UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

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OFFICE OF
AIR AND RADIATION

R. Paul Detwiler, Acting Manager
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Dear Dr. Detwiler:

In a December 10, 2002, letter from Dr. Triay, the Department of Energy (DOE) requested our approval to dispose of standard waste and compressed waste from the Idaho National Environmental and Engineering Laboratory's (INEEL) Advanced Mixed Waste Treatment Facility (AMWTF) at the Waste Isolation Pilot Plant (WIPP). (Docket A-98-49, Item II-B2-15; all subsequent citations to same docket) We approved the disposal of standard transuranic waste from the AMWTF in a June 2003 letter, and recently approved related waste characterization processes at the facility. (II-B3-56, II-A4-42) Subject to EPA quality assurance and waste characterization inspections, with this letter we now approve disposal of compressed (super-compacted) waste at WIPP with the requirement to place additional magnesium oxide (MgO) with the compressed waste to maintain the current safety factor.

As part of the 40 CFR Part 194.4 planned change requirement, we have reviewed multiple information submissions and held several technical exchanges on this topic. Our conclusion is that the compressed waste is adequately represented by the current performance assessment methodology and that the disposal of compressed waste is not a significant change to EPA's 1998 certification decision or to activities and conditions important to the containment of waste. Additional conclusions from our review are:

1. When compared to standard (uncompressed) waste, compressed waste is expected to: 1) be more rigid, 2) contain higher concentrations of gas generating material (cellulosic, plastic and rubber materials or "CPR"), and 3) have lower radioactivity content. The primary effect of compressed waste in the repository is to create more gas from the increased amounts of cellulosic, plastic and rubber; the structural characteristics of the compressed waste produce small performance effects and may reduce releases if DOE were to take credit for them.

2. We agree with DOE that radioactive releases with compressed waste are similar to or below those of standard waste.

3. DOE needs to use additional MgO with the compressed waste to maintain the current MgO safety factor. The additional MgO will compensate for any additional gas that may be produced by increased amounts of CPR.

Review Process

DOE submitted its original request to dispose of standard and compressed waste from the AMWTF on December 10, 2002. This precipitated additional correspondence, including technical

reports. In June 2003, we approved the standard transuranic waste from the AMWTF for disposal at WIPP after receiving additional information from DOE. DOE's compressed waste submissions included more detailed analyses such as performance assessment calculations, structural analyses and analyses of chemical conditions. EPA and DOE also held several technical exchanges to discuss DOE's information submissions.

The correspondence, reports and technical exchanges are identified in the enclosure. The full technical report describing our review can be found in Docket A-98-49, Item II-B3-68. Enclosure 1 summarizes in greater detail the issues discussed below.

General Background on AMWTF Compressed Waste

The AMWTF at INEEL is designed to retrieve, characterize, repackage, and compress 55-gallon drums of contact-handled, mixed transuranic debris waste. The compressed AMWTF waste will consist of 55-gallon steel drums of debris waste compressed vertically, resulting in flattened cylinders called "pucks" (see picture below). These pucks would be placed in 100-gallon steel drums for shipping and disposal at WIPP.

Each 100-gallon drum is expected to contain from 3 to 5 pucks, with an average of 4 pucks per drum. If these pucks do not degrade, the pucks will be stronger and more rigid than the standard waste, potentially propping up the room ceiling.

DOE states that approximately 52,440 100-gallon drums are expected to be shipped from INEEL to WIPP. DOE also estimates that compressed waste will occupy 19,875 m^3 or 11.8% of the 168,500 m^3 of the contact-handled waste inventory at WIPP. The compressed waste radionuclide inventory is estimated as 89,252 curies versus an overall repository total of 2.48 million curies (decayed to 2033). The compressed waste will have about ten times the density of cellulosic, plastic, and rubber materials than the average standard waste.

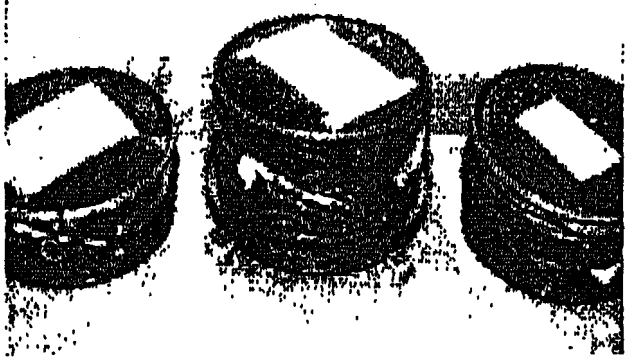

Figure 1.
Compressed waste pucks as generated in the AMWTF
(Source: DOE)

In our review of the IN-BN-510 waste stream, we identified that remote-handled (RH) waste streams are included in the waste stream inventory. Upon further review we have found that the AMWTF contractor, BNFL, is required by contract to separate out RH waste that is found in the waste that comprises the IN-BN-510 waste stream and the non-debris waste. In addition, BNFL's operating procedures (i.e., waste acceptance criteria) and shipping requirements should prevent any RH waste from being compressed (DOE 2004).

No Change in Total Radioactive Releases with Compressed Waste

DOE analysis of the impact of compressed waste on the WIPP repository included performance assessment calculations that included the different compressed waste characteristics. The results of these performance assessment calculations show that releases of radioactivity with compressed waste are similar to or below those of standard waste. This is because the repository performance, using brine saturation and gas pressure as metrics, appears to show limited response to the placement of the compressed waste. The most significant conclusions from the compressed waste performance assessment are:

- Cuttings and Cavings: Compressed waste would reduce releases from this mechanism because of its lower radioactivity than the average used for the standard waste and potentially greater strength than the standard waste.

- Spallings: Since the compressed waste has lower activity than the average of the repository and the waste is potentially stronger than average waste, spallings releases from the compressed waste would be lower than the standard waste assumed.

- Direct brine releases (short-term releases): These releases are a small fraction (~1%-3%) of the total releases. Increased permeability of the compressed waste may increase releases from this mechanism, but there is no noticeable effect on the mean total releases.

- Long-term releases: Releases to the anhydrite marker beds and overlying Culebra also remain negligible with the presence of the compressed waste.

More MgO Needs to Be Added to Maintain Safety Factor

DOE assumes that microbes will sequentially use CPR in waste as energy sources. This process generates carbon dioxide. DOE uses magnesium oxide (MgO) as an engineered barrier to sequester the carbon dioxide produced from microbial processes. In the 1998 Certification Decision and since, DOE includes more than necessary for performance as a "safety factor."

However, the CPR density in AMWTF compressed waste is much higher than the average waste. In addition, there is uncertainty associated with the amount of carbon dioxide that may be produced from the possible microbial processes. For these reasons, EPA is requiring DOE to place additional MgO with the compressed waste containers sufficient to maintain the current 1.67 MgO safety factor. MgO safety factors need to be calculated assuming all carbon could be converted to carbon dioxide. For example, we estimate that approximately 1.3 MgO supersacks will be required per 100-gallon drum 3-pack (averaging 4 pucks per 100-gallon drum) to be consistent with the currently approved MgO safety factor. The safety factor could also be calculated on a room basis.

Compressed Waste in WIPP is Not a Significant Change

EPA has identified that the primary consequence of the compressed waste is to create more gas from the increased amounts of cellulosic, plastic and rubber materials. The structural characteristics of the compressed waste have little effect on total releases as modeled. Since the main result of the compressed waste is essentially a change in the non-radioactive inventory and the radioactive releases are similar to releases with standard waste, we do not consider the presence of compressed waste in WIPP a significant change. The AMWTF compressed waste therefore does not alter the Agency's original compliance determination.

In EPA's December 2000, "Guidance to the U.S. Department of Energy on Preparation for Recertification of the Waste Isolation Pilot Plant with 40 CFR Parts 191 and 194," EPA states that a "significant" change may be generally understood as the degree to which the change departs from a factor that was important to our determination of compliance with a specific requirement of the Compliance Criteria. Today's decision is similar to previous decisions EPA has made on clay seam G (II-A3-24) and Panel 1 Utilization (II-B3-19), where there was a determination that the changes would not have a significant impact on long-term performance. We have also previously approved an adjustment to the amount and placement of MgO in disposal rooms (II-B3-15).

Summary

As part of the 40 CFR Part 194.4 planned change requirement, we have evaluated the effect of the compressed waste on the safety of WIPP and compliance with EPA's disposal regulations. We have determined that the issue with the compressed waste is primarily one of CPR inventory and its potential to generate additional gas.

We agree with DOE that the compressed waste will not affect total radioactive releases. DOE is approved to dispose of compressed waste at WIPP, subject to the following condition: EPA is requiring DOE to maintain the current 1.67 MgO safety factor by adding extra MgO backfill with the compressed waste. DOE is expected to calculate the MgO safety factor assuming that all carbon in the waste could be converted to carbon dioxide and calculate the safety factor accordingly. EPA will verify the 1.67 MgO safety factor has been consistently maintained by DOE at WIPP during our annual Emplacement Inspection.

If you have any questions, please contact Tom Peake at 202-343-9765.

Sincerely,

Frank Marcinowski, Director
Radiation Protection Division

Enclosures

cc: Russ Patterson, DOE/CBFO
Steve Casey, DOE/CBFO
Matthew Silva, EEG
Larry Allen, EEG
Steve Zappe, NMED
EPA WIPP Team
EPA Docket

Enclosure

Discussion of Major Issues Associated With EPA's Compressed Waste Review

This attachment provides an expanded discussion of the major issues addressed in the correspondence from Frank Marcinowski to Paul Detwiler. The primary documents examined in the review of the compressed waste are the reports, *Effects of Supercompacted Waste and Heterogeneous Waste Emplacement on Repository Performance,"* Revisions 1 and 2 by Hansen et al. (2003a and 2003b) and the *Determination of the Porosity Surfaces of the Disposal Room Containing Various Waste Inventories for WIPP PA* by Park and Hansen 2003b. These documents and others are in EPA's Docket A-98-49 or are contained as part of the 2004 Draft Compliance Recertification Application (CRA).

An even more comprehensive review than that below is provided in the document *Review of Effects of Supercompacted Waste and Heterogeneity Waste Emplacement on WIPP Repository Performance* (TEA 2004; Docket A-98-49, Item II-B3-68). Enclosure 2 lists the correspondence between DOE and EPA and the associated docket numbers for this review.

General Background on AMWTF Compressed Waste

The Department initially requested EPA to approve emplacement of compressed waste at the WIPP in correspondence dated December 10, 2002 (DOE 2002; Docket A-98-49, Item II-B-15). Compressed waste would be generated at the Advanced Mixed Waste Treatment Facility (AMWTF), currently undergoing testing at the Idaho National Engineering and Environmental Laboratory (INEEL). The AMWTF is designed to retrieve, characterize, repackage, and compact 55-gallon drums of contact-handled, mixed transuranic debris waste, and place the compressed drums into 100-gallon drums for disposal at WIPP.

Non-debris waste would also be processed at the AMWTF but would not be compressed. The uncompressed waste (or standard waste) would be placed in standard 55-gallon drums or in standard waste boxes for shipment and disposal at WIPP. The Agency approved disposal of uncompressed AMWTF waste on June 11, 2003, assuming all additional requirements were also met (EPA 2003a; Docket A-98-49, Item II-B3-56).

All AMWTF waste to be emplaced at WIPP will be contact-handled (CH), transuranic (TRU) waste. The inventory of compressed AMWTF debris waste is based on a total of 52,440 100-gallon containers being shipped to the WIPP. The total emplaced volume of these wastes, based on an inner volume of 0.379 m^3 per 100-gallon container, is estimated to be 19,875 m^3 or 11.8% of the total planned 168,500 m^3 CH TRU waste volume. However, the actual compressed waste volume is reported by INEEL to be 11,635 m^3, which is 41 percent less than the container volume due to void space within the 100-gallon containers. In the Advanced Mixed Waste (AMW) performance assessment (PA), DOE modeled the repository using the same total inventory as expected in the 2004 Compliance Recertification Application.

DOE indicates that the supercompaction portion of the AMWTF intends to undergo the site certification process in the fall of 2004 with the intent of shipping waste in the spring of 2005, assuming the facility obtains all other applicable approvals.