Planned Emplacement of Magnesium Oxide in the WIPP Repository

1.0 Overview

In December 2002, the Department of Energy (DOE) submitted a request to the Environmental Protection Agency (EPA) for disposal of supercompacted waste from Idaho's Advanced Mixed Waste Treatment Facility (AMWTF). On March 26, 2004, the DOE received approval to dispose of AMWTF's supercompacted waste provided magnesium oxide (MgO), the approved engineered barrier, was emplaced in sufficient quantities to comply with the EPA's safety factor. DOE will take necessary measures to ensure that sufficient amounts of MgO are emplaced within each disposal room. The current plan is to be ready for receipt of supercompacted waste by March 1, 2005. No AMWTF supercompacted waste will be shipped to WIPP until the site is ready to receive that waste, and procedures to emplace additional MgO are in place. In most instances, the standard (current) practice of emplacing MgO (i.e., one supersack of MgO on top of each waste stack) will adequately meet the required safety factor. There may be circumstances when high concentrations of cellulose, plastic, and rubber (CPR) will increase the quantity of MgO required. In rooms where the CPR mass is much greater, additional MgO will be emplaced to ensure compliance with the safety factor requirement. The amounts of MgO and CPR will be tracked. The tracked mass of CPR and MgO will be used to determine if additional amounts of MgO are needed to retain the required safety factor in each room. In addition to emplacing one MgO supersack per waste stack, emplacement of additional MgO will typically be in separate stacks of MgO sacks or shaped sacks of MgO emplaced in void spaces that are present at the ends of rows in the room but may also include the following options:

- In separate columns located throughout the room
- At the ends of rows in various locations

Placement of added MgO must comply with the ventilation space requirement of a minimum of 16 inches above the top of the column. Based upon room conditions, waste stacking configurations, and required quantities, Waste Handling Operations will determine the safest manner for emplacing the additional MgO in each room such that flexibility is preserved in waste handling operations while meeting all WIPP requirements.

The following illustrations provide two examples of potential MgO emplacement. The upper layout shows emplacement of additional MgO using existing supersacks stacked in a typical waste emplacement space. The lower layout is an example of MgO packaging used to occupy existing room void spaces and minimize impact to waste emplacement.

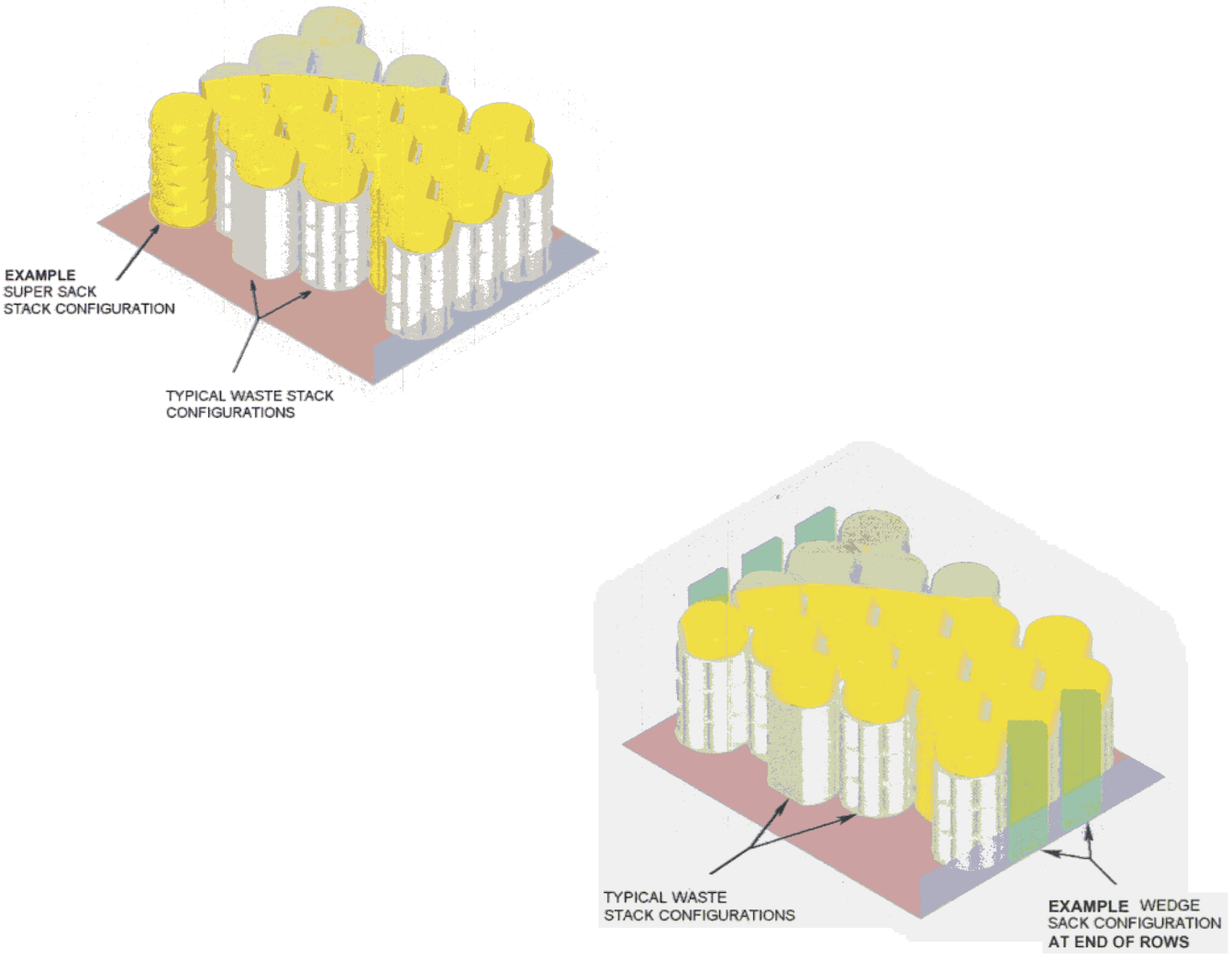

Figure 1. Example of Additional MgO Emplacements; top layout shows use of existing MgO sack design (yellow), bottom layout shows both existing and shaped sacks (green)

2.0 Compliance Requirements

In accordance with 40 CFR §191.14, assurance measures in the repository design include active institutional controls, monitoring, permanent markers, and both engineered and natural (multiple) barriers. In the Compliance Certification Application (CCA; DOE 1996, Section 3.3), DOE stated that MgO was selected as one of the four engineered barriers for the repository. The MgO is intended to ensure chemical conditions in the repository that lower actinide solubility in WIPP brines. The MgO provides these conditions by sequestering CO_2 that could be produced by potential biodegradation of CPR materials in the waste room. Further details on the effects of MgO in the disposal system can be found in the Compliance Recertification Application (CRA; DOE 2004) Appendix PA, Attachment SOTERM and Appendix BARRIERS.

MgO Emplacement

Scope

This plan provides the emplacement methods and configurations, tracking and control methods, and data quality objectives for the safe emplacement of the additional MgO as required for the emplacement of supercompacted wastes. Emplacement activities will be conducted in accordance with approved WIPP procedures. The MgO will be placed in sufficient quantities to comply with EPA requirements.

Process Safety Management and Hazard Review

Every activity and process performed at WIPP is accomplished with safety as the primary consideration. The emplacement of additional MgO will be performed safely in accordance with approved WIPP procedures. A Hazard Operability study will be conducted to identify hazards associated with the proposed activity. The identified hazards will be addressed through suitable engineering controls or Technical Safety Requirements (administrative controls). An Unreviewed Safety Question (USQ) evaluation will be performed to assess the activity against postulated accidents [WIPP CH-Documented Safety Analysis] and determine if additional concerns exist. Issues will be mitigated through engineering and administrative controls. The "As Low As Reasonably Achievable" (ALARA) principle applies to all activities at WIPP. Engineering and operability considerations will employ this principle to maintain exposure levels ALARA.

Schedule

The WIPP site is expected to be ready to receive and dispose of supercompacted waste and emplace additional MgO as needed by March 1, 2005.

4.0 Emplacement Configuration

Ensuring Sufficient Amounts of MgO are Emplaced

Additional MgO will be identified through regulatory assurance tools developed by DOE, WTS, and SNL. Determinations of the need for additional MgO will be based on CPR values of emplaced waste. To ensure sufficient amounts of MgO are emplaced, estimates will be performed using waste shipment projections prior to room fill and then confirmed periodically as room fill progresses. Section 5 discusses use of a tracking tool to ensure a specified safety factor is retained.

Verification of compliance with the safety factor is most important when a room is nearing capacity. In most instances, the standard practice of emplacing MgO will adequately meet the required safety factor. Variations in the CPR content within a room may influence the quantity of MgO to be emplaced. Due to the variety of waste characteristics and components within received shipments, the overall CPR loading will vary per room. In rooms where the CPR mass is greater, additional MgO will be emplaced as necessary to ensure compliance with the EPA specified safety factor.

Emplacement

As shown in the examples within Figure 1, MgO packages will be used as necessary to provide the amounts required by the supercompacted waste. The MgO sacks will be retrieved from the storage racks and emplaced using suitable lifting and handling equipment. Due to the existing waste geometries and the ventilation space requirement of a minimum of 16 inches above each waste column, the emplacement of additional supersacks is limited.

Waste Handling Operations

WTS Operations maintains the responsibility for emplacement of additional MgO. WIPP's scientific advisor, Sandia National Laboratories (SNL) will help develop regulatory assurance tools to ensure compliance. Based upon room conditions, waste stacking configurations, and required quantities, Waste Handling Operations will determine the safest manner for emplacing the additional MgO per room, such that flexibility is preserved in waste handling operations while adhering to all other WIPP requirements.

WIPP operations procedure WP05-WH1011, *CH Waste Processing*, is the primary procedure for waste handling. As necessary, other procedures will be revised to support this activity including training and qualification procedures.

5.0 Tracking and Reporting

Tracking Emplaced Quantities

WIPP currently tracks CPR values as well as ferrous and non-ferrous metals (as mass in kilograms) for each container of emplaced waste. The location of these materials is tracked by row, column, and height coordinates for each room within a panel along with the date of emplacement. Information currently tracked does not include; 1) CPR materials emplaced as a result of waste emplacement activities, nor 2) emplaced MgO values (quantity, location, and emplacement date). Prior to shipping supercompacted wastes, WIPP will ensure a system is in place to gather and track information on values for added CPR materials and MgO. Once completed, the Waste Handling group will be responsible for entering the emplacement data into the database. The entered information combined with a safety factor algorithm will aid in determining the need for additional MgO.

Reporting Emplaced Quantities

The WIPP Annual Change Report, submitted to EPA every November, will provide summary-level data indicating the room contents, MgO quantity emplaced, and the resulting safety factor. Related information to be included within the report will provide the mass of CPR as: 1) total CPR, 2) waste and container amounts, and 3) added emplacement material amounts.

6.0 Data Quality

Tracking System Data Quality

The tracking system development and maintenance will comply with software development, procurement, maintenance, use, and retirement as achieved through WIPP procedures and specified by the CBFO Quality Assurance Program Document [DOE/CBFO 94-1012]. By following the appropriate DOE and WIPP policies, directives, and procedures, the tracking system and data entry will be maintained as a quality product.

Safety Factor calculations

The SNL WIPP QA program as described in Sandia National Laboratories Nuclear Waste Management Procedure NP 1-1, Organization and QA Program shall be applied in the work that Sandia National Laboratories performs in support of the WIPP including development of the regulatory assurance tools. The SNL WIPP QA requirements applicable to work activities shall be specified during the planning phase to ensure the development and implementation of effective reporting mechanisms (e.g. MgO algorithm and verification calculations, per Section 5).

7.0 References

DOE (U.S. Department of Energy). 2004. Title 40 CFR Part 191 Compliance Recertification Application for the Waste Isolation Pilot Plant. DOE/WIPP 2004-3231. Carlsbad, NM: US DOE Waste Isolation Pilot Plant, Carlsbad Field Office.

DOE (U.S. Department of Energy). 1996. Title 40 CFR Part 191 Compliance Certification Application for the Waste Isolation Pilot Plant. DOE/CAO-1996-2184. Carlsbad, NM: US DOE Waste Isolation Pilot Plant, Carlsbad Area Office.

EPA (U.S. Environmental Protection Agency). 1993. 40 CFR Part 191 Environmental Radiation Protection Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes: Final Rule. Federal Register, Vol. 58, no. 242, pp. 66398 . 66416, December 20, 1993. Office of Radiation and Indoor Air, Washington D.C.

EPA (U.S. Environmental Protection Agency). 1996. 40 CFR Part 194: Criteria for the Certification and Re-Certification of the Waste Isolation Pilot Plants Compliance with the 40 CFR Part 191 Disposal Regulations: Final Rule. Federal Register, Vol. 61, No. 28, pp. 5224. 5245, February 9, 1996. Office of Radiation and Indoor Air, Washington, D.C.

EPA (U.S. Environmental Protection Agency). 1998. 40 CFR Part 194: Criteria for the Certification and Re-Certification of the Waste Isolation Pilot Plants Compliance With the Disposal Regulations: Certification Decision; Final Rule. Federal Register, Vol. 63, No. 95, pp. 27396, May 18, 1998. Office of Radiation and Indoor Air, Washington, D.C.

EPA Letter from Bonnie Gitlin (ORIA) to R. Paul Detwiler DOE/CBFO, September 10, 2004, RE: Annual WIPP Inspection Report.

EPA Letter from Elizabeth Cotsworth (ORIA) to R. Paul Detwiler DOE/CBFO, September 2, 2004, RE: CRA Comments (3rd set).

EPA Letter from Elizabeth Cotsworth (ORIA) to R. Paul Detwiler DOE/CBFO, May 20, 2004, RE: CRA Comments (1st set).

EPA Letter from Frank Marcinowski to R. Paul Detwiler DOE/CBFO, March 26, 2004 RE: Approval to dispose of super compacted waste at WIPP.

FR 63, N.95, pp. 27353-27408; EPA WIPP Certification Decision; Final Rule. May 18, 1998.