

# Radioactive waste: Where to put it?

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As the U.S. makes new plans for disposing of spent nuclear fuel and other high-level radioactive waste deep underground, geologists are key to identifying safe burial sites and techniques. Scientists at The Geological Society of America (GSA) meeting in Denver will describe the potential of shale formations; challenges of deep borehole disposal; and their progress in building a computer model to help improve understanding of the geologic processes that are important for safe disposal of high-level waste.

In the United States, about 70,000 metric tons of spent commercial nuclear fuel are located at more than 70 sites in 35 states. Shales and other clay-rich (argillaceous) rocks have never been seriously considered for holding America's spent [nuclear fuel](#), but it is different overseas. France, Switzerland, and Belgium are planning to put waste in tunnels mined out of shale formations, and Canada, Japan, and the United Kingdom are evaluating the idea.

At the GSA meeting, U.S. Geological Survey hydrogeology expert C.E. Neuzil of Reston, Virginia, will report that some shales are so impermeable that there is little risk of radioactivity from buried nuclear waste reaching ground or surface water.

"This is usually difficult to demonstrate," Neuzil says, "but some shales have natural groundwater pressure anomalies that can be analyzed—as if they were permeability tests—on a very large scale." This capability was shown recently at the Bruce Nuclear Site, explains Neuzil, a proposed low/intermediate waste repository 1,200 feet underground in Ontario,

Canada. Argillaceous rocks have additional attractive qualities, Neuzil says: They are common, voluminous, and tend to be tectonically quiet—meaning no earthquakes to crack the walls of a fuel-rod burial chamber.

Another disposal option for nuclear waste is deep boreholes. The 2012 presidential Blue Ribbon Commission on America's Nuclear Future recommended more research, and the U.S. Department of Energy is now developing an R&D plan. However, the U.S. Nuclear Waste Technical Review Board (NWTRB) has statutory responsibility for evaluating the technical validity of DOE's nuclear waste activities, and is on the record with the position that deep boreholes present many technical challenges and studying them "should not delay higher priority research on a mined geologic repository."

At next week's GSA meeting, Review Board senior staff professional Bret W. Leslie and Stanford University geophysicist Mary Lou Zoback, an NWTRB member, will present the board's assessment of:

- the technical feasibility of drilling a borehole of the proposed depth (3 miles) and width (about 20 inches), which has never been done;
- the exposure risk for workers, who would have to repackage waste currently stored in canisters that are wider than the width of the proposed boreholes;
- the reliability of existing sealing technology; and
- the large number of deep boreholes that would be required—nearly 700.

Whether nuclear waste winds up in tunnels, boreholes or both, the planning will be helped by new analytical tools. One is a new computer model that will evaluate the behavior of various forms of [nuclear waste](#), and [waste](#) containers and barriers, if stored in various rocks. The model

is being developed under the auspices of the Center for Nuclear Waste Regulatory Analyses (CNWRA), the NRC's federally funded research and development center, and will be described at the GSA meeting by NRC performance analyst Jin-Ping Gwo.

**More information:** [gsa.confex.com/gsa/2013AM/webp ...  
am/Session32767.html](https://gsa.confex.com/gsa/2013AM/webpage/Session32767.html)

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