

Use of geochemical information from natural systems in safety case development

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Analogues - natural, archaeological and industrial - can be helpful in demonstrating understanding of how components of a geological repository for radioactive waste could perform over very long term timescales. Consideration of discrete 'natural analogues', and associated upscaled 'natural systems', plays an important role in studies associated with developing a safety case for a repository, providing long-term practical demonstrations to support theoretical and mathematical arguments. Such natural analogues / systems do not, however, provide conclusive proof of how repository components will perform, as conditions under which the analogue has survived may differ from those expected to occur or to evolve in a repository. Related uncertainties and differences between a natural analogue / system and a repository therefore need to be considered.

This presentation considers examples of natural analogues / systems that illustrate aspects of the performance of potential repository-relevant processes over long timescales. These could be used to support aspects of a safety case for a geological repository for radioactive waste. The examples are grouped according to the safety-relevant functionality of the multiple barriers present in a repository:

- Engineered barrier system (wasteforms; container performance; bentonite / crushed rock backfill);
- Natural barrier system (long term performance of fractured crystalline, clay and halite host rocks; radionuclide migration and retardation).

Examples draw from international studies, ongoing and precedent. Collectively, they confirm the key importance that development of understanding from appropriate natural analogues / systems has to the related and complementary development of a safety case built on multiple lines of evidence and reasoning including data from modelling, laboratory and underground rock laboratory experiments.