

Evolution Of A Geological Disposal Facility For Radioactive Waste In Domal Salt

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Abstract

In the Netherlands, radioactive substances and ionizing radiation are widely used in sectors such as medicine, industry, agriculture, research, education, and energy production. These applications inevitably produce radioactive waste. Under current Dutch policy, this waste must be collected, treated, and stored above ground for 100 years at the Central Organisation for Radioactive Waste (COVRA). After this period, all radioactive waste is intended—according to current policy—to be permanently disposed of in a deep geological disposal facility (GDF) located several hundred meters below the surface, in either rock salt or poorly indurated clay formations. To demonstrate the long-term safety of a GDF, a safety assessment is carried out using numerical models to simulate both expected and alternative evolutions.

Fig. 1) The general layout of a two-level GDF for the disposal of radioactive waste in a generic salt dome.

Here, we present an update of the Dutch COPERA (2020-2025) safety assessment for a GDF in domal rock salt (Fig. 1, Bartol and Vuorio, 2025). In this updated assessment, heat generation from radioactive waste is incorporated into the numerical model for two scenarios: the current situation—with one nuclear power plant and disposal planned around 2130—and a potential future scenario in which four new nuclear reactors are constructed, as currently being considered by the Dutch government (Erkens, 2024), with disposal likely occurring decades earlier. The added thermal load affects various processes, such as compaction within the GDF, which in turn influences both fluid flow within the facility and the overall layout.

The long-term evolution of a GDF in domal rock salt was modelled in 2D using COMSOL Multiphysics, combining the Heat Transfer and Subsurface Flow modules. Additionally, the model was improved by implementing a smoother transition between unsaturated and saturated conditions in COMSOL.

Reference

Bartol, J., Vuorio, M., 2025. Safety assessment for a geological disposal facility in domal salt: the Dutch case. *Geomechanics for Energy and the Environment*.

Erkens, S., 2024. Kabinetsaanpak Klimaatbeleid - Motie van het lid Erkens (nr 1358).

Figures used in the abstract

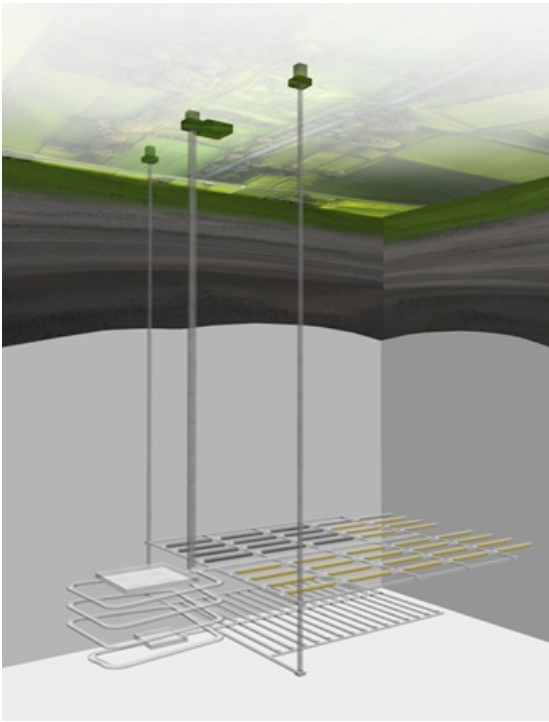


Figure 1