nwmo news

Nuclear Waste Management Organization

Volume 16, Issue 2
2018

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What is the rock telling us?

Rigorously managed data will help form the answer



Members of the Geoscientific Data Management System team (left to right): Jim McLay, Andre Vorauer, Christiaan Piller, and Alec Blyth.

As the Nuclear Waste Management Organization (NWMO) drills its first bore-holes to understand rock characteristics at potential repository sites, it is of paramount importance that the information coming to the surface from deep underground is managed with consistency, security and quality assurance.

Enter members of the NWMO's Geoscientific Data Management System (GDMS) team and the sophisticated software they use to manage the information.

"We have created a framework for describing the data that is very controlled and ensures the pedigree of the information," says Dr. Alec Blyth, Section Manager of Geoscientific Site Evaluations and GDMS System Manager. "This is a legacy issue. We are securing our data assets, which are fundamental in decision-making, and also preserving them for future generations."

See What is the rock telling us? p. 3

The NWMO plays prominent role at CNS conference

The NWMO played a prominent role in the Canadian Nuclear Society (CNS) 38th annual conference in Saskatoon on June 3 to 6.

In addition to chairing an opening day plenary session, NWMO President and CEO Laurie Swami also presented as part of a day two panel on "Developments in the Canadian Nuclear Sector."

"My job and that of the NWMO is to ensure the safe, long-term management of used nuclear fuel," she told the diverse audience in her address. "We have to get this right not just for the generation following us, but also for the generations and generations of Canadians to come."

See CNS conference, p. 8

Multi-university corrosion research project receives $4 million in Ontario funding

The NWMO has been instrumental with four Ontario universities in winning a research grant to further study the long-term stability of used nuclear fuel containers for deep underground applications.

The new $4-million five-year research excellence grant from the Ontario Research Fund builds on funding that is already in place from the NWMO and the Natural Sciences and Engineering Research Council of Canada for this multidisciplinary initiative.

See Multi-university corrosion research project, p. 3



The new funding will bring researchers together. Here, scientists from the NWMO and Western University visit a national research facility where coatings are made and applied to prototype used nuclear fuel containers.

MESSAGE FROM THE CEO

Sustaining momentum

As we head into the second half of the year, I am extremely proud of the level of focus across our organization and the milestones we have achieved. From the completion of the first borehole near Ignace, to the delivery of our Annual Report to the Honourable James Gordon Carr, Minister of Natural Resources, through to the local community initiatives supporting scientific and technology learning, we are creating a level of sustained energy that will help propel us towards one of our most important milestones – the selection of a site with an informed and willing host.

The following pages explore some of the impressive work taking place across the organization that exemplifies our forward momentum. This includes actively exploring shared values and the potential for partnership in communities, managing – with scrupulous attention to quality – data obtained from the first borehole, collaboratively working with counterparts around the world to ensure best practices are shared, and supporting academic research in corrosion and geoscience to advance technical aspects of our project.

Threaded throughout our work, you will also notice references to Indigenous Knowledge. At the NWMO, traditional teachings are taking their rightful place alongside western science to help inform key aspects of decision-making.

Finally, I would like to encourage you all to continue to engage with the NWMO by sending us your valuable feedback and comments on our recently updated and published Implementation Plan, or by connecting with us on Facebook, Twitter, or LinkedIn.



Laurie Swami
President and CEO

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WHAT WE DO

The NWMO is responsible for implementing Canada's plan for the safe, long-term management of used nuclear fuel.

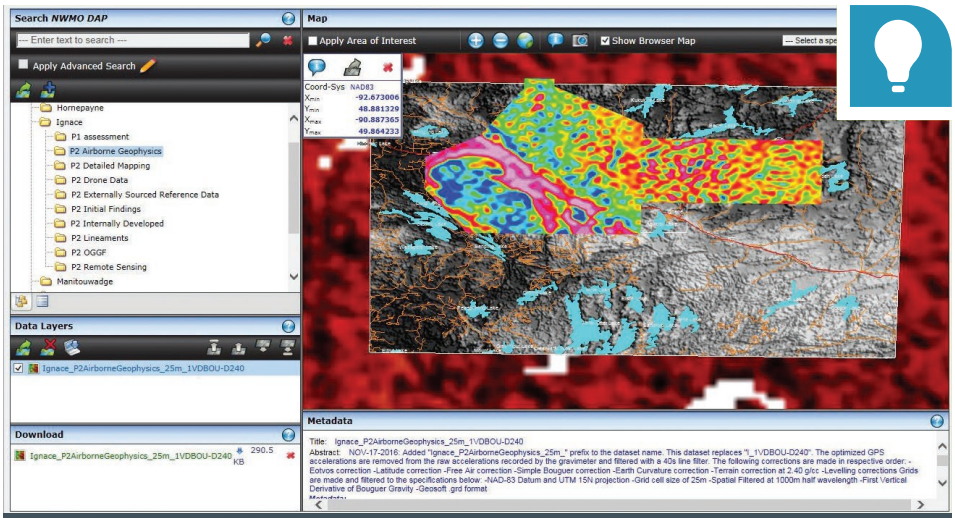
The plan, known as Adaptive Phased Management (APM), emerged through dialogue and was selected by the Government of Canada in 2007.

APM involves constructing a deep geological repository in which to contain and isolate the used fuel. The repository must be located in an area where communities, including First Nation and Métis communities, are willing hosts, working in partnership with the NWMO to implement it.

We are currently working with communities in a number of siting areas and expect to identify a preferred site by 2023.

What is the rock telling us?

Continued from p. 1



This screenshot shows an example of scientific information within the data management system.

Other members of the GDMS team are Jim McLay, Senior Scientist; Christiaan Piller, Database Admin/Geographic Information Systems Analyst, and Andre Vorauer, Senior Technical Specialist.

These scientists have spent the past few years setting up the GDMS to store and process massive amounts of detail, some of it historical and some fresh from the field. These include geoscientific data – the rock type, features, strength, permeability, fracture patterns of the rock, and chemistry of water at every depth – layered upon information about geographical features, roads, rivers, lakes, and forests, as well as results from airborne geophysics assessments.

Before being entered into the system, data passes through a rigorous assessment process in which it is reviewed and approved by subject matter experts for accuracy, quality, consistency, and completeness.

Borehole drilling represents a key milestone in the NWMO's ongoing process to identify a site for a deep geological repository for used nuclear fuel. The drilling provides valuable geological information down to depths as low as 1,000 metres below the study areas, which can be added to social, cultural, environmental, transportation, and other considerations.

In January 2018, the organization completed the drilling of its first borehole, located between Wabigoon Lake Ojibway Nation and Ignace. The NWMO is working with communities to plan more boreholes in this and other areas.

Multi-university corrosion research project

Continued from p. 1

"This project will enhance our understanding of the physical and chemical interactions of the containers with corrosive species, groundwater, clay, and micro-organisms," says Dr. Mehran Behazin, an associate scientist in corrosion and microbiology at the NWMO. "This is crucial to demonstrating the long-term safety of the deep geological repository."

The project brings together nine academic researchers with diverse expertise – in metallurgy, electrochemistry, corrosion science, thermodynamics, hydrogeology, mineralogy, microbiology, synthetic chemistry, and computer modelling – to understand the complex interactions that will take place in the repository over hundreds of thousands of years. It will also enable improved communication between research groups, and provide training for emerging scientists.

The project is led by Prof. Jamie Noël from Western University, who will work collaboratively with researchers from the University of Toronto, University of Waterloo and York University.

Viewpoint

Mahrez Ben Belfadhel,
Vice-President of Site Selection

Curiosity. Learning. Dialogue.

These are elements of engagement that we have seen throughout the site selection process since it began in 2010. They come from people – people at learning and sharing gatherings, trade shows, meetings, tours, exhibits at community events, one-on-one conversations, science classes, barbecues, information nights, Indigenous ceremonies, and walking-the-land activities. And these elements are the building blocks upon which we are working with communities to explore social willingness to host Canada's plan for used nuclear fuel.

With five areas remaining in the process, together we are progressing towards a new element of engagement: partnership. The project will only proceed with the involvement of the interested community, Indigenous communities in the area, and surrounding communities, working in partnership to implement it.

What does partnership look like? We know that it will be based on a shared set of values and principles. We know that it will be anchored by a clear demonstration of safety. We know that it will be rooted in enhanced well-being and a willingness borne of grassroots acceptance. We know that people are the key ingredient.

People will help us get this right.

This is an exciting and unique place to be: working towards identifying a site where Canada's used nuclear fuel can be safely managed in the long term, in an area where communities are willing hosts – and partners.

Curious.
Knowledgeable.
Heard.



Annual Geoscience Seminar showcases contributions to project

The NWMO's 16th annual Geoscience Seminar, held in June in Toronto, brought together specialists from Canada and other countries to discuss research funded through the organization's technical research program. Scientific understanding and methods advanced through this program contribute to Canada's plan for the safe, long-term management of used nuclear fuel.

"This seminar is an annual opportunity to showcase the geoscience work conducted as part of Adaptive Phased Management (APM), here and abroad," says Sarah Hirschorn, Manager of Geoscience at the NWMO. "It is important because we need to apply the most recent knowledge and approaches to understand the characteristics of the rock at the potential sites we are studying."

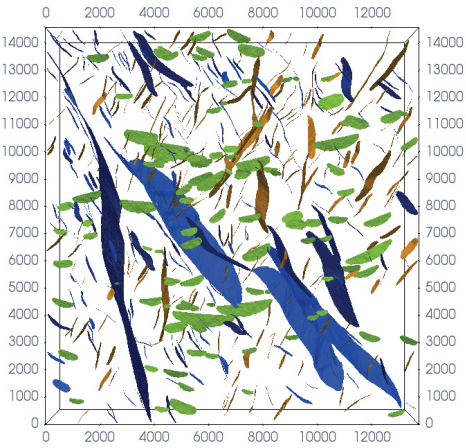
Among the 86 attendees were researchers from 10 Canadian universities involved in geoscience and engineered barrier science research, as well as representatives from the Geological Survey of Canada (part of Natural Resources Canada), the Canadian Nuclear Safety Commission, the U.S. Geological Survey, the University of Bern (Switzerland), and the NWMO's counterparts in Finland (Posiva) and Sweden (SKB).

During 28 presentations, scientists described applied research related to rock types the NWMO is studying – crystalline rock of the Canadian Shield and sedimentary rock in southwestern Ontario.

In addition, NWMO specialists provided the researchers with an update on the APM project, including geoscience research and development, site investigations, repository engineering, safety assessment, and interweaving traditional knowledge with scientific research.

Attendees also participated in a poster session and had an opportunity to ask graduate students and professors about their NWMO-supported research projects.

Academic research moving into practical applications



Detailed modelling of rock fracture systems such as that depicted above helps scientists to understand how the geosphere will behave over long periods of time.

One of the themes at this year's NWMO Geoscience Seminar in Toronto was moving research from the development stage to application at potential sites. This evolution is important to ensure the site ultimately selected will meet the project's rigorous technical and safety requirements.

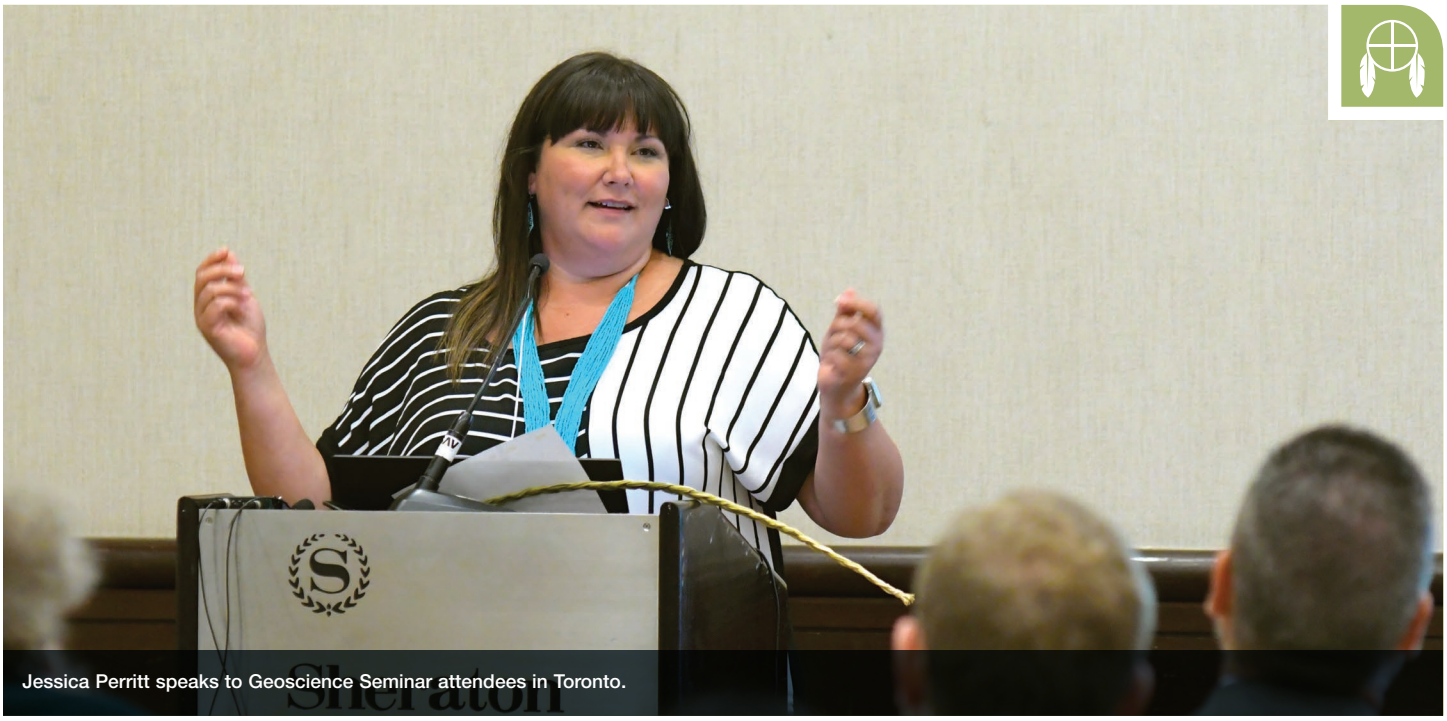
"Now that the Adaptive Phased Management site characterization program is collecting data from potential sites, we are entering a new phase of research," says Monique Hobbs, Manager of Geoscience Research and Development at the NWMO. "Approaches and methods that have been developed by the researchers to understand how conditions could affect a deep geological repository over hundreds of thousands of years can be applied to potential sites."

One example of applied research was presented by Dr. Lorrie Fava from Laurentian University. Her team is developing state-of-the-art software to create 3D models of fracture networks in crystalline rock. Representing and visualizing structures in crystalline rock at depth is an important aspect of understanding how the geosphere will behave over long periods of time. The NWMO will be working to apply this kind of modelling to the site selection process by creating site-specific models using data obtained in the field.

Another presenter was Dr. Stefano Normani, a research assistant professor in the department of Civil and Environmental Engineering at the University of Waterloo. His work involves developing and applying approaches to model how groundwater behaves deep underground over millions of years. For potential sites in crystalline rock, the 3D fracture networks created by Dr. Fava's team will be incorporated directly into his models to better understand multiple aspects of the geosphere.



Indigenous Knowledge meets western science at geoscience seminar



Jessica Perritt speaks to Geoscience Seminar attendees in Toronto.

To express the NWMO's commitment to interweaving Indigenous Knowledge throughout our work, Jessica Perritt, the NWMO's Senior Advisor on Indigenous Knowledge, was invited to speak at this year's Geoscience Seminar on the topic of "Indigenous Knowledge meets western science."

"Seeking, understanding and including Indigenous Knowledge is an important part of advancing the plan for the long-term management of used nuclear fuel," she said. "Interweaving the two different knowledge systems helps us achieve greater understanding, which will lead us to better decision-making and in turn a better project."

Ms. Perritt's presentation provided an overview of the many steps the NWMO is taking to ensure the project is incorporating Indigenous Knowledge. Examples include engaging on an ongoing basis with Indigenous communities, receiving ongoing advice from the Council of Elders and Youth, using guidance drawn from the NWMO's Aboriginal Policy and Indigenous Knowledge Policy, having staff and contractors participate in Indigenous cultural awareness training, incorporating ceremony, and having strong Indigenous representation on the NWMO staff, Board of Directors, Advisory Council, and Council of Elders and Youth.

"Mutual respect and interest in others' way of seeing things is very important," said Swiss Geoscience Consultant Dr. Andreas Gautschi, who attended the geoscience seminar and also visited a First Nation community on a previous visit.

Dr. Gautschi is former Division Head of Geology and Safety and Chief Geoscientific Advisor of the Swiss National Cooperative for the Disposal of Radioactive Waste, and a member of the Adaptive Phased Management-Geoscientific Review Group. He noted that all intersections of science and oral teachings contribute to a continuum that leads to greater understanding. "For good communication between scientists and Indigenous peoples, we have to learn a lot from each other, step by step, over a long time period."



Attendees at the 2018 NWMO Geoscience Seminar.

The NWMO signs co-operation agreements with international partners



NWMO President and CEO Laurie Swami (right) with Thomas Ernst, CEO of Nagra (Switzerland), in Toronto on May 14, 2018.

The NWMO has signed or renewed co-operation agreements with counterparts from five countries: Belgium, France, Sweden, Switzerland, and the United Kingdom. The NWMO is committed to international knowledge sharing, and these agreements join accords already in place with nuclear waste organizations in Finland, South Korea and Japan.

"These agreements ensure we are applying the best international practice to Canada's plan for the safe, long-term management of used nuclear fuel, and sharing our experience with our global counterparts," said Laurie Swami, President and CEO of the NWMO.

The new agreements were the focus of a signing ceremony at the opening reception for the 2018 EDRAM annual meeting, hosted this year by the NWMO in Toronto. EDRAM is the International Association for Environmentally Safe Disposal of Radioactive Materials, an organization that promotes the exchange of knowledge among member countries.

Kim Rudd, Parliamentary Secretary to Canada's Minister of Natural Resources, the Honourable James Gordon Carr, provided remarks at the signing ceremony and expressed appreciation for the NWMO's leadership in promoting international co-operation. "As it makes steady progress in implementing Canada's plan, I am pleased that the NWMO is sharing Canadian research and innovation with the rest of the world, and learning from the experiences and knowledge of other countries. Collaboration of this sort is vital in the global imperative to safely manage used nuclear fuel to protect people and the environment."

The EDRAM annual meeting consisted of two days of meetings, concluding with a tour of the NWMO's proof test facility in Oakville, where delegates saw first-hand some of the Canadian technology and research underway.

> *"Collaboration of this sort is vital in the global imperative to safely manage used nuclear fuel to protect people and the environment."*
>
> **Kim Rudd**
> Parliamentary Secretary to Canada's Minister of Natural Resources, the Honourable James Gordon Carr

NWMO SCIENTISTS SHARING AND LEARNING ON GLOBAL SCALE

Taoyuan, Taiwan

Sarah Hirschorn, Manager of Geoscience, is travelling to Taoyuan, Taiwan, in early July to speak to scientists at the Institute of Nuclear Energy Research there. She will share with the Taiwanese team the NWMO's experience in understanding the subsurface, ensuring quality assurance, and planning and conducting site characterization studies.

Busan and Gyeongju, South Korea

Mark Gobien, Senior Scientist/ Engineer, is travelling to Busan and Gyeongju, South Korea, in late June to attend the World Nuclear University Summer Institute. He will join 60 attendees from 20 countries in this prestigious program; he is the first person from the NWMO to attend. The six-week course focuses on energy supply and demand, nuclear technology in sustainable development, nuclear law, waste management, project management, and developing future leaders.

We are looking forward to featuring more about these stories in our next newsletter.

The NWMO active in Vienna at IAEA Joint Convention

In May, the NWMO played a key role in Canada's delegation to the International Atomic Energy Agency's Sixth Review Meeting of the Joint Convention.

The Joint Convention – the full name of which is the *Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management* – is a legal instrument that was established in 2001 to address the safe management of spent fuel and radioactive waste on a global scale. International peer review meetings are held every three years.

"The Joint Convention commits all 78 ratifying countries, including Canada, to demonstrate that they are safely managing radioactive waste and used nuclear fuel," said Dr. Mihaela Ion, Manager of Nuclear Safety and Advanced Fuels at the NWMO, who supported Canada's national report and participated in the meeting as a review officer. "It also promotes open discussions on the safety of waste management programs, with the goal of identifying and sharing best practices."

Representatives from the NWMO were Dr. Mahrez Ben Belfadhel, Vice-President of Site Selection; Dr. Paul Gierszewski, Director of Safety and Technical Research; and Dr. Ion. The Canadian delegation was led by Ramzi Jammal, Executive Vice-President and Chief Regulatory Operations Officer of the Canadian Nuclear Safety Commission.

As part of Canada's presentation, Dr. Ben Belfadhel provided an update to information provided at the Fifth Review Meeting in 2015 towards the long-term management of the country's used nuclear fuel. He discussed progress made in the site selection process in applying Indigenous Knowledge to decision-making, and in continuing to develop and test technical aspects of the project.

In addition, during one of the topical sessions of the review meeting, he presented the NWMO's perspective on aspects of public acceptance associated with the storage and disposal of used nuclear fuel in Canada.



The Canadian delegation joined other country representatives at the 2018 Joint Convention in Vienna.

MEET THE EXPERT

Mihaela Ion



Manager of Nuclear Safety and Advanced Fuels

Canada's plan for the safe, long-term management of used nuclear fuel is powered by people in a wide variety of professions. People like Dr. Mihaela Ion.

Dr. Mihaela Ion has come a long way since her days as a student in Romania. Back then, her world view, her career path and her knowledge of the English language were yet to be established.

Two major turning points led her to where she is now: playing an important role at the International Atomic Energy Agency Joint Convention in Vienna, not only representing Canada, but also ensuring other countries around the world meet their commitment to managing used nuclear fuel and radioactive waste safely.

The first pivotal moment for Mihaela was the Chernobyl accident in 1986. "When that happened," she says, "I decided it was time to learn more about nuclear science and what you can do to protect those around you." She obtained a bachelor's and master's degree in Power Engineering in Bucharest, Romania.

The second turning point occurred in 1996 when Mihaela won a United Kingdom scholarship to study more about environmental protection in the nuclear field, and English. "This opportunity became my window on the world and a chance to learn my fourth language. Up until then, the only English I knew was from watching American movies," she says.

Mihaela went on to obtain a master's degree and PhD in Nuclear Engineering in the United States and has been dedicated to nuclear safety for more than 25 years.

At the NWMO since 2009, she has embraced her role in ensuring Canada safely manages used nuclear fuel over the long term, as well as her responsibilities on the world stage. "It is such a great honour to be able to help in protecting people and the environment."



The NWMO's President and CEO Laurie Swami talks to a guest at the NWMO booth at the CNS conference in Saskatoon.

CNS conference

Continued from p. 1

The CNS conference is an annual opportunity for those working in all aspects of the nuclear industry to come together to exchange information on nuclear science, technology, applications, and societal impacts.

"Our search for a site involves so much more than graphs, maps, drills, and suitable rock formations," she said. "It involves people – our experts at the NWMO, as well as the thousands of people in the municipalities and First Nation and Métis communities across Ontario with whom we are exploring and trying to find a preferred site."

"We feel it is our responsibility – even before a site is selected – to dig not only into the rock, but also into the bedrock of the community."

Ms. Swami expressed confidence that the plan is technically sound and spoke of the progress being made at the NWMO. She went on to describe a number of recent activities, including drilling its first borehole at a potential repository site in northern Ontario, signing international knowledge-sharing agreements, and developing best practices with research partners.

Jo-Ann Facella receives Canadian Nuclear Society award

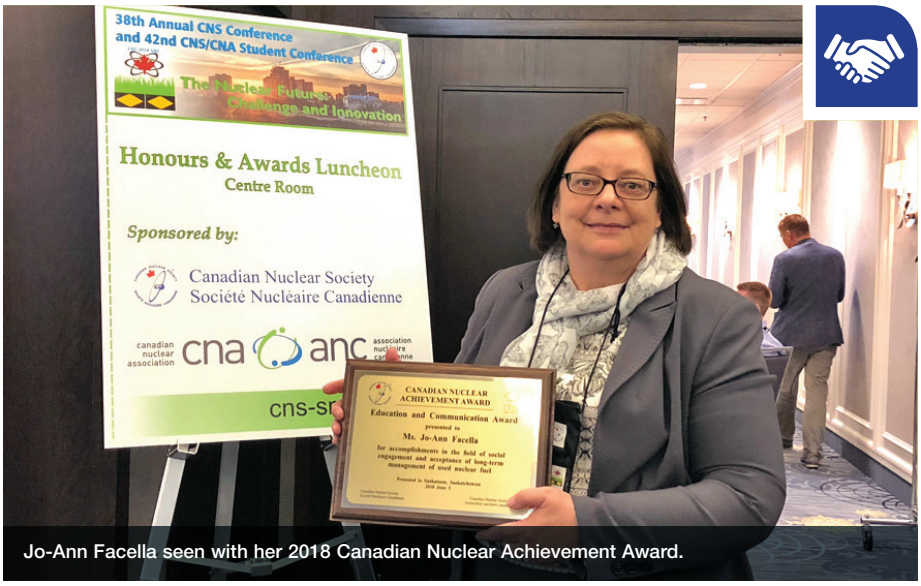
On June 5, the NWMO's Jo-Ann Facella won a prestigious award from the Canadian Nuclear Society (CNS) for her longtime work in social engagement.

Ms. Facella, Director of Community Well-Being, Assessment and Dialogue, accepted the 2018 Canadian Nuclear Achievement Award in Education and Communication at the annual CNS meeting in Saskatoon.

"I am very honoured to receive this award," said Ms. Facella. "Our team has learned a lot about how to implement Canada's plan in a way that meets the priorities and objectives of Canadians by engaging people all along the way. And we continue to learn from the leadership of the municipal and Indigenous communities that we work with in the siting process. It is a privilege to be part of this process."

Ms. Facella, whose career in nuclear waste management spans several decades, is a passionate advocate for bringing meaningful community engagement to each stage of implementing Canada's plan for used nuclear fuel.

The NWMO's systematic approach to engagement – carefully planned, measured, and documented by Ms. Facella and her colleagues over the 15 years the organization has been in existence – has also been recognized on the global stage as other countries undertake their long-term plans for nuclear waste.



Jo-Ann Facella seen with her 2018 Canadian Nuclear Achievement Award.

We welcome your comments on our five-year plan

Do you have comments on how we are implementing Canada's plan for the long-term management of used nuclear fuel? We welcome them! Please get in touch with us by July 20, 2018, to provide feedback on our latest five-year strategic plan, *Implementing Adaptive Phased Management 2018 to 2022*, which was published in March.

The report is available at www.nwmo.ca/implementationplan. Hard copies are also available on request by emailing contactus@nwmo.ca or calling 416.934.9814.

To comment, please contact:

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We welcome all suggestions and ideas about our work and how we can help you learn more about Canada's plan for used nuclear fuel.

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SOCIÉTÉ DE GESTION DES DÉCHETS NUCLÉAIRES

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