WHAT'S INSIDE

1 » Central Huron Completes Phase 1 Preliminary Assessments

2 » The NWMO's Engineered-Barrier System Enters the Proof-Testing Stage

4 » Fieldwork Continues in Northern Ontario

5 » New Grant Helps Fund Repository-Related Research

6 » The NWMO Helps Bring Science North to More Classrooms in Northern Ontario

6 » Indigenous Knowledge, a Key Aspect of the Site Selection Process

8 » Check Out the NWMO's Newest Publications

nwmo news

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Central Huron Completes Phase 1 Preliminary Assessments

In October, the NWMO completed the first phase of preliminary assessment for the Municipality of Central Huron, Ontario. Based on this work, Central Huron was assessed as having potential to meet site selection requirements for a deep geological repository for used nuclear fuel, and warrants further study.

"The objective of the site selection process is to arrive at a single location for a deep geological repository and a Centre of Expertise with a willing and informed host," said Kathryn Shaver, Vice-President of Adaptive Phased Management Engagement and Site Selection at the NWMO.

"Increasingly detailed field studies and engagement, completed in collaboration with the community, will provide additional learning about the area's potential for meeting strict safety requirements and for the project to align with the community's long-term vision," she said.

The community requested a preliminary assessment after expressing interest in learning about Canada's plan for the safe, long-term care of used nuclear fuel.

The NWMO has now completed Phase 1 preliminary assessments in all the 21 communities that requested them, including Central Huron. Preliminary findings do not confirm technical suitability and safety of any site, and at this early point in the process, no community is asked to confirm its willingness to host the project. The findings for Central Huron do not affect work ongoing in eight other areas in Ontario involved in the site selection process.

It is expected to take several more years to complete the necessary studies to identify a preferred site in an area with an informed and willing host.

Communities Currently Engaged in Preliminary Assessments

- Blind River
- Central Huron
- Elliot Lake
- Hornepayne
- Huron-Kinloss
- Ignace
- Manitouwadge
- South Bruce
- White River

Recognizing Community Leadership

Central Huron is also being recognized at this milestone in the process for its leadership in advancing Canada's plan. The NWMO will provide $400,000 to the municipality upon the establishment of a Community Well-Being Reserve Fund. Other communities were also recognized upon completion of their Phase 1 studies.

Administered by the community, these funds support continuing efforts to build community sustainability and well-being. Examples of activities the fund could support include projects, programs or services that benefit community youth or seniors, community sustainability, energy efficiency, or economic development initiatives.

The NWMO's Engineered-Barrier System Enters the Proof-Testing Stage

Earlier this year, the NWMO began testing its recently completed engineered-barrier system (EBS) design. This testing, which will take several years to complete, is meant to demonstrate that the EBS can meet the project's rigorous technical safety requirements.

The first tests are being conducted on two of the system's bentonite clay components:

- The highly compacted clay that will encase the used nuclear fuel container in a **buffer box**; and
- The **gapfill** that will fill voids in the underground rooms (known as placement rooms) where the used fuel containers will be placed.

"Bentonite clay is the ideal material for creating sealing systems," explains Alan Murchison, the NWMO's Manager of Fuel Handling and Sealing System Design. "Basically, it is volcanic ash, formed millions of years ago. It provides a buffer that remains chemically stable over time within the repository. Just as importantly, it inhibits both water flow and microbial activity."

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The NWMO's Engineered-Barrier System Design

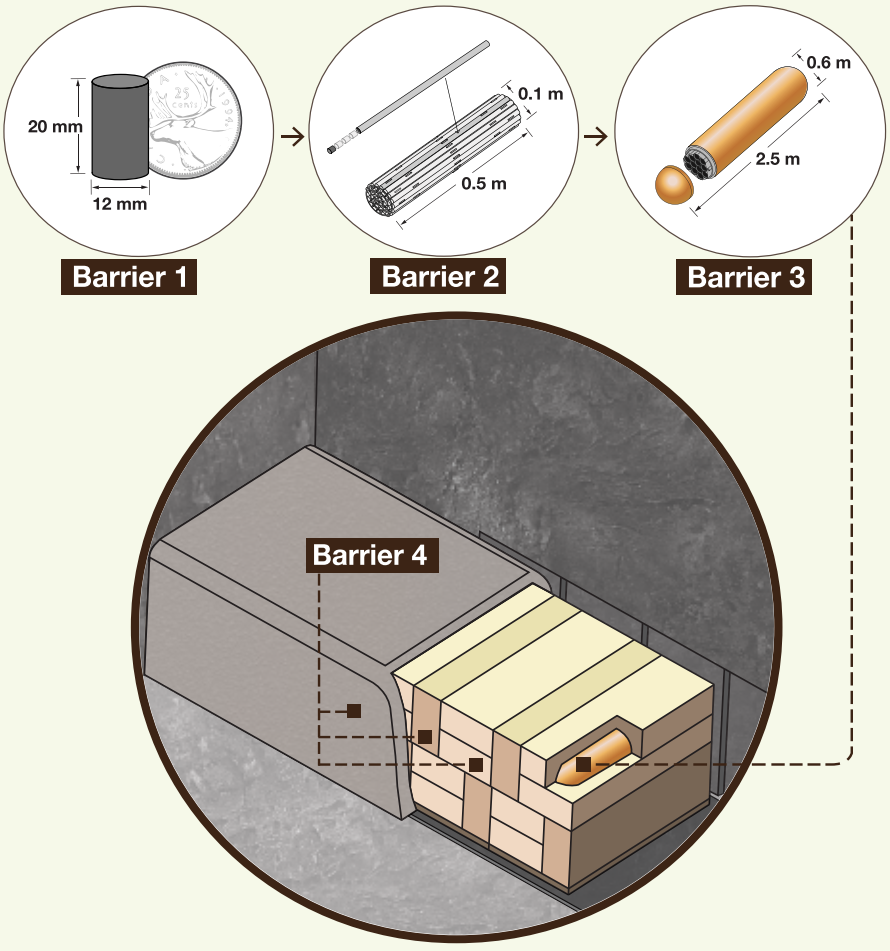
Within Canada's deep geological repository, a series of engineered and natural barriers will work together to safely contain and isolate used nuclear fuel from people and the environment. In addition to a natural barrier of rock, there is an engineered-barrier system (EBS) consisting of four physical barriers:

Barrier 1: Hard, high-density ceramic **nuclear fuel pellets** that are extremely durable, and resistant to water, wear, and high temperatures.

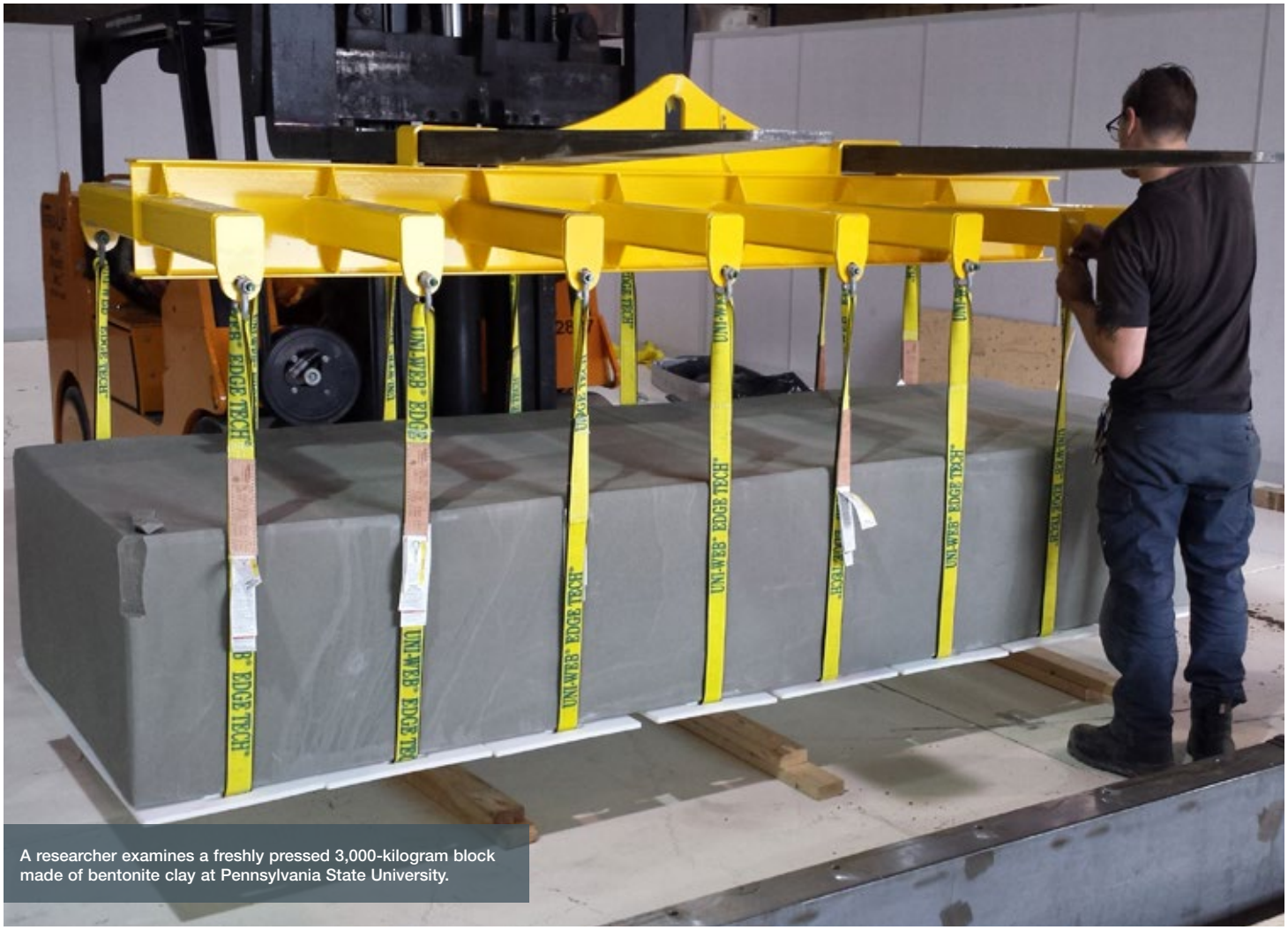
Barrier 2: The tubes, or **fuel elements**, in which the pellets are sealed. Together, these make up the **fuel bundle**. The fuel elements are made of a strong, corrosion-resistant metal called Zircaloy that contains and isolates the fuel pellets.

Barrier 3: The **used nuclear fuel container**, which is made of carbon steel and coated with corrosion-resistant copper.

Barrier 4: Bentonite clay, which is used to make the buffer boxes in which used fuel containers are encased, the spacer bricks placed between them, gapfill, and the seal blocking off the placement room.



(Continued from page 2)



A researcher examines a freshly pressed 3,000-kilogram block made of bentonite clay at Pennsylvania State University.

Buffer Boxes

Each assembled buffer box measures one metre by one metre by three metres, and can weigh up to eight metric tonnes. The boxes are made by pressing bentonite under very high pressure to form a large block. The block is hollowed out, and the used fuel container is placed in the hollow. The box is then capped with a matching block.

NWMO engineers are working with researchers at Pennsylvania State University to develop procedures for manufacturing these large buffer blocks.

Gapfill

Gapfill is made by pressing bentonite powder into pellets roughly the size of livestock feed. The pellets are then conveyed into the emplacement room through a hollow tube, until any remaining openings have been entirely filled.

The NWMO recently completed small-scale gapfill placement trials. Full-scale trials are planned for later in the year.

The NWMO and Nagra, Switzerland's radioactive waste management organization, have been exchanging data from their studies. This collaboration has allowed both organizations to benefit from each other's expertise and technical advances.

Benoit Garitte, a Project Manager in Geomechanics at Nagra, has been monitoring the NWMO's gapfill studies for the past year. "Our work with the NWMO on sealing materials makes use of the latest available science," he explains. "Together with strict quality control, we thus ensure the highest quality of the sealing elements that are required for a deep geological repository."

Over the next several years, engineers will test the safety performance of the entire EBS. They will also test manufacturing processes and feasibility for all the system's components, with the goal of demonstrating that the components can be repeatedly manufactured to the high standards required.

Fieldwork Continues in Northern Ontario

Over the summer and early fall, geoscientific fieldwork such as airborne surveys and detailed geological mapping was undertaken around several of the northern Ontario communities that have asked to learn more about Canada's plan for the long-term management of used nuclear fuel.

"The studies we are undertaking are designed to advance understanding of the geology and suitability of potential siting areas in crystalline rock," said Dr. Mahrez Ben Belfadhel, the NWMO's Director of Adaptive Phased Management Geoscience. "Planning and conducting fieldwork is a very collaborative process with people in each of the areas we are studying."

As part of working with people in potential siting areas to develop the scope, location, and timing of field studies, NWMO staff worked closely with local First Nation and Métis communities to ensure fieldwork was carried out in a way respectful of the land and traditions of the people who use it.

(Continues on page 5)



Geoscientists conduct detailed geological mapping in the vicinity of Ignace, Ontario.

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Airborne Surveys

Between July and October, airborne geophysical surveys were conducted over potential siting areas in the vicinity of Hornepayne, Manitouwadge and White River. The NWMO will use the data to develop a more detailed understanding of the geological characteristics of the areas being studied, including rock types, homogeneity, potential presence of faults and fractures, and the depth and extent of potentially suitable host rock formations.

Detailed Geological Mapping

The NWMO also began detailed geological mapping, also known as detailed outcrop mapping, in areas around Ignace. This work helps advance understanding of the characteristics of the rock.

Prior to mapping activities, Elders and knowledge holders from Wabigoon Lake Ojibway Nation (WLON) initiated a Traditional Knowledge Program that included knowledge holders workshops, local First Nation guides, Cultural Awareness Training, community feasts, and most importantly, the incorporation of ceremony prior to commencing any mapping activities. The week of ceremonies ended with a ceremony that included a gift exchange among the Chief of WLON, the Mayor of Ignace, and the NWMO's Associate Vice-President of Aboriginal Relations, Bob Watts.

To plan the mapping, study areas of exposed bedrock were first identified by an initial flyover, after which the actual mapping activity was undertaken by experienced structural geologists and geological engineers. Local guides with knowledge of the land



helped the teams in their work. Additional mapping will resume in the late spring or early summer of 2016.

As with all other geoscientific preliminary assessments carried out by the NWMO, the Adaptive Phased Management Geoscientific Review Group reviewed the approach and methods of the studies. They will also be reviewing the findings as they become available. The group is made up of five internationally recognized experts in geoscience.

New Grant Helps Fund Repository-Related Research

In September, the Natural Sciences and Engineering Research Council of Canada (NSERC) awarded a four-year Collaborative Research and Development Grant to Prof. Ming Cai at Laurentian University. Professor Cai's project will contribute to the safety of deep geological repositories by developing new and more detailed ways of modelling fracture networks in rock masses. The grant will also help support the work of one postdoctoral fellow and four graduate students.

"The idea is to develop methods to better understand the rock masses we are studying as potential sites for a repository," said Eric Sykes, an Associate Scientist at the NWMO who will provide support for this collaborative project. "Professor Cai's research will give us yet another tool to investigate rock formations, and identify those with the strongest potential to contain and isolate used nuclear fuel."

The work of Professor Cai and his team of researchers from Laurentian University, the Mining Innovation Rehabilitation and Applied Research Corporation, and the University of Alberta will be jointly funded by NSERC, the NWMO, and Rio Tinto, with additional support from the Ontario Trillium Scholarships program, the Centre for Excellence in Mining Innovation, FSS Canada, and the Swedish Nuclear Fuel and Waste Management Company.

Professor Cai's is the third NSERC-NWMO grant this year. In May, Prof. J. Clara Wren at Western University was awarded a senior Industrial Research Chair in Radiation-Induced Corrosion, while in June, Profs. Tom Al and Ian Clark of the University of Ottawa received a grant to conduct advanced hydrogeochemical research.

The NWMO Helps Bring Science North to More Classrooms in Northern Ontario

Since 2012, the NWMO has helped Science North deliver programs to classrooms in and around northern Ontario communities engaged in learning more about Canada's plan for the long-term management of used nuclear fuel.

"Leading a project that will take several generations to implement means we need to identify ways to nurture today's students as they develop the scientific skills they will need to understand the project and carry it forward in the future," said Lisa Frizzell, Director of Corporate Affairs at the NWMO.

In the school year 2014-15, NWMO funding to Science North benefited a total of 44 schools, including four serving First Nations youth. The funding supported two programs – one on science innovation and the other on financial literacy. The first offered students hands-on experience with simple machines, renewable energy, and electricity. The second had students manage a budget while extracting mineral from their own virtual mines.

For Emily Kerton, a Senior Scientist at Science North, "Teaching Science through active learning and experimentation is at the core of what Science North does. We would not have been able to reach the number of schools we did last year without the funding from the NWMO."

Both programs were developed with funds from Ontario's Ministry of Education and are designed to complement the province's science curriculum.

The NWMO also supports other science-based initiatives for students. These include Scientists in School, a program for kindergarten to Grade 8 students, and Shad, a program that allows exceptional high-school students to attend a month-long summer program on Canadian university campuses.

Indigenous Knowledge, a Key Aspect of the Site Selection Process



Indigenous Traditional Knowledge is the unique understanding, relationship, and connection to the land that defines the way of life of First Nation and Métis communities. As part of its promise to work in partnership with these communities, the NWMO is committed to interweaving Indigenous Knowledge in all aspects of its work.

The Council of Elders is an advisory body that provides guidance to the NWMO about applying Indigenous Knowledge. Made up of 12 First Nation and Métis Elders and seven youth, the Council also provides advice on enhancing the development and maintenance of good relations with First Nation and Métis communities.

(Continues on page 7)

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"We have the opportunity to make our project better by learning from Indigenous Knowledge," explains Jessica Perritt, an engagement officer at the NWMO and a member of the Chippewas of Nawash First Nation. "The Council of Elders has played an instrumental role in helping build working relationships with Aboriginal communities to determine if and how the community wishes to share its indigenous knowledge."

The Council is currently guiding the NWMO in finalizing an Indigenous Knowledge Policy. The purpose of the policy is to set out how the NWMO will support communities, as well as guide the work of the NWMO and contractors working on its behalf. It is also designed to help ensure that Indigenous Knowledge in all its forms will continue to be valued and respected by the NWMO, and included in planning and decision-making processes.

Individual members of the Council have also attended various meetings organized by the NWMO, including First Nation and Métis community meetings, open houses, trade shows, and cultural events. "These meetings are a great opportunity for the Elders to engage with people out in the communities," explains Ms. Perritt. "It is important that they hear from the Elders themselves about the Council and the guidance it has provided the NWMO over the years."

The Council of Elders has welcomed youth members, and encouraged them not only to learn, but also to voice their opinions and perspectives, and actively participate in the ceremonies associated with the meetings. In addition to the youths' learning about the NWMO and Canada's plan, they are also learning from the Elders with regards to traditional practices, protocols and processes.

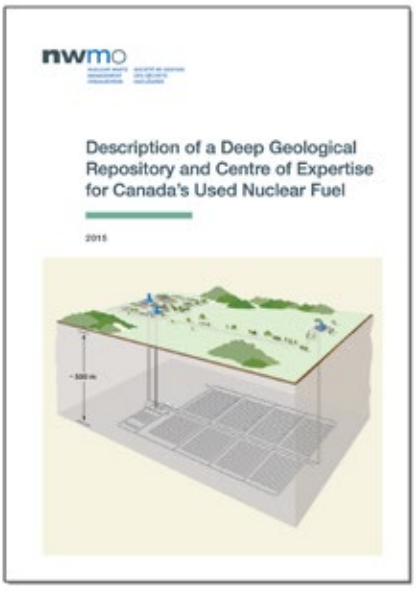


The NWMO's Jessica Perritt hands out blueberries as part of opening ceremonies at the Council of Elders' July meeting.

Check Out the NWMO's Newest Publications

The NWMO recently published major updates to three of its publications:

- *Description of a Deep Geological Repository and Centre of Expertise for Canada's Used Nuclear Fuel*;
- *Ensuring Safety: Multiple-Barrier System*; and
- *Programs Around the World for Managing Used Nuclear Fuel*.



Programs Around the World features a fold-out map showing how other countries are planning to manage their high-level radioactive waste over the long term. Canada's approach is consistent with best practice around the world. Most countries with commercial nuclear power production are also planning to isolate the waste byproduct of their nuclear fuel cycle in a deep geological repository.

Ensuring Safety graphically illustrates how Canada's deep geological repository will rely on five barriers, four engineered and one natural, to safely contain and isolate used nuclear fuel over the long term. The update is based on the engineered-barrier system design the NWMO completed in 2014 and is currently proof testing.

The updated project description reflects the extensive work the NWMO has undertaken since 2012, the year the original was first published. The 2015 edition contains new information on such topics as the latest reference design for surface and underground facilities at the repository site, potential uses for the Centre of expertise that is part of the project, and new estimates of the types and numbers of jobs by project phase.

All three publications are available online at www.nwmo.ca.

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