Deep Isolation Safety Webinar Summary

Safety calculations overview

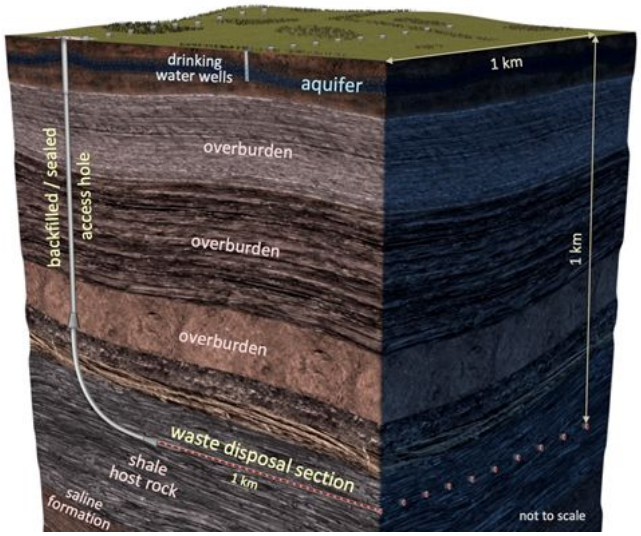
Deep Isolation has completed initial safety calculations for a generic horizontal drillhole repository for spent nuclear fuel. The Deep Isolation drillhole repository was simulated in this study at a depth of 1 km (about 3,300 ft) to investigate the post-closure safety of disposed spent nuclear fuel. However, in a site-specific study, the best depth of disposal will be determined by the site. In some locations, the best depth might be a few thousand feet; at others, it might be two miles or more. The waste is placed far below aquifers, where water has had no contact with the surface for thousands to millions of years or more. We are seeking geologic environments best suited to dispose of nuclear waste and keep it isolated from humans for as long as it poses a health risk.

Non site specific design

The layout and design of the generic repository represent the general disposal concept as no site-specific characterization data or detailed technical designs are yet available. Generic calculations are a necessary step toward developing a comprehensive, site-specific safety analysis that will support the safety case of a deep horizontal drillhole repository in compliance with all applicable regulations.

Effects on drinking water

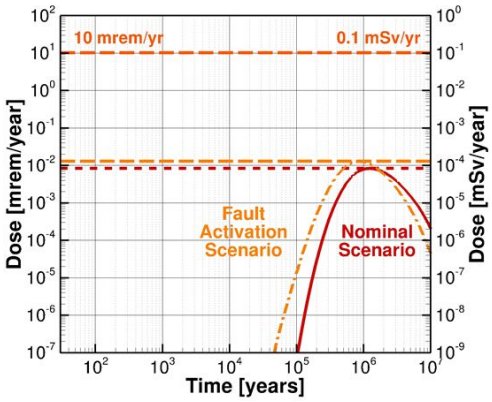
The simulations analyze radionuclide transport from a deep repository to the biosphere, aiming to address anticipated disposal regulatory requirements such as the radiological dose a person could receive if drinking potentially contaminated water from a well located directly above the center of the repository. Multiple scenarios and a wide range of conditions were examined. The study found that under scientifically conservative assumptions, radionuclides will reach peak dose at approximately 1.5 million years and remain 1,000 times under the regulatory dose limit. These calculations are preliminary and do not derive from a potential or specific repository site.



The above illustration depicts the drillhole, which goes straight down then makes a turn, to create a well-isolated horizontal section where the waste would be located.

Unlikely scenario: Earthquake

What happens in the case of an earthquake that activates a fault cutting through the repository? The peak dose would only be slightly increased. Deep Isolation modeled the disruptive scenario of a fault rupturing the horizontal disposal section of the repository. The radionuclides released into the fault zone are directly transported by advection toward the aquifer. This mechanism, although giving all radionuclides in the repository the possibility to move axially along the drillhole and be flushed up the fault zone, did not alter the safety of the repository, and exposure remained significantly under the regulatory dose limit. Such axial flow toward the fault intersection is unlikely, as the fault is connected to the overpressured saline formation that is at a higher pressure than the repository.



Simulations looked at range of probable conditions

Monte Carlo simulations were performed to examine how the exposure dose changes given uncertainties in the parameters that describe the radionuclide inventory, source term, thermal processes, the geosphere, biosphere and exposure models. This probabilistic analysis showed that the calculated peak dose and the conclusions about the safety of the repository are robust despite the wide range of possible properties and conditions examined in the generic analysis.

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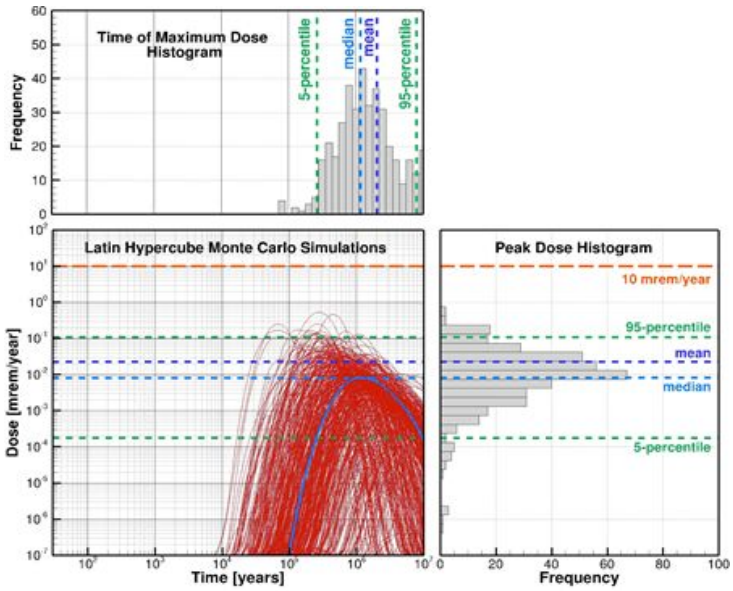

The above images show Latin Hypercube Monte Carlo Simulations of a generic Deep Isolation repository sited in shale. (Lower Left) An overlay of all 400 Monte Carlo simulations. Parameter values are selected at random from a probabilistic range of each parameter. (Top) Frequency of when the peak dose occurs. (Lower Right) Frequency of peak dose for the Monte Carlo simulations.