nwmo news

Nuclear Waste Management Organization

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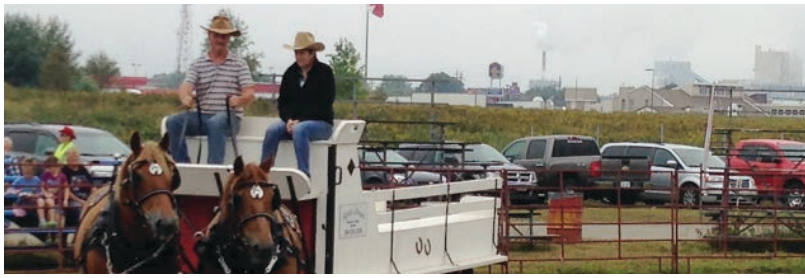






















15 YEARS • ANS

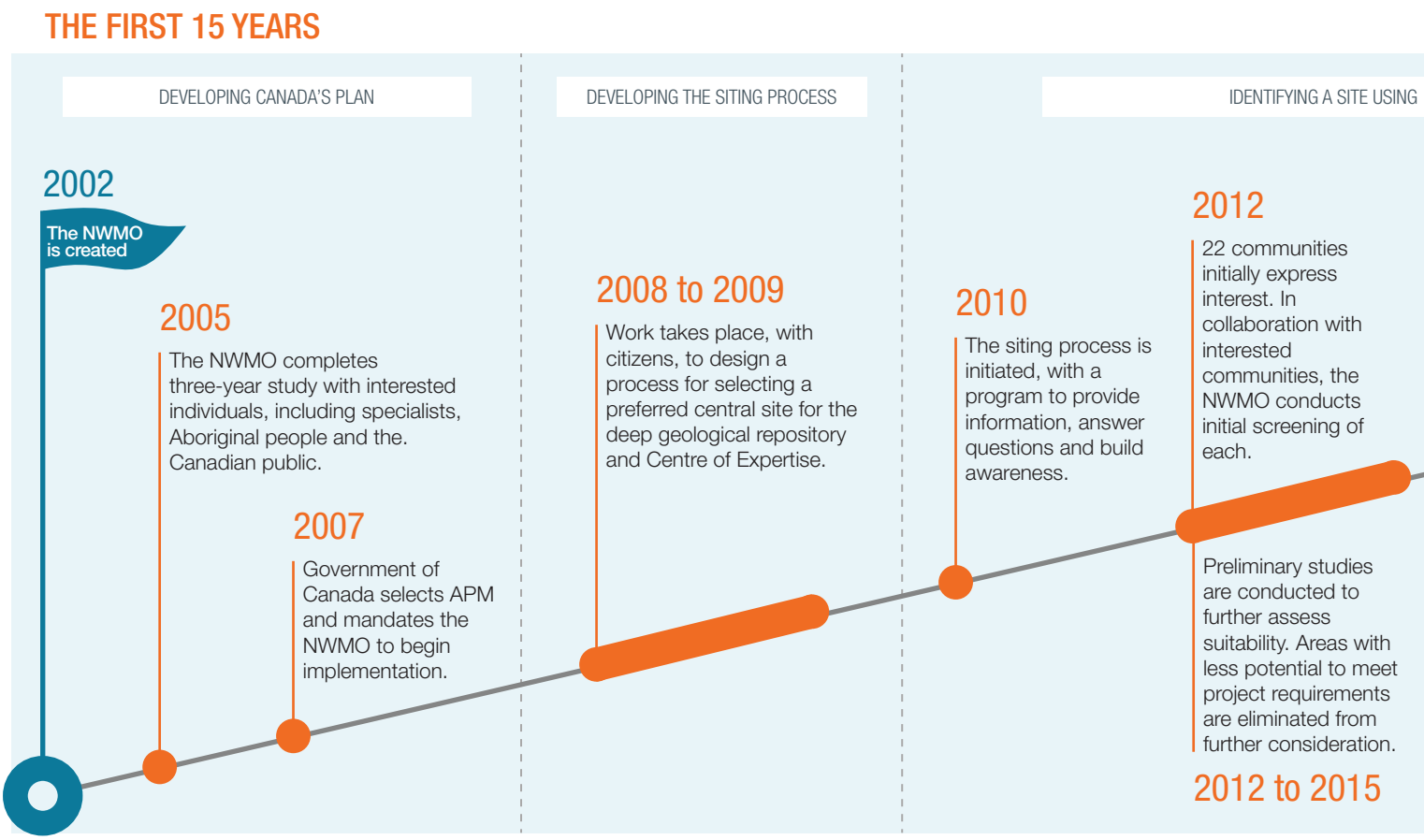
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NUCLEAR WASTE MANAGEMENT ORGANIZATION

SOCIÉTÉ DE GESTION DES DÉCHETS NUCLÉAIRES

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The NWMO Marks 15 Years of Achievements



This fall marks 15 years since the Nuclear Waste Management Organization (NWMO) was established.

Since its creation in 2002, the NWMO has engaged with thousands of Canadians in hundreds of communities, first to develop Canada's plan for the long-term management of used nuclear fuel, and then to implement it.

"Canadians told us they wanted our generation to take action on used nuclear fuel, rather than leave it as a burden for the future. I am extremely proud of the NWMO's collaborative approach toward achieving that goal," says Laurie Swami, President and CEO. "By working with people in municipal, First Nation and Métis communities as well as with specialists in Canada and around the world, we have built strong momentum toward implementing Canada's plan."

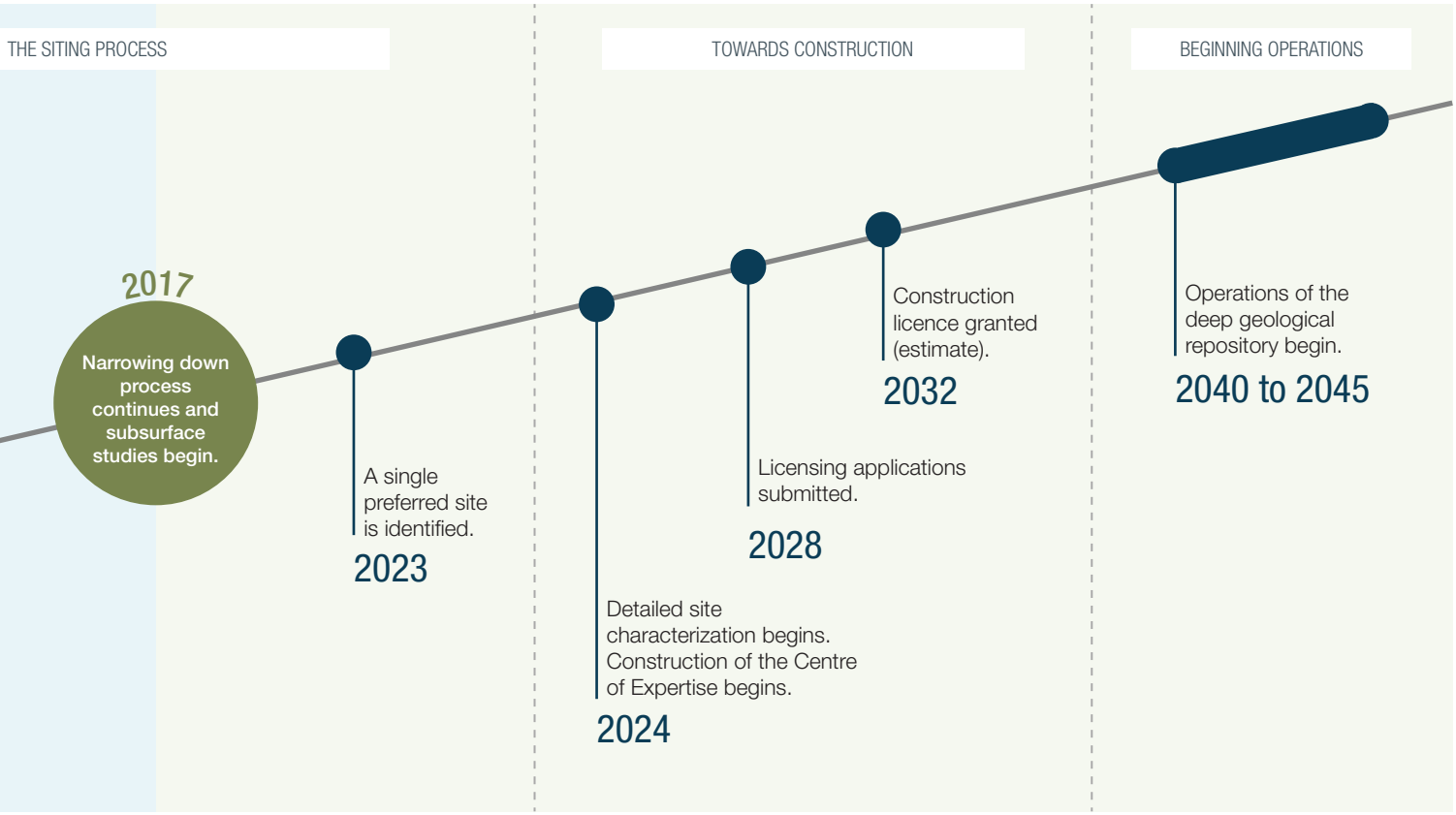
The journey began with Canada's *Nuclear Fuel Waste Act*. The *Act* required that nuclear fuel waste owners create an organization that would take a "comprehensive, integrated and economically sound approach" to Canada's nuclear fuel waste. Shortly thereafter, the NWMO was born.

In the 15 years since, the NWMO has made significant progress. First, it worked together with Canadians to develop Canada's plan – known as Adaptive Phased Management (APM). Over a period of three years, the approach emerged through dialogue with the

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THE FUTURE



general public, Indigenous peoples and specialists. It was selected by the federal government in 2007 to be the plan for Canada's used nuclear fuel.

The technical end point of APM requires construction of a deep geological repository that will contain and isolate Canada's used nuclear fuel. The plan also includes realistic, manageable phases and sustained engagement of people and communities throughout its implementation.

In 2010, a site selection process was started to find a willing and engaged host for the repository.

After 22 communities expressed interest in learning more, the NWMO's specialists began working together with people in each area on an increasingly intensive process of study and engagement. Over time, the process has successfully and collaboratively narrowed the number of study areas to a handful. From these, a preferred site is expected to be identified by about 2023.

As it continues to implement Canada's plan for used nuclear fuel, some of the hallmarks of the NWMO's approach include interweaving knowledge from Indigenous people, engaging with communities, collaborating with local and international technical specialists, and developing engineering breakthroughs.

International geoscientists visit planned site of the NWMO's first borehole



NWMO employees and the APM-GRG gather near Ignace in advance of borehole drilling

In late August, members of the Adaptive Phased Management Geoscientific Review Group (APM-GRG) visited the site near Ignace where the NWMO is drilling a deep borehole – its first at a potential repository location. The purpose of borehole drilling is to obtain and test rock samples from underground, to see if the geology is suitable for a deep geological repository.

The APM-GRG is a group of internationally recognized experts in geoscience disciplines. As reviewers of the NWMO's geoscience plans and findings, they play an important role in ensuring the organization's technical work is the best it can be.

"The APM-GRG members provide careful and thorough review of our geoscientific work," says Sarah Hirschorn, Manager of Geoscience at the NWMO. "They help ensure we consistently meet or exceed international best practices."

The APM-GRG's visit to the Ignace area not only provided the scientists with a first-hand look at the rock, but also an opportunity to meet people in the area, including keepers of Indigenous Knowledge.

"This visit and future visits to other communities where we are planning to drill gives them context," says Dr. Hirschorn. "Our decisions involve social considerations, so this helps the scientists appreciate aspects of our work beyond geology."

The APM-GRG is composed of five internationally recognized experts from Canada, Sweden, Switzerland, and Australia. They combine extensive multidisciplinary experience relevant to the siting of deep geological repositories in both crystalline and sedimentary rock formations.

The group meets regularly in-person and by teleconference. Contributions include reviewing and providing advice on the approaches, methods, criteria and findings related to the broad geoscientific issues addressed by the NWMO. The APM-GRG produces annual reports and presents its findings to the NWMO Advisory Council and Board of Directors. Biographies of the APM-GRG members, as well as their reports, are available online at www.nwmo.ca/APM-GRG.

GEOSCIENCE SEMINAR RECAP

Annual Geoscience Seminar showcases contributions to APM



Attendees at the NWMO's 15th annual Geoscience Seminar

The NWMO's 15th annual Geoscience Seminar, held in June in Toronto, brought together specialists from Canada and other countries to discuss advances in geoscience related to the safe, long-term management of used nuclear fuel. This gathering provides an important forum to showcase NWMO-funded and directed geoscience activities.

The 77 attendees included researchers from eight Canadian universities, as well as representatives from the Geological Survey of Canada, the U.S. Geological Survey, the Canadian Nuclear Safety Commission and the NWMO's counterparts in Switzerland (NAGRA), Finland (Posiva) and Sweden (SKB).

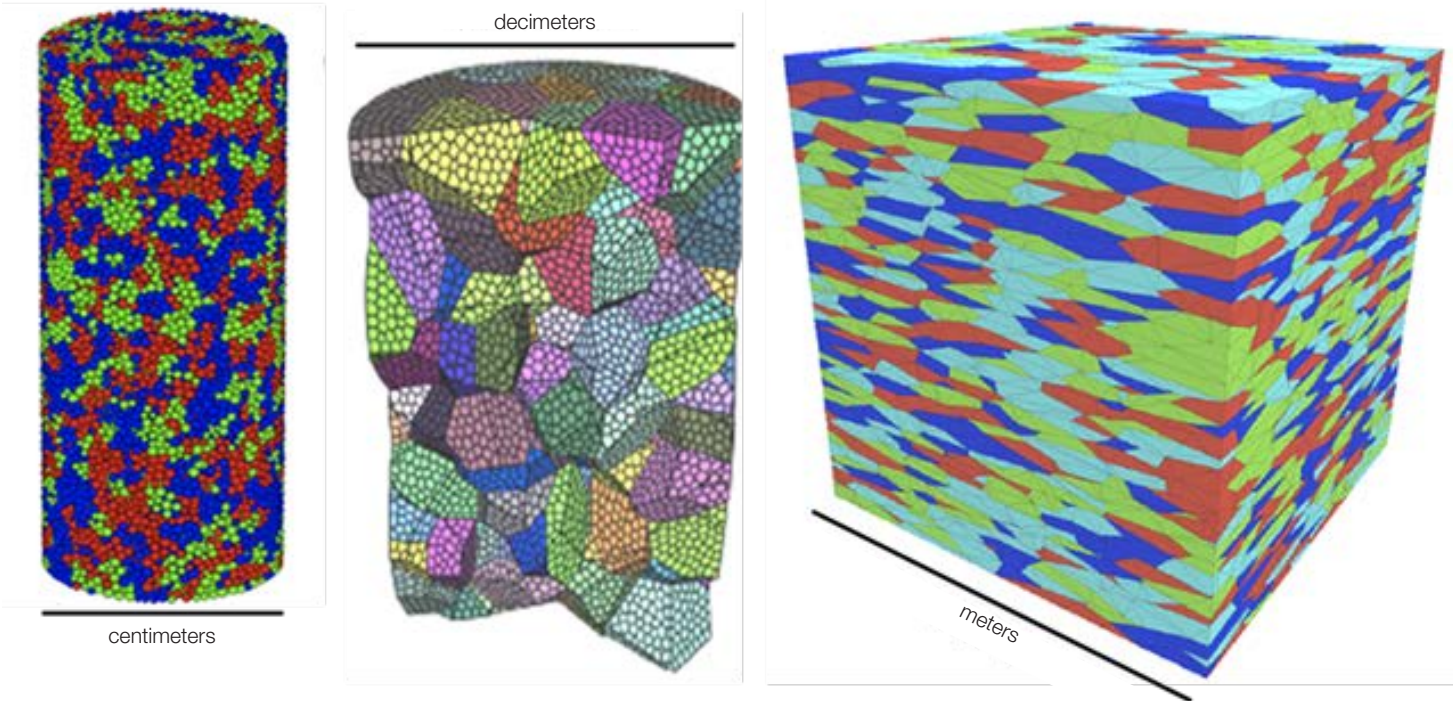
"This seminar provides an interesting mosaic of everything we do in our geoscience program," says Mark Jensen, Director of Deep Geological Repository Geoscience and Research at the NWMO. "It provides a snapshot of the many geoscientific projects we sponsor here and abroad that contribute to the Adaptive Phased Management (APM) technical program."

Among the 32 presentations, NWMO staff provided an update on their work, including repository engineering and safety assessment. In addition, attendees heard about the status of repository planning in Sweden and Switzerland. Technical presentations described applied research within both crystalline Canadian Shield and sedimentary rock.

Attendees also heard from graduate students whose work is being supported by the NWMO.

GEOSCIENCE SEMINAR RECAP

Innovative Canadian research predicts how rock near a deep geological repository will behave



Increasingly detailed modelling of rock strengths and weaknesses over different scales will help predict how rock behaves and ensure the deep geological repository is safe and supported (courtesy of Queen's Geomechanics Group)

State-of-the-art computer modelling developed at Queen's University is breaking new ground in how scientists understand the impact of a deep geological repository on surrounding rock.

The excavation of underground openings can lead to the formation of fractures near the exposed opening walls. It is important in the case of the NWMO's deep geological repository that steps be taken to minimize or mitigate such fracturing to maximize repository safety. This work program is providing the tools necessary to achieve this end.

"This project has among the longest timelines of any human engineered project in the world. That's why we need detailed models. It has to be reliable," says Dr. Day, a PhD in Geological Engineering, who presented the research of the Queen's Geomechanics Group, directed by Dr. Mark Diederichs, to attendees at the recent NWMO Geoscience Seminar in Toronto.

The Queen's Geomechanics Group, supported by the NWMO, uses data from borehole samples, combined with innovative computerized modelling, to determine how strengths and weaknesses in rock develop over different scales and time periods. "This will help us predict how rock behaves and ensure the deep geological repository is safe and supported," says Dr. Day.

This emerging science is important internationally. "We are not just studying the rock but we are also developing tools and methodologies to apply to any deep geological repository around the world," she adds.

Dr. Day recently completed her PhD under Dr. Diederichs' supervision and accepted a position as an Assistant Professor at the University of New Brunswick.



Dr. Jennifer Day presented the Queen's research to attendees at the recent NWMO Geoscience Seminar in Toronto

GEOSCIENCE SEMINAR RECAP

Ancient sedimentary rocks deep below the Bruce area are highly stable

New research at two Canadian universities is contributing further evidence that the sedimentary rocks beneath the Bruce area have been stable for hundreds of millions of years.

"Despite geologic events and water movement closer to the surface, the fluid found in rock deep below the surface has been there since the Ordovician period, which ended about 443 million years ago," says University of Toronto geochemist Dr. Chelsea Sutcliffe, who presented her research at the recent NWMO Geoscience Seminar in Toronto.

These findings are relevant as the NWMO continues its process of selecting a site for a deep geological repository. Among the many criteria that must be met – including social acceptability – the site must be geologically stable. Two of the communities in the process are located in Bruce County: Huron-Kinloss and South Bruce. In addition, there are five communities in northern Ontario in the siting process, and geological studies are ongoing near those as well.

Using a state-of-the-art laser system, Dr. Sutcliffe, a postdoctoral fellow at the University of Toronto, studied mineral deposits in the veins of rock core samples obtained from the Bruce site. These minerals preserve evidence of when even tiny amounts of fluid may have last migrated through the rocks.

Results showed seawater brine interacted with the rock approximately 435 million years ago. Other than that, the rock has remained virtually impermeable for all the intervening years. This is true despite unstable geologic events at higher levels, such as seismic activity, glaciation, mountain-building events, and movements in the Earth's crust.



University of Toronto geochemist Dr. Chelsea Sutcliffe described her research to the NWMO Geoscience Seminar



For Dr. Duane Petts, a postdoctoral fellow at the University of Ottawa, this research is rewarding scientifically and personally

Geochemist Dr. Duane Petts, a postdoctoral fellow at the University of Ottawa, further analysed the origin and evolution of past fluid migrations within the rock samples from the area. He found no evidence of fracture-related fluid migrations beyond the time frame that Dr. Sutcliffe pinpointed. For him, this scholarly research is rewarding both scientifically and personally.

"My family has a cottage on the Bruce peninsula so this is in my backyard," he says. "By understanding the mechanisms of the past fluid migrations, we can better understand the susceptibility of these rocks to future fluid migrations. A key aspect is that these rocks have been able to retain their extremely low permeabilities for periods of time measured on the geologic time scale."

SHAD program reaches more than 500 high school students in 2017

Under Isaac Werner's keen leadership, the NWMO's outreach through SHAD is growing every year, introducing more and more young people to Canada's plan for used nuclear fuel.

SHAD is a four-week enrichment program for high-achieving students in grades 10 through 12. Workshops and lectures focusing on science, technology, engineering and math (STEM) disciplines are held at 13 Canadian universities. The NWMO has been a sponsor of the SHAD program since 2009, providing scholarships, bursaries and support of travel. This year, the NWMO's program reached more than 500 students at eight campuses.

"These future leaders from all over the country are becoming knowledgeable about Canada's plan for nuclear waste," says Mr. Werner, a Government and External Relations Analyst at the NWMO. "This is important because the project is such a long-term one, which will touch many generations. These young people need to be involved in the discussion; as decision makers of tomorrow, they'll be able to say, 'Oh yes, I'm familiar with this project'."

The NWMO's presentations to SHAD students are two-pronged. While Mr. Werner presents the public policy and social aspects of the APM project, the scientific facets of the project are outlined by NWMO technical specialists. In 2017, this was done by Associate Engineer Mark Gobien and Senior Technical Engineer Melissa Mayhew.

Together, these specialists bring an energy to the SHAD program that encourages lively dialogue. There is lots of time for discussion and questions, and breakout sessions provide opportunities to delve into details of the project in smaller groups.



Isaac Werner engages with students who are learning about Canada's plan

> *"I appreciated the chance to personally experience NWMO's commitment to educating the next generation of STEM leaders."*
>
> **- Tim Jackson**
> President and CEO of SHAD

"I love to see the lights go on and students get inspired about this project," says Mr. Werner. "By the end of the session, they are very engaged and want to continue the conversation."

Tim Jackson, SHAD President and CEO, observed students learning about the APM project. "This July, I enjoyed taking part in NWMO's outstanding workshop at SHAD Lakehead in Thunder Bay. The information shared was impactful and relevant, and opened a lot of minds about the large-scale scientific and engineering planning underway to deal with Canada's used nuclear fuel. The SHAD participants were left with a much better understanding of the complex strategies and relationships that come into play. I appreciated the chance to personally experience NWMO's commitment to educating the next generation of STEM leaders."

Though Mr. Werner describes himself as a "policy nerd," he has a young, hip vibe that puts students at ease. He began his career at the NWMO five years ago, fresh from completing his Bachelor of Arts and Business at the University of Waterloo and his Masters of Public Administration at Queen's University.

Recently married, he is often found hanging out with his wife in Toronto's west end, or attending cultural events. He is an avid runner and plays recreational hockey and softball. He is a people person with a contagious passion for fairness and sustainability. "Even if they have some hesitation around nuclear," he says of the students, "they see the responsibility that the nuclear industry takes to manage its waste. They also see that this project is so unique and so multidisciplinary. Pretty amazing."

In addition to presenting at Lakehead University, Mr. Werner and colleagues conducted sessions at Carleton University, Ryerson University, University of Waterloo, McMaster University, Western University, University of New Brunswick, and Queen's University.

SHAD is one of several organizations supported by the NWMO's Corporate Social Responsibility Program (CSRP) that help students living in areas in and around the site selection process to enhance their appreciation of science. Others are Scientists in School, a charity providing science workshops for students in Kindergarten to Grade 8, and Science North, an interactive science program for elementary students in northern Ontario.

NWMO CEO welcomed at Métis Nation of Ontario event



NWMO CEO Laurie Swami joins Métis Nation of Ontario's Annual General Assembly attendees for arrival ceremony and receives a painting from Métis artist Kelly Duquette



As part of the NWMO's involvement in the Métis Nation of Ontario (MNO)'s 2017 Annual General Assembly (AGA), the NWMO's President and CEO Laurie Swami participated in the opening ceremonies. The event, held in Kenora, Ontario in August, drew more than 400 MNO citizens – to renew friendships, strengthen family ties, and celebrate Métis culture and heritage.

"I was honoured to attend the General Assembly," says Ms. Swami. "It provided a special opportunity to learn about Métis customs and history and meet many of the people the NWMO has been working with. It was a very positive experience."

The MNO has been involved in learning about the Adaptive Phased Management project since 2012, through community information sessions, workshops, transportation dialogues, and used nuclear fuel dry storage tours. This year, the NWMO was the Platinum Corporate Sponsor of the AGA, providing support for cultural activities and increased MNO youth participation.

Ms. Swami was one of several guests invited to paddle in a ceremonial canoe. This celebration is important because Métis settlements historically emerged along waterways and watersheds as an outgrowth of the fur trade.

She also received a painting from Kelly Duquette, who considers herself to be a "new generation" Métis. The work portrays two women gathering medicinal plants, their silhouettes trapped between layers of paint and glaze. "The series from which this painting belongs depicts cultural activities that have united Métis peoples and defined Métis identity and nationhood for centuries," explains Ms. Duquette, who is currently in her second year of law school at the University of Ottawa.

The NWMO looks forward to continuing to work with MNO to better understand how Métis values and knowledge can strengthen Canada's plan for safe long-term management of used nuclear fuel.

Partnering with Japan to share engineering expertise



NWMO staff host a tour of its Oakville proof test facility for the Japanese delegation

The NWMO is partnering with its Japanese counterpart to share knowledge of best practices in waste management.

In June, senior representatives from the Nuclear Waste Management Organization of Japan (NUMO) visited the NWMO's head office in Toronto and proof test facility in Oakville. Dr. Shunsuke Kondo, NUMO's President, and Laurie Swami, the NWMO's President and CEO, signed two co-operation agreements.

"These agreements are important examples of the homegrown Canadian research and innovation that is in demand around the world," says Ms. Swami.

One of the agreements involves the exchange of knowledge pertaining to many aspects of managing used nuclear fuel, including public engagement, site selection, site characterization, engineering technology, engineered barriers, and licensing. The other is an agreement specifically about the NWMO's copper-coating program.

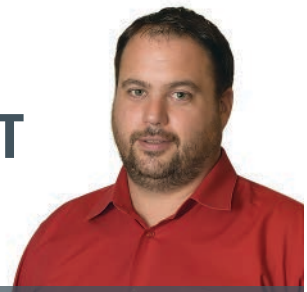
The NWMO's advanced copper coating techniques are one component of its multiple-barrier system to keep used nuclear fuel isolated from people and the environment. NUMO is interested in this technology as a promising option for its own vitrified waste container.

"We are eager to learn more about the NWMO's project," says Dr. Kondo. "Exchanging information between the two organizations will be useful to both sides, and both will be able to find various areas for mutual cooperation and learning."

The NWMO's partnership with NUMO further demonstrates the Canadian organization's commitment to co-operate with other organizations and share leading practices for safely managing used nuclear fuel. Other co-operation agreements are already in place with France, Switzerland, Finland, Sweden, the U.K. and South Korea.

MEET THE EXPERT

Peter Keech



Manager of the Engineered Barrier System

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 Peter Keech.

One of the components of the multiple barrier system that will be used in the deep geological repository is an NWMO-designed steel container that is coated with copper to prevent corrosion.

Predicting with extreme precision the stability of copper over long periods of time in a deep geological repository is the focus of Dr. Keech and his team's research at the NWMO. Dr. Keech, who obtained his PhD in electrochemistry at the University of Calgary, and worked as a postdoc at Western University, is one of Canada's leading experts in the field.

"Scientists have 30 years of research in copper," he says, "but we need to increase our confidence. We are always working to eliminate the unknowns." Canada's state-of-the-art multi-barrier system, complete with its NWMO-designed copper-coated used fuel container, is in demand around the world.

Most recently, it caught the attention of Japan's Nuclear Waste Management Organization (NUMO), which signed a knowledge-sharing agreement with the NWMO. "Our Japanese counterparts are very keen to learn more about our copper coating program," says Dr. Keech, who facilitated the visit by senior NUMO officials to the NWMO's head office and proof testing facility.

When not at work delving into the finer details of how copper interacts with other elements, Dr. Keech can be found at home with his wife and two daughters obsessing over chemical alchemy of a different sort – how to create the perfect hot salsa. The strategy is highly scientific. "You need peppers that build heat gradually and those that are hot at first and fade quickly," he explains.

While Dr. Keech is quick to share his expertise on copper corrosion with colleagues from research organizations and universities around the world, the particulars of the salsa recipe are "a closely guarded household secret."

NWMO specialists host breakfast at municipal officials' conference



Bob Watts, VP of Indigenous Relations (on stage at left) and Jo-Ann Facella, Director of Community Well-being, Assessment and Dialogue (middle), discuss the NWMO's approach to relationship building. Norm Sandberg, Relationship Manager from North of Huron (right) facilitates the conversation

NWMO staff joined municipal leaders from around Ontario at the Association of Municipalities of Ontario (AMO) Conference in Ottawa on Tuesday, August 15. The AMO conference is the largest annual gathering of municipal officials in Ontario. It provides a chance for municipal leaders to liaise with counterparts from across the province and participate in learning opportunities.

The NWMO hosted an AMO Insight Breakfast, featuring a conversation between NWMO leaders Bob Watts, Vice-President of Indigenous Relations, and Jo-Ann Facella, Director of Community Well-being, Assessment and Dialogue.

This well-attended breakfast session brought together municipal leaders and administrators, industry leaders, and provincial government officials to hear about the NWMO's approach to relationship building while working to site a deep geological repository for used nuclear fuel.

Particular attention was paid to the work that the NWMO has done to help foster partnerships in the areas considering hosting the project, including experiences working with both municipal and First Nation and Métis communities.

"The AMO Insight Breakfast provided the NWMO with an important forum to share some of our experiences as an organization," said Mr. Watts. "We have seen first-hand that through hard work and respectful dialogue, municipalities, First Nation and Métis communities can work toward partnership."

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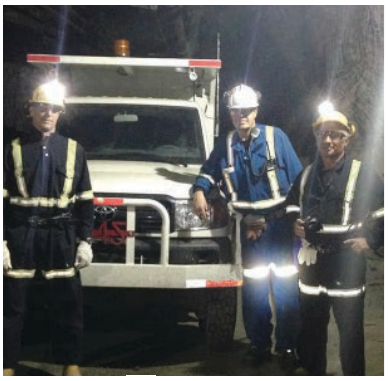


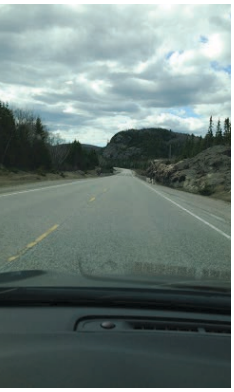








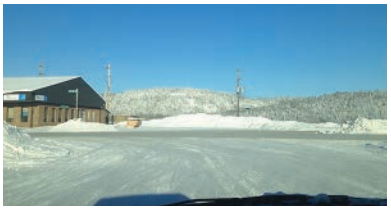


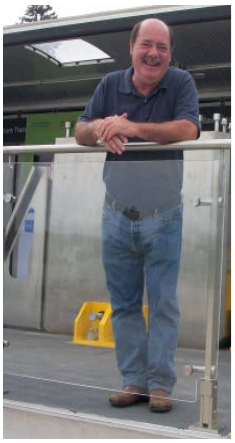












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