



# NUCLEAR INFORMATION AND RESOURCE SERVICE

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## Why Yucca Mountain Would Fail as a Nuclear Waste Repository

Yucca Mountain's remote location and arid climate were proclaimed to be winning attributes that would make the site acceptable for the development of a repository that would contain the radiation in highly radioactive waste for the necessary thousands of centuries. This turned out to be wrong.

Irradiated (or "spent") fuel from reactors contains over 95% of the radioactivity in all the waste ever generated by industrial-scale nuclear activity in the US (including the production of nuclear weapons). The Yucca Mountain site on Western Shoshone Treaty Lands in Nevada was selected as the only site to be characterized under the Nuclear Waste Policy Amendments Act. The Western Shoshone Nation, the State of Nevada, and others strongly oppose the decision.

As studies were carried out at the site, the federal agencies (EPA, DOE and NRC) in charge of the project have all relaxed or eliminated important health and safety protection rules rather than rejecting the site when it did not meet their regulatory requirements.

In 1998 NIRS petitioned Secretary of Energy Bill Richardson, to disqualify Yucca Mountain from consideration as a nuclear waste repository site since new data showed that it would not meet the Site Recommendation Guidelines in the Nuclear Waste Policy Act. See: <http://www.nirs.org/radwaste/yucca/disqualifyyuccapetitionfinal.htm>. The key issue was the rate of movement of water inside the rock at the Yucca Mountain site. The tuff, a rock formed of compressed volcanic ash, is heavily fractured at this site due to ongoing seismic activity. The fractures allow surface water to travel into and through the mountain far more quickly than the Guideline criterion permits. The Guideline says that the site should be disqualified if the groundwater travel time from the buried waste to the accessible environment is less than 1000 years. The Petition to disqualify the site was co-signed by 218 other organizations: (<http://www.nirs.org/radwaste/yucca/disqualifyyuccafinalletterwithsignatures.htm>).

Secretary Richardson responded, acknowledging the issues but stating that, nonetheless, the study of the site would continue; the Secretary gave no justification for this position and eventually the guidelines were eliminated. These organizations welcomed the action by President Obama to take Yucca off the table in 2009. Detailed here are additional dramatic concerns with the site.

### Key failings of Yucca:

**Fractured Rock.** In addition to water moving fast in fracture flow pathways within the rock of the mountain, the very same fractures allow gases to move up and out of the mountain. It is the impossibility at Yucca of containing gaseous emissions from radioactive waste that led to Congress passing the Energy Policy Act of 1992 that directed EPA to write a new, "reasonable" radiation protection standard specific to Yucca Mountain.

This is a second case of molding the requirements to meet the site, rather than applying objective criteria in the determination of whether the site is appropriate. It has been estimated (by European regulators) that the Carbon-14 emissions alone could cause as many as 25,000 "excess" cancer deaths worldwide over time. A new standard was written for Yucca. NIRS, Public Citizen and allies joined the challenge of the site-specific standard in court and won a decision that EPA has to consider doses all the way to 1 million years.

**Fractured Salty Rock + Water + Oxygen + Heat = Corrosion of Metal** (waste containers).

It was not until an access tunnel had been dug that it became clear how much moisture is inside Yucca Mountain. This author visited that tunnel and walked through puddles and saw drips from the ceiling. The assembled experts realized that air and water flow inside the mountain and this would be accelerated by the heat generated by radioactive waste. The chemistry of the rock is salty. Waste containers will be made of an iron-nickel alloy. All together the result is accelerated chemical reactions that would result in the corrosion of the containers.

Given the fast-flow pathways for water inside Yucca—due to the many faults, fractures and ongoing seismic activity—a failed container would lead to the migration of radioactivity into the ground water and away from the site. The water below Yucca flows out to the surface in the adjacent Amargosa Valley and as springs near Death Valley.

**Fictional Fix.** The designed plan to deal with the corrosion issue are titanium “drip shields.” Once all of the waste-filled containers have been robotically emplaced in the repository tunnels, a drip shield would be robotically placed over each cask in a feat never before attempted. It is estimated that this drip shield emplacement would be about 100 years after the opening of the repository, which means that DOE would delegate this project to several generations in the future. This cannot be taken seriously! Without this massive investment in titanium drip shields (that may or may not work to prevent corrosive action) Yucca would definitely be a dangerous failure, not a safe repository.

**Fractured Rock – Symptom of Seismic / Volcanic Activity.** From 1976 to 1996, more than 600 earthquakes measured over 2.5 on the Richter scale within 50 miles of Yucca Mountain. Indeed, a 1992 5.6 magnitude quake broke windows and cracked the stairwell at the Yucca field office. Over time the number of known fault lines at Yucca Mountain has grown to 33. As recently as 2007 the Department of Energy discovered one of the fault lines penetrates the mountain in a path that is dramatically different than previously thought. The seismic activity has resulted in volumetric fracturing of the Yucca rock. This is evidence that this area has been actively bouncing for some time, and shows no sign of stopping. While the DOE claims that earthquakes do not preclude burial, the effects on waste handling facilities on the surface and deep water fuel pools would be greater.

A row of lava cones in Crater Flat are clearly visible from the crest of Yucca Mountain. This means that Yucca Mountain is within a volcanic area. Studies done under contract with the US NRC in the 1990's, used a GPS tracking system and confirmed crustal expansion at this site – consistent with tectonic activity.

**Waste Eruption.** Highly unlikely? Yes. Impossible? No. The US Department of Energy considered a volcanic eruption through the waste repository in its environmental impact statement for Yucca. Federal agencies include only “credible scenarios” in a site analysis. The Department then used a “probabilistic risk analysis” that used math calculations to determine that the impact of a nuclear eruption would be “acceptable.” This determination is made because probabilistic risk assessment, unlike common sense, allows a conclusion that the level of radiation dose that could result would be reduced by the probability of this event occurring. The public knows that radiation levels are not lowered by likelihood.

Highly radioactive waste is piling up at reactor sites—the owners of those sites regularly claim that this is because there is nowhere to ship the waste. In truth, it is piling up at those sites because the owners continue to generate it without a permanent storage solution in place. The ultimate solution to radioactive waste is to stop making more.

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