THE REMOTE-HANDLED TRU WASTE PROGRAM

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ABSTRACT

RH TRU Waste is radioactive waste that requires shielding in addition to that provided by the container to protect people nearby from radiation exposure. By definition, the radiation dose rate at the outer surface of the container is greater than 200 millirem per hour and less than 1,000 rem per hour. The DOE is proposing a process for the characterization of RH TRU waste planned for disposal in the WIPP. This characterization process represents a performance-driven approach that satisfies the requirements of the New Mexico Hazardous Waste Act, the Environmental Protection Agency (EPA) regulations for WIPP long-term performance, the transportation requirements of the Nuclear Regulatory Commission (NRC) and the Department of Transportation, as well as the technical safety requirements of RH TRU waste handling.

The transportation, management and disposal of RH TRU waste is regulated by external government agencies as well as by the DOE itself. Externally, the characterization of RH-TRU waste for disposal at the WIPP is regulated by 20.4.1.500 New Mexico Administrative Code (incorporating 40 CFR 261.13) for the hazardous constituents and 40 CFR 194.24 for the radioactive constituents. The Nuclear Regulatory Commission certifies the shipping casks and the transportation system must meet DOT regulations. Internally, the DOE evaluates the environmental impacts of RH TRU waste transportation, handling and disposal through its National Environmental Policy Act program. The operational safety is assessed in the RH TRU Waste Safety Analysis Report, to be approved by the DOE.

The WIPP has prepared a modification request to the Hazardous Waste Facility Permit that includes modifications to the WIPP facility for the safe receipt and handling of RH TRU waste and the addition of an RH TRU waste analysis plan. Modifications to the facility include systems and equipment for safe handling of RH-TRU containers. Two shipping casks are to be used to optimize RH TRU waste throughput: the RH-72B and the CNS 10-160B transportation casks. Additionally, a draft Notification of Proposed Change to the EPA 40 CFR 194 Certification of the WIPP has been prepared, which contains a proposal for the RH TRU characterization program for compliance with the EPA requirements.

INTRODUCTION

The Waste Isolation Pilot Plan (WIPP) Land Withdrawal Act authorizes the Department of Energy (DOE) to dispose of 7,080 m^3 of Remote-Handled (RH) transuranic (TRU) waste in 250 million-year old salt beds 650 meters below the surface. The characterization, transportation, and disposal of RH TRU waste is regulated by external government agencies as well as by the DOE itself. Externally, the characterization of RH-TRU waste for

disposal at the WIPP is regulated by 20.4.1.500 New Mexico Administrative Code (NMAC) (incorporating 40 CFR 261.13) for the hazardous constituents and 40 Code of Federal Regulations (CFR) 194.24 for the radioactive constituents. The Nuclear Regulatory Commission (NRC) certifies the shipping casks and the transportation system must meet Department of Transportation (DOT) regulations. Internally, the DOE evaluates the environmental impacts of RH TRU waste transportation, handling and disposal through its National Environmental Policy Act (NEPA) program. The operational safety is assessed in the RH TRU Waste Safety Analysis Report (1), to be approved by the DOE. This paper summarizes the ongoing efforts to develop the RH TRU waste program in the areas of RH TRU waste characterization for disposal, RH TRU waste transportation, and RH TRU waste disposal operations at the WIPP facility.

RH TRU Waste Characterization For Disposal

The NMED issued a Hazardous Waste Facility Permit (HWFP) for the WIPP in October 1999 (2). The HWFP contains a HWFP condition (Module II, Section II.C.3.h) that prohibits the management and disposal of remote handled (RH) transuranic (TRU) mixed waste at the WIPP facility. During the permitting process, NMED stated that WIPP shall not store or manage TRU waste in the RH Bay of the Waste Handling Building Unit or dispose of any RH waste in any HWDU unit until the Permittees obtain a modification for the methods for characterizing RH waste under the WAP. During the WIPP HWFP Hearings, the Hearing Officer stated that prior to accepting any RH TRU mixed waste at WIPP, the Applicants must clear the regulatory hurdle of obtaining a permit modification (3). In addition, the Finding of Fact and Conclusions of Law (4) states that the RH TRU WAP must be included and submitted as a modification to the existing HWFP to allow storage and disposal of RH TRU mixed waste. To respond to the prohibition on RH TRU waste, the DOE is in the process of finalizing a permit modification request to add an RH TRU WAP to the HWFP (5).

The EPA issued a certification of the DOE's compliance with the radioactive waste disposal requirements and criteria found respectively in 40 CFR Parts 191 and 194. This certification allowed DOE to ship and dispose of TRU waste in the WIPP repository, with certain limitations. One of those limitations was that the DOE could not receive nor dispose of RH TRU waste until such time as the DOE presented a waste characterization program for RH TRU waste. After reviewing the Compliance Certification Application (CCA) (6), EPA determined that DOE did not provide any waste characterization methods for RH-TRU waste, nor was there discussion specific to how DOE will quantify the RH-TRU waste. Therefore, EPA was not able to certify that DOE demonstrated that the WIPP would comply with the radioactive waste disposal regulations for any RH TRU wastes. To respond to the EPA concerns about RH TRU waste characterization, the DOE is in the process of finalizing a Notification of Proposed Change to the EPA 40 CFR 194 Certification of the WIPP (7) that contains a proposal for a characterization program for RH TRU waste.

The Institute for Regulatory Science (RSI) performed a technical and regulatory peer review of the HWFP permit modification and the Notification of Proposed Change to the EPA 40 CFR 194 Certification of the WIPP following procedures established by the American Society of Mechanical Engineers (ASME). In addition, the National Academy of Science (NAS) National Research Council's Committee on the WIPP reviewed the documents. Both of the reviews supported the DOE's proposals and made specific recommendations for further improving the documents. The recommendations from the RSI (8) and NAS (9) reviews are being incorporated into the final versions of the documents.

Hazardous Waste Facility Permit

The DOE proposes the use of a data quality objective (DQO)based characterization approach for RH TRU waste as part of the HWFP modification request. Based on the results of repository modeling and the volatile organic compound (VOC) emission modeling, the DOE believes there are no specific RH TRU waste parameters that need to be measured with precision in order to assure repository integrity and assure protection of human health

and the environment. This does not mean that no characterization of RH TRU waste is necessary. To the contrary, in order to meet the requirements of the facility design and the facility waste acceptance criteria specific needs for waste analysis have been identified. These needs are embodied in the following DQOs: 1) determine the physical form of the waste, 2) determine the absence of prohibited items in the waste, and 3) determine the US EPA hazardous waste numbers for each RH TRU mixed waste stream.

RH TRU waste, by definition, has a surface dose rate of 200 mrem/hr or greater, and thus, must be handled remotely to protect operators and the public from ionizing radiation. Therefore, characterization methods implemented for RH TRU waste must incorporate the best method available to obtain the information needed, while minimizing worker and public risk. This does not mean that "no dose" is acceptable; rather, it means that the DOE must make decisions that minimize the worker dose. The RH TRU Waste Analysis Plan (WAP) proposes to meet the DQOs using the acceptable knowledge (AK) process and testing. The proposed testing methods are radiography and visual examination (VE). The proposed RH WAP establishes the specific requirements for implementing these characterization methods for RH TRU waste. The DOE believes that headspace gas and homogeneous solids sampling and analysis are not required characterization methods for RH TRU waste. The permit modification request includes the basis for this belief. Analytical data (i.e., chemical analysis data) available for RH TRU waste streams will be compiled as part of the AK process.

In the proposed approach, the AK process is required for determining the US EPA hazardous waste numbers. Any waste stream that cannot meet this DQO through the AK process will be unacceptable at the WIPP. Sites may develop additional AK information through sampling and analysis to satisfy this DQO. The physical form and absence of prohibited items DQOs can be met using either the AK process or testing on a representative sample of the waste.

Similarly to the CH WAP, the proposed approach incorporate an audit and surveillance program that requires the RH TRU waste characterization program at the generator/storage sites to be audited and approved prior to initiating shipments to the WIPP.

40 CFR 194 Certification

The DOE also proposes the use of a DQO-based characterization approach for RH TRU waste as part of the Notification of Proposed Change to the EPA 40 CFR Part 194 Certification of the WIPP. The CBFO proposal describes the waste characterization activities DOE proposes to implement to satisfy characterization requirements and criteria established by 40 CFR Part as well as requirements from the EPA's final certification decision, and the WIPP Land Withdrawal Act (LWA) (10).

The characterization program prepared by the DOE for RH TRU waste in the notice of proposed change the is similar to that established for CH TRU waste except that the LWA establishes radiological limits specific to RH TRU waste. As with CH TRU waste, the WIPP Waste Information System (WWIS) will be used to track and control the LWA limits as well as any RH TRU waste components that are important to repository performance.

The RH TRU waste characterization program in the notice of proposed change takes the following topics into consideration:

- nature of the waste;
- needs and uses of the waste component information;
- importance of waste component information to ensure repository performance limits are maintained; and
- safety concerns when gathering the waste component information.

As with CH TRU waste characterization, RH TRU waste characterization will rely primarily on the AK process on a waste stream basis to provide characterization information. Measurements are only proposed for qualifying AK characterization information or when there is insufficient AK characterization information to meet program objectives.

Other than the LWA imposed requirements, there will only be minor differences between CH TRU and RH TRU waste characterization program implementation. However, because the RH TRU waste disposal inventory makes up only a small fraction of the total WIPP disposal inventory (about 4% by volume), the uncertainty for RH TRU waste characterization data can be much higher than that for CH TRU waste.

An RH TRU Inventory Impact Assessment Report (11) was prepared to document an analysis of the impacts to determine the importance of both radioactive and non-radioactive components in RH TRU waste upon repository performance. The analysis demonstrates that there is an insignificant impact on the original performance predictions even if there are large uncertainties in the quantities of the RH TRU waste components of concern (metals, free liquids, cellulosics, plastic, rubber, and radionuclides). This impact analysis serves as the scientific basis for establishing the DQOs for the RH TRU waste characterization program.

In addition, the RH TRU waste characterization program will utilize the provisions of 40CFR194.22(b) to meet performance objectives in lieu of the AK process/measurement methods employed currently for CH TRU waste characterization. The 40CFR194.22(b) criteria dictate that old data and information must be qualified by one or any combination of the following four methods: Peer Review, Corroboration (using new data), Confirmation (by testing), and QA Program Equivalency (equivalent to ASME NQA). Examples for each of the four methods are given below.

- Peer Review: Existing Safeguards and Security or Material Disposition records for a particular waste stream may include sufficient information that a Peer Review Panel would conclude program objectives are met without the need for any further characterization activities.

- Corroboration: Safeguards and Security or Material Disposition information may be qualified by comparison with data generated from another program such as waste characterization for treatment, storage, or disposal.

- Confirmation: AK information for a waste stream may be qualified by making measurements on a representative sample of the waste stream.

- QA Program Equivalency: AK information may be qualified by showing that the information was collected under a program that is effectively equivalent to the QA program required in 40 CFR Section 194.22.

The RH TRU waste characterization program has been developed to be compliant with the existing requirements of 40CFR191/194 including the "Final Rule" and associated documents such as Compliance Application Review Document number 24 (CARD 24). The proposal is also consistent with the TRU waste characterization descriptions in the existing CCA, and thus the DOE believes the program does not represent a significant change to the existing certification.

The auditing process described in 40 CFR Section 194.8 will be the compliance mechanism for obtaining EPA approval of each individual generator site prior to disposal of its RH TRU waste at the WIPP. Identical to the current CH TRU waste characterization program, each specific RH TRU waste generator site will develop a site-specific RH TRU waste characterization program that will undergo audit by the DOE and inspection by the EPA before approval to ship and disposal of RH TRU waste from that site commences.

TRANSPORTATION

The DOE plans to use two NRC certified shipping casks for transporting RH TRU waste from the generator/storage sites to the WIPP for disposal. The two casks are the RH 72-B shipping cask and the CNS 10-160B shipping cask. The two casks are used to accommodate canisters (RH 72-B) and 55-gallon drums (CNS 10-160B) as shipping containers to optimize the shipments of RH TRU waste to the WIPP for disposal.

RH 72-B Cask

The RH-72B shipping cask is designed to meet DOT Type B shipping container requirements and is a cylinder consisting of a separate inner vessel within a stainless steel, lead-shielded outer cask protected by impact limiters made of stainless steel skins filled with polyurethane foam at each end. The inner vessel is made of stainless steel and provides an inner containment boundary and a cavity for the payload. Neither the outer cask nor the inner vessel is vented. The payload capacity of each RH-72B shipping cask is 8,000 lbs (3,628 kg). The payload consists of a canister of RH TRU mixed waste, which may contain 31.43 ft^3 (0.89 m^3) of directly loaded waste or waste in smaller containers.

The NRC reviewed the Safety Analysis Report for the RH-TRU 72-B Waste Shipping Package, Revision 2 (NRC-Docket-71-9212) (12) and issued a revised certificate of compliance for the RH-72B shipping cask in June 2001 (13). The revised certificate of compliance included revisions to engineering drawings to clarify production related issues, allow for a stainless steel canister with a removable lid, and added additional content codes for Battelle Columbus Laboratories (BCL) and Energy Technology Engineering Center (ETEC) waste.

CNS 10-160B Cask

The 10-160B shipping cask is designed to meet DOT Type B shipping container requirements and consists of two carbon steel shells and a lead shield, welded to a carbon steel bottom plate. A 12-gauge stainless steel thermal shield surrounds the cask outer shell, which is equipped with two steel-encased, rigid polyurethane foam impact limiters attached to the top and bottom of the cask. The 10-160B shipping cask is not vented. The payload capacity of each 10-160B shipping cask is 14,500 lbs (6,577 kg). The payload consists of up to ten 55-gallon drums.

Initially, the certificate of compliance for the CNS 10-160B shipping cask did not include RH TRU waste as an authorized payload. A revision to the Safety Analysis Report for the CNS 10-160B shipping package (NRC-Docket-71-9204) (14) that contained RH TRU waste payloads was submitted to the NRC. The NRC reviewed the information and issued a revised certificate of compliance for the CNS 10-160B shipping cask in February 2001 (15). The revised certificate of compliance included the revisions necessary to allow the shipment of RH TRU waste in the CNS 10-160B cask.

DISPOSAL OPERATIONS

The prohibition on the storage and management of RH TRU waste in the RH Bay of the Waste Handling Building Unit and disposal of RH TRU waste in the HWDU was also based on the intent of the DOE to alter its proposed RH TRU waste handling process. Therefore, the NMED required that the DOE obtain a Permit modification for the procedures used for the storage and management of RH TRU waste in the RH Bay. In addition, the Finding of Fact and Conclusions of Law (4) states that the facility operating modifications must be included and submitted as a modification to the existing HWFP to allow storage and disposal of RH TRU mixed waste. Therefore, the DOE's proposal for modifying the HWFP includes drawings, process descriptions, and quality assurance/quality control requirements necessary to manage and store RH TRU mixed waste in the Parking Area Container Storage

Unit and RH Complex of the Waste Handling Building Container Storage Unit, and to dispose of the RH TRU mixed waste in the underground hazardous waste disposal unit.

Because the DOE plans to accept canisters of RH TRU waste in the RH 72-B shipping cask and 55-gallon drums of RH TRU waste in the CNS 10-160B shipping cask, two different waste handling processes have been developed for the RH Bay. Once the RH TRU waste is placed on the waste hoist for disposal in the HWDUs, the underground emplacement process for disposal is the same. Figures 1 and 2 present a schematic of the RH TRU waste handling process for the RH 72-B and CNS 10-160B shipping cask, respectively.

RH 72-B RH Bay Waste Handling Process

Upon arrival at the gate, external radiological surveys, security checks and shipping documentation reviews are performed, including inspections of the RH-72B shipping cask, to verify compliance with WIPP requirements. After the initial inspection, the trailer that carries the RH-72B shipping cask is moved to the RH Bay or to the Parking Area Unit for storage.

Once inside the RH Bay, the two impact limiters that protect the cask in transit are removed from each end of the RH-72B. The RH Bay bridge crane rotates the shipping cask to the upright position. The bridge crane then moves the RH-72B shipping cask to the cask transfer car. The transfer car is electrically powered and moves the RH-72B shipping cask to the work stand. This work stand allows access to the head area of the RH-72B shipping cask for radiological surveys, inspection, minor maintenance, and decontamination, if necessary.

The outer lid on the RH-72B shipping cask is removed and radiological surveys are performed to verify absence of surface contamination. Next, the inner vessel lid lift fixture is attached. The cask transfer car moves the RH-72B shipping cask to the Cask Unloading Room.

Inside the Cask Unloading Room, an overhead bridge crane removes the RH-72B shipping cask from the transfer car and positions it over the port in the Cask Unloading Room floor. The port opens and the RH-72B shipping cask is lowered into the shuttle car located in the Transfer Cell. Once a robotic manipulator can loosen the bolts on the inner vessel lid, the shuttle car moves the shipping cask directly under the Transfer Cell shield valve.

The grapple is lowered through the facility cask into the Transfer Cell where it lifts the canister from the RH-72B shipping cask into the facility cask. As the canister is being lifted, radiological swipes on the canister are taken remotely to verify that there is no radiological contamination. During the lifting process, the canister may also be inspected with the use of the closed circuit video cameras. The facility cask is rotated to the horizontal position on the facility cask transfer car, and moved to the waste hoist conveyance where it is lowered underground via the waste shaft for the emplacement process.

10-160B RH Bay Waste Handling Process

Upon arrival at the gate, external radiological surveys, security checks and shipping documentation reviews are performed, including inspections of the CNS 10-160B shipping cask, to verify compliance with WIPP requirements. After the initial inspection, the trailer that carries the CNS 10-160B shipping cask is moved to the RH Bay or to the Parking Area Unit for storage.

Once in the RH Bay, the RH Bay bridge crane removes the top impact limiter and the lifting devices are installed onto the CNS 10-160B shipping cask. The CNS 10-160B shipping cask is transferred from the trailer to the cask transfer car. The CNS 10-160B lid bolts are removed and the Cask Unloading Room shield door is opened and the cask transfer car moves the CNS 10-160B shipping cask into the Cask Unloading Room. Once in the Cask Unloading Room, the CNS 10-160B shipping cask is centered under the Hot Cell shield plug port. The Hot Cell

is located above the Cask Unloading Room.

The Cask Unloading Room shield door is closed and the Hot Cell bridge crane is used to transfer the two drum carriage units into the Hot Cell. Each drum carriage unit holds up to five drums each. The Hot Cell overhead powered manipulator lifts one drum from the drum carriage unit. The Hot Cell manipulators, operated by personnel from the Hot Cell Gallery, collect swipe samples from the drum for radiological counting and the overhead powered manipulator lowers the drum into a facility canister previously positioned for drum transfer from the drum carriage. Once three drums have been loaded, the canister is ready to be lowered through the Hot Cell port and airlock into a shielded insert or empty RH 72-B shipping cask in the shuttle car located in the Transfer Cell.

The shuttle car then moves the shipping cask directly under the Transfer Cell shield valve. The grapple is lowered through the facility cask into the Transfer Cell where it lifts the canister from the shuttle car into the facility cask. As the canister is being lifted, radiological swipes on the canister are taken remotely to verify that there is no radiological contamination. During the lifting process, the canister may also be inspected with the use of the closed circuit video cameras.

The facility cask is rotated to the horizontal position on the facility cask transfer car, and moved to the waste hoist conveyance where it is lowered underground via the waste shaft for the emplacement process.

Underground Emplacement Process

Once the facility cask containing the RH TRU waste canister is underground, it is removed from the facility cask transfer car by forklift, and transported to the disposal room. The underground handling and waste emplacement equipment consists of diesel forklifts and the horizontal emplacement and retrieval equipment (HERE). The forklift is used to place the facility cask containing a canister is on the HERE, which has been previously aligned with a previously drilled horizontal hole bored into the disposal room wall.

The facility cask is moved forward to mate with the shield collar and the transfer carriage is advanced until it mates with the rear of the facility cask. The facility cask shield valves are opened and the transfer mechanism advances to push the canister into the horizontal hole for permanent disposal. Next, a shield plug is pushed into the horizontal hole using the HERE.

Operation Readiness Review

The Carlsbad Field Office plans to perform an operational readiness review (ORR) to verify that appropriate procedures and processes are established and employees are properly trained to manage and dispose of RH TRU waste from both the RH 72-B and CNS 10-160B shipping cask. Emergency management plan and associated training with mock RH TRU waste will also be required in order for WIPP to declare readiness for disposal operations, tentatively planned for 2003.

SUMMARY

The WIPP RH TRU program is currently under development to allow the management, storage, and disposal of RH TRU waste at the WIPP. RH TRU program development is focused on three areas: RH TRU waste characterization, RH TRU waste transportation, and RH TRU waste disposal. Because each of these areas is regulated by external government agencies as well by the DOE itself, the DOE is preparing regulatory submittals to the NMED, EPA, and NRC that will provide the basis for the RH TRU program. However, these regulatory submittals are only the next stage in the RH TRU program with the final stage being regulatory approval and subsequent implementation of the program.

REFERENCES

1. *Remote Handled Transuranic Preliminary Safety Analysis Report*, DOE/WIPP-Draft, 2001.

2. *Waste Isolation Pilot Plant Hazardous Waste Facility Permit*, Permit Number NM4890139088—TSDF, New Mexico Environment Department, Santa Fe, October 1, 1999.

3. *Report of the Hearing Officer*, HRM 98-04(P), J. Gulin, Santa Fe, September 9, 1999.

4. *Findings of Fact and Conclusions of Law*, HRM 98-04(P), J. Gulin, Santa Fe, September 9,1999.

5. *Request for Class 3 Permit Modification in Accordance with 20.4.1.900 NMAC (incorporating 40 CFR Part 270)*, DOE/WIPP-Draft, Carlsbad, September 25,2001.

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

7. *Notification of Proposed Change to the EPA 40 CFR Part 194 Certification of the Waste Isolation Pilot Plant*, DOE/WIPP-Draft, Carlsbad, September 25, 2001.

8. *Technical Peer Review Report, Requirements for Disposal of Remote-Handled Transuranic Wastes at the Waste Isolation Pilot Plant*, Institute for Regulatory Science, ASME International, ASME/CRTD-RP-01-84, August 2001.

9. *Interim Report for the Disposal of Remote-Handled Transuranic Wastes at the Waste Isolation Pilot Plant*, National Academy of Sciences, 2001.

10. *Waste Isolation Pilot Plant Land Withdrawal Act*, Public Law 102-579, 102d Congress, October 30, 1992.

11. *RH TRU Inventory Impact Assessment Report*, Sandia National Laboratories, Carlsbad Programs Group, Carlsbad, June 1,2001.

12. *RH 72-B Safety Analysis Report for Packaging, Revision 2*, NRC-Docket-71-9212/Rev.2, November 2000.

13. *Certificate of Compliance for the RH 72-B Shipping Container*, NRC-Docket-71-9212/Rev.1, June, 2001.

14. *CNS 10-160B Safety Analysis Report for Packaging*, NRC-Docket-71-9204, Rev. 15, 2001.

15. *Certificate of Compliance for the CNS 10-160B Shipping Container*, NRC-Docket-71-9204/Rev. 7, August 10, 2001.