

## **Planned Change Request for Shielded Containers**

### **Summary**

The U.S. Department of Energy (DOE) is proposing to package and emplace a portion of the Remote Handled (RH) Transuranic (TRU) Waste inventory in shielded containers at the Waste Isolation Pilot Plant. The use of the shielded containers will enable DOE to expedite the cleanup of various TRU waste sites by significantly increasing the rate at which portions of the RH TRU waste can be received and emplaced at the WIPP. The shielded containers will be transported to WIPP in the HalfPACT transportation container. The shielded containers will be managed and emplaced in the rooms of the repository in a fashion similar to what is currently used for Contact Handled (CH) TRU waste. The robustness of the containers has been demonstrated by passing the Department of Transportation (DOT) 7A Type A and the Nuclear Regulatory Commission (NRC) Type B drop tests and are awaiting regulatory approval.

The RH waste that will be emplaced in shielded containers is included in the current inventory for the WIPP. Candidate RH waste streams for shipment and disposal in shielded containers have been selected based on the requirement to keep the radiation surface dose rate below 200 millirems per hour (mrem/h). These waste streams and containers will remain designated as RH waste in the WIPP Waste Information System (WWIS).

A performance assessment (PA) was conducted to evaluate the effect of emplacing shielded containers in the disposal rooms on long-term repository performance. Bounding assumptions were used to evaluate the effects of emplacing shielded containers in the repository. Results show that the WIPP will continue to comply with the containment requirements.

This document and its attachments demonstrate that emplacing RH waste in the WIPP using shielded containers will not have a significant impact upon repository performance.

### **1.0 Current Practice for RH TRU Waste**

Currently RH TRU waste is loaded into a single type of container, the RH TRU waste canister. This canister is cylindrical in shape with approximate dimensions of 120 inches in length and 26-inches in diameter. The canister walls have a nominal thickness of 0.25-inches and are constructed entirely of steel. The canister is either directly loaded or loaded with waste that that has been pre-packaged in 55 gallon drums, 30 gallon drums or metal cans. Shipment of the canisters is in the RH-TRU 72-B Cask, an NRC Type B certified transportation container. Another Type B container that will be used to ship RH TRU waste is the CNS-10-160B. In this cask the waste is shipped in 55-gallon drums. The 55-gallon drums are then loaded into canisters at the WIPP facility. For disposal the canisters are placed in holes that are drilled in the walls of the disposal rooms.

## **2.0 Proposed Change**

### **2.1 Description of Shielded Container**

The shielded container has approximately the same exterior dimensions as a 55-gallon drum and is designed to hold a 30-gallon drum. The cylindrical sidewall of the shielded container has 1-inch thick lead shielding sandwiched between a double-walled steel shell as shown in Figure 1. The external wall is 1/8 inch thick, and the internal wall has a thickness of 3/16 inch. The lid and the bottom of the container are made of carbon steel and are 3-in thick. The empty weight of the containers is approximately 1,800 pounds. The shielded container and the inner 30-gallon drum will be vented. The container has been tested to DOT Type 7A and NRC Type B Hypothetical Accident Conditions (HAC) specifications. This will ensure the container is safe for transport and handling and will contain and shield the waste under the most severe accident conditions.

### **2.2 Performance Assessment**

The DOE demonstrates compliance with the containment requirements according to the Certification Criteria in Title 40 CFR, Part 194 by means of PA calculations. WIPP PA calculations are used to estimate the probability and consequence of radionuclide releases from the repository to the accessible environment for a regulatory period of 10,000 years after facility closure, and compared to regulatory limits.

The baseline assumption in WIPP PA is that all RH TRU waste would be emplaced in canisters in the walls of the repository. An impact assessment, termed the Shielded Container Performance Assessment (SCPA) was conducted in the following five step process to quantify the affect of shielded containers use on long term repository performance:

1. Evaluate the WIPP PA baseline assumptions, models, and parameters to determine which are affected by the use of shielded containers;
2. Develop an analysis design to incorporate necessary modifications to the baseline approach;
3. Develop necessary parameters for the SCPA;
4. Execute WIPP PA codes; and
5. Conduct an analysis of results, including a comparison with baseline predictions of long term repository performance.

The review of WIPP PA determined that the primary modification to the baseline assumptions was the re-location of a portion of the RH TRU waste from boreholes in the walls of the waste rooms to the disposal rooms. This change requires the creation of new parameters in certain PA models. The new parameters represent the fraction of repository volume occupied by waste and the area for RH TRU waste disposal in the walls of the repository for scenarios that model the inclusion of shielded containers. It was determined that no other

changes to the baseline were necessary to represent the presence of shielded containers.

The SCPA used a bounding approach to model the effects of waste in shielded containers. The baseline scenario (SCPA scenario 1) assumes that all of the RH TRU waste is emplaced in canisters in the walls of the repository. SCPA scenario 2 assumes that all of the RH TRU waste is emplaced in shielded containers, rooms of the repository. No other changes were made to the PA baseline for this scenario. SCPA scenario 3 assumes that half of the RH TRU waste is emplaced in shielded containers in the rooms of the repository and half of the RH TRU waste is emplaced in canisters in the walls of the repository. No other changes were made to the PA baseline for this scenario. A comparison of the results from SCPA scenario 2 and SCPA scenario 3 to the baseline estimates of releases in SCPA scenario 1 identified the effects of the emplacement of shielded containers on repository performance. As described below, the effect was not discernable.

A single, composite waste stream is used to represent all of the RH TRU waste in SCPA scenarios 1 through 3. SCPA scenario 4 is a repeat of SCPA scenario 2, with the exception that the 77 individual RH TRU waste streams are explicitly represented instead of using a single average waste stream to represent the RH TRU waste. A comparison of the results from SCPA scenarios 2 and 4 identified the effects of using an average RH TRU waste stream to represent all RH TRU waste.

The SCPA concludes that the WIPP continues to comply with the containment requirements specified in 40 CFR §191.13 if RH TRU waste is emplaced in shielded containers. The results with shielded containers in scenarios 2, 3 and 4 are not discernibly different than the results of the current compliance baseline with scenario 1. This statement applies to all release pathways: cuttings and cavings, spillings, direct brine releases, groundwater releases, and total releases. Furthermore, the explicit representation of individual RH TRU waste streams is not warranted since the representation of RH TRU waste with a single, composite RH TRU waste stream does not result in discernibly different results than when individual RH TRU waste streams are used.

- The radionuclides Cs-137, Co-60, and Sr-90 are much more prevalent in RH waste, but their impact on long-term performance is negligible because these radionuclide have relatively short half-lives of 30, 5, and 29 years, respectively (Leigh and Trone 2005). After roughly 100 years the total activity of RH waste is approximately 0.1% of that of CH waste.
- The remote-handled (RH) waste inventory is limited to a maximum volume of 7080 m<sup>3</sup> (250000 ft<sup>3</sup>) which accounts for approximately 4% of the total waste volume (DOE 2004).

The summary report for the SCPA is provided in Attachment 1, Analysis Report for the Shielded Container Performance Assessment, Sandia National Laboratories, 2007.

### **2.3 Waste Inventory**

An analysis of RH TRU waste streams was performed to determine which waste streams could be loaded in shielded containers and meet the 200 mrem/hour limit surface dose rate limit. This analysis started by calculating the number of 30-gallon drum equivalents expected to be generated using the WIPP capacity volume for RH TRU waste (7,080 m<sup>3</sup>). Each 30-gallon drum will be inserted in a 55-gallon shielded container (see Figure 1 for a drawing of the shielded container). Once the number of shielded containers was determined, the inventories of cellulose, plastic, and rubber (CPR), steel, and lead used in packaging and emplacement were determined. Though DOE does not plan to put the entire inventory of RH waste into shielded containers, this assumption was made to identify an upper bound on the change to CPR, steel, and lead inventories. The emplacement scenarios for the shielded container, for purposes of this analysis, assume that 3-packs will be stacked 3 high in the WIPP repository. As part of this analysis, the RH TRU waste inventory was also screened using gamma factors and Microshield<sup>®</sup> evaluations to estimate the limiting gamma emitter activity per shielded container that would produce a contact dose of less than 200 mrem/h. Candidate waste streams were then selected from populations of drums that have a high probability to be adequately shielded (i.e. are less than 200 mrem/h) for handling based on these calculations. The details of his analysis are provided in Attachment 2 - Analysis of RH TRU Wastes for Containment in Lead Shielded Containers, INV-SAR-08, Rev. 0, Los Alamos National Laboratory-Carlsbad.

### **2.4 Operations**

Upon arrival at the WIPP facility, the shielded containers will be processed in the same fashion as CH TRU waste. After receipt at the WIPP facility, the 3-pack assemblies will be removed from the HalfPACT transportation container using existing lifting fixtures and equipment in the CH Waste Handling Building. The 3-pack assemblies will remain intact and will enter the sequence of operations and will be processed, tracked and downloaded to the underground repository along with CH containers. The 3-pack assemblies of shielded containers will be emplaced randomly in the underground disposal rooms along with the CH waste. Figure 3 shows a typical anticipated emplacement configuration, with 3-pack assemblies of shielded containers interspersed with CH container types. Emplacement of the 3-pack assemblies of shielded containers is expected to utilize existing waste handling equipment and fixtures.

The handling and emplacement of shielded containers will have minimal impact on waste handling equipment and ventilation systems. For example the slip sheets will be modified to accommodate the 3-pack assemblies and a new

triangular spaceframe pallet will be developed. The WWIS (WIPP Waste Information System) will be used to track the waste components, packaging, transportation and emplacement information in the same method as other waste that is transported and emplaced at the WIPP. The waste will be tracked as RH TRU waste. Certain data fields in the WWIS will be modified to accommodate the new payload container and associated waste component limits.

## **2.5 Transportation**

The shielded containers will be assembled in a 3-pack configuration on a triangular pallet, be surrounded by radial and axial dunnage components, and be transported within the existing HalfPACT transportation container. The 3-pack configuration will remain intact throughout transportation and emplacement (Figure 2). The shielded container is designed to stay within the parameters of the HalfPACT design and licensing bases e.g., payload weight, decay heat and radiation dose rate limits. To ensure the robustness of the container, it was subjected to DOT 7A Type A testing that included 4 foot drops of the bare container onto an unyielding surface using four potentially worse-case orientations. As part of the safety analysis, a 3-pack of containers was drop tested 30-feet inside a HalfPACT ICV (Inner Containment Vessel) as part of the Hypothetical Accident Condition (HAC) evaluation required by Title 10 CFR Part 71. The HAC tests evaluate and ensure the containers will adequately shield the RH TRU waste contained within under the most severe accident conditions. The thermal, shielding and criticality evaluations were performed by analysis using similar methodology as presented in the HalfPACT Safety Analysis Report (SAR), RH-TRU 72-B SAR and the TRUPACT II SAR. The tests were successful and the results will be used to demonstrate compliance with all applicable DOT and NRC standards, ultimately leading to certification of the payload container as a DOT 7A, Type A container and as an authorized payload container for shipment within the NRC certified HalfPACT Type B Packaging. DOE is awaiting regulatory approval. The success of this testing proved the container is safe even after being subjected to worst case severe handling or accident condition impacts as specified within the DOT and NRC regulations.

## **3.0 Conclusion**

The results of the Shielded Containers PA indicate that the shielded containers will have a minimal impact on long-term repository performance and therefore on compliance with the 40 CFR Part 194 requirements. With regard to the Waste Inventory, the DOE will not be adding or removing RH TRU waste streams and will be selecting those that will not exceed the surface dose rate limit of 200 mrem/hr when emplaced in shielded containers. The impact on the WIPP facility and operations will be limited to revision of certain aspects of the WWIS and to procedural changes to the process of transporting, handling and emplacement of the shielded containers. The addition of this payload container will allow DOE to realize greater efficiencies in transporting and emplacing RH TRU waste in a safe and compliant manner.

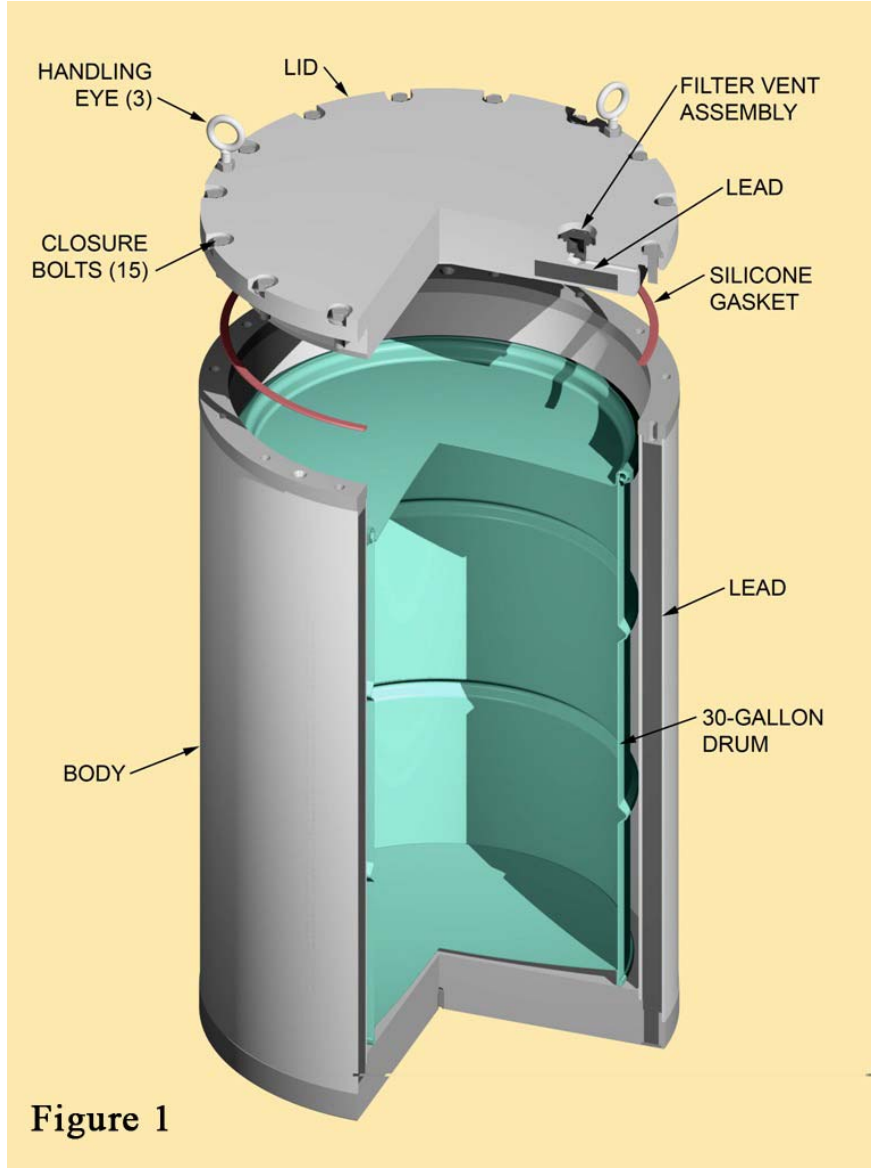


Figure 1

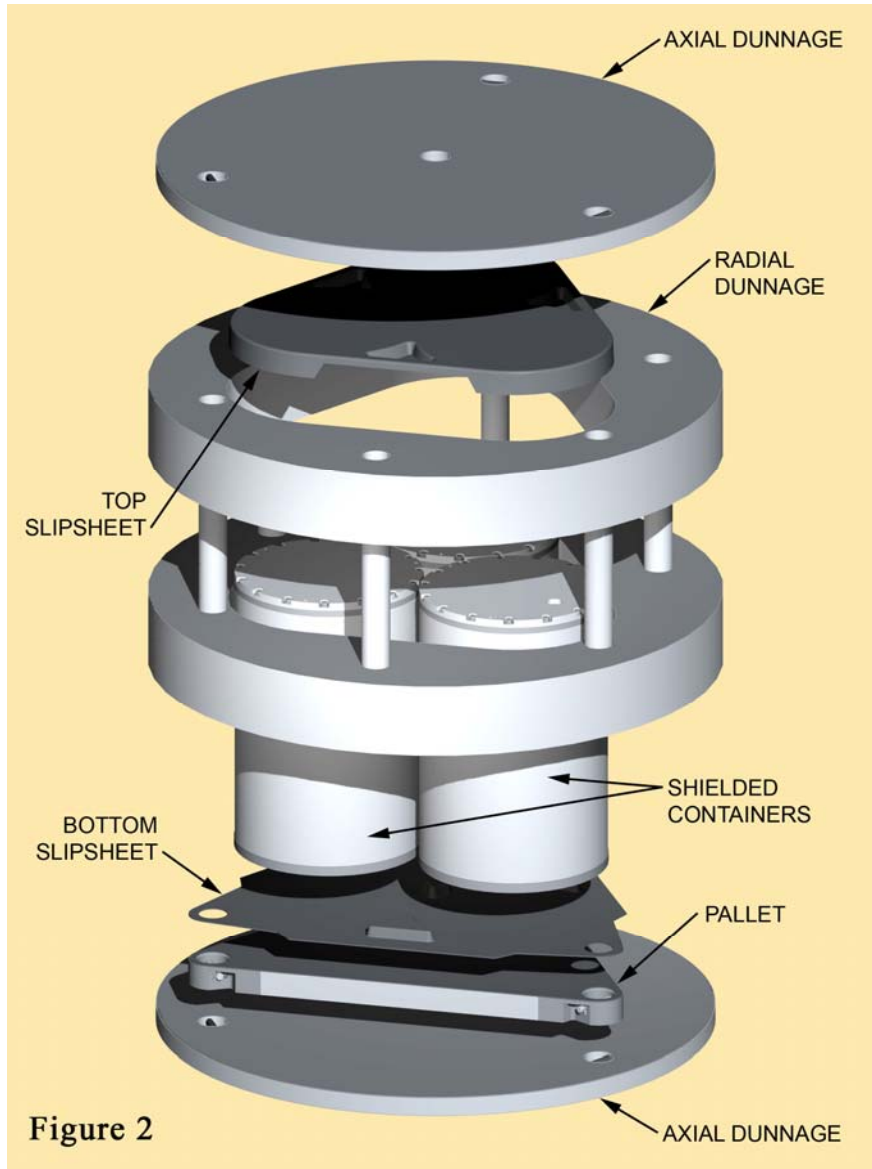


Figure 2

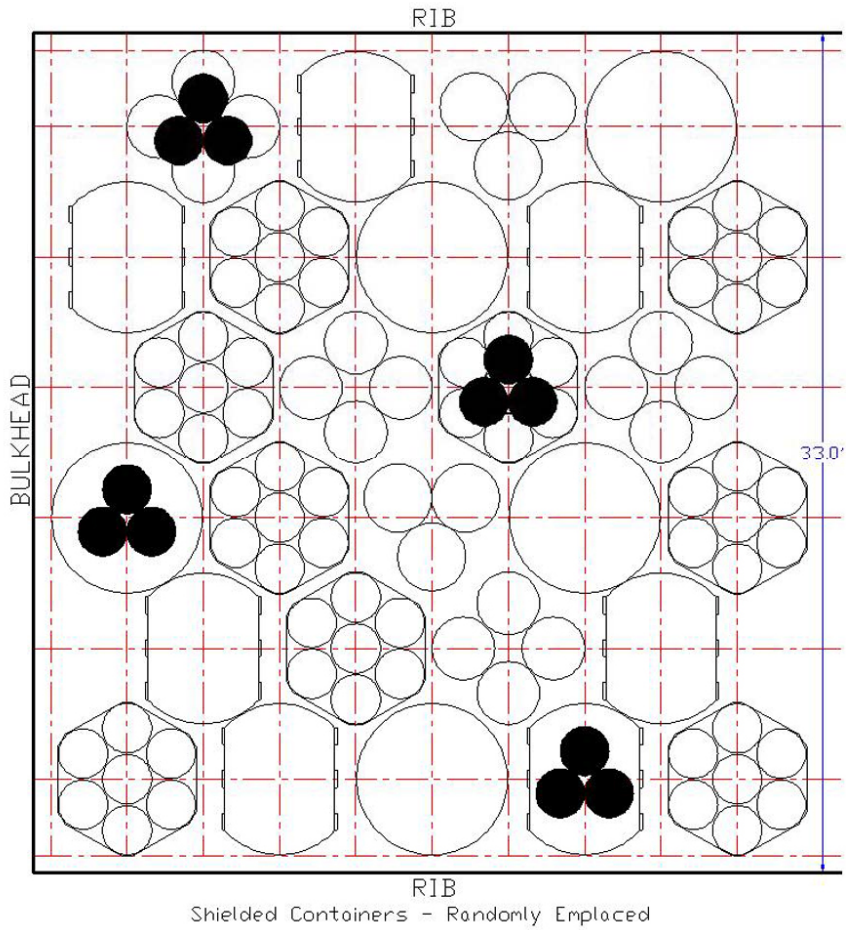


Figure 3

Shielded Containers - Randomly Emplaced



## **References**

DOE. 2004. Title 40 CFR Part 191 Compliance Recertification Application for the Waste Isolation Pilot Plant, DOE/WIPP 2004-3231, 10 vols., US Department of Energy, Carlsbad Field Office, Carlsbad, NM.

Leigh, C. D. and Trone, J.R. 2005. Calculation of the Waste Unit Factor For the Performance Assessment Baseline Calculation, Rev. 0. Sandia National Laboratories. Carlsbad, NM. ERMS 539613.