OVERVIEW OF NEAR-FIELD GEOCHEMICAL PROCESSES AND CONDITIONS EXPECTED IN THE WIPP

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The Waste Isolation Pilot Plant (WIPP) is a U.S. Department of Energy repository in southeast New Mexico for defense-related transuranic (TRU) waste. The repository, which opened in March 1999, is located at a subsurface depth of 655 m in the Salado Fm., a Permian bedded-salt formation. The repository will eventually comprise 56 disposal rooms, each 91.4 m long by 9.14 m wide by 3.96 m high, arranged in eight seven-room panels. After filling the rooms and access drifts and installation of panel closures, creep closure of the salt will crush the waste containers in most cases and encapsulate the waste.

Anoxic corrosion of Fe- and Al-base metals and microbial consumption of cellulosic, plastic, and rubber (CPR) materials could produce significant quantities of gas in the WIPP. Radiolysis will not produce gas at rates comparable to those at which anoxic corrosion and microbial activity could. If significant gas production occurs, it would affect, and would be affected by, other processes and parameters in the repository. These include: (1) the rates and extent of brine inflow and outflow, (2) the rates and extent of room closure, and (3) the chemical conditions that affect the actinide source term.

MgO is being emplaced in the WIPP to decrease the solubilities of the actinide elements in TRU waste in any brine present in the repository after closure. MgO will decrease actinide solubilities by consuming essentially all CO_2 produced by microbial consumption of CPR materials (even if microbes consume all CPR materials in the TRU waste and waste containers), thereby buffering f_{CO_2} and pH within ranges favorable from the standpoint of actinide solubilities. MgO could also consume significant quantities of H_2O from brine or the gaseous phase.

The strongly reducing conditions created by the processes that produce gas, and the low f_{CO_2} and mildly basic pH imposed by MgO will result in low solubilities of Th, U, Np, Pu, and Am, the actinides for which solubilities and distribution coefficients have been quantified.

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