USE OF MgO AS THE ENGINEERED BARRIER IN THE WIPP

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The U.S. Department of Energy is emplacing MgO in the Waste Isolation Pilot Plant (WIPP) to serve as the engineered barrier by decreasing the solubilities of the actinide elements in transuranic (TRU) waste in any brine present in the repository after closure. In its May 1998 certification rulemaking, the U.S. Environmental Protection Agency specified MgO as the only engineered barrier in the WIPP disposal system.

MgO will decrease actinide solubilities by consuming essentially all aqueous or gaseous CO_2 produced by microbial consumption of cellulosic, plastic, and rubber (CPR) materials (even if microbes consume all CPR materials in the repository), thereby buffering f_{CO_2} and pH within ranges favorable from the standpoint of actinide solubilities. The DOE is emplacing significantly more MgO than required to consume all CO_2. MgO could also consume significant quantities of H_2O from brine or the gaseous phase.

MgO is being emplaced in polypropylene “supersacks” on top of the stacks of waste containers. Each supersack contains 1905 ± 23 kg of MgO. Emplacement in supersacks: (1) facilitates handling and emplacement of MgO; (2) minimizes potential worker exposure to dust; (3) minimizes the exposure of periclase, the main reactive constituent of MgO, to atmospheric CO_2 and H_2O during handling and emplacement, and prior to panel closure.

The supersacks contain dry, granular MgO, of which less than 0.5 % can exceed 9.5 mm in diameter. Emplacement of granular MgO instead of powder (1) results in a bulk density high enough that sufficient MgO can be emplaced without causing operational difficulties, (2) reduces the likelihood of release of dust in the event of premature rupture of a supersack, and (3) ensures that the permeability of the material is high enough to promote complete reaction with CO_2.

Creep closure of WIPP disposal rooms will rupture the supersacks and disperse the MgO among and within ruptured waste containers. This will expose the MgO to the room atmosphere, to CO_2, and to brine and water vapor.

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