



# Responsible Nuclear Waste Management: OPG's Deep Geologic Repository

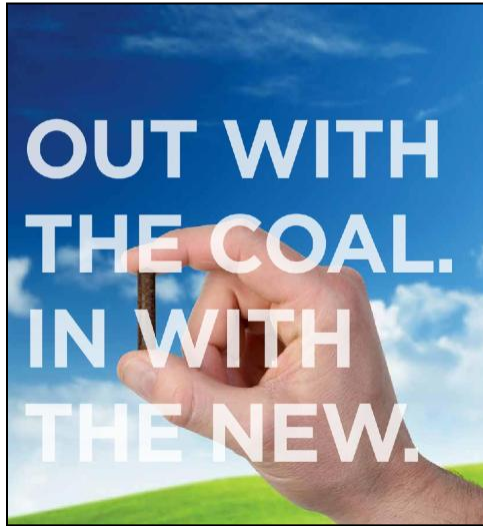
Submission to City of London municipal council

For consideration on August 22, 2017

**ONTARIO**POWER  
GENERATION




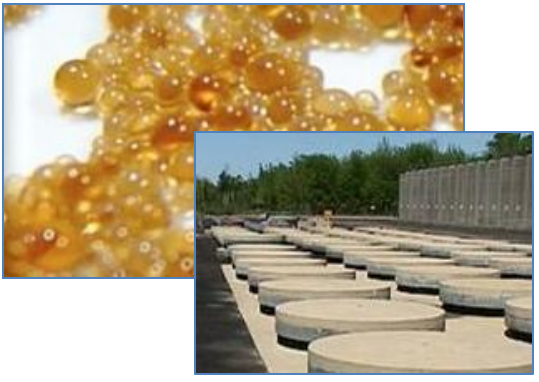
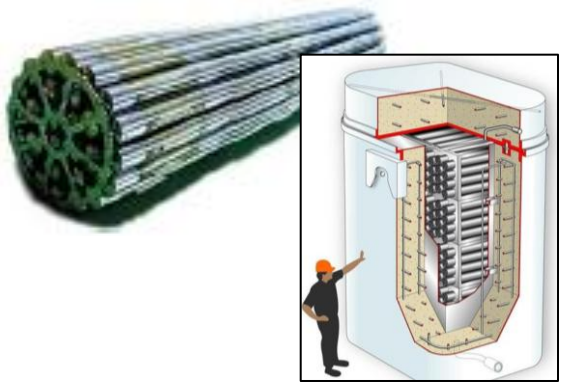
# Nuclear Energy in Ontario



- Nuclear waste is a by-product of nuclear energy.
- Nuclear energy generates about 60% of Ontario's electricity.
- Nuclear energy has important benefits for Ontario:
  - *Clean* – Nuclear energy produces zero carbon emissions. It is an important element of Canada's plan to meet its targets on climate change.
  - *Safe* – Ontario's nuclear industry has an excellent record of safety throughout the past 40 years.
  - *Low-cost* – Nuclear energy is lower than average cost and helps to moderate consumer bills.
  - *Reliable* – Unlike solar and wind, nuclear energy is always available.
- **We must deal responsibly with the waste.**
  - This generation has benefited from the clean energy of nuclear, and should not punt the waste issue to the next generation to resolve.

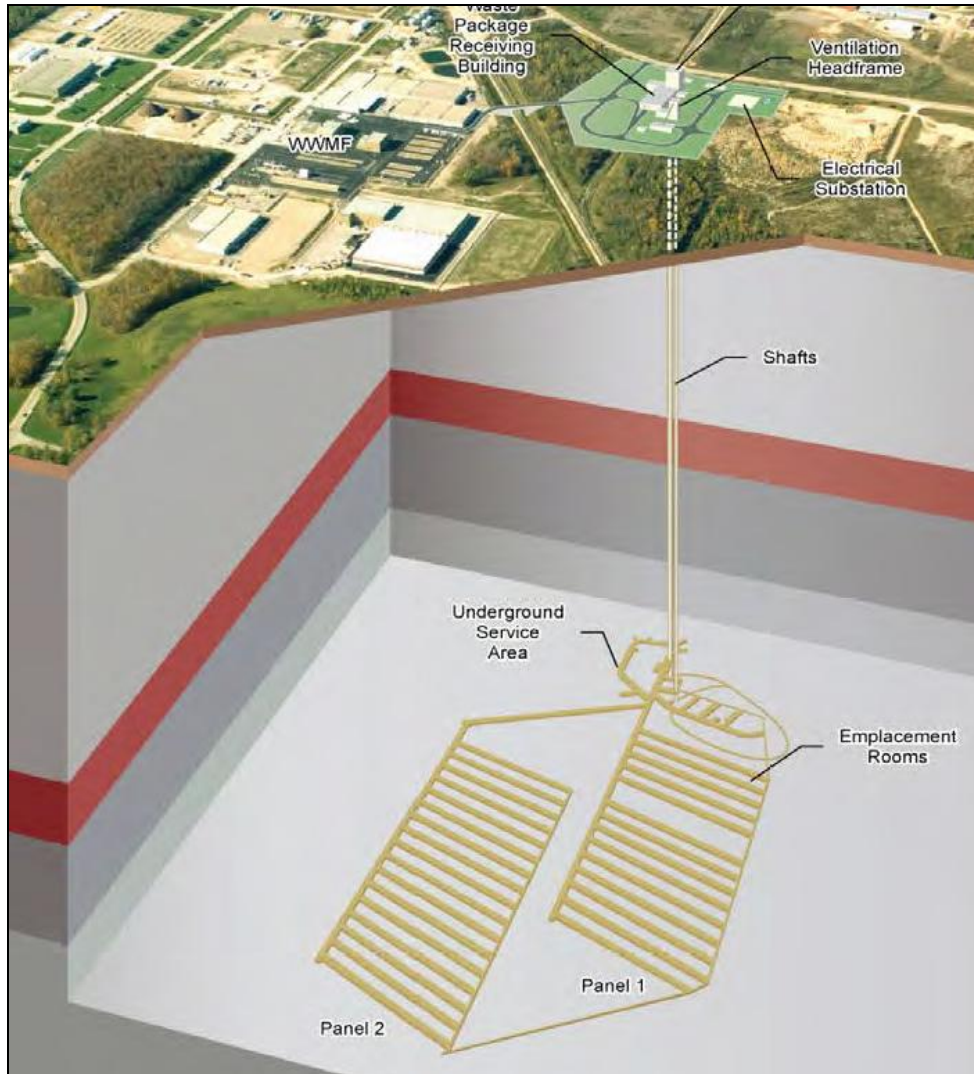


# Three Types of Nuclear Waste

Low-level	Intermediate-level	High-level
<p><b>Clothing, mops, rags, paper, plastic, wood</b></p> 	<p><b>Resins, filters, used reactor components</b></p> 	<p><b>Used fuel rods (spent uranium)</b></p> 
<p>Radioactive for about 100 to 300 years.</p>	<p>Radioactive for about 100,000 years.</p>	<p>Radioactive for about 1 million years.</p>
<p>Incinerated or compacted. Stored in warehouses, on interim basis, at Bruce site.</p>	<p>Stored in in-ground containers, on interim basis, at Bruce site.</p>	<p>Stored in concrete &amp; steel containers, on interim basis, at each generating station.</p>
<p><b>Destined for OPG's proposed DGR at the Bruce site.</b></p>		<p>Destined for a separate DGR, being explored by the Nuclear Waste Management Organization for all of Canada. Seven sites are in the running.</p>



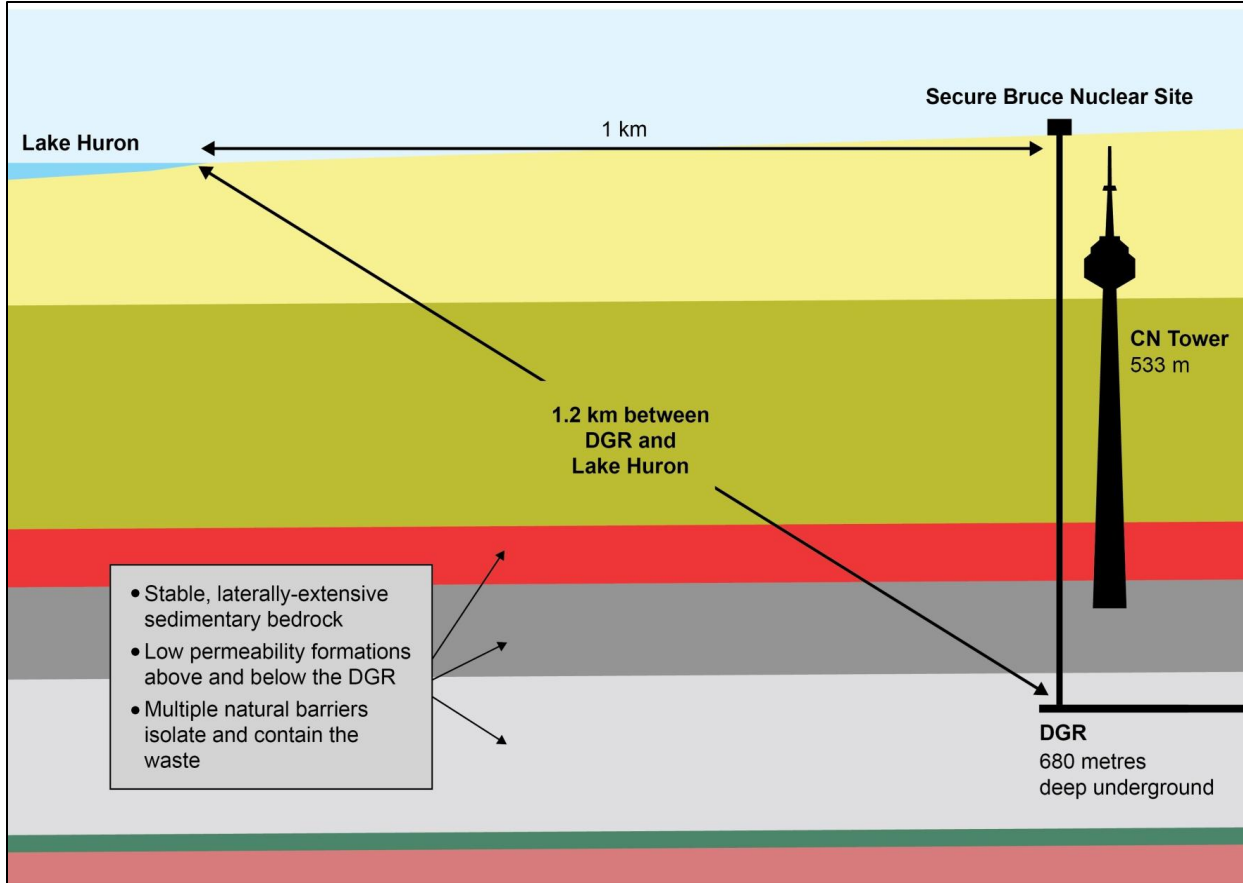
# Deep Geologic Repository (DGR)



- Nuclear waste has been safely stored at the Bruce site, at the surface, for the past 40 years – but only on an interim basis.
- For permanent disposal of its low- and intermediate-level waste, OPG proposes to build a DGR.
- Shafts would be mined, down to 680 metres below the Bruce nuclear site.
- Limestone rock at that depth is 450 million years old.
  - Rock is completely isolated from surface groundwater.
  - Rock is stable – has survived continental shifts and multiple glaciers.



# DGR Isolated from Lake Huron



- At 680 metres, DGR would be deeper than the CN Tower is tall.
- DGR rock at depth has no interaction with the lake or groundwater.
- DGR rock has extremely low hydraulic conductivity – no water flows.
- A molecule of water would take more than 300,000 years to move just 1 metre in the rock.

**DGR is safe and poses no risk to the lake, environment or public**



# Willing Host Community



Kincardine Mayor Anne Eadie signs council's February 2017 resolution reaffirming municipal support for OPG's Deep Geologic Repository.

- Municipality of Kincardine has formally supported the DGR since 2004.
- Kincardine council approached OPG in 2001 for a lasting solution to low- and intermediate-level nuclear waste.
- Kincardine and OPG jointly explored options, agreeing that a DGR would be best practice.
- Survey found majority of residents in favour of DGR (60% versus 22%) in 2005. Surveys and views of elected leaders indicate that, since then, support in wider region has grown to 70% or more.
- Adjacent municipalities also formally support the DGR, including Saugeen Shores, Huron-Kinloss, and the higher-tier Bruce County government.
- DGR is also supported by local Chambers of Commerce, the regional labour council and the regional public health unit – based on careful review of the evidence.



# DGR is Science-Based



Researcher studies samples of limestone rock drilled from one of eight boreholes around DGR site.



Environmental Assessment hearings years in Kincardine were the longest on record in Canada.

- Proposal intensively studied for over 12 years.
- Project scrutinized by an independent, quasi-judicial Joint Review Panel (JRP).
  - Panel led by three prominent experts: biologist, professor of mining engineering, professor of geology.
  - 33 days and more than 300 hours of public hearings over two years.
  - Longest such hearings on record.
  - 12,500 pages of evidence from OPG.
  - More than 300 interventions.
- JRP concluded in 2015 that:
  - The Bruce site is appropriate.
  - The environment and lake are protected.
  - The DGR should be built “now rather than later.”



# Why Bruce is Preferred Site

- Bruce site geology is ideal: The limestone at 680 metres deep will safely isolate the environment, lake and groundwater for hundreds of thousands of years.
- In 2016, federal Minister of Environment and Climate Change asked OPG to study alternate locations.
- OPG looked at two alternate locations, by geologic region:
  - Crystalline rock, Canadian Shield
  - Sedimentary rock, Southwest Ontario
- Studies conclude that alternate locations for the DGR are technically feasible, but result in:
  - **Greater environmental impact**, due to trucking the existing waste and building a new nuclear facility.
  - **Higher cost**, of up to \$3.5 B more, mainly to transport the existing waste.
  - **Delay of 20 years**, or more, to find a new willing host.
- For these reasons, Bruce site remains the preferred site.







# International Consensus on DGR

## FAVOURABLE GEOLOGIC SITE FEATURES

**Many Barriers:** Multiple rock formations cover the DGR.

**Predictable:** Undeformed sedimentary shale and limestone formations with large lateral extent.

**Seismically Quiet:** DGR site is comparable to seismically stable Canadian Shield setting.

**Geo-mechanically Stable:** DGR limestone suitable for stable, dry tunnels.

**Groundwater Isolated:** Near-surface groundwater aquifers are distantly separated from the deep rock formation.

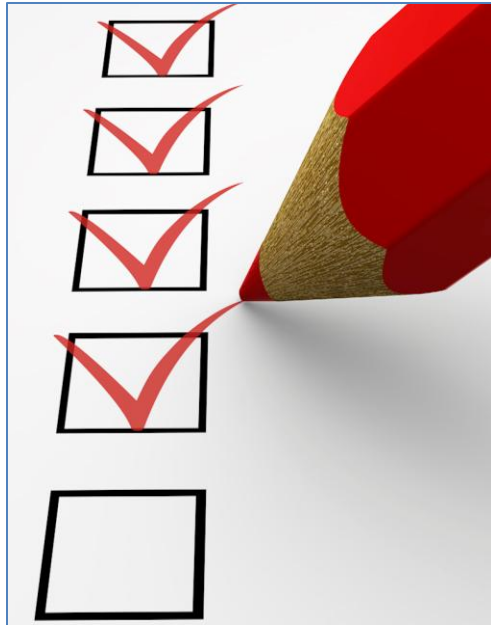
**No Water Movement:** Deep rock has extremely low permeability and low hydraulic conductivity

**No Natural Resources:** No commercially viable oil and gas; no base-metal reserves present.

- **Canadian Nuclear Safety Commission**
  - *“The environmental assessment concluded, and CNSC concurred, that the DGR for LILW [low- and intermediate-level waste] will not likely cause environmental effects.”*
- **U.S. Environmental Protection Agency**
  - *“In comparison to other international programs, the proposed DGR site, at 2,230 feet beneath the Bruce Nuclear site, is the deepest planned facility in the world, is bounded by the thickest assemblage of low permeable cap rocks, and is isolated from surface and drinking water” (July 24, 2012)*
- **Department of Environmental Quality – Michigan**
  - *“In summary, the RMD (Resource Management Division) has reviewed the EIS (Environmental Impact Statement) and supporting radiological and geological studies and has no technical objections to the conclusions reached in the many various studies.” (Aug., 2, 2012)*



# DGR: Further Approvals Required



- Even if federal Minister approves the Environmental Assessment by end of 2017, more steps would be required:
- OPG would apply to the Canadian Nuclear Safety Commission (CNSC) for a site preparation and construction licence, expected in 2018.
- 2-3 more years needed for further design/engineering.
- OPG has committed to Saugeen Ojibway Nation (SON) that DGR will not be built without SON's prior consent.
  - OPG and SON are engaged in respectful dialogue.
  - OPG is also consulting with two local Métis groups.
- Construction would take several years.
- After construction, OPG would need to apply to CNSC for an operating licence, requiring more public hearings.
- DGR in-service date could be more than 10 years away.



# Protecting the Great Lakes



- More than 40 sites around Great Lakes store nuclear waste at the surface, on an interim basis – mostly in the U.S.
- This is not sustainable forever. Safe storage would require continual construction of new buildings, maintenance and institutional controls for thousands of years.
- With OPG’s DGR, Canada and Ontario can implement the best practice– a lasting solution, based on science, in ideal geology, in a willing host community.
- The DGR is the right thing to do – for the environment and for future generations.