as part of ongoing dialogue with the public to help guide the plans that are ultimately developed.

We have included information in the *Transportation* section of this plan about the planning and engagement process for developing a draft transportation planning framework that will be the focus of further discussion in 2020.

Adapting to technical developments

Several commenters noted that the NWMO needs to be prepared to adapt to new developments. It was noted that last year's plan acknowledged Canada's active research sector exploring new technologies such as SMRs, fuel reprocessing and other types of advanced reactors. As noted in the section *Keeping abreast of the external landscape and adapting to change*, we continue to encourage organizations developing new concepts to work with us so we can determine potential impacts to repository designs. We also actively monitor and report on new technical developments and maintain a watching brief on alternative technologies, updating it annually (www.nwmo.ca/adaption).

Several commenters asked why Canada's plan is to contain and isolate used nuclear fuel in a deep geological repository, rather than recycling it. If Canada chooses to reprocess nuclear fuel in the future, it would be a joint decision by nuclear energy producers, the associated provincial governments and the federal government. If such a decision was taken, the NWMO would work with utilities and government to safely manage the high-level fuel waste resulting from this process. This approach is aligned with international best practice – countries that reprocess used nuclear fuel and others that are examining advanced fuel cycles all have plans to implement deep geological repositories.

Accessing land

After we published the 2019-23 implementation plan, we heard interest in learning more about how we would access land in Huron-Kinloss and South Bruce, where constructing a repository on Crown land is not an option as it is in northern Ontario communities. Since then, we launched a process inviting local landowners to consider signing option or purchase agreements with the NWMO that will allow us to conduct site investigations, and potentially, if the site is later selected, to purchase the land in question.

Once land access is secured, we expect to proceed with borehole drilling and other environmental baseline studies at the identified site as described in the *Site Assessment* section of this plan.

Managing risks related to site selection

We received a number of comments about risks associated with selecting a site and implementing Canada's plan, including concerns that we may not be successful in finding a site, delays could occur, or institutional arrangements for regulation and ownership of generation and storage facilities could change.

While we remain adaptable, we are ultimately planning for success – in each potential siting area, geoscientific and environmental evaluation studies to date have given us confidence that we can build and operate a deep geological repository for used nuclear fuel. The next part of the project is about working towards partnership with communities, and our plans for achieving that goal are described in the *Partnership* section of this plan. We are fortunate to be working with communities that are actively engaged in helping to shape these plans.

We also have an active process in place for managing risks. This process involves identifying events that may affect the NWMO or our work, assessing their likelihood, implementing mitigation strategies, and managing resulting risks to ensure we can achieve our mandate.

With respect to changes in regulations and ownership of used nuclear fuel, these are among the factors we monitor on an ongoing basis to ensure we are able to adapt if needed. For example, as described in the section *Keeping abreast of the external landscape and adapting to change*, this year's plan demonstrates how we have adapted to the *Impact Assessment Act*, which was passed in 2019.

Share your thoughts on

Implementing Adaptive Phased Management 2020 to 2024

1. Are the priorities that we have identified appropriate? Have we missed key areas?

2. The plan identifies activities we propose to undertake to accomplish these priorities. Have we set out appropriate activities?

3. 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?

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

5. Other comments, questions or suggestions?

Name (optional): _____

Organization (if appropriate): _____ Date: _____

Address: _____

Email: _____ Tel.: _____

Would you like your comments posted on the NWMO website? Yes No

Please reply by
June 10, 2020, to:
Lisa Frizzell
Vice-President,
Stakeholder Relations

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

By email learnmore@nwmo.ca

By fax 647.259.3692

Through website
www.nwmo.ca/contactus

Through social media
@nwmocanada
/company/nwmocanada

Implementing Adaptive Phased Management 2020 to 2024

For more information, please contact:

Nuclear Waste Management Organization
22 St. Clair Avenue East, Sixth Floor
Toronto, Ontario M4T 2S3, Canada
Tel.: 416.934.9814 Toll Free: 1.866.249.6966
Email: contactus@nwmo.ca
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nwmo
NUCLEAR WASTE MANAGEMENT ORGANIZATION
SOCIÉTÉ DE GESTION DES DÉCHETS NUCLÉAIRES

16 Auditor's report and financial statements

Management's responsibility for financial reporting

The accompanying financial statements of the Nuclear Waste Management Organization (NWMO) and all the information in this annual report are the responsibility of management and have been approved by the Board of Directors.

The financial statements have been prepared by management in accordance with Canadian accounting standards for not-for-profit organizations set out in Part III of the Chartered Professional Accountants Canada Handbook. When alternative accounting methods exist, management has chosen those it deems most appropriate in the circumstances. Financial statements are not precise since they include certain amounts based on estimates and judgments, particularly when transactions affecting the current accounting period cannot be finalized until future periods.

Management has determined such amounts on a reasonable basis in order to ensure that the financial statements are presented fairly, in all material respects, and in light of information available up to February 13, 2020.

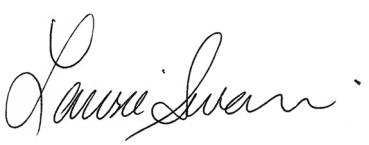
Management has a system of internal controls designed to provide reasonable assurance that the financial statements are accurate and complete in all material respects. The internal control system includes an established business conduct policy that applies to all employees. Management believes that the systems provide reasonable assurance that transactions are properly authorized and recorded, financial information is relevant, reliable and accurate, and the Organization's assets are appropriately accounted for and adequately safeguarded.

The Board of Directors is responsible for ensuring management fulfils our responsibilities for financial reporting, and is ultimately responsible for reviewing and approving the financial statements. The Board carries out this responsibility through its Audit, Finance and Risk Committee (the Committee).

The Committee is appointed by the Board and meets periodically with management, as well as the external auditor, to discuss internal controls over the financial reporting process, auditing matters and financial reporting issues; to satisfy itself that each party is properly discharging its responsibilities; and to review the financial statements and the external auditor's report. The Committee reports its findings to the Board for consideration when approving the financial statements for issuance to the members. The Committee also considers, for review by the Board and approval by the members, the engagement or reappointment of the external auditor.

The financial statements have been audited by Deloitte LLP, the independent external auditor, in accordance with Canadian generally accepted auditing standards on behalf of the members.

February 13, 2020



Laurie Swami
President and CEO

Georgina Kossivas
Chief Financial Officer

Independent Auditor's Report

To the Members of Nuclear Waste Management Organization

Opinion

We have audited the financial statements of Nuclear Waste Management Organization (the "Organization"), which comprise the statement of financial position as at December 31, 2019, and the statements of operations, changes in net assets (deficiency) and cash flows for the year then ended, and notes to the financial statements, including a summary of significant accounting policies (collectively referred to as the "financial statements").

In our opinion, the accompanying financial statements present fairly, in all material respects, the financial position of the Organization as at December 31, 2019, and the results of its operations and its cash flows for the year then ended in accordance with Canadian accounting standards for not-for-profit organizations.

Basis for Opinion

We conducted our audit in accordance with Canadian generally accepted auditing standards ("Canadian GAAS"). Our responsibilities under those standards are further described in the *Auditor's Responsibilities for the Audit of the Financial Statements* section of our report. We are independent of the Organization in accordance with the ethical requirements that are relevant to our audit of the financial statements in Canada, and we have fulfilled our other ethical responsibilities in accordance with these requirements. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.

Responsibilities of Management and Those Charged with Governance for the Financial Statements

Management is responsible for the preparation and fair presentation of the financial statements in accordance with Canadian accounting standards for not-for-profit organizations, and for such internal control as management determines is necessary to enable the preparation of financial statements that are free from material misstatement, whether due to fraud or error.

In preparing the financial statements, management is responsible for assessing the Organization's ability to continue as a going concern, disclosing, as applicable, matters related to going concern and using the going concern basis of accounting unless management either intends to liquidate the Organization or to cease operations, or has no realistic alternative but to do so.

Those charged with governance are responsible for overseeing the Organization's financial reporting process.

Auditor's Responsibilities for the Audit of the Financial Statements

Our objectives are to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes our opinion. Reasonable assurance is a high level of assurance, but is not a guarantee that an audit conducted in accordance with Canadian GAAS will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of these financial statements.

As part of an audit in accordance with Canadian GAAS, we exercise professional judgment and maintain professional skepticism throughout the audit. We also:

- Identify and assess the risks of material misstatement of the financial statements, whether due to fraud or error, design and perform audit procedures responsive to those risks, and obtain audit evidence that is sufficient and appropriate to provide a basis for our opinion. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control.
- Obtain an understanding of internal control relevant to the audit in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the Organization's internal control.
- Evaluate the appropriateness of accounting policies used and the reasonableness of accounting estimates and related disclosures made by management.
- Conclude on the appropriateness of management's use of the going concern basis of accounting and, based on the audit evidence obtained, whether a material uncertainty exists related to events or conditions that may cast significant doubt on the Organization's ability to continue as a going concern. If we conclude that a material uncertainty exists, we are required to draw attention in our auditor's report to the related disclosures in the financial statements or, if such disclosures are inadequate, to modify our opinion. Our conclusions are based on the audit evidence obtained up to the date of our auditor's report. However, future events or conditions may cause the Organization to cease to continue as a going concern.
- Evaluate the overall presentation, structure and content of the financial statements, including the disclosures, and whether the financial statements represent the underlying transactions and events in a manner that achieves fair presentation.

We communicate with those charged with governance regarding, among other matters, the planned scope and timing of the audit and significant audit findings, including any significant deficiencies in internal control that we identify during our audit.

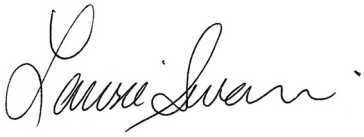
Deloitte LLP

Chartered Professional Accountants
Licensed Public Accountants
February 13, 2020
Vaughan, Ont.

Statement of financial position as at December 31, 2019

	2019	2018
	$	$
Assets		
Current assets		
Cash	19,071,819	6,813,329
Member contributions receivable (Note 5a)	20,639	1,011,001
Other receivable from members and AECL	120,217	671,468
Accounts receivable (Note 12)	440,591	-
Prepaid expenses and deposits	1,807,654	977,407
	21,460,920	9,473,205
Capital assets (Note 3)	5,612,904	3,408,158
Accrued pension asset (Note 7)	48,655,845	33,840,455
	75,729,669	46,721,818
Liabilities		
Current liabilities		
Accounts payable and accrued liabilities (Note 12)	21,025,491	9,061,464
Deferred lease inducements (Note 8)	627,508	711,174
Deferred/payable contributions from members and AECL (Note 5b)	257,921	150,567
	21,910,920	9,923,205
Deferred capital contributions (Note 6)	5,612,904	3,408,158
Deferred contributions from members and AECL (Note 5c)	12,016,357	12,003,582
Other post-employment and pension benefits liability (Note 7)	29,294,534	23,225,919
	46,923,795	38,637,659
Net assets (deficiency)	6,894,954	(1,839,046)
	75,729,669	46,721,818

Approved by the Board of Directors, February 13, 2020



Laurie Swami

President and CEO
Toronto, Ont.

Beth Summers

Chair – Audit, Finance and Risk Committee
Toronto, Ont.

The accompanying notes to the financial statements are an integral part of this financial statement.

Statement of operations
year ended December 31, 2019

	2019	2018
	$	$
Revenue		
Contributions from members (Note 4)	95,013,221	73,869,512
Contributions from AECL	789,608	486,240
	95,802,829	74,355,752
Change in deferred capital contributions (Note 6)	(2,204,746)	(346,585)
Change in long-term deferred contributions from members and AECL (Note 5c)	(12,775)	(439,863)
Change in member contributions receivable (Note 5a)	(990,362)	(6,285,542)
Change in deferred/payable contributions from members and AECL (Note 5b)	(107,354)	158,425
Total contribution revenue (Note 11)	92,487,592	67,442,187
Interest income (Note 11)	177,102	122,032
Total revenue	92,664,694	67,564,219
Expenses (Note 13)		
Adaptive Phased Management		
Staffing and administration	35,426,412	30,296,945
Engagement	21,552,150	13,877,617
Site assessment	12,109,456	4,445,129
Engineering	10,469,149	8,265,789
Stakeholder relations	4,017,817	2,639,221
Safety	3,621,592	2,576,049
Regulatory approvals	2,251,224	1,005,412
Transportation	560,561	923,954
	90,008,361	64,030,116
Deep Geologic Repository		
Safety assessment/waste characterization	924,135	1,309,393
Geoscience	528,123	668,568
Environmental assessment	174,563	594,258
	1,626,821	2,572,219
Amortization of capital assets	1,029,512	961,884
Total expenses (Note 11)	92,664,694	67,564,219
Excess of revenue over expenses for the year	-	-

The accompanying notes to the financial statements are an integral part of this financial statement.

Statement of changes in net assets (deficiency)
year ended December 31, 2019

	2019	2018
	$	$
Net (deficiency) assets, beginning of year	(1,839,046)	6,364,954
Excess of revenue over expenses for the year	-	-
Remeasurements during the year:		
Accrued pension asset	13,065,000	(11,393,000)
Other post-employment and pension benefits liability	(4,331,000)	3,189,000
Net assets (deficiency), end of year	6,894,954	(1,839,046)

Statement of cash flows
year ended December 31, 2019

	2019	2018
	$	$
Operating activities		
Cash received from contributions	92,682,485	72,912,348
Interest received	177,102	122,032
	92,859,587	73,034,380
Cash paid for salaries and benefits, materials and services	(80,601,097)	(71,772,938)
	12,258,490	1,261,442
Investing activity		
Purchase of capital assets (Note 3)	(3,120,344)	(1,443,404)
Financing activity		
Cash received from contributions for purchase of capital assets	3,120,344	1,443,404
Net increase in cash	12,258,490	1,261,442
Cash, beginning of year	6,813,329	5,551,887
Cash, end of year	19,071,819	6,813,329

The accompanying notes to the financial statements are an integral part of these financial statements.

Notes to the financial statements
December 31, 2019

1. Description of organization

The Nuclear Waste Management Organization ("NWMO") is a not-for-profit corporation without share capital, established under the *Canada Corporations Act*, 1970 ("the Act"), as required by the *Nuclear Fuel Waste Act* ("*NFWA*"), 2002, which came into force November 15, 2002.

The *NFWA* requires electricity-generating companies which produce used nuclear fuel to establish a waste management organization. In accordance with the *NFWA*, the NWMO established an Advisory Council, conducted a study and provided recommendations on the long-term management of used nuclear fuel to the Government of Canada. The results of the study and the recommendations were submitted in November 2005. As part of the long-term mandate, the NWMO is now responsible for implementing Adaptive Phased Management ("APM"), an approach selected by the Government of Canada to address the management of used nuclear fuel.

The NWMO formally began operations on October 1, 2002. Its founding members are Hydro-Québec, New Brunswick Power Corporation, and Ontario Power Generation Inc. ("OPG") ("members"). The *NFWA* requires that the NWMO offer nuclear fuel waste management services at a fee to all owners of nuclear fuel waste produced in Canada, including non-members and Atomic Energy of Canada Limited ("AECL").

Pursuant to a Membership Agreement, cost sharing of APM costs in 2019 is based on the principles of projected total number of fuel bundles and the assumed timing of access to the long-term used fuel management facility. These cost sharing percentages are in effect since January 1, 2018.

In late 2017, OPG advised that it was reviewing the level of NWMO support related to its Low and Intermediate Level Waste Deep Geologic Repository ("DGR") given the status of the regulatory approvals. As such, the NWMO's activities related to this program were reduced in 2018, consistent with the 2018 work plan and transitioned the project management activities to OPG. As part of this transition, effective December 31, 2018, OPG terminated its Engineering, Procurement and Construction Management Agreement with the NWMO. The NWMO continued to offer limited support to OPG in 2019 under the existing DGR Services Agreement and will continue into 2020.

2. Significant accounting policies

Basis of presentation

The financial statements of the NWMO are the representations of management prepared in accordance with Canadian accounting standards for not-for-profit organizations set out in Part III of the Chartered Professional Accountants Canada ("CPA Canada") Handbook using the deferral method of reporting restricted contributions. The significant accounting policies adopted by the NWMO are as follows:

Capital assets

Capital assets are recorded at cost. Amortization is provided for on the straight-line basis over their estimated useful lives as follows:

Office building	15 years
Furniture and office equipment	7 years
Transport and work equipment	7 years
Vehicles	5 years
Computer equipment and software	3 years
Leasehold improvements	Initial lease term plus one renewal period

Income tax

The NWMO is a not-for-profit organization, and pursuant to section 149(1)(1) of the *Income Tax Act*, is not subject to income tax.

Revenue recognition

Contributions received from members and AECL are treated as restricted contributions, and as such, they are not recognized as revenue until associated costs have been incurred. Any excess or shortfall of member contributions is recorded as deferred revenue or member contributions receivable, respectively.

Contributions used for the purchase of capital assets owned by the NWMO are deferred and amortized into revenue at the rate corresponding with the amortization rate of the related capital assets.

Pension and other post-employment benefits

The NWMO's post-employment benefit programs include a contributory defined benefit registered pension plan, a defined benefit supplementary pension plan, and other post-employment benefits, including group life insurance, health care and long-term disability ("LTD") benefits. The NWMO has adopted the following policies with respect to accounting for these post-employment benefits:

(i) The NWMO accrues its obligations under pension, supplementary pension plan, and other post-employment benefit ("OPEB") plans. The defined benefit obligation for pension is determined using the projected benefit method pro-rated on service and is measured based on the actuarial valuation prepared for funding purposes (but not one prepared using a solvency, wind up, or similar valuation basis). Under this method, the benefit costs are amortized over the average remaining service period of active employees as indicated in Note 7. For other unfunded plans such as supplementary pension plan and OPEB, a similar accrual method is used and the benefit obligations are measured based on the actuarial valuation for accounting purposes. Remeasurements and other items for the period are recorded through the statement of changes of net assets (deficiency).

2. Significant accounting policies (continued)

Pension and other post-employment benefits (continued)

(ii) The obligations are affected by salary levels, inflation, and cost escalation of specific items (e.g., dental and health claims). Pension and OPEB costs and obligations are determined annually by independent actuaries using management's best estimate assumptions. The discount rate used by the NWMO in determining projected benefit obligations and the costs for the NWMO's pension plan is based on the funding valuation on a going concern basis, while other employee benefit plans' discount rates are based on representative AA corporate bond yields in effect at the end of the year.

(iii) Pension fund assets are valued using market-related values for the purposes of determining actuarial gains or losses and the actual return on plan assets. The plan's assets consist of pooled funds and fixed income securities. Market and credit risk on these securities are managed by the plan by placing plan assets in trust and through the plan's investment policy.

Research and development

Research and development costs are charged to operations as expenses in the year incurred.

Foreign currency translation

Monetary assets and liabilities denominated in foreign currencies are translated into Canadian currency at the year-end exchange rate. Any resulting gain or loss is reflected in staffing and administration expenses. Transactions in foreign currencies throughout the year have been converted at the exchange rate prevailing at the date of the transaction.

Financial instruments

Financial instruments include cash, member contributions receivable, other receivable from members and AECL, accounts receivable, and accounts payable and accrued liabilities.

Financial assets and financial liabilities are initially recognized at fair value when the NWMO becomes a party to the contractual provisions of the financial instrument. Subsequently, all financial instruments are measured at amortized cost. Financial assets measured at amortized cost are assessed at each reporting date for indications of impairment. If such impairment exists, the asset is written down and the resulting impairment loss is recognized in the statement of operations.

Related party transactions

Related party transactions are recorded at the exchange amount.

Use of estimates

The preparation of financial statements in conformity with Canadian generally accepted accounting principles requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities, disclosures of contingent assets and liabilities at the date of the financial statements, and the reported amounts of revenues and expenses during the reporting period. Due to the inherent uncertainty in making estimates, actual results could differ from those estimates. Accounts requiring significant estimates include accrued pension asset, other post-employment and pension benefits liability, certain accrued liabilities and amortization which is based on the estimated useful life of the capital assets.

3. Capital assets

			2019	2018
	Cost	Accumulated amortization	Net book value	Net book value
	$	$	$	$
Land	10,000	-	10,000	10,000
Computer equipment and software	5,278,114	4,198,113	1,080,001	804,002
Transport and work equipment	3,978,869	990,825	2,988,044	1,184,647
Furniture and office equipment	2,827,469	2,200,360	627,109	422,918
Leasehold improvements	2,234,099	2,234,099	-	-
Office building	1,182,612	274,862	907,750	986,591
Vehicles	374,231	374,231	-	-
	15,885,394	10,272,490	5,612,904	3,408,158

Capital asset additions totalling $190,143 (2018 – $76,228) have been excluded from the statement of cash flows as they remain unpaid at year-end. During 2019, capital asset additions totalling $76,228 (2018 – $211,163) have been included in the statement of cash flows as they were accrued at December 31, 2018, and paid in 2019 (2018 – accrued at December 31, 2017, and paid in 2018).

4. Related party transactions and balances

Transactions and balances not otherwise disclosed separately in these financial statements are as follows:

			2019	2018
	APM	DGR	Total	Total
	$	$	$	$
Transactions during the year				
Member contributions received				
Ontario Power Generation Inc.	88,397,000	1,018,426	89,415,426	70,063,026
New Brunswick Power Corporation	3,455,795	-	3,455,795	2,561,000
Hydro-Québec	2,142,000	-	2,142,000	1,245,486
	93,994,795	1,018,426	95,013,221	73,869,512

5. Member and AECL contributions

The NWMO is solely funded through contributions it receives from its members and AECL. The contributions are restricted in nature, and thus revenue is recognized when qualifying expenses are incurred. Amounts received in advance of qualifying expenses are recorded as deferred member contributions. Commitments for contributions which have not been received by the NWMO are recorded as contributions receivable when the amount is determinable and the ultimate collection is likely.

(a) Contributions receivable from members
Contributions receivable from members are comprised of the following:

	2019	2018
	$	$
Hydro-Québec	20,639	114,912
Ontario Power Generation Inc.	-	896,089
	20,639	1,011,001

(b) Deferred/payable contributions from members and AECL – current
Deferred/payable contributions from members and AECL are comprised of the following:

	2019	2018
	$	$
Atomic Energy of Canada Limited	176,342	140,361
New Brunswick Power Corporation	68,617	10,206
Ontario Power Generation Inc.	12,962	-
	257,921	150,567

(c) Long-term deferred contributions from members and AECL
Long-term deferred contributions from members and AECL represent amounts received or receivable to fund various employee future benefits as follows:

	2019	2018
	$	$
Accrued pension asset	48,655,845	33,840,455
Other post-employment benefits	(29,294,534)	(23,225,919)
Pension and other post-employment benefit liabilities – short term (Note 7)	(450,000)	(450,000)
Remeasurements and other items in net (assets) deficiency	(6,894,954)	1,839,046
	12,016,357	12,003,582

(d) Continuity of deferred contributions from members and AECL

The continuity of deferred contributions from members and AECL is as follows:

	2019	2018
	$	$
Balance, beginning of year		
Deferred/payable contributions from members and AECL – current	150,567	308,992
Deferred contributions from members and AECL – long term	12,003,582	11,563,719
	12,154,149	11,872,711
Contributions received	95,802,829	74,355,752
Contributions receivable	20,639	1,011,001
Contribution revenue recognized	(92,487,592)	(67,442,187)
Amounts received previously recognized	(1,011,001)	(7,296,543)
Change related to deferred capital contributions	(2,204,746)	(346,585)
	12,274,278	12,154,149
Balance, end of year		
Deferred/payable contributions from members and AECL – current	(257,921)	(150,567)
Deferred contributions from members and AECL – long term	12,016,357	12,003,582

6. Deferred capital contributions

	2019	2018
	$	$
Balance, beginning of year	3,408,158	3,061,573
Contributions for the purchase of capital assets	3,234,258	1,308,469
Less amortization into revenue	(1,029,512)	(961,884)
Balance, end of year	5,612,904	3,408,158

7. Pension and other post-employment benefit plans

Effective January 1, 2009, the NWMO offers certain benefits to employees and retirees. A brief overview of these benefit plans is set out below:

(a) Registered pension plan
The registered pension plan is a contributory defined benefit plan covering eligible employees and retirees. The registered pension plan is funded, and plan assets include pooled funds and fixed income securities managed by third parties. The benefit costs and assets related to this plan are recorded in the NWMO's financial statements.

(b) Supplementary pension plan
The supplementary pension plan is a defined benefit plan covering certain employees and retirees. The plan is unfunded.

(c) Other post-employment benefit plans
These other post-employment benefit plans provide medical, dental, LTD, and group life insurance coverage for certain groups of full-time employees who have retired from the NWMO. These plans are unfunded.

A funding valuation, which was completed for the registered pension plan as of January 1, 2019, reported an actuarial surplus of $34.1 million on a going concern basis and a surplus of $1.8 million on a solvency basis.

The most recent actuarial valuations were performed for the registered pension plan as at January 1, 2019, and for the supplementary pension plan and other post-employment benefit plans as at December 31, 2017.

The significant actuarial assumptions for benefit obligations and costs adopted in estimating the NWMO's accrued benefit obligations are as follows:

	Registered pension plan		Supplementary pension plan		Other post-employment benefit plans	
	2019	2018	2019	2018	2019	2018
	%	%	%	%	%	%
Discount rate at the beginning of the period	5.50	5.75	4.00	3.50	4.00	3.50
Salary schedule escalation rate	3.00	3.00	3.00	3.00	-	-
Rate of cost of living increase	2.00	2.00	2.00	2.00	-	-
Rate of increase in health-care cost trend	-	-	-	-	5.45	5.55
Discount rate at the end of the period	5.50	5.50	3.20	4.00	3.20	4.00
Average remaining service life for employees	13 years	13 years	13 years	13 years	15 years	12 years

Information for the NWMO's pension plans and post-employment benefits, including LTD is as follows:

	Registered pension plan		Supplementary pension plan		Other post-employment benefit plans	
	2019	2018	2019	2018	2019	2018
	$	$	$	$	$	$
Changes in accrued benefit obligation						
Accrued benefit obligation, January 1	(69,458,000)	(62,459,000)	(6,514,164)	(6,792,077)	(17,161,755)	(18,305,564)
Current service cost	(2,046,000)	(2,157,000)	(245,000)	(261,000)	(967,000)	(1,145,000)
Interest cost	(3,902,000)	(3,693,000)	(279,000)	(254,000)	(719,000)	(675,000)
Past service cost	(12,000)	(20,000)	-	-	-	-
Employee contributions	(1,211,000)	(1,117,000)	-	-	-	-
Benefits paid	2,181,000	1,965,000	259,927	242,913	220,704	324,809
Net actuarial gain (loss)	315,000	(1,977,000)	(883,000)	550,000	(3,457,000)	2,639,000
Accrued benefit obligation, December 31	(74,133,000)	(69,458,000)	(7,661,237)	(6,514,164)	(22,084,051)	(17,161,755)
Changes in plan assets						
Fair value of plan assets, January 1	103,298,455	105,485,314	-	-	-	-
Expected return on plan assets	5,707,000	6,105,000	-	-	-	-
Benefits paid	(2,181,000)	(1,965,000)	-	-	(221,000)	(325,000)
Net actuarial gain (loss)	12,750,000	(9,416,000)	-	-	-	-
Employer contributions	1,991,000	1,952,141	-	-	221,000	325,000
Past service cost	12,000	20,000	-	-	-	-
Employee contributions	1,211,000	1,117,000	-	-	-	-
Fair value of plan assets, December 31	122,788,455	103,298,455	-	-	-	-
Funded status						
Fair value of plan assets	122,788,455	103,298,455	-	-	-	-
Accrued benefit obligation	(74,133,000)	(69,458,000)	(7,661,237)	(6,514,164)	(22,084,051)	(17,161,755)
Accrued benefit asset (liability)	48,655,455	33,840,455	(7,661,237)	(6,514,164)	(22,084,051)	(17,161,755)
Short-term portion	-	-	(200,000)	(200,000)	(250,000)	(250,000)
Long-term portion	48,655,455	33,840,455	(7,461,237)	(6,314,164)	(21,834,051)	(16,911,755)
	48,655,455	33,840,455	(7,661,237)	(6,514,164)	(22,084,051)	(17,161,755)
Components of cost recognized						
Current service cost	2,046,000	2,157,000	245,000	261,000	967,000	1,145,000
Interest cost on accrued benefit obligation	3,902,000	3,693,000	279,000	254,000	719,000	675,000
Expected return on plan assets	(5,707,000)	(6,105,000)	-	-	-	-
Cost recognized	241,000	(255,000)	524,000	515,000	1,686,000	1,820,000

The short-term portion of the accrued benefits liability of $450,000 (2018 – $450,000) that is included in accounts payable and accrued liabilities is part of the total $29,744,534 (2018 – $23,675,919) accrued benefits liability at the end of the year for the supplementary pension and other post-employment benefit/LTD plans.

The pension and other post-employment benefit costs recognized are included in the respective expense categories in the statement of operations.

7. Pension and other post-employment benefit plans (continued)

Sensitivity information related to the other post-employment benefit plans is as follows:

	2019	2018
	$	$
Effect of 1% increase in health-care cost trends on		
Accrued benefit obligation	5,630,000	3,853,000
Service cost and interest cost	742,000	530,000
Effect of 1% decrease in health-care cost trends on		
Accrued benefit obligation	(4,082,000)	(2,887,000)
Service cost and interest cost	(503,000)	(372,000)

The supplementary pension plan is unfunded and is secured by a Standby Letter of Credit of $9,721,600 (2018 – $8,196,100) obtained on the NWMO's behalf by OPG, as approved by the members.

8. Deferred lease inducements

	2019	2018
	$	$
Tenant inducements	835,676	835,676
Less accumulated amortization	(208,168)	(124,502)
	627,508	711,174

9. Guarantees

In the normal course of business, the NWMO enters into agreements that meet the definition of a guarantee.

(a) The NWMO has provided indemnities for various agreements. Under the terms of these agreements, the NWMO agrees to indemnify the counterparty for various items, including, but not limited to, all liabilities, loss, suits, and damages arising during, on or after the term of the agreement.

(b) The NWMO indemnifies all directors, officers and employees acting on behalf of the NWMO for various items, including, but not limited to, all costs to settle suits or actions due to services provided to the NWMO, subject to certain restrictions.

The nature of these indemnification agreements prevents the NWMO from making a reasonable estimate of the maximum exposure due to the difficulties in assessing the amount of liability which stems from the unpredictability of future events and the unlimited coverage offered to counterparties. Historically, the NWMO has not made any payments under such or similar indemnification agreements, and therefore, no amount has been accrued with respect to these agreements.

The NWMO also arranged a Standby Letter of Credit issued by OPG to secure its supplementary pension plan (Note 7).

10. Operating leases

The NWMO has entered into a number of leases for office premises and a vehicle which expire at various dates up to June 30, 2027.

The estimated annual minimum payments over the initial term of these leases up to their expiration are as follows:

	$
2020	995,606
2021	997,870
2022	1,011,348
2023	1,030,148
2024	1,036,392
Thereafter	2,611,496
	7,682,860

11. Segment reporting

The NWMO has two reportable segments as follows:

» Federal mandated program (APM);

» Direct services outside its mandated program include a service contract with OPG for DGR, which became effective February 1, 2011.

Segment information is as follows:

	APM		DGR		Total	
	2019	2018	2019	2018	2019	2018
	$	$	$	$	$	$
Contribution revenue	90,860,407	64,868,614	1,627,185	2,573,573	92,487,592	67,442,187
Interest income	173,949	116,151	3,153	5,881	177,102	122,032
Total revenue	91,034,356	64,984,765	1,630,338	2,579,454	92,664,694	67,564,219
Amortization of capital assets	1,025,995	954,649	3,517	7,235	1,029,512	961,884
Operating expenses	90,008,361	64,030,116	1,626,821	2,572,219	91,635,182	66,602,335
Total expenses	91,034,356	64,984,765	1,630,338	2,579,454	92,664,694	67,564,219
Capital asset additions	3,234,258	1,308,469	-	-	3,234,258	1,308,469

The allocation of the common service expenses to each function of the above segment is based on direct staff in each function.

12. Government remittances

Government remittances is comprised of the following:

	2019	2018
	$	$
Goods and Services Tax/Harmonized Sales Tax ("GST/HST") payable	(120,295)	(606,343)
GST/HST receivable	560,032	325,915
GST/HST receivable (payable), net	439,737	(280,428)
Workplace Safety and Insurance Board premiums payable	-	(1,200)
	439,737	(281,628)

The net government remittances receivable balance of $439,737 as at December 31, 2019, has been included in accounts receivable. The net government remittances payable balance of $281,628 as at December 31, 2018, has been included in accounts payable and accrued liabilities.

13. Comparative amounts

In 2019, the presentation of expenses in the statement of operations was revised to reflect how the NWMO is managing project activities at the current phase of the APM and DGR projects. The following comparative amounts have been reclassified to conform to the current year's financial statement presentation:

		2018
	As reclassified	As previously stated
	$	$
Statement of operations		
Expenses		
Adaptive Phased Management		
Staffing and administration	30,296,945	30,247,452
Engagement	13,877,617	13,877,617
Site assessment	4,445,129	4,445,129
Engineering	8,265,789	8,265,789
Stakeholder relations	2,639,221	2,639,221
Safety	2,576,049	2,576,049
Regulatory approvals	1,005,412	1,005,412
Transportation	923,954	923,954
Mobilization	-	49,493
	64,030,116	64,030,116
Deep Geologic Repository		
Staffing and administration	-	1,090,894
Safety assessment/waste characterization	1,309,393	763,945
Geoscience	668,568	395,845
Environmental assessment	594,258	321,535
	2,572,219	2,572,219

14. Subsequent events

Subsequent to December 31, 2019, the NWMO has incorporated three wholly owned subsidiaries and entered into various agreements to support site assessment activities.

17 Report of the Advisory Council 2017 to 2019

The Honourable Seamus O'Regan

Minister, Natural Resources Canada

Ottawa, ON K1A 0A6

March 2020

Dear Minister,

On behalf of the Advisory Council to the Nuclear Waste Management Organization (NWMO), I am pleased to submit our three-year review, included in the NWMO's 2017 to 2019 Triennial Report.

This is our fourth independent review of the NWMO's progress in implementing Adaptive Phased Management, Canada's plan for the safe and secure long-term management of used nuclear fuel. The Advisory Council comments are submitted as required under sections 8 and 18 of the *Nuclear Fuel Waste Act*.

The first section of our report provides an overview of our mandate, approach and framework for evaluating the NWMO's work. This is followed by a summary of the Advisory Council's activities over the past three years and our comments on the work of the NWMO from 2017 to 2019. The third section includes a review of the NWMO's five-year implementation plan, *Implementing Adaptive Phased Management 2020 to 2024*, with comments and suggestions. In the final section, we provide contextual information on planning for long-term nuclear waste management in Canada and our reflections at this critical time in the project.

We look forward to continuing our ongoing review and constructive commentary on the NWMO's work and to our next triennial review in three years' time.

Sincerely, on behalf of the members of the Advisory Council,

Dr. David R. Cameron

Advisory Council Chair

Copy: NWMO Advisory Council

- Mr. Joseph Cavalancia
- Dr. Monica Gattinger
- Ms. Sue Hartwig
- Dr. Dean Jacobs
- Ms. Diane M. Kelly
- Dr. Derek Lister
- Dr. Dougal McCreath
- Mr. Donald Obonsawin, Vice-Chair
- Ms. Linda Thompson

Mr. Wayne Robbins

Chairman of the Board of Directors

Nuclear Waste Management Organization

22 St. Clair Avenue East, 6th Floor

Toronto, ON M4T 2S3

March 2020

Dear Mr. Robbins,

On behalf of the Advisory Council to the Nuclear Waste Management Organization (NWMO), I am pleased to submit our comments for inclusion in the NWMO's Triennial Report 2017 to 2019.

We provide comments as required of the Advisory Council under sections 8 and 18 of the *Nuclear Fuel Waste Act*.

Respectfully submitted on behalf of members of the Advisory Council,

Dr. David R. Cameron

Advisory Council Chair

Copy: NWMO Advisory Council

- Mr. Joseph Cavalancia
- Dr. Monica Gattinger
- Ms. Sue Hartwig
- Dr. Dean Jacobs
- Ms. Diane M. Kelly
- Dr. Derek Lister
- Dr. Dougal McCreath
- Mr. Donald Obonsawin, Vice-Chair
- Ms. Linda Thompson

Table of contents

1. Introduction and background

This Advisory Council (Council) report fulfils the requirement in the *Nuclear Fuel Waste Act* (*NFWA*) that the Council comment every three years on the process and findings of the Nuclear Waste Management Organization (NWMO).

Section 1 provides an overview of the mandate, approach and framework that we developed for the purpose of evaluating the NWMO's work. Section 2 provides a summary of our activities over the past three years and our evaluation of the work the NWMO has undertaken during that period. Section 3 includes comments and recommendations on the NWMO's plans for future work as described in its implementation plan, *Implementing Adaptive Phased Management 2020 to 2024*. Finally, Section 4 provides contextual information on planning for long-term nuclear waste management in Canada and our reflections at this critical time in the project.

1.1 *Nuclear Fuel Waste Act* requirements

As required by the *NFWA*, the NWMO Board of Directors established the Advisory Council in 2002. The *NFWA* specifies that the membership of the Council should reflect a broad range of scientific and technical disciplines related to the management of nuclear fuel waste, as well as expertise in public affairs, social sciences and Indigenous Knowledge. Council members are profiled in Chapter 10 of the NWMO's triennial report.

Below is a list of former and current members.

Advisory Council
Current members

David R. Cameron, Chair	2002-ongoing
Joseph Cavalancia	2015-ongoing
Monica Gattinger	2018-ongoing
Sue Hartwig	2018-ongoing
Dean Jacobs	2015-ongoing
Diane M. Kelly	2015-ongoing
Derek Lister	2002-ongoing
Dougal McCreath	2008-ongoing
Donald Obonsawin, Vice-Chair	2002-ongoing
Linda Thompson	2015-ongoing

Advisory Council
Former members

Marlyn A. Cook	2008-15
Helen Cooper	2002-08
Wesley Cragg	2012-15
Gordon Cressy	2002-08
David Crombie (past Chair)	2002-17
Frederick Gilbert	2002-15
Rudyard Griffiths	2008-11
Eva Ligeti	2002-17
Michel R. Rhéaume	2010-15
Daniel Rozon	2002-09

The Council is required by the *NFWA* to comment every three years on the previous three years of NWMO activity. In addition, the Council is obliged to comment on the organization's five-year strategic plans and budget forecasts. These comments on the NWMO's work are published in the NWMO's triennial reports; they are submitted to Canada's Minister of Natural Resources and made public at the same time.

1.2 Relationship with the NWMO

The Council follows the development of the NWMO's plans and activities closely, and provides ongoing counsel and advice. We generally meet four times a year. The Chair works with staff to set the agenda. At our meetings, staff members make presentations on the NWMO's work, and members of the Council ask questions, request more information, raise issues, consider the NWMO's work, and provide advice. We hold an in-camera session at the end of most of our meetings, during which we deliberate without the presence of NWMO management or staff. The Council Chair provides a report to NWMO Board meetings to ensure a comprehensive exchange of information. Council members and the NWMO Board of Directors meet annually for an exchange of views, and in recent years, a focused discussion on one or two strategic issues.

In order to fulfil our legislated reporting requirements, the Council provides written comments on the NWMO's work. Previous comments were provided in the following documents:

- The NWMO's Final Study Report, *Choosing a Way Forward – The Future Management of Canada's Used Nuclear Fuel* (2005)
- The NWMO's Triennial Report 2008 to 2010, *Moving Forward Together* (2011)
- The NWMO's Triennial Report 2011 to 2013, *Learning More Together* (2014)
- The NWMO's Triennial Report 2014 to 2016, *Progress Through Collaboration* (2017)

In addition, several Council members have presented papers at international conferences commenting on the NWMO's work:

- *Canada's Approach to the Management of Used Nuclear Fuel: the Role of the Advisory Council to the Nuclear Waste Management Organization* by David Crombie and Derek Lister for the 15th Pacific Basin Nuclear Conference, Sydney, Australia, 2006.
- *Managing Used Nuclear Fuel in Canada – Challenges Ahead as a Repository Site is Sought* by David Crombie, Derek Lister and Daniel Rozon for the 16th Pacific Basin Nuclear Conference, Aomori, Japan, 2008.
- *Canada's Policy for the Management of Used Fuel: the Perspective of the Advisory Council to the Nuclear Waste Management Organization* by David R. Cameron, Derek Lister and Dougal McCreath. Proceedings of the 39th Annual Canadian Nuclear Society Conference, Ottawa, Canada, June 23-26, 2019.

The Council's activities are summarized on a yearly basis for inclusion in the NWMO annual report. The NWMO also documents the actions taken by the organization in response to our advice. They are recorded in tracking matrices, which are posted on the NWMO's website (www.nwmo.ca/advisorycouncil).

1.3 Evaluation framework

In order to fulfil our obligations to provide an independent review of the NWMO's work, we developed criteria for evaluation. In developing these criteria, we considered the mandate and mission of the NWMO, which are described earlier in the NWMO's triennial report. We paid particular attention to the NWMO's Ethical and Social Framework, and to the experience and recommendations of the Seaborn Panel, a Canadian Environmental Assessment Agency panel chaired by Blair Seaborn between 1989 and 1998. The panel examined the disposal concept for used nuclear fuel management proposed by Atomic Energy of Canada Limited (AECL) – placement in a deep geological repository. A major finding in the panel's report, entitled *Report of the Nuclear Fuel Waste Management and Disposal Concept Environmental Assessment Panel*, was that while the concept was technically sound, it did not have sufficient public support to allow the government to proceed.

Advisory Council evaluation criteria

In 2005, the Council developed a statement – *How the Advisory Council of the Nuclear Waste Management Organization Intends to Fulfill its Mandate* (available at www.nwmo.ca/ACMandate). The statement included four evaluation criteria (comprehensiveness, fairness and balance, integrity, and transparency) to provide a basis for our assessment of the NWMO's work.

In 2010, 2013, 2016, and 2019, we updated these criteria. Just as one of the cornerstones of Adaptive Phased Management (APM) is adaptability, so the evaluation criteria are also slightly modified over time to reflect the evolution of the NWMO's work. These are the standards we used to evaluate the NWMO's work over the last three years and to look ahead.

1. **Comprehensiveness.** Is the NWMO effectively evaluating and taking into account all reasonable alternative approaches and experiences of other organizations and jurisdictions? Is the NWMO comprehensively planning for all aspects of the project, including siting, transportation, and moving staff to the host community? Is the organization appropriately assessing the consequences to the community, both intended and unintended, of the arrival of a major project? Is the organization itself evolving and changing to keep pace with the growing and emerging needs of the project? Is the NWMO identifying and proactively mitigating political, policy, regulatory, and legal risks associated with project approval and construction? In addition to answering these questions, we evaluate how effectively the NWMO has integrated the guidance and knowledge it acquired from the APM Geoscientific Review Group (APM-GRG)[1], the Council of Elders and Youth[2], and the Municipal Forum[3] into its work.

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[1] The APM-GRG provides advice and guidance to the NWMO on the approach, methods and findings for the preliminary assessments being conducted as part of the site selection process. For more information, please visit www.nwmo.ca/apmgrg.

[2] The Council of Elders and Youth is an independent advisory body that provides counsel to the NWMO on how to apply Indigenous Knowledge to Canada's plan. For more information, please visit www.nwmo.ca/eldersandyouth.

[3] The Municipal Forum is an assembly of municipal association representatives with experience and expertise on municipal issues and challenges. The forum provides advice and guidance to the NWMO. For more information, please visit www.nwmo.ca/municipalorganizations.

2. **Fairness and balance.** Is there fairness and balance in the siting process as it seeks to ensure there is a compelling demonstration of willingness on the part of the community at the site selected? Is adequate consideration being given to diverse points of view and representativeness in the voices sought out and considered? Is due consideration being given to fairness and balance in the treatment of communities that are not retained in the site selection process, communities on transportation routes, and staff as the organization plans its human resources requirements in the host community?
3. **Integrity.** Is the NWMO fulfilling its mandate with integrity, honesty and consistency? In seeking partnerships with communities, including First Nation and Métis communities, is it respectfully undertaking meaningful deliberation and shared decision-making with those communities?
4. **Transparency and accountability.** Is the NWMO at all times transparent and accountable to the public, communities and stakeholders? Are decisions and activities clearly communicated? Is the NWMO appropriately involving communities in defining safety issues of societal concern?
5. **Technical and societal strength.** Does the NWMO have the human resources required to address the engineering and scientific dimensions of site characterization, repository design and safety assessment? Equally, does the NWMO have the human resources necessary to ensure the accurate understanding of the societal and Indigenous dimensions of the site selection process, as well as the delineation and evaluation of alternative transportation corridors? Included in this aspect of our assessment is ensuring that adequate provision is made for building capacity in the communities remaining in the site selection process, and once a site is selected, having in place, through retention, development and recruitment, the highly skilled people needed at the site.
6. **Financial capacity.** Does the funding formula adequately reflect the costs of the APM approach to dealing with Canada's nuclear fuel waste? Are cost estimates being kept up-to-date, and are financial contributions being adjusted to reflect these estimates?
7. **Culture of learning.** Is the NWMO actively pursuing new ideas and perspectives, and applying its learning – regarding science, technology, Indigenous Knowledge, history, ethics, sociology, and culture – in a responsive way? Is new knowledge being absorbed by its own staff, shared adequately with its partner organizations, and reflected adequately in all aspects of the work and activities of the organization?

In this triennial report, we provide our assessment of how effectively the NWMO is carrying out its mandate when viewed in light of these criteria.

2. Activities and comments: 2017 to 2019

This section provides the Council's comments on the work of the NWMO during the years 2017 through 2019. We provide an overview of our process and activities during the time period (Section 2.1). Then we provide details of our discussions and comments on the NWMO's work (Section 2.2).

2.1 Overview of Advisory Council activities

During 2017, 2018 and 2019, the Council held four formal meetings each year and was kept informed about the NWMO's activities between meetings. Council meetings included progress reports from the NWMO, discussions about current activities and plans, as well as updates on developments in other jurisdictions.

At our request, formal records of our meetings, our annual tracking matrix and copies of conference papers by Council members are posted on the NWMO website (www.nwmo.ca/advisorycouncil). Summaries of our work are published regularly in the NWMO's annual reports (www.nwmo.ca/reports).

We viewed and discussed correspondence received from outside parties. At the Council's request, the NWMO staff provided regular updates and assessments of potential risks to the NWMO's work that might result from internal or external socio-political, technical and organizational factors.

We held five additional, full-day working sessions and a conference call in 2019 to discuss the contents of this triennial report.

The Council's activities include participation on other advisory groups to the NWMO. We have a principal representative on each of the Municipal Forum and the Council of Elders and Youth, as well as an alternative representative for both groups. These representatives provide regular verbal reports and updates to the Council on the activities of these groups.

Advisory Council meetings
2017 to 2019

Feb. 13, 2017

May 29, 2017

Sept. 18, 2017

Nov. 28, 2017
(included meeting to exchange views with the Board of Directors)

March 20, 2018

June 25, 2018

Sept. 18, 2018

Dec. 4, 2018
(included meeting to exchange views with the Board of Directors)

March 25, 2019

June 17, 2019

June 18, 2019*

Sept. 24, 2019

Sept. 25, 2019*

Oct. 29, 2019*

Oct. 30, 2019

Dec. 3, 2019*

Dec. 4, 2019
(included meeting to exchange views with the Board of Directors)

Dec. 5, 2019*

* Working sessions to prepare Triennial Report

Guests

During the three-year period, the Council welcomed several guests to attend our meetings. Tom Isaacs, an expert on nuclear waste issues from the United States, is an advisor to the NWMO and other national nuclear waste programs. He attended the Sept. 18, 2017, meeting and called in to the Oct. 30, 2019, meeting to share his independent review of the NWMO's approach, criteria and methodology for stock-taking.

Dr. Michael Stephens, member of the APM-GRG, came to our Nov. 28, 2017, meeting to discuss geoscientific matters. The Council also welcomed guest Dr. Peter Ottensmeyer, former Chair of the Department of Medical Biophysics at the University of Toronto, to our Sept. 18, 2018, meeting to outline his views on reprocessing/recycling used nuclear fuel.

On Dec. 4, 2019, Dr. Sandy Cruden, professor, School of Earth, Atmosphere and Environment, at Monash University in Australia, presented on activities of the APM-GRG regarding the approach, methods, data, and criteria used to conduct geoscientific assessments of potential siting areas.

Responding to Triennial Report 2014 to 2016 recommendations

One of the Council's activities in 2017 to 2019 was reviewing with the NWMO how the organization was addressing the Council's 13 recommendations from the Triennial Report 2014 to 2016. The manner in which these recommendations were dispositioned is discussed in this chapter. In December 2018, we confirmed to the NWMO that we were satisfied that all recommendations had been addressed in a systematic and traceable manner.

Training and extracurricular activities

Members of the Council participated in activities beyond formal meetings to deepen our understanding of the NWMO's work and the context in which it occurs. Here are some highlights.

In February 2017, the Council visited the NWMO's proof test facility in Oakville, Ont. The facility is used by the NWMO's engineers to conduct scientific tests for full-sized components of the used fuel container (UFC) and multiple-barrier system that will be implemented in the deep geological repository.

Also in February 2017, the Vice-Chair of the Council reported to the Council on his experience attending the International Conference on Geological Repositories in Paris in December 2016. Among the delegates at that conference were many representatives from the municipal and Indigenous siting communities with which the NWMO is working, as well as a member of the Municipal Forum. It was noted by Council that the size of the NWMO contingent was illustrative of the organization's broad efforts in public engagement.

In March 2018, the Council received Indigenous cultural awareness training, which provided an opportunity to learn about Indigenous history, spiritual teachings, ceremonies, treaties, residential schools, and truth and reconciliation. The trainer was Lyndon Linklater from Thunderchild First Nation, Sask. A member of the Council attended two-day workshops in September 2018 and December 2019 hosted by the NWMO that brought together Indigenous Knowledge keepers and academics. Workshop attendees discussed ways to interweave Indigenous Knowledge and modern science in advancing elements of the multiple-barrier system that is planned in the deep geological repository. Additionally, the Council was pleased to participate in reconciliation training in October 2019, provided by Reconciliation Canada.

In May 2018, the Council's Vice-Chair attended the signing ceremony (for new or renewed co-operation agreements with counterparts from five countries) at the opening reception for the annual EDRAM meeting. While there, he met with then-Parliamentary Secretary to the Minister of Natural Resources Canada and the Assistant Deputy Minister. EDRAM is the International Association for Environmentally Safe Disposal of Radioactive Materials, an organization that promotes the exchange of knowledge among member countries. The 2018 annual meeting was held in Toronto and hosted by the NWMO. The Vice-Chair reported it was a productive meeting with a positive exchange of information with the Parliamentary Secretary on the work of the Council.

Several Council members contributed to the 39th Annual Canadian Nuclear Society Conference in Ottawa on June 23-26, 2019, including presenting the paper mentioned in Section 1.

In addition, a member of the Council attended the Nuclear Waste Management, Decommissioning and Environmental Restoration Conference in Ottawa in September 2019. Again, the NWMO's extensive efforts in engagement were noted by Council, as evidenced by the numerous delegates from the NWMO potential siting communities in attendance, as well as members of the Municipal Forum.

In December 2019, members of the Council visited the NWMO's new Mobile Learn More Centre.

2.2 Discussions and comments on the NWMO's activities: 2017 to 2019

Before outlining our discussions and comments in specific areas of the APM Project, the Council notes that we appreciated the strong and positive interactions and ongoing communications that occurred between the Council and the NWMO during this three-year period.

Our comments on the NWMO's work during the 2017 to 2019 period are provided below for the following 10 areas of focus, with a short conclusion at the end:

- Building sustainable relationships;
- Site selection process and post-site selection planning;
- Reconciliation;
- Technical program;
- Transportation;
- Environment;
- Financial surety;
- Planning and governance;
- Regulatory framework; and
- External factors.

2.2.1 Building sustainable relationships

A key element of the Advisory Council's work over the three years has been to track and evaluate the NWMO's continued engagement with the many groups involved in the long-term management of Canada's used nuclear fuel. These include potential host communities, First Nation and Métis organizations and communities, municipal associations, federal and provincial governments, young Canadians, and the public at large. An overview of our discussions on the NWMO's work in building sustainable relationships is provided on the following pages.

Ethical and Social Framework

One of the subjects of strong interest to Council over the three-year period was the NWMO's Ethical and Social Framework. The framework was approved in 2004 as recommended by a Roundtable on Ethics, and was reviewed by a group of ethics practitioners in 2011. In our previous Triennial Report 2014 to 2016 (Section 3.1), the Council made four recommendations regarding the Ethical and Social Framework:

- To make its application more explicit in all implementation plans and triennial reports.
- To consider providing support to communities to learn about it, strengthen it and explore how it can be put into practice during the site selection process.
- To seek to understand and apply the ethical and social values that are embodied in the First Nation and Métis communities in the siting study areas.
- In consultation with the Council, to conduct a review of its application every three years, as part of the triennial report process. Based on the outcome of these reviews, the NWMO should refine the Ethical and Social Framework if necessary to reflect the needs of each stage of the organization's work.

During the three-year period 2017 to 2019, the Council had lengthy discussions with the NWMO about work underway to address the Council's recommendations and increase its applicability to the current phase of work. The framework document has been substantially refined in light of recommendations from the Council.

The Council was pleased that the framework was subject to external review.

Council members suggested that the framework become a living document reflecting a broader articulation of enduring principles, including the principles outlined in the original framework, and a reflection of current and future siting activities (i.e. site selection and partnership development).

The NWMO has been receptive to the Council's suggestions and has acted on these recommendations.

Recognition programs

In the period 2017 to 2019, the Council discussed the principle-based program the NWMO uses to acknowledge the time, leadership and contribution of communities that stepped forward to advance Canada's plan for the long-term management of the country's used nuclear fuel. We reviewed proposed funding for the following categories of municipal and Indigenous communities: core communities; neighbouring and surrounding communities; recently engaged Indigenous communities and associations; and previous core communities that were removed from the siting process but remained as neighbouring communities.

We supported the NWMO's approach to funding to support building sustainable partnerships, and suggested the program should reflect a greater emphasis on communities conducting environmental studies and provide a clearer articulation of support for core communities. We further suggested that the NWMO provide a high-level summary report on communities' use of the funds and annually post it on the NWMO website. The NWMO agreed with this advice and will post the summaries.

Community engagement on safety

The Seaborn Panel report, which we refer to in Section 1, reached a key conclusion concerning safety of the nuclear fuel waste disposal concept that had been developed by AECL. The conclusion that "from a technical perspective, safety of the AECL concept has on balance been adequately demonstrated from a conceptual stage of development, but from a social perspective, it has not" continues to provide guidance on acceptance of the concept of managing used nuclear fuel waste. An important element of the seven elements the Panel stated as necessary to safety was that in order to be considered safe, a concept for managing nuclear fuel wastes must be judged, on balance, to be based on public participation in safety analyses.

In our previous Triennial Report 2014 to 2016 (Section 3.5.4), the Council recommended that the NWMO develop a participatory approach to engage the public and potential host communities in identifying, analyzing and addressing safety concerns.

In the three-year period 2017 to 2019, the NWMO shared with the Council updates on the ongoing process to engage the public and communities in discussions about safety. The NWMO reported that its goal is to ensure that the public and communities' concerns are addressed, that all scenarios are inclusive, and that technical and social safety are clearly linked. The Council was pleased to see the continued prominence of safety in the NWMO's work, and acknowledged that specific steps were being taken to define what safety means from a social perspective.

The Council continues to emphasize the importance of working with the public and potential host communities to ensure that their safety concerns are addressed.

Communication about the potential effects of radiation on humans

The Council continues to believe it is important to ensure that potential host communities and the public are well-informed about the health effects of radiation in the environment. In our previous Triennial Report 2014 to 2016 (Section 3.5.2), the Council recommended that the NWMO increase its efforts to ensure that potential host communities are provided with reliable information regarding the effects of low doses of radiation on human health.

During our meetings with the NWMO, Council members also noted that NWMO staff should be well-prepared to answer questions related to past international nuclear power incidents such as Chernobyl. Further, Council members suggested that legacy issues in a number of Indigenous communities related to mining and nuclear projects will need to be acknowledged.

The NWMO increased its efforts to ensure communities and the public receive information about this important topic, through presentations, infographics, focused campaigns, and website material and links to external resources.

Issues around safety and water

The Council stresses that the investigation of how groundwater moves in deep geological environments and how groundwater may interact with nuclear waste containers is critically important to the public and should be communicated accordingly. In our previous Triennial Report 2014 to 2016 (Section 3.5.3) and in the 2019 paper presented at the Canadian Nuclear Society conference, the Council recommended that the NWMO develop a plain language communication package regarding groundwater flow and interactions with nuclear waste containers in deep geological settings.

In response, the NWMO has developed several iterations of a presentation called *The Journey of Water*, which has been shaped by and provided to potential siting communities, including Indigenous communities.

The Council was pleased with the NWMO's collaborative efforts to translate this complex subject into understandable material and disseminate the information widely. We provided suggestions to enhance the presentation.

Willingness and partnership

The technical end point of APM is the centralized containment and isolation of Canada's used nuclear fuel in a deep geological repository located at a safe site *in an area with an informed and willing host*.

The Council has focused a great deal of attention on the subject of willingness. In our previous Triennial Report 2014 to 2016 (Section 3.8), we recommended that the NWMO explain, in its communications with the public and communities in the siting study areas, how its understanding of the willing host concept has been enhanced to include supportive and inclusive partnerships.

The NWMO has shared with us how the willing host concept is evolving to include supportive and inclusive partnerships, based on mutual trust. Furthermore, it is to be jointly defined with communities, to take into consideration multiple indicators, and to be clearly communicated to communities and the public.

We are satisfied with the NWMO's approach to this critical area and will continue to follow this item closely.

Youth engagement

Given that the APM Project will span many generations in the future, the Council continued to emphasize the importance of increasing youth awareness and understanding of the project and capacity for future decision-making. In the period 2017 to 2019, we were kept up-to-date on the NWMO's programs that build youth awareness and capacity. These include the Early Investments in Education and Skills program, Learn More programs, and the Sponsorships and Donations program.

In our previous Triennial Report 2014 to 2016 (Section 3.2), we recommended that the NWMO develop an evaluation system for its youth engagement program, based on desired outcomes and measurable goals. The Council reviewed a draft youth engagement reporting scorecard to provide an at-a-glance quantitative view of performance against desired outcomes and performance trends over time. We noted that multiple generations are being engaged in learning about the project, and we are satisfied that the NWMO has addressed our concerns regarding the youth file.

First Nations and Métis engagement

During 2017 to 2019, the Council continued to advocate and provide advice on ways to build solid and healthy relationships with First Nation and Métis organizations and communities. We acknowledge that the NWMO respectfully seeks to understand and honour Indigenous perspectives, and continues to demonstrate leadership in its Indigenous engagement program.

The Council heard regularly from the NWMO's Indigenous Relations team, which ensures there are robust policies in place to guide its work. The NWMO participates in a wide range of Indigenous events and activities, and receives ongoing guidance from the Council of Elders and Youth. It continues to learn and teach about legacy issues, mark important occasions through ceremony, and adhere to Indigenous Knowledge and Reconciliation policies.

In this three-year period, the NWMO successfully completed consultation with five First Nation communities and the Métis Nation of Ontario regarding drilling boreholes in the Ignace area. The NWMO also worked collaboratively with a nearby Indigenous community, which provided guides to help with fieldwork.

The Council continued discussions with the NWMO on the relationships and interactions between municipalities and the surrounding Indigenous communities, engagement of treaty organizations, and the involvement of women's and youth organizations in Indigenous communities.

2.2.2 Site selection process and post-site selection planning

Since 2010, the NWMO has been working collaboratively with interested communities to select a site where Canada's used nuclear fuel can be safely and securely contained over the long term.

During the 2017 to 2019 period, the NWMO continued to narrow its focus to areas with strong potential to host the facility. When 2017 began, there were nine communities remaining in the site selection process. This number was narrowed down three times by the NWMO during the three-year period. At the end of 2019, there are two potential siting areas remaining in the process.

During this time, the Council continued to seek information and provide advice on various aspects of the site selection process. Site selection and stock-taking were discussed in detail at all the Council's meetings, and we provided ongoing advice on the pace of the process, transparency, fairness, funding, and possible risks related to narrowing down. The Council sought to ensure that the NWMO's selection criteria are grounded in the values expressed in the Ethical and Social Framework.

We noted that federal, provincial, municipal, and Indigenous election cycles might impact the timeline for selecting a site by 2023.

We supported the NWMO's site selection process, which was rolled out according to the stock-taking plans we reviewed. The Council believes the NWMO's approach to narrowing down is systematic and structured, and the decisions rest on a solid methodology.

We noted during the three-year period:

- As the number of potential host sites is narrowed down, the external interest in the project may increase dramatically.
- Communication on narrowing down decisions would become more and more challenging as the number of communities in the process diminishes.
- International experience would be useful in shaping expectations for the NWMO's siting communities.

Third-party reviews

Guest Tom Isaacs, an independent reviewer (mentioned in Section 2), provided reviews of the narrowing down process, which looked at the NWMO's approach, criteria and methodology for stock-taking. He reported to the Council that he was supportive of the NWMO's approach and that the quality of decision-making by the NWMO was very high. He also provided some suggestions to further enhance the methodology for future assessments.

Borehole drilling

During 2017, 2018 and 2019, the NWMO completed drilling, down-hole testing and instrumentation of its first two deep boreholes for the APM Project, and more boreholes are in progress. The boreholes are located between Wabigoon Lake Ojibway Nation and Ignace, Ont., in a rock formation known as the Revell Batholith. The Council was updated throughout the three years on borehole drilling activities and plans, as well as related social media outreach and other communications. The Council asked that technical findings from borehole drilling such as hydraulic conductivity be explained to the public using plain language.

The Council asked the NWMO to ensure there were employment opportunities related to borehole drilling in the local siting communities. It was noted that the NWMO is working with the contractors to maximize these opportunities.

We were also kept up-to-date on, and asked questions about, the status of technical studies being conducted on borehole samples.

Land access

During the time period 2017 to 2019, the Council had lengthy discussions with the NWMO on matters related to land access in areas within the site selection process. These conversations centred around community engagement, timelines, political factors, Indigenous consent, contingency plans, and the complexities of accessing private versus Crown land.

The Council cautioned that some communities in the NWMO's site selection process may suffer from "process fatigue" related to borehole drilling and land acquisition.

We were pleased to hear that strategies and plans are being developed by the NWMO to mitigate this issue and guide land acquisition activities in both southern and northern Ontario.

Post-site selection planning

The Council was kept up-to-date on how the NWMO is preparing to begin activities at the selected site, beyond 2023.

The Council noted that the NWMO's proposed move to the host community could be disruptive to both the community and the NWMO itself, and therefore, the organization would benefit from examining best practices from similar moves by large organizations in other industries and government ministries.

We discussed the NWMO's plans for the Centre of Expertise that will be established in or near the area selected to host the deep geological repository. The NWMO confirmed that the centre will be developed collaboratively with those living in the area, and that it will eventually be home to an active technical and social research and technology demonstration program.

The Council continued to discuss with the NWMO the importance of building the resilience in the siting communities that will be needed once a site is selected.

We noted the NWMO acknowledges the broad support that will be needed once a single site is selected and is acting on plans for achieving the needed support. Through its visibility strategy, the NWMO is informing and involving many audiences about its progress in implementing APM. We provided a number of suggestions in relation to the NWMO's visibility strategy, which are outlined in Section 3.

2.2.3 Reconciliation

The Truth and Reconciliation Commission of Canada in 2015, in call to action #92, called upon the corporate sector to build respectful relationships with Indigenous peoples, and provide education for management and staff on the history of Indigenous peoples, including the history and legacy of residential schools.

During the years 2017 to 2019, the Council has received regular updates on the steps the NWMO is taking towards reconciliation. For instance, a majority of the NWMO's staff has participated in reconciliation training, as has the Council and the Board. We have been impressed with the work the NWMO has undertaken in this area and congratulate the organization for its approach.

The Council was involved in discussions about the substance and language of the NWMO's Reconciliation Statement as it was being developed. In 2018, the statement was finalized through an Indigenous ceremony attended by senior staff, the Board of Directors and the Council of Elders and Youth.

Building on the statement, the NWMO worked on a Reconciliation Policy, a draft of which was reviewed by the Council. We were supportive of the policy as written, and emphasized the importance of developing assessment tools to measure the organization's progress against its stated commitment to reconciliation. The policy was approved by the Board in September 2019 and blessed through Indigenous ceremony in October 2019. We were pleased to see that the NWMO issued a reconciliation assessment tool in November 2019. The Council fully accepts the guidance of the Reconciliation Policy and assessment tool, which will aid us in assessing the NWMO's activities.

2.2.4 Technical program

During the period 2017 to 2019, the Council received regular updates on the technical program of the NWMO. Our focus continued to be on safety as we considered the NWMO's innovative work on the following:

- Development of the NWMO-designed UFCs, which are made from standard steel piping machined to size and coated with copper for protection against corrosion;
- Technical improvements in copper-coating systems;
- Advancing the hybrid laser arc welding process, which will be used to seal the UFCs;
- Development of the equipment that is used to hold and rotate the UFCs during closure welding;
- Preparing for serial manufacturing of the UFCs;
- Further refinement of the used fuel transportation package system;
- Design and fabrication of the highly compacted bentonite clay buffer boxes that will contain the UFCs in the deep underground;
- Design of a humidity-controlled storage area for the buffer boxes;
- Preparation of a full-scale mock-up of the underground emplacement rooms where the buffer boxes will be placed;
- Development of a bentonite block handling system using readily available materials and adapting them for this purpose;
- Development of a bentonite gapfill emplacement machine;
- Work to prepare for emplacement trials; and
- Updates on safety cases for both sedimentary and igneous rock.

The Council noted favourably that the NWMO has research underway at multiple universities to better understand how the system of engineered and natural barriers will work together to isolate used nuclear fuel from the surrounding environment.

We also observed the NWMO's continued involvement in international collaborations, conferences and educational opportunities, and that the APM Project continues to attract considerable international interest from countries seeking to learn from both the social and technical aspects of the Canadian experience.

In our previous Triennial Report 2014 to 2016 (Section 3.6), the Council recommended the NWMO consider establishing additional mechanisms, including independent experts with international experience, to provide periodic, comprehensive evaluation of scientific and technical aspects of the APM Project and make the results publicly available.

The Council is satisfied that for the engineering program, the NWMO has opted for the approach of peer reviews for specific elements and/or activities versus a holistic review of the overall design and proof testing program. An example of this was the generic corrosion peer review report, which the Council reviewed in detail, and which is posted on the NWMO's website (www.nwmo.ca/2016corrosionreport).

In addition, the NWMO seeks reviews from the Canadian Nuclear Safety Commission (CNSC) on aspects of the technical program. These have recently included review of the methodology of recent safety cases, which are simulations that calculate repository performance in various rock settings for one million years or longer. The CNSC also reviewed a Pre-Licensing Vendor Design Review of the UFC design and provided a public statement on the adequacy of the NWMO's product. The NWMO has also outlined its intent to conduct a comprehensive international independent review at a later stage in the program.

In emphasizing safety in all aspects of technical work, we noted that public scrutiny tends to focus on worst-case scenarios and stressed that it is necessary for the NWMO to take this into account.

2.2.5 Transportation

Ensuring Canada's used nuclear fuel will be transported safely to the selected repository site from the reactor sites where it is presently stored is the NWMO's responsibility.

The issue of transportation was a major focus of the Council's interest over the three-year period.

The NWMO's transportation planning work, which is ongoing and which the Council watches closely, includes: 1) an engagement program that follows the principles and values of the overall APM social program, and 2) a technical program that focuses on the safety of the transportation packages and modes of transportation.

While transportation is not expected to begin until 2043, the Council emphasized that work undertaken now is of vital, long-term importance. It will take many years to build knowledge and a level of awareness for people on the transportation routes. We acknowledge that the NWMO is doing good work to understand what is required to develop a socially acceptable transportation plan, to develop mitigation measures, to generate meaningful dialogue around transportation – including with municipal and county road staff and first responders – and to conduct public attitude research to help guide plans.

2.2.6 Environment

In our previous Triennial Report 2014 to 2016 (Section 3.4), we recommended that the NWMO undertake a scan of best practices for environmental sustainability in related industries and that the NWMO develop a Statement of Corporate Environmental Responsibility.

During the period 2017 to 2019, the NWMO developed a draft Corporate Environmental Responsibility statement and presented it to the Council for review. The Council had a lengthy discussion on the statement presented.

The Council suggested there should be a strong link between the NWMO's environmental sustainability statement and the work underway in partnerships. We further suggested the statement should include Indigenous environmental values.

We noted favourably that natural environment is one of the five assets in the sustainable livelihoods framework the NWMO is using to explore well-being and partnership with communities.

2.2.7 Financial surety

The Council continued to receive financial reports from the NWMO on an annual basis. The reports show that the NWMO maintains a lifecycle cost estimate and continues to ensure funds are available to pay for the safe, long-term management of Canada's used nuclear fuel. We are satisfied that the lifecycle cost estimate and financial surety mechanisms have been peer-reviewed and are in good order.

2.2.8 Planning and governance

The Council was pleased to see a strengthening of planning and governance activities within the NWMO in the three-year period from 2017 to 2019. We noted that during the three-year period, the NWMO experienced changes in leadership and a quickening of the pace of work. The NWMO has continued to conduct itself with fairness, integrity and transparency.

During the three years, the Council continued to provide advice on the NWMO's business and implementation plans, stressing the importance of pursuing new ideas, maintaining a culture of learning, and managing the required changes to the organization as the process moves forward.

Knowledge management

In our previous Triennial Report 2014 to 2016 (Section 3.9), we recommended that the NWMO review best practices in related industries and consider developing its own knowledge management system.

The NWMO outlined the actions it took, or was planning to take, in response. This included participation in the Nuclear Energy Agency (NEA) Preservation of Records, Knowledge and Memory Across Generations working group.

The Council acknowledged this was a positive development and stressed that knowledge management goes beyond record-keeping and should include knowledge management of social and Indigenous components as well. The NWMO agreed and reported to Council it is acting on this and has integrated knowledge management elements in its 2020-24 business plan.

Business risk assessment

During the period 2017 to 2019, the Council reviewed and discussed in detail with the NWMO the possible risks related to the APM Project. During these three years, the NWMO developed a new risk reporting system, which the Council reviewed. It tracks social/community risks, risks related to regulatory requirements, potential legislative changes, legal risks, and emerging risks.

Council members sought to better understand the risk reporting methodology, how the scoring was done and how "likelihoods" were predicted. After providing some suggestions to enhance the clarity of some aspects of the report, the Council was pleased with the systematic and thorough procedure that is being taken by the NWMO to identify, assess and mitigate risks.

2.2.9 Regulatory framework

The APM Project is subject to a complex regulatory approval process that has evolved and changed over the last three years. APM will require approval from the CNSC, Transport Canada, various federal and provincial agencies and departments, and municipalities. A licensing decision by the CNSC on a repository can be taken only after the successful completion of Canada's new impact assessment process.

Because of this evolving regulatory environment, the Council believes it is increasingly important for the NWMO to prepare as early and as thoroughly as possible for the regulatory process.

We note that the NWMO is proactively monitoring the evolving regulatory landscape to understand and prepare for regulatory expectations.

2.2.10 External factors

The Council stays up-to-date and discusses with the NWMO the many external factors that could affect the APM Project. These include developments in the nuclear industry in Canada and other countries, disposal projects for other categories of nuclear waste, social and technical aspects of deep geological repositories in other countries, decisions on other large Canadian energy projects, changes to NAFTA, and the implementation of Canada's new *Impact Assessment Act*.

The Council is also interested in following developments in small modular reactors (SMRs), the types of fuel waste that may result and the potential impacts on APM.

2.2.11 Conclusion

Over the period 2017 to 2019, the NWMO has been receptive and responsive to suggestions by the Council. We congratulate the organization for its creative, innovative and collaborative approach to advancing Canada's APM plan.

3. Implementing Adaptive Phased Management 2020 to 2024

In this section of the report, we review the November 2019 draft of the NWMO's five-year strategic plan, *Implementing Adaptive Phased Management 2020 to 2024*, and provide comments and recommendations regarding future work.

3.1 Reflections on the planning period: A turning point

In discussing the NWMO's strategic planning document, we note that the APM Project is approaching a critical juncture. The site selection process that was initiated by the NWMO in 2010 is drawing to a close. Initially, 22 communities stepped forward to learn more about APM, and 21 of them requested preliminary assessments. The ensuing site selection process has followed rigorous ethical guidelines, increasingly detailed technical and social studies, and deep ongoing engagement to gradually narrow down the number of communities with strong potential to host the deep geological repository. As 2020 begins, there are two potential siting areas remaining in the process. In 2023, the NWMO plans to have selected a single, preferred site.

Strong emphasis in the NWMO's work plans in the past has been placed on building sustainable relationships, collaboratively implementing the site selection process, and demonstrating the safety and feasibility of the repository and engineered-barrier design at hypothetical sites.

Over the next five years, the emphasis of activity will pivot to engaging the remaining communities and their regional partners in an even more focused manner, implementing partnership agreements, and building robust relationships. It will also involve developing a strong technical safety case at a real site, preparing to undertake impact assessment and licensing processes, and finally, planning construction of the Centre of Expertise at or near the selected site, which should be in operation soon afterwards.

Given this, the ability of the NWMO to adapt to significant changes in the nature of its work is critical.

As the 2023 milestone approaches, the project will begin to feel more real to Canadians, and we believe there will be significantly greater scrutiny and pressure on the NWMO, on governments at all levels, and on the two potential siting areas – from the public, the media, non-governmental organizations, and other actors. This could leave the organization, and the project, vulnerable if a variety of measures are not taken to prepare adequately.

It is our view that the organization's fundamental values of safety, integrity, excellence, collaboration, accountability, and transparency, to which it has adhered with dedication to date, as well as its commitment to clear communications, will continue to provide a reliable compass.

Further, the Council suggests the central tenets of APM – that APM be carried out in manageable phases, and that it allows for flexibility and adaptability in the pace and manner of implementation – are more important than ever. An increasingly publicized issue that may have implications for APM in the long term is the development and possible deployment of different reactor technologies and different forms of used fuel. This includes SMRs, which are being developed for demonstration in New Brunswick, Ontario and Saskatchewan. Whatever reactor types may be developed in Canada, there will be a need for used fuel to be managed, and we note that the adaptive nature of the APM approach is well-suited to such issues. The NWMO is actively following the situation. It will be important for the organization to keep the public and concerned communities up-to-date about the implications for APM of these technologies.

We congratulate the NWMO for showing a readiness to learn from its experiences, to adjust according to new information, and to evolve with APM.

3.2 Emerging strategic imperatives

In reviewing the November draft of *Implementing Adaptive Phased Management 2020 to 2024*, we concluded that the NWMO, standing as it does at the cusp of a major shift, has developed an appropriate approach and strategy for the next five years.

We identified four strategic imperatives for careful attention that are particular to this time in the NWMO's history: ensuring the integrity, fairness and comprehensiveness of the site selection process; implementing the new Reconciliation Policy; preparing for regulatory and political processes; and preparing the organization itself, as well as communities remaining in the site selection process, for upcoming transitions.

In addition to these emerging strategic imperatives, we highlight three items for continued vigilance – safety, defining social willingness, and transportation.

3.2.1 Ensuring the integrity, fairness and comprehensiveness of the final stage of the site selection process

As the site selection process draws to a close, it will be necessary for the NWMO to assure that the process used to select the preferred site is sound and defensible. The organization will need to stay true to the values that have served it well over the last 17 years. It will also need to demonstrate that it has continued to work very closely and collaboratively with communities, including Indigenous communities, in defining social willingness, ensuring community well-being, and building long-term resilience and capacity.

In the first few years of this planning timeline, there will be a two-region, north-south dynamic in play. This could lead to regional and political tensions, which the NWMO will need to manage.

The Council reiterates the need for transparency and fairness in narrowing down from two potential siting areas to one. We underscore the importance of the NWMO explicitly preparing both sites for each potential outcome – whether it be hosting this major project or exiting the process. Included in these preparations should be an extensive assessment of both intended and unintended consequences.

Participants and observers will ask: What is the methodology for decisions? What are the criteria? How are they weighted? The announcement of the final result will bring increased scrutiny to the project and, no doubt, opposition.

It is vital that all decisions be clearly justified, that the process be comprehensive, that the rights of all parties be respected, and that communications be effective. The Council cannot stress enough the importance of clear communications and transparency as these developments unfold and scrutiny increases.

Further, we emphasize the importance of the NWMO continuing to provide support and resources towards fostering positive relationships and developing sustainable partnerships. These relationships and partnerships must be tailored to the communities involved, including Indigenous communities and neighbouring municipalities, and should leave communities better off for having participated in the process.

3.2.2 Implementing the Reconciliation Policy

As mentioned in Section 2.2.3, the NWMO has issued a Reconciliation Policy to apply to all NWMO activities. This arose from the long-standing presence and guidance of the Council of Elders and Youth. Reconciliation, as defined by the Truth and Reconciliation Commission of Canada, is an ongoing process of establishing and maintaining respectful relationships with First Nation, Métis and Inuit peoples. In addition to the policy, the NWMO has issued a reconciliation assessment tool, an important and novel instrument in determining the effectiveness of its policies and procedures.

We congratulate the NWMO for embracing the principles outlined in the Reconciliation Policy, and for continuing to follow guidance from the Council of Elders and Youth. The policy and associated assessment tool together provide a leading example for other corporations across the country. This kind of innovative work does not happen overnight: it is the culmination of a long history of the NWMO engaging respectfully with Indigenous peoples.

Over the next five years, we expect implementation of the Reconciliation Policy and assessment tool to be increasingly central to activities. We see this as an opportunity and a challenge – to keep the policy alive and continuously weave reconciliation into the fabric of the organization. Embedding the policy successfully will affect every member of the organization and perceptibly change practices. The organization will need to ask itself: Is engagement with Indigenous communities deep enough? Are we correcting our course where necessary? Are we continuously looking through a reconciliation lens?

3.2.3 Preparing for regulatory and political processes

The Government of Canada has put in place new impact assessment legislation.

We recommend that the NWMO work closely with the federal government to understand the evolving regulatory landscape, and that, equally, the federal government help to provide clarity and certainty with regards to what is necessary within the new regulatory parameters. The NWMO will need to ensure decision-makers are educated about the robust processes by which APM was designed.

On the regulatory side, in the next four years, it will be necessary for the NWMO to obtain a high degree of confidence that it is going to meet the regulatory requirements for both construction and transportation at whichever site is selected. This would include preparing for formal impact assessment submission to the extent possible for both of the two potential siting areas so long as they remain in the process.

The Council stresses the importance of clear communications when talking about this aspect of the NWMO's work. We suggest the organization aim very high in this regard, performing at the highest international standard on its technical, social and engagement communications work, as part of planning for the regulatory phase.

On the political side, the NWMO will need to work closely with all provincial and federal governments involved, as well as opposition parties, not only to clarify the regulatory processes required to assess the project, but also to seek and receive from them clarity on their expectations and concerns. We advise the NWMO and pertinent government bodies to work together to ensure there is a mutual and continual exchange of information.

3.2.4 Preparing the NWMO itself and communities for upcoming transitions

The period 2020 to 2024 will have a major impact on the NWMO itself.

Over the next five years, the NWMO will undergo a transition in the nature of its work, from having a site selection focus to having a project implementation emphasis. Internally, the NWMO will need to ensure it has the human, organizational and information capital in place to proceed with implementing Canada's plan for the long-term management of used nuclear fuel.

The organization should prepare for a major upheaval as it moves significant resources from its current location in downtown Toronto to the selected site. It is critical that the NWMO prepare now for this transition and continue to retain and recruit the highly skilled people it needs to carry out its mandate. We recommend the NWMO outline the impact that a major move from Toronto to a small community would have on the organization and on the community.

Simultaneously, the NWMO will need to support the selected site with capacity-building and other initiatives. The APM Project represents a large social, economic and technical project for communities in the selected region, including Indigenous communities and neighbouring municipalities. It is crucial that the NWMO attend to both its own transition priorities and the transition-related and infrastructure-related needs of these communities.

3.3 Continuing items of importance

In addition to our four key strategic imperatives above, the Council would also like to highlight three particular items of continuing importance over the next five years. We urge the organization to keep these matters in sharp focus.

3.3.1 Safety

In the draft *Implementing Adaptive Phased Management 2020 to 2024*, the NWMO expresses its commitment to keeping people and the environment safe as being first and foremost in everything it does, and we commend the NWMO's implementation of this fundamental objective. The NWMO also describes the preferred site for the deep geological repository: a rock formation with characteristics that support the safe, long-term containment of used nuclear fuel.

The NWMO has prepared several generic safety case studies for crystalline and sedimentary rock settings by applying preclosure and postclosure safety assessment methodology. These assessments examine features of the repository system, test key safety parameters, and confirm that people and the environment will be safe in the long term under various scenarios. Feeding into assessments is the long-term integrity of the containment canisters under a variety of possible conditions, which continues to be supported by ongoing research programs.

In the period 2020 to 2024, the NWMO will build on this work by developing preliminary safety assessments that are site specific rather than generic. The NWMO states its commitment to continuously improve technical knowledge in collaboration with international partners. This includes participating in the NEA of the Organisation for Economic Co-operation and Development to exchange information in such areas as safety case development, and in initiatives with the International Atomic Energy Agency involving nuclear waste issues.

The NWMO will also continue to conduct joint research projects with international organizations and counterparts in other countries. In addition, research partnerships with universities play an important role in ensuring the NWMO's technical work is scientifically rigorous. The work is reviewed periodically by international panels of independent experts.

While the Council applauds the NWMO's commitment to keeping people and the environment safe through rigorous scientific assessment, we stress that a vital component of safety is the social element as noted in our previous Triennial Report 2014 to 2016.

We strongly recommend that the NWMO continue to develop a participatory approach to engage the public and potential host communities in identifying and addressing their safety concerns, i.e. safety from a social perspective. How do people in the communities, including Indigenous communities, define safety concerns, and how can these concerns be addressed? How is safety defined from a social perspective when it comes to transporting used nuclear fuel?

3.3.2 Social willingness

Defining "social willingness" is one of the most challenging and innovative activities in the next phase of the NWMO's work. It will be important for the organization to sustain the many relationships it has established as discussions move forward and partnerships are built.

In the draft *Implementing Adaptive Phased Management 2020 to 2024*, the NWMO outlines how it will build supportive and resilient partnerships with communities, leading to mutually supported partnership agreements, and begin jointly implementing those agreements.

It will also develop project implementation plans compatible with the well-being of communities, including a vision for the Centre of Expertise at or near the repository location. It will work with communities to build awareness and support to achieve willingness.

The Council notes that the NWMO has a number of excellent policies and plans in place that continue to guide its work, including the Ethical and Social Framework and the Reconciliation Policy. We are supportive of the respectful and collaborative manner in which the NWMO is approaching social willingness and partnerships.

As noted in Section 2, the NWMO has shared with us how the willing host concept has evolved to include supportive and inclusive partnerships. We have been assured the concept will be jointly defined, will reflect mutual trust and working together, will take into consideration multiple indicators, and will be clearly communicated to communities and the public.

We suggest that, as the number of potential siting areas is narrowed from two to one, it is important for the NWMO to provide clarity and transparency on how it, in collaboration with communities, defines indicators of willingness. Then, beyond site selection, partnerships must be based on dynamic and resilient relationships to sustain willingness into the future.

We recommend that as the organization seeks to advance partnership discussions, it continue to engage with the Indigenous communities directly involved, as well as surrounding Indigenous communities and organizations as appropriate.

3.3.3 Transportation

In the draft *Implementing Adaptive Phased Management 2020 to 2024*, the NWMO outlines its responsibility for establishing safe, secure and socially acceptable plans for transporting used nuclear fuel from the current interim storage sites to the used fuel repository.

The Council notes that used nuclear fuel has been transported safely under strict regulatory controls for many years across several provinces of Canada.

In the APM Project, transportation planning and evaluations must fully address regulatory requirements for safely transporting used nuclear fuel through different provinces.

Well in advance of seeking regulatory approval and licensing from the regulatory authorities, the NWMO will need to meaningfully demonstrate the safety and security of proposed transportation systems to citizens, including Indigenous communities. Transportation is an important focus of public engagement, and a high level of social confidence in safety will need to be attained before transportation to the repository can begin.

In the next five-year period, the NWMO will undertake transportation logistics studies and risk assessments; consider road and rail transport; seek CNSC design approval certificates for road and rail transport packages; and continue ongoing dialogue with municipalities, First Nation and Métis communities, municipal associations, and Indigenous organizations, regarding ways to communicate about transportation plans.

We note that the NWMO's work on transportation is underway. The organization is engaging with communities that may be on a transportation corridor for used nuclear fuel, conducting dialogue and using public attitude research to explore public understanding, questions and concerns, and reviewing the experience and best practices for transportation of hazardous materials, including transportation of nuclear waste in Canada and internationally. In the interest of transparency, the organization publishes a "What we heard about transportation" document annually on its website.

We stress that transportation engagement must remain a very high priority. We recommend the NWMO develop a deep and thorough understanding of what safe transportation means to communities along the transportation corridors. The organization will need to demonstrate it is able to transport used nuclear fuel safely to the two remaining sites in a manner that addresses public concerns.

4. Reflections on planning for long-term nuclear waste management in Canada

In this Advisory Council Triennial Report, we have provided our comments as required under sections 8 and 18 of the *NFWA*. In this final section, we offer some context for the APM Project and provide our reflections at this critical juncture.

In reviewing the work of the NWMO over the last three years and its plans for the next five years, we note the organization is reaching a turning point as it evolves from a site selection organization to a project implementation one. It is our view that the NWMO is well positioned to continue carrying out its mandate to safely manage Canada's used nuclear fuel in a collaborative and responsible manner. In fact, the NWMO is a high-performing and innovative organization.

Nuclear fuel wastes have been accumulating in Canada for more than 50 years, and this continues today at about 90,000 spent fuel bundles per year. Over this period, studies and reviews have consistently concluded that for Canada the management of fuel wastes should be addressed through construction of a deep geological repository (e.g., The Hare Report, 1977)[4], which aligns with international practice.

As directed jointly by the governments of Canada and Ontario, and after more than a decade of research, development and analysis, AECL submitted to the federal government a concept for geological disposal of nuclear fuel wastes, without identifying any specific site[5]. In 1988, this concept was referred for public review by the Government of Canada under the federal environmental assessment and review process. After almost 10 years of public consultations and review, the Environmental Assessment Panel (The Seaborn Panel) concluded in 1998 that while the concept was potentially acceptable from a technical perspective, it had not been demonstrated to have broad public support[6].

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[4] *The Management of Canada's Nuclear Wastes*. F.K. Hare, Chairman, A.M. Aitken, J.M. Harrison (report of a study prepared under contract for the Minister of Energy, Mines and Resources Canada). Report EP776. 1977.

[5] *Environmental Impact Statement on the Concept for Disposal of Canada's Nuclear Fuel Waste*. Atomic Energy of Canada Limited. Report AECL-10711, COG-93-1. 1994.

[6] *Nuclear Fuel Waste Management and Disposal Concept*. Report of the Nuclear Fuel Waste Management and Disposal Concept Environmental Assessment Panel (The Seaborn Panel). Minister of Public Works and Services Canada, Catalogue No: EN-106-30/1-1998E. 1998.

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In response to the panel recommendations, the Government of Canada passed the *NFWA* in 2002, under which the NWMO was formed. The stated objective of the *NFWA* is to provide a framework to enable the Governor in Council to make, from the proposals of the waste management organization, a decision on the management of nuclear fuel waste that is based on a comprehensive, integrated and economically sound approach for Canada.

Following three years of extensive dialogue with Canadians, including Indigenous peoples, in 2005, the NWMO presented its final study, *Choosing a Way Forward – The Future Management of Canada's Used Nuclear Fuel (Final Study)*. The study outlined three technical options for the management of fuel wastes: deep geological disposal in the Canadian Shield; storage at nuclear reactor sites; and centralized storage, either above or below ground. In 2007, by an Order in Council, the Government of Canada accepted the NWMO's recommendation of an adaptive, phased approach to the siting and development of a deep geological repository for the long-term management of nuclear fuel waste, referred to as Adaptive Phased Management (APM).

Over the past 17 years, the Government of Canada has received annual reports, as well as triennial reports on the progress of the NWMO's work. Regular briefings with Government of Canada senior public servants and political representatives have enabled the NWMO to answer questions and keep the government abreast of developments through each phase of the project.

The site selection process, which is centred on being open, fair and inclusive, and is guided by an Ethical and Social Framework, began in 2010. Today, the extensive process is drawing to a close. In 2023, a single, preferred site with informed and willing host communities will be selected. We anticipate this announcement will bring increased scrutiny and opposition to the project.

We stress that successful progress of the APM Project relies on the continuing and steadfast commitment of the Government of Canada to its selection of APM as the preferred and responsible approach for the management of Canada's accumulating nuclear fuel wastes. It would be timely for the Government to reaffirm this commitment.

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(Estimates of timelines)

WHERE WE ARE GOING

2023

A single, preferred site is selected

The site to host the deep geological repository.

2023-26

Impact assessment project description and studies are submitted and approved*

An impact assessment is required for a licence for the repository, under the *Nuclear Safety and Control Act*.

Licence to Prepare Site application is submitted and granted*

The application focuses on the suitability of the site and the activities necessary to prepare for construction such as clearing and grading.

2024

Licence application to begin construction of the Centre of Expertise is submitted

The centre supports a multi-year program of technical testing and verification, and ongoing planning with community members.

2028-32

Construction licence application is submitted and granted*

The application seeks approval for the design of the nuclear facilities the NWMO will build.

2033

Design and construction start

The NWMO starts construction of the repository and associated surface facilities at the selected site.

2043

Operations begin

The NWMO begins transportation and emplacement of Canada's used nuclear fuel in the deep geological repository.

2088

Post-operations commence

The NWMO monitors the site for about 70 years and then starts decommissioning it.

2020 | 2030 | 2040

*Timelines for regulatory approvals determined by legislative framework.
www.canada.ca/en/impact-assessment-agency/services/policy-guidance/impact-assessment-process-overview/phase1.html

nwmo

NUCLEAR WASTE MANAGEMENT ORGANIZATION

SOCIÉTÉ DE GESTION DES DÉCHETS NUCLÉAIRES