How research under the sea in British Columbia is helping to implement Canada’s plan in Ontario

NWMO scientists travel to Finland to visit world’s most advanced used nuclear fuel repository project

Three NWMO engineers crossed the Atlantic and Arctic oceans in May on a journey to Finland, where the world’s first deep geological repository for used nuclear fuel is under construction.

Posiva is the Finnish counterpart to the NWMO — it too is responsible for the safe, long-term management of used nuclear fuel in a manner that protects people and the environment. And it is doing so by building a deep geological repository on Olkiluoto Island, which is about 275 kilometres northwest of Helsinki.

The projects vary in design and engineering, but both organizations can learn a lot from each other, especially because the Posiva project is already building the repository at its ONKALO site, where three nuclear power plant units are also located. That organization is also in the midst of a large-scale research project — Full-Scale In-Situ System Test (FISST) — that will inform nuclear waste management efforts around the world.

Research that begins deep under the sea could help the Nuclear Waste Management Organization (NWMO) with the safe, long-term storage of Canada’s used nuclear fuel half a continent away.

It is all thanks to a partnership with Ocean Networks Canada, an oceanographic research and monitoring arm of the University of Victoria. The collaboration allowed specialists with the NWMO last October to sink copper coins surrounded by bentonite clay under the salty waters of Saanich Inlet, off the B.C. coast. The underwater experiment creates a pressurized environment that allows researchers to better understand how these two elements of the engineered-barrier system will behave under pressure and over time.

For six months, the clay-coated coins sat 90 metres below the water’s surface in what is hoped to be the first of many underwater trials for the NWMO’s engineered-barrier system. The multiple-barrier system will eventually be part of a deep geological repository the NWMO hopes to build in Ontario, thousands of kilometres away from the ocean.

“It is like an accelerated exposure test,” said Dr. Jeff Binns, a corrosion scientist with the NWMO, examining a robot used in underwater research by Ocean Networks Canada. A partnership with that organization has allowed the NWMO to place elements of our engineered-barrier system underwater to test their behaviour under pressure and in different environments.

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Community drives everything we do at the NWMO.
Yes, science, design, engineering, and many other technical aspects are also central to the implementation of Canada’s plan for the safe, long-term management of used nuclear fuel.

It is only by working with communities that we can move forward with any of our plans – technical or social. Those connections are integral to our success; we need them.

For me, the past quarter has highlighted the many communities we, at the NWMO, are a part of every single day: local communities in our site selection process, scientific communities, and the global nuclear community.

Over the last few months, I had the pleasure to tour all the areas working with us to find informed and willing hosts for a deep geological repository. I met the hard-working men and women who are collaborating with us every day to help their communities learn more about Canada’s plan. And not just NWMO staff, but also local leaders and community groups.

The NWMO also works hard to give back to those communities. I enjoyed visiting with young people engaging in STEM (science, technology, engineering, and mathematics) education because of our investments, seeing environmental efforts bolstered by our support, and seeing how we are making a lasting difference in these areas.

We also worked with Indigenous partners to learn more about reconciliation here and abroad, and sought to contribute to that effort here at home.

This past quarter also saw the NWMO attend a number of conferences and deepen ties with members of the nuclear and energy communities around the world.

The NWMO is part of many communities; they enhance our work, and make us stronger and better informed.
Meet the team:
Office Services and Records

Our memories shape our image of the environment. As a child, I picked wild blueberries with my mom and grandmas. They taught me how blueberries love the acidic, thin membrane of soil between rock and juniper. That they depend on a wet spring and a hot summer. How they spread not by seed, but by roots. And those roots help stabilize the membrane of soil and make it more resilient to erosion. Those late-summer afternoons first showed me the complex connections of nature.

Today, that knowledge informs my work at the NWMO, where we study connections and ecosystems – which are really a system, within a system, within a system. Each is connected, and each gives and takes. For example, a forest system draws nutrients from a soil system, gives oxygen to the atmospheric system, and decomposes back to nutrients in the soil system. A resilient system is a diverse system of connections. At the NWMO, we seek to measure and maintain that resiliency.

Environmental scientists use western scientific data and analysis methods with statistical certainty and repeatability at their core. But when we define systems or limit which parts to study, we insert our values into the process. We may miss unseen connections and local knowledge. So at the NWMO, we ask ourselves: how do we interweave Indigenous Knowledge with western science? How do we incorporate and respect diverse perspectives? What information do we collect and how?

Those concerns highlight why the NWMO is taking a participatory planning approach to baseline environmental monitoring. It means listening to Indigenous Knowledge keepers and local community members, and to technical experts and academics.

We are already working collaboratively with communities, both absorbing and addressing their concerns, and testing our ideas with experts. Eventually, a team of experts, Indigenous and community partners, colleagues, and academics will serve as stewards of the environmental review process as we move closer to site selection. In sum, we are building connections in order to ensure Canada’s plan is implemented in a manner that protects people and the environment for generations to come.

You will not often see them sharing their work at conferences or outside the company, but there is one team that keeps the NWMO running smoothly.

They keep our offices stocked and our facilities running well, and ensure everything is well-maintained. And as we approach licensing in the coming years, one of their core functions will prove even more essential: record keeping.

The Office Services and Records team touches every aspect of the NWMO’s business. And this winter, they welcomed for the first time a co-op student into their ranks.

Amanda Carter, a Community Integration Through Co-Operative Education student at Humber College, graduated this past April after she spent part of her final semester with the NWMO. She helped with research and data entry, and said she enjoyed her venture into office work.

“I enjoy doing office work, and everyone is really nice to me,” she said, before joking, “The best part of working at the NWMO is a great work environment, although people need to smile more.”

Others on her team echoed her sentiments about the company.

“I enjoy working at the NWMO because I am surrounded by a legion of bright individuals from various scientific and engineering disciplines. I index and maintain all research and supporting documentation for Canada’s plan and the repository project,” said Records Clerk Michael Orrett.

“Being in records allows me to interact with all the departments in the organization and gives me a unique overview of all that goes on in the company, from a documentation perspective.”

“I enjoy working at the NWMO because I strongly believe in our vision, mission and values. I am honoured to work for such a dynamic organization and being part of a project that is going to make a difference in our world,” said Office Support Representative Maria Novello. “My role allows me to interact daily with all my colleagues who have a wide range of expertise and from whom I am constantly learning.”
Over the past few months, NWMO President and CEO Laurie Swami has criss-crossed Ontario and visited all five areas remaining in our site selection process. From food hampers to baby baskets, she helped spread just a small bit of the support the NWMO provides to the communities with which we work. She also took the time to visit with local leaders in each community, while also digging into environmental initiatives and some of the ways the NWMO supports STEM (science, technology, engineering, and mathematics) education.

On this spread, we share a few highlights from Ms. Swami’s tours.
Food bank at Calvary Gospel Church, Hornepayne.

Eagle’s Earth Addictions Treatment and Mental Wellness Centre, Constance Lake First Nation.

Mary Berglund Community Health Centre Hub, Ignace.
Reconciliation around the world: The NWMO connects with efforts in Australia

The NWMO is committed to interweaving Indigenous Knowledge throughout our work and to implementing the principles of Reconciliation across the organization.

Ensuring actions speak louder than words can prove challenging, and our organization is not alone. Resource and energy companies around the world struggle with Reconciliation in their own ways, and members of the NWMO’s team recently joined a conference in Australia that, in part, tackled this complex, timely and important topic.

Jessica Perritt, Senior Advisor for Indigenous Knowledge, and Melissa Mayhew, Senior Environmental Scientist, travelled down under to present at the annual International Association for Impact Assessment conference in Brisbane. Their involvement ranged from discussions of incorporating Indigenous Knowledge to how impact assessments are evolving for the next generation. But Ms. Perritt said she was pleasantly surprised to see how deeply Indigenous rights and knowledge were woven into the program.

Land acknowledgments preceded every speaker, and the event included a traditional welcome to land done by an Indigenous Knowledge keeper.

She noted the opening ceremonies also included a smoke ceremony to cleanse the space, which she said is “very similar practice to a smudge ceremony that is done by First Nations people in Canada.”

While in Australia, Ms. Perritt also had the opportunity to meet with Reconciliation Queensland, an organization working to further Reconciliation between Indigenous peoples in that state and Australia.

“As the NWMO embarks on this journey of Reconciliation, it is important that we are learning from each other in Canada, and I felt extremely privileged and honoured to learn from our brothers and sisters in Queensland, Australia,” she said. “It was amazing to see and learn how similar some of the ceremonies, protocols and the connection to land is between Indigenous peoples in Canada and in Australia.

“Something that Reconciliation Queensland kept referring back to was the importance of understanding the truth and history of Indigenous peoples before stepping into the Reconciliation arena, and that education was the key to success,” she added. “This experience really reassured me that the NWMO is on the right path.”
The NWMO shares insights into capacity building with national study

On April 4, 2019, NWMO leadership added to an important national discussion about capacity building by sharing the organization’s unique insights garnered over the last 17 years.

NWMO CEO Laurie Swami and Vice-President of Indigenous Relations Bob Watts appeared in Ottawa before the Standing Committee on Indigenous and Northern Affairs to share their insights to its study of capacity building and retention of talent in remote and Indigenous communities.

The NWMO offered its unique perspective into capacity building as we work to implement Canada’s plan for the long-term management of used nuclear fuel in a manner that protects people and the environment.

“We have also committed that the project will only proceed with the involvement of municipalities, Indigenous communities in the area, and surrounding communities, working in partnership to implement it,” Ms. Swami said. “In order to do so, we have had to work to build capacity in potential host communities. Canada’s plan is a 100+ year, $24-billion infrastructure project. It will have economic and social benefits for generations, but ensuring local communities are well-informed and prepared to take on a project of this magnitude takes time and resources.”

The NWMO has striven to include Indigenous perspectives since our founding in 2002. That includes a commitment to Indigenous representation across the organization, from the Board through management to the workforce. The organization also has a Council of Elders and Youth that inform our work and a policy to integrate Indigenous Knowledge in all our work, and is in the midst of finalizing a formal reconciliation policy.

As we get closer to selecting a site in 2023, our efforts are increasingly focused on working with communities, which includes helping to build their capacity.

“In this work, we recognize the fact that resources are required to engage with our process. And we have committed that no community should be out-of-pocket for learning about and engaging with Canada’s plan,” Mr. Watts told the committee.

Part of the NWMO’s capacity-building work includes investments in training and education to equip community members, including youth, to benefit from the project. These investments support building transferable skills that could be applied to other projects or workplaces as well.

The NWMO shared with the committee some of the specific ways the organization works with communities to build capacity:

• Covering travel and meeting costs for engagement activities;
• Hosting 45 youth engagement activities in 2018 alone;
• Funding 18 positions within Indigenous communities to support their involvement in the project, comprised of 15 community liaison office positions, one youth position, one technical officer, and one administrative support person;
• Investing in communities and organizations at the community, local, regional, provincial, and national levels; and
• An approach to capacity building that recognizes there is no one-size-fits-all approach, but which prioritizes transparency, respect and partnership.

The NWMO supports cultural awareness training in communities

The NWMO has, since we were founded, worked to interweave Indigenous Knowledge and cultural awareness across the organization.

Now, for the first time, we have supported cultural awareness training for the broader community in Bruce County.

The events held on May 16 and 17 in Huron-Kinloss and South Bruce mirror the cultural awareness training that NWMO staff receive, and that has been offered to municipal staff, mayors, councillors and community liaison committee (CLC) members. Following the popularity of one such session in the area last year, the CLC decided offering the cultural awareness training is another way that NWMO resources can be used to build capacity and help citizens develop their skills. They identified the training as an opportunity to share information on Canada’s cultural heritage, increase awareness of cultural competency and gain an understanding of relationship-building skills to promote positive partnerships with Indigenous peoples in the municipality.

Lyndon Linklater from Thunderchild First Nation in Saskatchewan led the session, which included storytelling, humour, music, and interactive exercises. Some of the themes and topics included Indigenous world view, spiritual teachings and ceremonies, treaties, residential schools, and Truth and Reconciliation.

More than two dozen people gathered for each training session, which opened with a smudging ceremony led by Jessica Perritt, NWMO Senior Advisor for Indigenous Knowledge. We will also be supporting similar training in the other communities involved in the site selection process.

Lyndon Linklater from Thunderchild First Nation in Saskatchewan leads a cultural awareness training workshop in Bruce County.
NWMO scientists travel to Finland

“The fantastic part about being involved in the FISST project is that Posiva is at the most advanced stage of development of a geological repository for used nuclear fuel of any organization since it received a construction licence for the project in November 2015,” said Chip Lee, NWMO Manager of Mining and Repository Engineering. He had just returned from a workshop that included a tour of the ONKALO site and a run-through of what they have learned from FISST so far. “As this test is the first of its kind in the world, ONKALO is the only location on the planet we could have gone to witness and learn from this type of trial.”

Mr. Lee was joined by NWMO Director of Engineering Chris Boyle, Safety Assessment Models Section Manager Mark Gobien, and three experts from the United Kingdom’s Radioactive Waste Management, which is also involved in the FISST experiment. It was the third of recent visits and workshops as part of a partnership between Posiva and the NWMO.

Mr. Gobien said participating in the FISST experiment “…provides the NWMO with a lot of good insights into what sorts of challenges are faced, and what sorts of technologies are working or not working in the underground environment. It allows us to benefit from the experience that they have had (in Finland) when they have actually tried constructing something of this scale.”

Eventually, years from now when we have selected a site and are in the licensing phase, the NWMO expects to conduct a similar emplacement trial, Mr. Gobien explained. It is just one of the many ways Canada’s plan and similar efforts around the world will gain invaluable knowledge from the work being done by Posiva.

“Certainly, the NWMO could learn from the practices, processes and procedures that they have. They are moving quite quickly,” he said. “The amount of responsibility that they are taking on as first in the world is immense, and it is really clear they want this project to be successful not just for themselves, but for everybody.”

Research under the sea

Continued from p. 1

Even though the deep geological repository will be nowhere near an ocean, seeing how these two elements of the NWMO’s engineered-barrier system – copper and bentonite clay – stand up to harsh oceanic conditions provides insight into how they will behave at depth in the repository. The coins, after spending months under the heavy ocean waters, have now been sent to research partners at the University of Waterloo and the University of Western Ontario. They will be tested to see how well bentonite clay protected the copper from any microbial activity and other possible corrosive effects.

“The project also highlights our commitment to collaborating with experts in different fields,” Dr. Birns added. “Ultimately, we would like to learn how elements of the engineered-barrier system work together under pressure.

“Eventually, elements of the engineered-barrier system may be sunk as deep as 2.6 kilometres below the surface, further out in the Pacific Ocean. And our experts hope they may even test an entire scaled version of the container, without any used fuel, at those watery depths.”

The used fuel container developed by the NWMO is part of an engineered-barrier system that will help ensure a deep geological repository will protect people and the environment for generations to come. It is part of a multiple-barrier system designed to safely contain and isolate Canada’s used nuclear fuel deep underground well into the future.
MEET THE EXPERT

Sarah Hirschorn
Director of Geoscience

For Sarah Hirschorn, 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,” Dr. Hirschorn 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.

“I do not think I really understood the scale of everything until I came here,” said Jan-Willem Lamberink, an inorganic chemistry graduate student from the University of Western Ontario. “The tour really put it into perspective. There are so many different things [going into Canada’s plan] and so many different people working on them.”

Others said the visit helped them understand how their work fit into the larger project and the repository itself.

“It was really nice to see the things I am working on in context. I have seen the pictures. But it was really helpful to see the size of the fuel containers and how they are going to put clay around them,” said Emilie Sapasov, who holds a master’s degree in microbiology from the University of Waterloo and now works in the Neufeld Research Group. Her team is looking at microbial growth in bentonite clay, among other things, which will inform the NWMO’s work on our engineered-barrier system for used nuclear fuel.

The engineered-barrier system is part of the multiple-barrier system that will safely contain and isolate Canada’s used nuclear fuel inside a deep geological repository for generations to come.

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“That multidisciplinary approach is one of the things I enjoy the most about working at the NWMO,” Dr. Hirschorn 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 recent promotion at the NWMO, Dr. Hirschorn 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, Dr. Hirschorn and her family love to go on walks around their city and camping on the weekends.

Tour of the NWMO’s proof test facility puts Canada’s plan in perspective

Students and researchers from some of Ontario’s top universities on a visit to the NWMO’s proof test facility in Oakville.
Mobile learning lab promotes STEM and skilled trades among Bruce County youth

A first-of-its-kind mobile learning lab will roll through Bruce and Grey Counties this summer.

This unique learning experience is a provincial first that will help students explore science, technology, engineering, and mathematics (STEM), and careers in the skilled trades. It was unveiled this spring thanks to strong leadership in South Bruce and Huron-Kinloss, and those communities’ work with the NWMO.

“At the NWMO, we are passionate about promoting STEM education and the skilled trades – especially to young people. I am thrilled to see those values come to life in this mobile learning lab,” said NWMO President and CEO Laurie Swami.

This roving lab will provide students from Grade 7 onwards a unique way to engage with STEM education and the skilled trades – and explore future careers that are in high demand across Bruce County.

The lab is expected to officially start rolling in summer 2019 and to reach over 20,000 students.

The lab will initially consist of simulation software and technology, including:

- A welding simulator;
- A crane simulator;
- An excavator simulator;
- A loader/backhoe and dozer simulator;
- STEM simulation software; and
- 3D printing and robotics.

The Bluewater District School Board, the Bruce Grey Catholic District School Board, the Four County Labour Market Planning Board (FCLMPB), the Ontario Youth Apprenticeship Program, the Township of Huron-Kinloss, the Municipality of South Bruce, and the NWMO partnered on the project.

Both communities provided $12,500, and the NWMO contributed $50,000. The trailer for components of the lab was provided by the FCLMPB.

Supporting Indigenous education in Manitouwadge

As part of our commitment to supporting the communities we work with, the NWMO is investing in Indigenous education in Manitouwadge.

Laurie Swami, NWMO President and CEO, recently dropped by Our Lady of Lourdes Catholic School and visited students taking a native language and culture class. Approximately 12 pupils are enrolled in the course. The students also showed off what they have learned in the class, which is offered across the Superior North Catholic District School Board to all elementary schools.

“The students are taught about drumming and the significance of the drum in Indigenous culture. Currently, the students are learning to play the Bear Song,” says Debbie Arola, teacher at the school.

Ms. Swami got a chance to see first-hand how the NWMO’s investments in education are supporting student learning, as the NWMO contributed $2,500 towards the purchasing of traditional drums at the school.
Robotics program demonstration at Holy Name of Jesus Catholic School

NWMO President and CEO Laurie Swami recently had the opportunity to witness students from the Holy Name of Jesus Catholic School in Hornepayne demonstrate their robotics skills.

The students showed off their creativity in building and programming robots. The robotics kits – that are part of the classroom thanks in part to the NWMO’s support – help improve their creative problem-solving and teamwork skills.

“I enjoyed the robotics demonstration by the students, as well as seeing kids learning while having fun. Such experiences can inspire young people to pursue careers in technical fields, including the nuclear industry. Science and technology are important to our project,” Ms. Swami noted.

In 2017, the NWMO made a $3,400 contribution to start the robotics program at the Holy Name of Jesus Catholic School in Hornepayne. The school purchased robotics kits and teacher’s guides for VEX Robotics.

“It is truly amazing to watch the students learn about coding and computer programming. These students have the potential to be our future engineers or machine operators as their learning is starting at such a young age,” noted Laurie MacEachern, Principal, Holy Name of Jesus Catholic School.

In 2018, more than 130 elementary and high-school students from Homepayne and Manitouwadge gathered for a Robotics Learning Fair in Manitouwadge. The NWMO supported 75 students from Homepayne to participate in the fair by providing $3,500 to the school.

Spring Fever Fun Day in Ignace supports good cause

Jam-packed with activities, the annual Spring Fever Fun Day in Ignace attracted more than 100 local kids and adults to raise money for the Ignace Food Bank.

The yearly tradition was held at the Ignace Upper Curling Hall on April 13, and included an Easter egg hunt, cake walk and bake sale. There were also tables set up to give families a chance to register for the kids soccer and baseball leagues.

NWMO staff were on hand to support the fun and good cause. Relationship Manager for the area Rachelle Davenport and Community Liaison Manager Chantelle Gascon created a craft table where kids could make a no-sew sock Easter Bunny. They also took the opportunity to engage in discussions with adult participants about Canada’s plan for the safe, long-term management of used nuclear fuel.

“I am always inspired to see the community coming together for such a good cause. We are proud to support this initiative and appreciate the commitment by all those involved in organizing this event,” Ms. Davenport noted.

“The Spring Fever Fun Day is an awesome event that brings our families out to engage with their children and other families,” one of the event organizers, Joanne Armstrong, EarlyON Coordinator said. “The delight on the children’s faces as they participate in the many activities is so heartwarming. All the work of organizing and the bringing together of partners is definitely worth the pleasure experience by all.”

The event was held in partnership with Ignace Nursery School, Ignace EarlyON Child and Family Centre, the Ignace Recreation Department, and the NWMO.
The NWMO embraces STEMinism on International Women’s Day – and all year round

NWMO CEO Laurie Swami is not shy about her STEMinism, and her commitment to increase equity and diversity is shared across the organization. That’s why the NWMO was so quick to embrace this year’s International Women’s Day theme: #BalanceForBetter.

Employees across the organization shared, ahead of the March 8 festivities, insights into what the day means to them, the NWMO’s successes, and how we can do better in promoting diversity. Many of their thoughts were shared on Twitter @NWMOCanada.

And to build on their reflections, the NWMO’s CEO carried her STEMinist banner to a special Ontario Energy Association Women in Energy panel about the keys to increasing female representation, and all forms of diversity in the energy sector and across the STEM (science, technology, engineering, and mathematics) fields.

“Over the years, I have gotten used to being one of just a handful of women around the table,” Ms. Swami said. “There were few female engineers when I started out, and though representation has increased, female graduation rates in some fields have flattened, and the higher up the corporate ladder you go, the fewer women you see.

“That is why it has been so important to me – and to everyone at the NWMO – that we live up to the values we espouse. Last year, I shared my commitment to STEMinism – to helping foster increased diversity not just in nuclear but also across the fields of science, technology, engineering, and mathematics,” Ms. Swami continued. “Our record at the NWMO speaks for itself – half our board is made up of women, and my senior leadership team is quite diverse, over 40 per cent female and comprised of visible minorities and Indigenous people – but we know more work remains.

“Because when we talk about #BalanceForBetter, we do not just mean a 50-50 split on gender; we mean more balanced diversity in all its forms.”

The NWMO’s work to promote diversity in STEM starts with education. The organization has supported dozens of STEM-based learning and extracurricular activities since we were founded in 2002, whether that is helping schools afford equipment that allow kids to learn about coding robots or sponsoring FIRST LEGO League competitions.

“I am proud to work for an organization that seeks to elevate women and foster diversity every day of the year, and not just on International Women’s Day or other markers on the calendar,” said Joanne Jacyk, Section Manager of Environmental Assessment at the NWMO. “But days like this are still an important reminder that we need to pause and take stock, to ask ourselves, ‘what more can we do?’”