WHAT'S INSIDE

nwmo news

Nuclear Waste Management Organization

VOLUME 14, ISSUE 1 2016

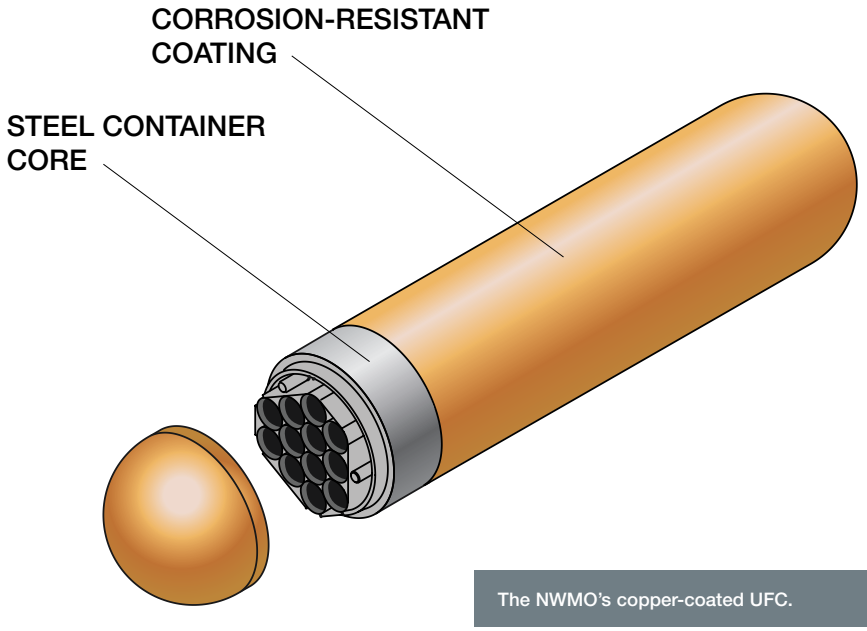
Holding Up Under Pressure: the NWMO's Copper-Coating Process Passes Crucial First Test

A used fuel container (UFC) is part of a multiple-barrier system for safely containing and isolating used nuclear fuel over long time spans. Pressure vessel grade steel provides the strength to resist extreme loading on top of the repository, including the massive buildup of ice that will occur during future ice ages, while the copper exterior provides a corrosion-resistant barrier.

A unique feature of the NWMO's UFC design is that it involves directly applying the copper coating onto the steel container.

"Other systems rely on a separate copper container that is more complex to manufacture and prone to leaving a gap between the inner steel container," explains Christopher Boyle, one of the NWMO engineers who is testing the new design. "By directly coating the steel container, we are able to achieve a single, unified component. This greatly simplifies the handling of the container."

The design uses standard nuclear grade materials and proven manufacturing processes to simplify fabrication. Machining, welding, non-destructive examination, and the copper coating of prototypes are all currently being completed at centres of excellence across Canada.



The NWMO's copper-coated UFC.

"In the long term, some UFC manufacturing processes could be completed in or near the area where the repository will be located," added Mr. Boyle.

(Continues on page 2)

(Continued from page 1)

To see how the NWMO's proposed copper coating stacked up against wrought copper, Mr. Boyle recently carried out a series of experiments to compare the structural response of various coatings when subjected to bend testing. The results, published in volume 293 of the peer-reviewed journal *Nuclear Engineering and Design*, showed that the copper-coating methods the NWMO is proposing to use had the strength necessary for containers in a deep geological repository.

The experiments represent what is known as "beyond-design-basis" testing. That means the tests went far beyond the conditions that a container would experience in a repository.

This work represents the initial phase of testing. Further experiments, including simulated crushing of container sections and full-scale prototype container pressure tests, are ongoing.

The article can be read online at www.nwmo.ca/en/~/media/Site/Reports/2016/02/29/09/47/CopperCoatingsPerformance_EN.ashx.

The NWMO's Christopher Boyle on-site at the Applied Research Laboratory's High-Pressure Test Facility at Pennsylvania State University. The results demonstrated that the container can withstand loads in excess of those anticipated at repository depth and matched the predicted failure load from the NWMO's computer models.

NWMO Shares Economic Modelling Studies With Communities

The NWMO recently completed preliminary economic modelling studies for areas involved in the site selection process. The initial findings are meant as a starting point for discussing how to maximize the project's economic benefits, and were shared with community liaison committees in February and March.

The new analyses provide initial estimates of the numbers and types of potential jobs the project would bring to the area, region, and province as a whole. The project has the potential to be an economic engine for many decades in the area where it will be located, as well as the larger economic region.

Specific numbers will depend on a range of factors, including the location, specific plan for implementing the project, cost, and schedule. These factors can evolve over time, and investments can be made to maximize benefits for an area in a way that aligns with the vision and goals held by people in the area.

Jo-Ann Facella, the NWMO's Director of Social Research and Dialogue, emphasized that jobs are only one of many factors communities might consider in reflecting on the project's potential to contribute to their area's well-being.

> "Over the coming years, we will be working together with communities to learn about the many dimensions of well-being that are important to people in each area. Economics and employment are just one aspect. Other aspects may include spirit, infrastructure, environment, community, and culture."

The third party contracted by the NWMO to produce the initial estimates worked closely with Statistics Canada.

NWMO-Supported Students Take Top Honours at R&D Workshop

One of the ways the NWMO plans for the long term is by helping support the research of exceptionally promising graduate students. In December, three of those students won first, second and third prizes at a poster competition held by the University Network of Excellence in Nuclear Engineering (UNENE). The competition, which was held in Toronto, brought together more than 50 graduate students from universities across Canada.

All three winners are PhD candidates studying under NWMO-sponsored Industrial Research Chairs at Western University.

- Shannon Hill won first prize for "The Corrosion Evolution on Carbon Steel Under Deep Geological Disposal Conditions for Spent Nuclear Fuel Waste." Her PhD supervisor, Prof. David Shoesmith, holds an Industrial Research Chair in Used Fuel Disposal Chemistry.
- Thalia Standish won second prize for "Galvanic Corrosion of Copper-Coated Carbon Steel for Used Nuclear Fuel Containers." Her PhD supervisor is Professor Shoesmith.
- Mojtaba Momeni won third prize for "Effects of pH and Radiation on Galvanic Corrosion of Stainless Steel-Carbon Steel Welds." His PhD supervisor is Prof. J. Clara Wren, who holds an Industrial Research Chair in Radiation-Induced Processes.

"The prize winners are a credit to the NWMO, Western University and UNENE," said Dr. Peter Keech, the NWMO's Manager of Engineered-Barrier Science. "Their success here also reflects the importance of their research, which is yielding valuable insights about how copper and steel might hold up over the lifetime of a deep geological repository."

UNENE is an alliance of universities, nuclear power utilities, and research and regulatory agencies for the support and development of nuclear education and research and development capabilities in Canadian universities. The NWMO became an associate member of UNENE in 2011.

The NWMO's Peter Keech (far left) poses with Prof. J. Clara Wren, Mojtaba Momeni, Shannon Hill, Thalia Standish, and Prof. David Shoesmith at the 2015 UNENE R&D workshop.

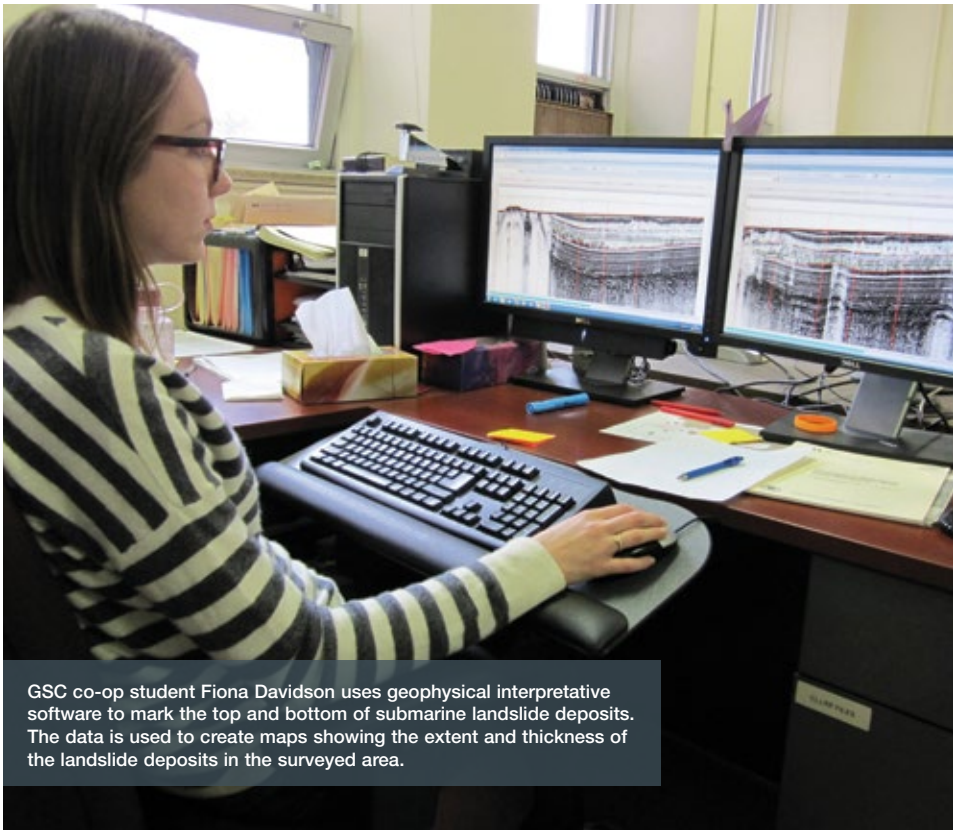
The NWMO and Geological Survey of Canada Team Up to Discover Ancient Earthquake Activity

Long-term safety for people and the environment is the NWMO's top priority in selecting a site for Canada's deep geological repository for used nuclear fuel. A key aspect of assessing safety is understanding the long-term stability of the geologic setting, including resilience to future earthquakes. Understanding ancient earthquakes in a given region is one of the methods that are used to assess the likelihood and magnitude of future earthquakes.

In Canada, written records of earthquakes go back to the mid-17th century, though it was not until the late 19th century that they were first measured with instruments. A national seismographic network for detecting and routinely reporting earthquake activity was established in the 1960s.

To go back farther in time, the NWMO is working with the Geological Survey of Canada (GSC) to examine whether layers of lake bed sediments may preserve evidence of moderate to strong earthquake activity that occurred many thousands of years ago. The goal is to establish a more complete picture of a region's long-term seismic history. This specialized area of work is known as paleoseismicity.

"The preliminary results are very encouraging," says Mark Jensen, the NWMO's Director of Deep Geological Repository Geoscience and Research. "They indicate that such paleoseimic techniques may be effective in providing evidence of earthquake activity going back many thousands of years. While the research is continuing, this type of information is helpful in evaluating regional seismic activity and may be able to further establish the scientific basis to evaluate the long-term safety of a deep geological repository."



GSC co-op student Fiona Davidson uses geophysical interpretative software to mark the top and bottom of submarine landslide deposits. The data is used to create maps showing the extent and thickness of the landslide deposits in the surveyed area.

The research is led by Dr. Greg Brooks, a research scientist at the GSC, and focuses on identifying distinct levels of lake-bottom deposits where numerous landslide deposits are present. The research methods were pioneered in Switzerland.

Dr. Brooks and his team have been conducting their fieldwork in a moderately sized Canadian Shield lake. Their work started with conducting extensive sonar surveys across the lake. These were used to create a dense network of two-dimensional images from which a three-dimensional picture of the lake-bottom deposits was established. This picture was used to identify key locations in the lake bed from which core samples were extracted and landslide deposits dated.

The next step will be to corroborate the results with evidence from other lakes in the region.

The NWMO and University of Toronto Study Effects of Future Glaciers on Repository Safety

Dr. Gordan Stuhne (left) and Dr. Dick Peltier (centre) meet with the NWMO's Eric Sykes to discuss their latest work.

When people think about climate change, they usually think about rising temperatures. But over the very long term, thousands of years in the future, the climate will eventually cool again, bringing with it the next ice age. That is why geoscientists will carefully consider the impact of past glaciers when assessing stability and safety of potential sites for Canada's deep geological repository for used nuclear fuel.

To develop a better understanding of how the last ice age evolved, the NWMO has been working for the past 10 years with researchers in the University of Toronto's Department of Physics. The current phase of research is headed by Drs. Dick Peltier and Gordan Stuhne.

> "This work is important because glaciation represents one of the most severe changes that can occur in the Canadian landscape," notes Eric Sykes, an associate scientist at the NWMO. "In the past, large parts of Canada have been covered by ice sheets with a thickness in excess of four kilometres."

The goal is to use the university's internationally recognized glacial systems model (GSM) to predict glacial ice sheet and permafrost history over the last 120,000 years. The predictions are tested by seeing whether they are consistent with observed geoscientific evidence from other sources.

"By using state-of-the-art GSM estimates of ice-sheet thickness and permafrost depth, we can better understand the likely impact of such conditions on the geology at potential repository depths," explains Mr. Sykes.

Check Out Our New Website!

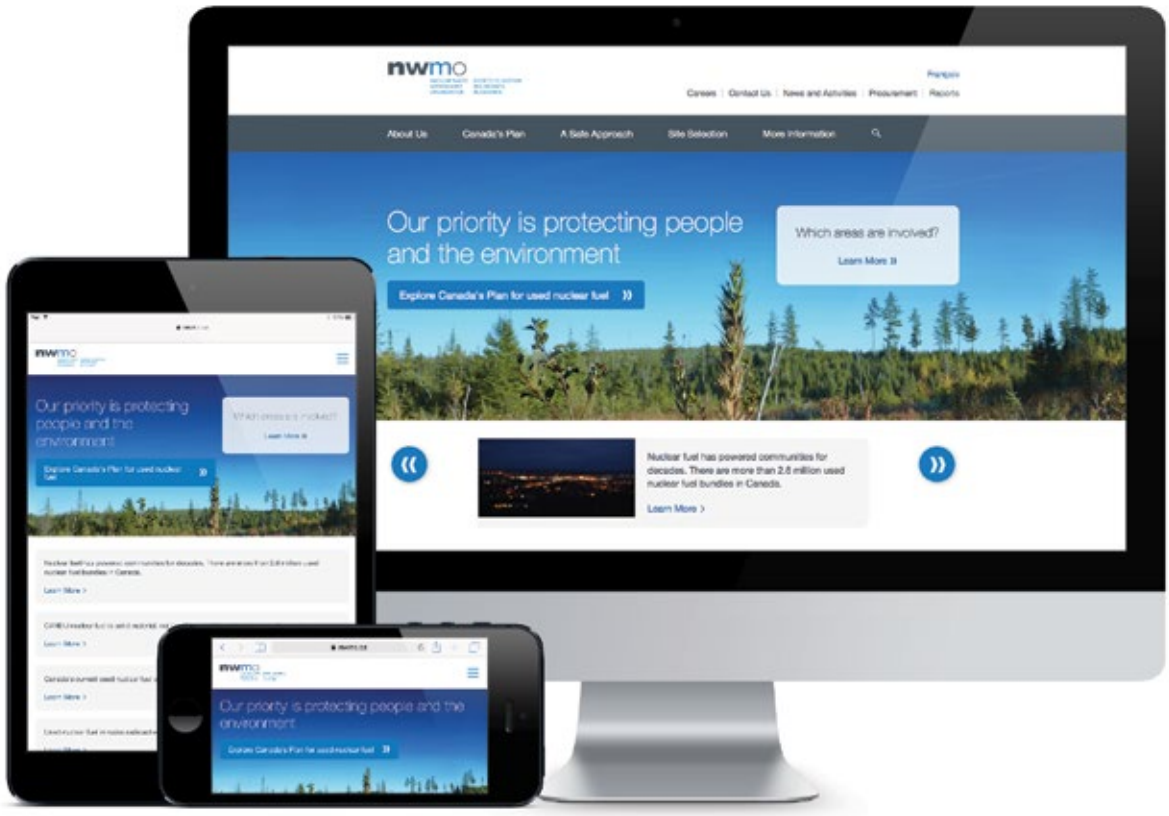
In December 2015, the NWMO rolled out a brand new website. You will still find it at www.nwmo.ca, but with a whole new look and feel.

"The new website is all about making it easier to learn about Canada's plan for used nuclear fuel," explains Michelle Dassinger, the NWMO's Digital Communications Program Manager. "We know that the Internet is constantly evolving and that Canadians are some of the savviest website users in the world. It was time to adapt our site to meet peoples' expectations."

The new site is mobile and tablet-friendly, is easier to navigate, and features streamlined materials that are easier to read on electronic devices. In addition to many more graphics and videos, there is also a new "You Asked Us" section where users will find answers to questions about a variety of topics. Community members can also access information about the work being done in their area in the new Study Areas pages.

We encourage you to visit the new website, and check back frequently for updates on the site selection process and ways in which the NWMO's technical program is working to meet the project's strict safety requirements. We also encourage you to share your feedback and ideas with us, on the website and on our work in general, by contacting us at www.nwmo.ca/ContactUs.

Learn More: www.nwmo.ca



nwmo
NUCLEAR WASTE MANAGEMENT ORGANIZATION
SOCIÉTÉ DE GESTION DES DÉCHETS NUCLÉAIRES

For more information, please contact:

Nuclear Waste Management Organization
22 St. Clair Avenue East, Sixth Floor
Toronto, Ontario M4T 2S3, Canada
Tel.: 416.934.9814 Toll Free: 1.866.249.6966
Email: contactus@nwmo.ca
Website: www.nwmo.ca