

Long-term Nuclear Waste Storage Deep Geologic Repository Study

Client:

Ontario Power Generation

Location:

Bruce Nuclear Site,
Ontario, Canada

Service Provided:

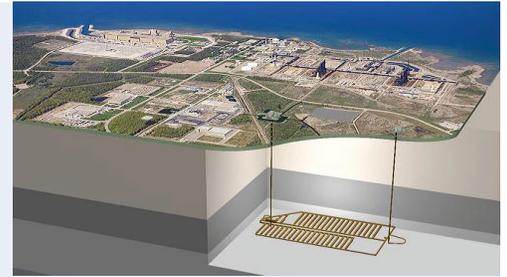
Geomechanical analyses to examine the long-term stability of multiple horizontal storage caverns.

Value Provided:

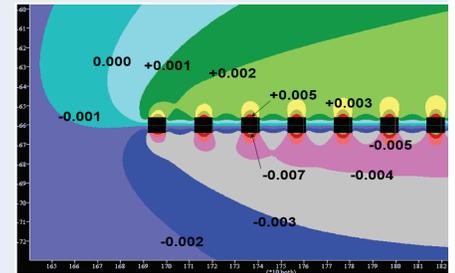
- Demonstrated that the proposed scheme was geomechanically stable for the pressure conditions predicted for over 500,000 years
- Showed that more detailed studies were required at locations of tunnel seals and intersections of the underground elements

Background & Project Challenges

In 2006, Ontario Power Generation (OPG) studied the feasibility of constructing and operating a Deep Geologic Repository (DGR) for the long-term storage of low and intermediate level nuclear waste. The concept was to mine out a repository approximately 660 meters below the ground surface to store 80,000-m³ of low level waste and 30,000-m³ of intermediate level waste materials. The waste materials would be packaged into engineered canisters for transport and placement in the mine repository. The repository would consist of multiple horizontal tunnels in which the waste canisters would be placed and each tunnel sealed. Nuclear decay and material decomposition was projected to generate gas and water pressures for as long as 500,000 years.



Artist Rendering of Ontario Power Generation Cavern



Vertical Deformations [meters]

Geocomp Role & Accomplishments

Geocomp performed geomechanical analyses to examine the long-term stability of the storage vaults under the full range of predicted gas pressure and ground water conditions. The results showed that the rock around the roughly rectangular- shaped vaults with rounded corners remained in a safe stress condition for all cases expected including internal gas pressure variations from 0 to 17 MPa.

The analyses showed that the stresses remained essentially within the elastic zone of the rock. The computed displacements were less than 2 cm for all cases. The most severe stress state occurred as the vaults and shafts were excavated. Should unexpected rock distress occur during excavation and waste placement, temporary support in the form of rock anchors could be utilized to maintain stability until the vault was filled and sealed. Such anchors would eventually deteriorate and fail. This might cause local rock falls but not endanger the containment abilities of the DGR.

Geocomp demonstrated that the general concept of locating the repository in the Lindsay formation, at a depth of 660 meters, was ideal for providing a long term stable storage facility from a geomechanical perspective.