Ontario Power Generation

Deep Geologic Repository

Presentation to Ontario municipal councils 2017

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What is OPG?

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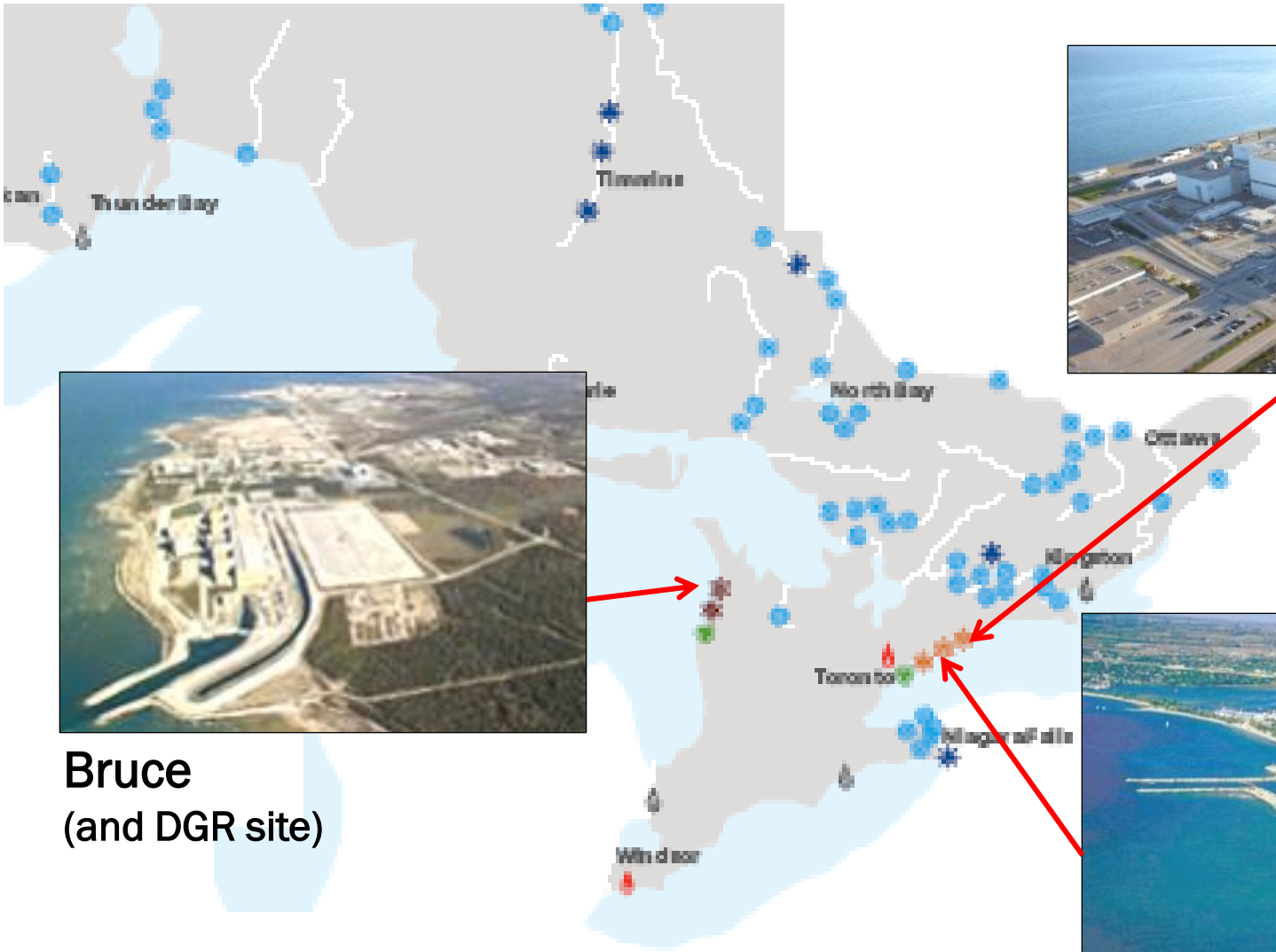
- Owned by province of Ontario
  - Supplies 50% of Ontario's electricity
  - 9,000 employees
  - 66 hydro stations
  - 2 biomass stations
  - 2 gas plants
- OPG owns 3 nuclear stations:
  - Pickering
  - Darlington
  - Bruce (leased and run by Bruce Power)

OPG-owned Nuclear Stations



Darlington

Bruce
(and DGR site)

Pickering

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Nuclear Energy in Ontario

- Nuclear energy generates about 60% of Ontario electricity
- Nuclear energy is:
  - **Clean** –zero carbon emissions
  - **Safe** – excellent record
  - **Low-cost** –moderates consumer bills
  - **Reliable** – even when no sun or wind
- We must deal responsibly with the waste

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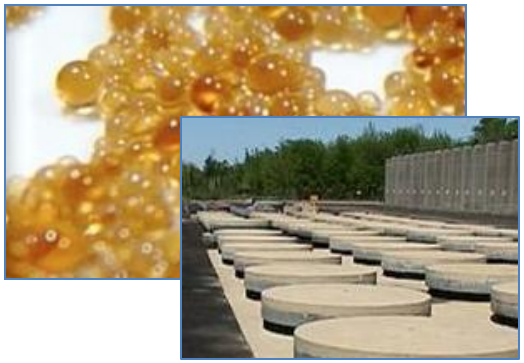
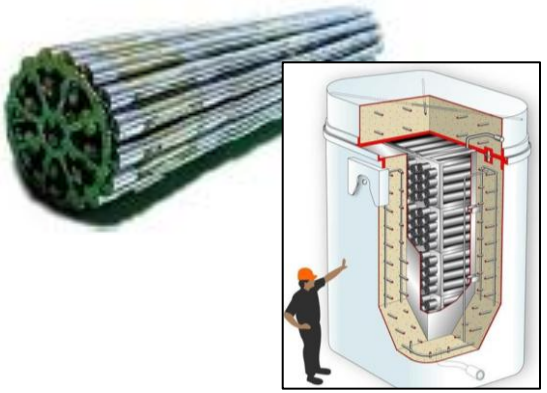
Three Types of Nuclear Waste

Low-level	Intermediate-level	High-level
Clothing, mops, rags, paper, plastic, wood 	**Resins, filters, metal components** 	**Used fuel rods (spent uranium)** 
Radioactive for about 100 to 300 years	Radioactive for about 100,000 years	Radioactive for about 1 million years
Incinerated or compacted. Stored in warehouses, on interim basis	Stored in in-ground containers, on interim basis	Stored in concrete & steel Dry Storage Containers, on interim basis
Destined for OPG's DGR		Destined for separate DGR

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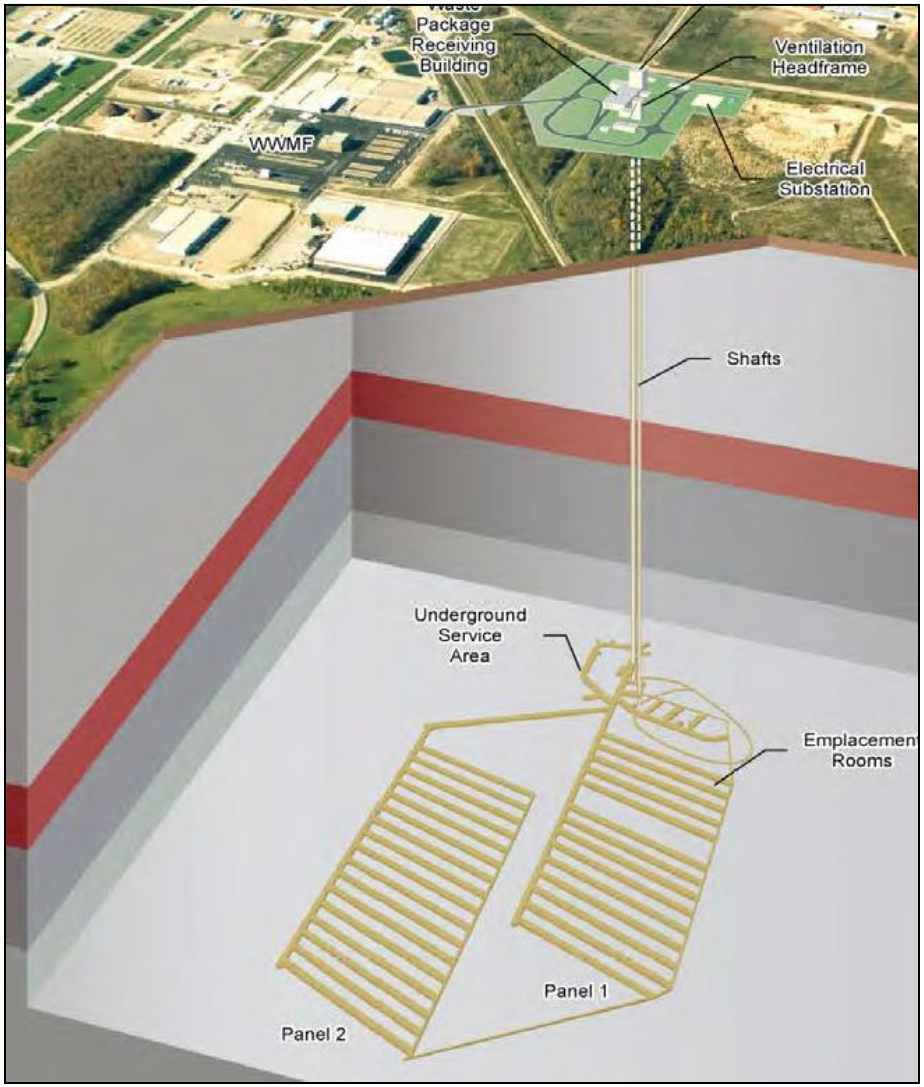
Deep Geologic Repository (DGR)



- OPG's DGR is proposed for permanent disposal of low- and intermediate-level waste
- Shafts would be mined, down to 680 metres below the Bruce nuclear site
- Rock at that depth is 450 million years old
- Rock is stable – has survived continental shifts and multiple glaciers

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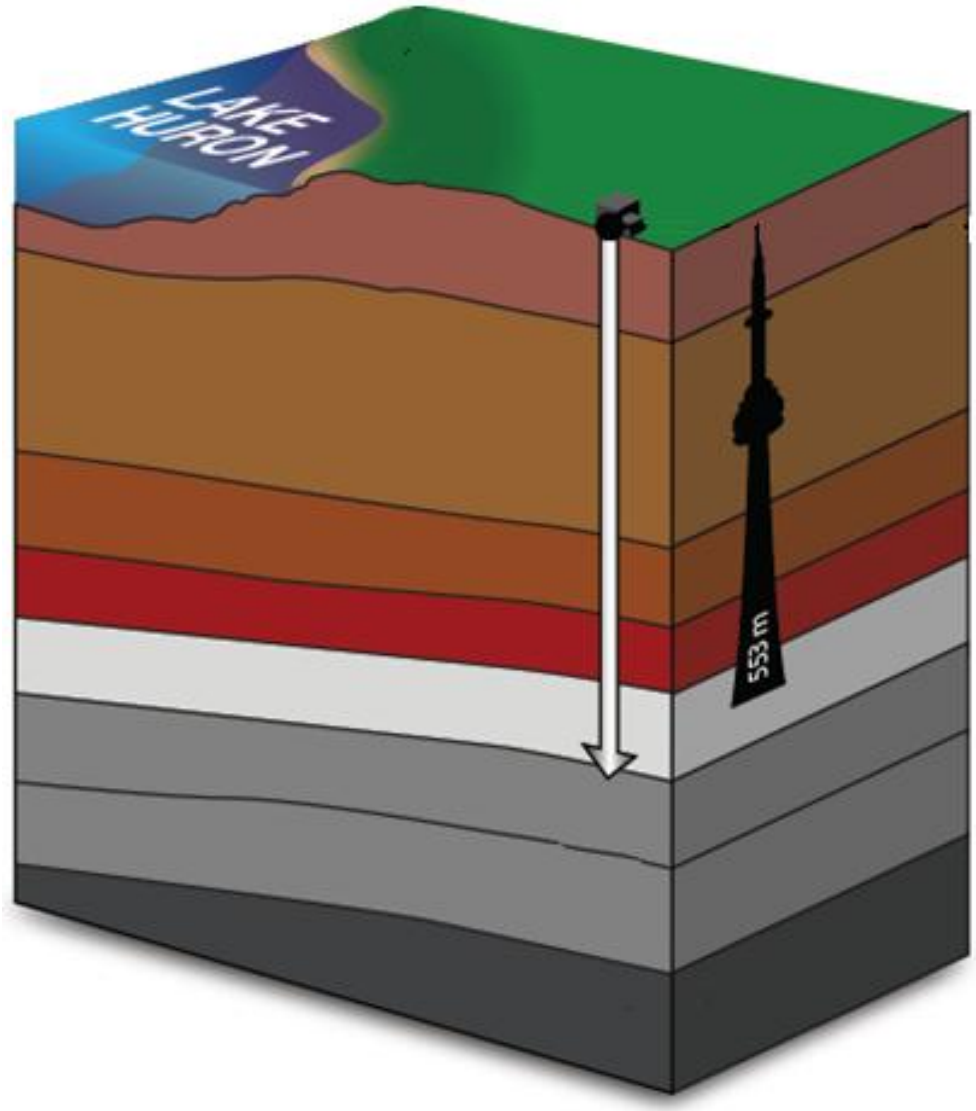
Impermeable Rock



- DGR would be deeper than the CN Tower is tall
- Limestone at DGR depth is some of the tightest, strongest rock in the world
- Extremely low rate of hydraulic conductivity – no water flows
- A molecule of water takes more than 300,000 years to move 1 metre

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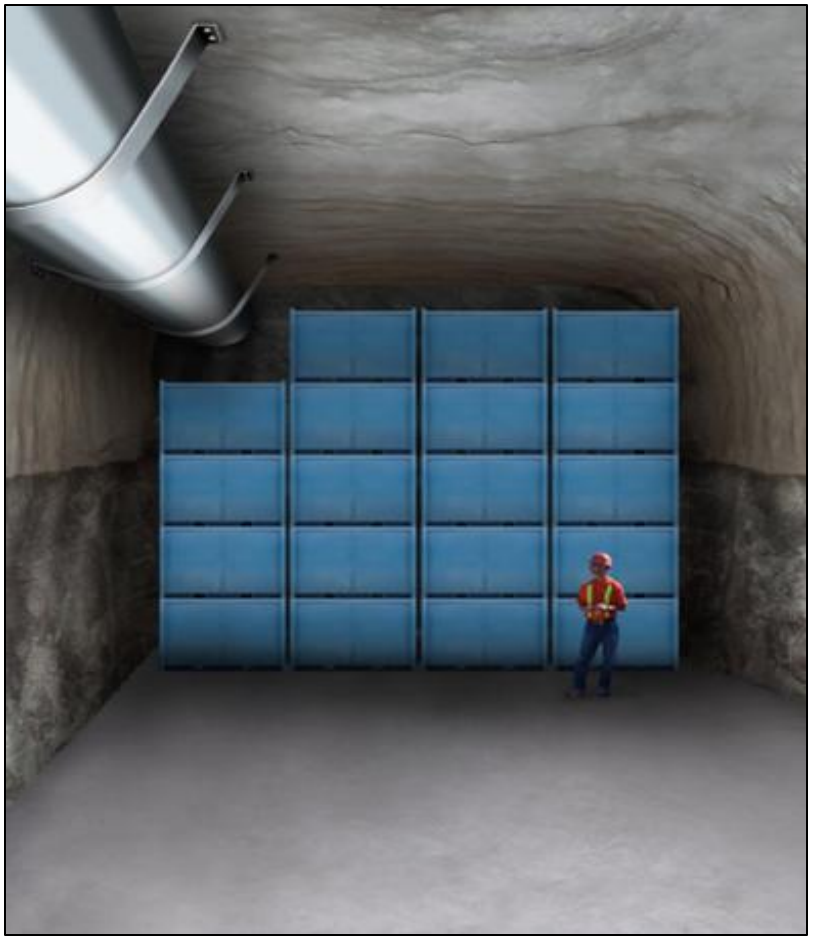
DGR Emplacement Rooms



Low-level waste storage in DGR

Intermediate-level waste storage in DGR

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History of DGR – Beginnings

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

- 2001 – Municipality of Kincardine approaches OPG for lasting solution to *low- and intermediate-level* waste
- 2003 – Kincardine and OPG explore options, study best practices around the world
- 2004 – Kincardine signs DGR hosting agreement with OPG
- 2005 – Survey finds majority of residents in favour of DGR (60% versus 22%)
- 2006 to 2010 – Geology testing and environmental studies

History of DGR – Public Review

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

- 2012 – Appointment of expert, independent Joint Review Panel (JRP)
- 2012-2013 – Public comment period
- 2013-2014 – JRP holds 33 days of public hearings
- 2015 – JRP concludes:
  - Bruce site is appropriate
  - Environment and lake are protected
  - DGR should be built “now rather than later”

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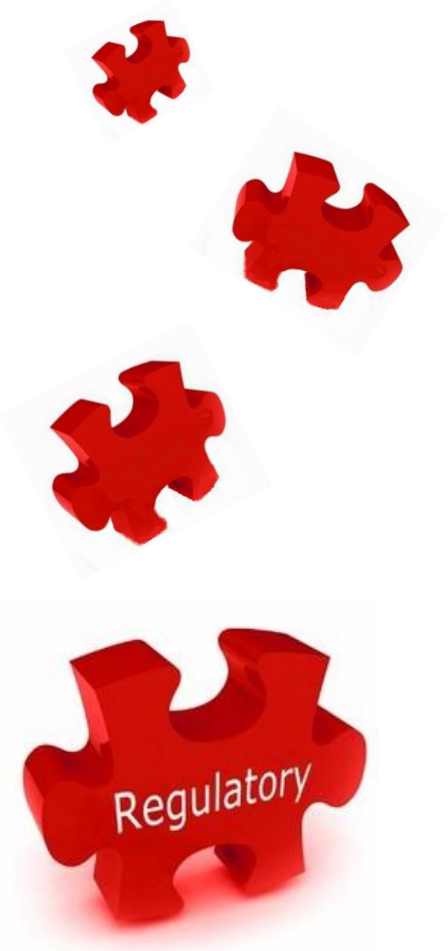
History of DGR – New Studies



- 2015 – Federal election; new government
- 2016 – New minister of Environment and Climate Change asks OPG for additional studies, including on alternate locations
- 2017– Public comment and review of OPG studies in February-March. In April, OPG receives 23 additional information requests. In May, all questions answered.
- This summer – Canadian Environmental Assessment Agency is expected to produce its report and recommendations
- By end of year– Federal Minister expected to decide on Environmental Assessment

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Study of Alternate Locations

- In 2016, OPG was asked to study alternate locations for the DGR.
- OPG looked at two alternate locations:
  - Crystalline rock, Canadian Shield
  - Sedimentary rock, Southwest Ontario
- Alternate locations are feasible, but:
  - **Greater environmental impact,** due to trucking the existing waste and building an entirely new nuclear facility
  - **Higher cost** – up to $3.5 B more
  - **Delay of 15-20 years,** or more, to find new willing host community, including municipal and Indigenous communities

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The Road Ahead

- Even if Environmental Assessment is approved, more steps are required:
  - Apply for a site preparation and construction licence – 2018
  - OPG to seek board approval for budget
  - Three more years for design and engineering work
  - OPG engaged in ongoing, respectful consultation with Saugeen Ojibway Nation
  - Construction would take several years
  - After construction, OPG would need to apply for an operating licence
  - In-service date could be 10 years away

Repositories Around the World

- **10 underground repositories in world** (50 metres or deeper)
- **None has leaked radiation:**

1. Asse II, Germany
2. Morselben, Germany
3. Waste Isolation Pilot Plant (WIPP), New Mexico, U.S.
4. Onkala, Finland
5. Loviisa, Finland
6. KORAD, South Korea
7. Bratrstvi, Czech Republic
8. Richard, Czech Republic
9. SKB Forsmark, Sweden
10. National Radioactive Waste Repository, Bátaapáti, Hungary

- 11th now under construction: Konrad, in Germany
- More DGRs being explored, including in: Canada (2 DGRs), Sweden (Oskarshamn), Czech Republic, Japan, France, Belgium, South Africa, China, U.K., U.S.

Nuclear Waste Around Lakes

- More than 40 sites around Great Lakes store nuclear waste at the surface, on an interim basis – mostly in the U.S.
- Canada and Ontario have opportunity to develop new model – a lasting solution, based on best practices

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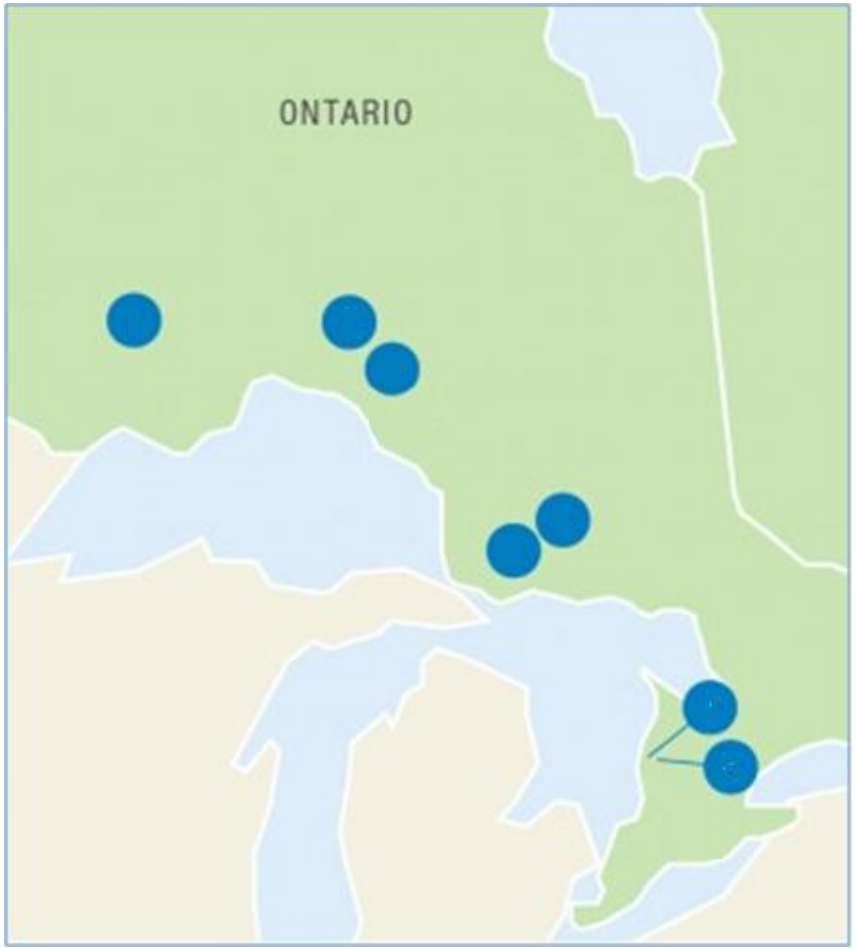
Separate DGR for Used Fuel



- Second DGR proposed, for high-level waste (used fuel)
- Project of the Nuclear Waste Management Organization
- 7 communities still being considered
- High-level waste DGR requires different design and engineering

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Questions Welcome

Drainage habitat in DGR project area, Bruce nuclear site

- **Summary:**
  - OPG DGR is based on solid science
  - International experts agree that a DGR is best practice for permanent disposal
  - 15 years of studies, extensive hearings and rigorous review
  - Geology at the Bruce site is ideal
  - Willing host community; ongoing consultation with Indigenous community
  - Lakes and environment are protected
- **The DGR is the right thing to do, for future generations**

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