

## CONNECTIONS OF A DGR KIND



*Tiverton Energy Solutions Expo - Dropping Science Rappers left, Rob Macleod, Ryan Berry and Lenny MacLeod took time out from singing songs about how cool science is to discover just how cool the DGR is.*



*Kincardine Home & Garden Show - Doug and Cathy Mallory of Kincardine have their questions answered by OPG's Manager of Repository Engineering Richard Heystee.*



*Chesley Agri Fair - OPG's Lynda Cain gets up close and personal with Sparky the Fire Dog who resides at the Chesley Fire Department.*



*Chesley Agri Fair - Left, Grey County Warden Kevin Eccles, Mayor of Arran-Elderslie Ron Oswald and Bruce County Warden Milt McIver chat with OPG's Director of Public Affairs Terry Squire.*



*Kincardine Scottish Festival - Kincardine News editor Troy Patterson checks out the hands-on activities at the mobile exhibit while covering the heavy events, sponsored by OPG.*



*Chesley Agrifair - Steven Elder creates his own energy with one of OPG's popular red balls.*

### We're coming to a town near you

There have been numerous DGR mobile exhibit sitings over the spring and summer, which is indeed a good thing. Ontario Power Generation (OPG) wants to ensure that members of the public have lots of information about the proposed Deep Geologic Repository (DGR) project for the long-term management of low and intermediate nuclear waste at the Bruce site. So saying, the exhibit has a tour schedule that has included: Chesley Kinsmen Mid-Western Agrifair, Saugeen Home and Recreation Show in Walkerton, Kincardine Home and Garden Show, Wiarton Home Show, Tiverton Energy Solutions Expo, Kincardine Scottish Festival, Kincardine Market in the Park, Port Elgin Flea Market, Keady Market, Walkerton Farmer's Market and Sauble Christian Fellowship Church Garage Sale.

Late summer and fall events include the Chippewas of Nawash Traditional Pow-Wow, Pumpkinfest, International Plowing Match, Clarington Family Safety Day and a number of open house venues for the DGR which will be held in Kincardine, Walkerton, Saugeen Shores, Ripley, Chesley, Wiarton and Owen Sound.

For more info visit [opg.com/dgr](http://opg.com/dgr)



## News from OPG's Western Waste Management Facility

SPECIAL EDITION: Keeping you informed about the Deep Geologic Repository

# Neighbours

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### Knowledge from different disciplines offers consistency to overall geologic model for DGR



*Geoscientists and technical experts working co-operatively on OPG's DGR met in June at a workshop held at Gartner Lee Limited in Markham to discuss their Phase One reports for the Geosynthesis. Members of OPG's Geoscience Review Group (GRG) were there to provide a review of the findings in the research reports. Left, Dr. Sean Frappe - University of Waterloo, Mark Jensen - OPG Manager of Geoscience, Ken Raven - Principal Intera Engineering, Dr. Derek*

*Martin - GRG member, Rob Frizzell - Gartner Lee Limited, Dr. Joe Pearson - GRG member, Dr. Dougal McCreath - Laurentian University, Dr. Monique Hobbs - OPG Senior Scientist, Dr. Jon Sykes - University of Waterloo, Bob Leech - Gartner Lee Limited and Tom Lam - OPG Senior Technical Specialist. Dr. Andreas Gautschi and Jacques Delay, the two other members of the GRG, were unable to attend the workshop.*

### OPG's seismograph network registers low level activity

OPG's seismograph network, which was installed in August of last year to measure low level seismic activity within a 150 km radius of the Bruce site, registered events at or about 11 p.m. on July 31 - the night many Kincardine residents heard two big bangs. OPG's Manager of Geoscience Mark Jensen, based on communication with the Geologic Survey of Canada, said that OPG's network (part of the site characterization activities for the DGR) registered a

seismic event at about 23:01, with a magnitude of 1.4. "It was a confirmed mining blast from the Goderich mine, and it definitely wasn't an earthquake," Jensen said. "A second event occurring at about 23:10 was comprised of two distinct shocks about 20 seconds apart. These shocks, which were likely what was heard, were related to a disturbance in the atmosphere, not ground motion." Jensen noted that seismic activity with a magnitude of 1.4 wouldn't be felt

or heard. "The network was designed and installed to pick up extremely low level seismic activity that could not previously be detected," he said. OPG's network routinely picks up low level seismic activity from the operation of quarries in Owen Sound, Collingwood and the salt mine at Goderich. OPG's seismographs are located at Ashfield, Meryville Lake near Southampton and Walkerton in shallow boreholes.

### Neighbours

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# Phase One work provides confidence in proposed location for DGR



Derek Martin

## DGR benefits from international expertise

Dr. Derek Martin, a professor in geotechnical engineering at the University of Alberta, knows a fair bit about the long-term management of nuclear waste.

Martin is a member of Ontario Power Generation's (OPG) Geoscience Review Group (GRG) that is offering peer review for the geoscientific site characterization of OPG's proposed Deep Geologic Repository (DGR) for the long-term management of low and intermediate nuclear waste at the Bruce site. He comes to the table with a cornucopia of invaluable knowledge gained from years of study, research and practical field experience in a variety of industries including nuclear waste management, oil and gas, mining and underground construction.

"At the end of the day, every country must live with the geologic mediums that they are given, and the challenges imposed by this is what makes the work stimulating," he said. "Each rock type has its own challenges and engineered solutions."

Martin said the differences in the various rock types found internationally encourages the countries involved in site characterization work to share the results of their investigations.

"Canada, with OPG's DGR project, is making significant contributions to our understanding of tight shales and limestone rock formations."

Martin is joined on the GRG by Dr. Joe Pearson, a hydrogeochemist from North Carolina, Jacques Delay from ANDRA – France's National Agency for Radioactive Waste Management and Dr. Andreas Gautschi from NAGRA – Switzerland's National Co-operative for the Disposal of Radioactive Waste.

## Scientific work at site supports regional geologic footprint

Dr. Martin is encouraged – "strongly encouraged" by the results to date of the multi-phased, multi-step, geoscientific site characterization of OPG's proposed DGR.

Based on existing, regional, geological information, there are expectations that the clay-rich, limestone sedimentary rock formations for the proposed site at 680 metres are: stable, predictable, spread out laterally over long distances, and exhibit extremely low permeabilities to provide multiple natural barriers in which to isolate the waste.

"The work done with the first two boreholes (DGR 1 and DGR 2) in Phase One supports the regional information for the project's geologic model," Martin said.

In terms of the site's ability to isolate the waste from Lake Huron and the area's drinking water and ground water systems, Martin said, "There is no evidence to support the presence of permeable zones in the tight, rock formations that would allow for the rapid movement of fluids.

means any movement of water will take place very slowly to the extent of about one millimetre a year, which is about one million times slower than the movement of water that flows in the upper 100 metres.

When asked about the position of the repository, which is about one km inland from Lake Huron, and whether that poses a threat to the integrity of the lake, Martin said that Canada isn't the first country to position a repository within the vicinity of a large body of water.

"Both Sweden and Finland have experience with repositories quite close to the water," he said, noting the Swedish SFR waste facility, which has been in operation since 1988, is located about 60 metres beneath the Baltic Sea underneath 55 metres of fractured crystalline rock and about five metres of low permeability soil near the Forsmark Nuclear Power Plant.

"It stands to reason that if they can operate their facility safely (since 1988) then how

Martin added that international experience provides evidence and confidence that the low permeability rock will adequately contain the waste. Although there are still four more boreholes to be drilled, cored, probed and equipped with multi-level ground water monitoring equipment, Martin said the program is already harvesting the "kind of results that were expected" and further investigations are expected to build and provide greater confidence on what has already been done.

Phase Two investigations began at the Bruce site in April 2008 with the coring of DGR 3 at a separate site as part of the plan to position the boreholes in a triangular arrangement. This will allow for an understanding of the three-dimensional nature of the subsurface. The geophysical logging of DGR 3, where various probes are inserted inside the borehole to test for properties such as clay content and borehole diameter, is complete. Hydraulic



Dr. Derek Martin (right) shares a moment with Dr. Dougal McCreath during a geosynthesis workshop held in Markham to discuss various streams of data from Phase One research. No one piece of data will determine the ultimate safety case for the DGR. Instead, it will be multiple lines of data and multiple lines of reasoning that will provide confidence in the location of the site for the construction of a long-term management facility for low and intermediate level nuclear waste.

## Multiple lines of reasoning will build confidence in DGR safety case

When it comes to verifying the rock formations which will host the DGR, Dr. Martin emphasizes that no single piece of data stands alone by itself, but multiple sets of data from all of the investigative programs will provide consistency that speaks to the pedigree of the host rock.

"For instance, during Phase One we established numerous data sets from two boreholes, which were drilled to different depths of 463 metres and 863 metres," he said. "They provided us with information, which reflects existing regional information which was the initial basis for our geologic model. As we go forward in Phase Two with the drilling of four more boreholes, we can expect the data from those to reflect what was done in DGR 1 & DGR 2. If there are no differences, then it provides us with great confidence as we go forward with more testing, providing even more confidence in our geologic model."

Martin also noted that it's important that the data from the different boreholes tell the same story.

"For example, the results of the geochemical analysis and the hydrogeologic testing must be compatible," he said. "They are very different data sets, but the results of

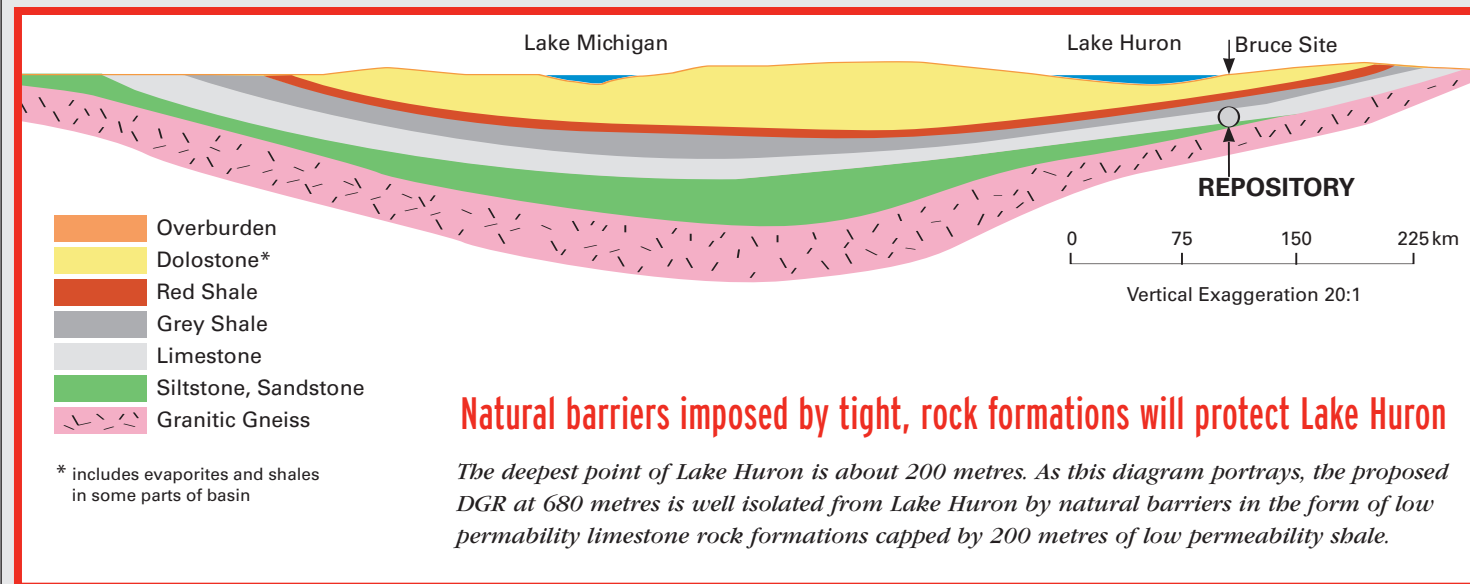
one must be consistent with the story being told by the other."

When asked at what point one can be sure that they have produced enough data to provide conclusive evidence as to the nature of the geologic footprint, Martin said it depends on the geology of the rock.

"The simpler the geology, the fewer the number of boreholes," he said, adding that the clay-rich limestone, sedimentary rock formations found at the Bruce site are relatively simple.

"How many boreholes very much depends on the consistency in the results as well as any issues that are identified during the repository design and safety assessment because the main purpose of the investigations is to provide information for those two elements," he said. "When those two aspects are satisfied, the surface investigations will be complete."

In addition to the data from the six deep boreholes currently planned, the results of other investigative work such as the 2D seismic survey and seismicity studies are expected to provide even more consistency and additional multiple lines of reasoning for the DGR.



"We are looking at rock formations so tight that we are pushing the limits of our investigation technology in order to measure the permeability. In fact, what we are learning in terms of how to deal with these extremely tight formations – how to characterize them – is of huge significance to the industry."

As Martin explains, the hydraulic conductivity of the pore water found at 680 metres

many more orders of magnitude safer are we when you compare 680 metres to 60 metres and the fact that our facility will be located in clay-rich, limestone sedimentary rock beneath a 200-metre cap of low permeability shale."

Emphasizing the fact that the geology offers multiple natural barriers between the lake and the drinking and ground water systems,

testing in DGR 3 is currently underway. DGR 4 is currently being drilled and cored, at a separate site, and as of press time progress had been made to 200 metres. The drilling of DGR 4 will continue to 860 metres. All work on DGR 3 and DGR 4 is expected to be completed by December. Two inclined boreholes will be drilled in 2009.