MgO Mini-sack Review

1.0 Introduction

This report summarizes EPA's review of DOE's proposal to eliminate magnesium oxide (MgO) mini-sacks from the Waste Isolation Pilot Plant (WIPP). This report responds to a formal request from Dr. Ines Triay of DOE dated July 21, 2000 (See Attachments 1 to 4). It includes information obtained during a DOE/EPA technical exchange meeting held in Washington, DC, on April 12-13, 2000 (See Attachment 5).

2.0 Overview of DOE Proposal

DOE requested that EPA approve the elimination of approximately 15% of the total quantity of MgO in the repository by removing backfill mini-sacks placed on and around waste drums and waste boxes (see Table 1). The backfill to be eliminated would be eighteen 25-lb bags (mini-sacks) of MgO around each waste stack and the mini-sacks from the floor around the waste containers. DOE states this proposal would "significantly enhance worker safety at the WIPP without adversely impacting repository performance" (see Attachment 2).

Table 1: DOE's Calculation of Excess of MgO

Case	Quantity	Value
Assume all organic carbon; cellulosics, papers, and rubbers, reacts to form CO_2	Moles CO_2	Maximum of 9.85×10^8 moles of CO_2 generated
	Original planned MgO in repository	85,600 tons @ 40.3 gm/mole = 1.93×10^9 moles
	Original CCA excess of MgO	1.95 times
	15% reduction	74,000 tons @ 40.3 gm/mole = 1.65×10^9 moles
	New MgO excess	1.67 times

In the Compliance Certification Application (CCA) DOE proposed, and EPA subsequently approved, the emplacement of approximately 85,600 tons of MgO as an engineered barrier to achieve two purposes: remove carbon dioxide (CO_2) gas created by microbial degradation of cellulosics, papers, and rubbers, and increase the pH in the repository to lower the solubility of dissolved actinides. As noted in DOE's letter of July 21, the amount of MgO presently planned for emplacement is almost twice that needed to sequester the CO_2 generated if all of the organic waste was converted to CO_2 (this constitutes a bounding assumption).

The primary benefits of this change would occur during the operational period by enhancing worker safety and decreasing cost. Decreasing the amount of MgO by 15% is not expected to significantly affect long-term repository performance, as discussed in Section 3.0 below.

3.0 Analysis

We reviewed relevant information in the CCA (especially Appendix BACK), EPA's Compliance Application Review Documents (CARDs) and Technical Support Documents (TSDs) for the certification rulemaking, the results of the CCA Performance Assessment (PA) and Performance Assessment Verification Test, and the DOE support documents submitted with the July 21st letter (Attachment 2).

Also, during a WIPP site visit in June following a technical meeting in Carlsbad, NM, EPA staff observed waste containers that had been placed in Panel 1 and noted that MgO mini-sacks were attached to containers and lay on the floor around the perimeter of the waste containers. Agency staff also evaluated the methods used to attach mini-sacks to waste containers. We found that DOE accurately represented the steps required to attach mini-sacks to the waste containers and the worker safety considerations involved in this activity (see Attachment 5).

DOE's conceptualization of MgO performance in the repository was very conservative. In CARD 44: Engineered Barriers, the Agency stated:

> ". . . the reaction of MgO to brucite would consume water, an added benefit for which DOE did not take credit in the PA. Additionally, other mineral species that may form (dypingite ($Mg_3(CO_3)_4(OH)_2 \cdot (5H_2O)$) and/or nesquehonite ($MgCO_3 \cdot 3H_2O$) consume five and time times as much water, respectively. These factors constitute a conservative approach that accounts sufficiently for uncertainties in geochemical processes that may occur in the disposal system" (p. 44-9).

The elimination of mini-sacks does not impact the CCA or PAVT results because DOE proposes to reduce only excess MgO, which was not used in the performance calculations. Compliance with EPA's containment requirements is not altered because there would still be a large excess of MgO relative to any potential evolved carbon.

The ability of the MgO remaining in super-sacks to react with brine in the repository is important if the mini-sacks are eliminated. Attachment 4 concludes that molecular diffusion alone can effectively mix brine with MgO from degraded super-sacks in a repository that has experience salt creep closure. Super-sacks of MgO will break open as the height of the repository compresses from 3 meters to .8 to 1.4 meters, mixing the MgO with the degraded

waste and waste containers. If brine is introduced into the disposal rooms MgO will be readily available to react chemically. We reviewed DOE's calculations and agree these processes will function as expected and sufficient MgO will be available to react.

4.0 Conclusion

In conclusion, we determined that the analysis of the effectiveness of MgO backfill, as described in EPA's certification decision, would not be compromised by the elimination of the mini-sacks:

- MgO is still expected to remove CO_2 and to affect pH and actinide solubility
- the excess amount of MgO proposed for emplacement ensures that adequate MgO will still be available to provide expected chemical effects
- the plan for emplacing MgO remains feasible.

The elimination of the MgO mini-sacks is not significant to long-term repository performance. DOE's proposal to decrease the amount of MgO in the WIPP by 15% by eliminating the MgO mini-sacks is acceptable.