Department of Energy
Washington, DC 20585

MAY 25 2004

The Honorable John T. Conway
Chairman
Defense Nuclear Facilities Safety Board
625 Indiana Avenue, NW, Suite 700
Washington, DC 20004-2901

Dear Mr. Chairman:

The purpose of this letter is to provide the response to your letter of November 7, 2003, regarding the retrieval, storage, and disposal of the waste drums containing Pu-238. The initial response on February 3, 2004, provided historical data, challenges faced, and activities being done to provide a plan to safely retrieve and disposition the Pu-238 drums.

The preferred processing path is to transfer the material to the Savannah River Site (SRS) for processing due to their extensive experience with this type of material. The SRS path includes a variety of challenges and the Department is also preparing an alternate on-site processing path as described in the attachment. The onsite processing path and one of the SRS paths will result in disposal at the Waste Isolation Pilot Plant (WIPP). An option that SRS may implement, if the material is shipped to SRS, is to dissolve the material through the canyons into storage tanks to await final disposition. The enclosure documents the conclusion that exiting procedures can be modified to safely retrieve this material. A general description of the processing paths and major remaining actions, along with estimated timeframes, is provided. The onsite processing path will be implemented only if the SRS path is eliminated. An update will be provided to the Board when the disposal plans and interim storage plans are finalized.

I have asked the Richland Operations Office to keep your staff apprised of the progress in the disposition these drums. Should you or your staff have any questions concerning these issues, please contact me at (202) 586-0738 or Keith Klein, Manager Richland Operations Office, at (509) 376-7395.

Sincerely,

Inés Triay

Dr. Inés Triay
Deputy Chief Operating Officer
Environmental Management

Enclosure

cc: M. Whitaker, DR/DOE
K. Klein, RL

Retrieval, Interim Storage, and Disposal of ^{238}Pu Drums

SUMMARY

Studies and analyses have been performed to establish a basis for a plan to safely retrieve and dispose the plutonium-238 (^{238}Pu) drums currently stored in burial ground 218-W-4C in the 200 West Area of the Hanford Site. These studies and analyses include a search of records; calculations to establish current characteristics of the drums; a review and update of the process flow diagram for waste retrieval; a review of the Master Documented Safety Analysis (MDSA); a preliminary hazard assessment (PHA) for retrieval; a security requirements analysis (SRA); an evaluation of interim storage location alternatives, if needed; and a workshop of subject matter experts from Hanford as well as other U.S. Department of Energy sites to identify and evaluate disposition paths for the drums. Based on the results of this work, a plan has been formulated for safe retrieval of the ^{238}Pu drums, and for the timely implementation of disposal plans. Two paths have been defined to proess this waste for disposal at the Waste Isolation Pilot Plant (WIPP). The preferred path is shipment of the drums to Savannah River Site (SRS) as transuranic (TRU) mixed waste for repackaging prior to disposal at WIPP or for possible processing through the canyons. The other path involves repackaging the ^{238}Pu in the Plutonium Finishing Plant (PFP) for disposal to WIPP. This path will be considered the on-site path and will be fully implemented should external decisions preclude Hanford from shipping the material to SRS.

ACTIONS TO DATE

Oversight and Steering Panel

An Oversight and Steering Panel has been chartered to ensure a sound basis is established for planning the safe retrieval and disposal of ^{238}Pu drums, and that the work proceeds in accordance with these plans. This panel is comprised of Hanford Site managers and specialists in Nuclear Safety, Industrial Safety, Operations, Engineering, Safeguards and Security, and Projects, as well as key individuals from WIPP; the Los Alamos National Laboratory (LANL), and SRS. This panel has reviewed and accepted the results of the aforementioned studies and evaluations, and the formulated plan based on those results.

Historical Records

A search of historical records has been performed and an interview conducted with the scientist responsible for the experiments at Hanford that the material was intended to support. This search and interview confirmed drum characterization information. ^{238}Pu of adequate purity became available about 1966. It was anticipated that more would become available, so the material was requested to be sent to Hanford. Records from SRS confirm that the drums were shipped to the Hanford Site in 1966 to be used in ^{238}Pu critical mass experiments. The purpose of these experiments was to obtain direct experimental determination of the critical mass of ^{238}Pu. Because an additional quantity of ^{238}Pu required for the tests could not be made available, the experiments were never performed. Consequently, the drums have never been opened at Hanford. The records search, including the drawings of the shipping container, H-2-26260 thru 26264, and the criticality documents confirms the robust

configuration of the containers. The package provides five confinement boundaries for the Pu. The two inner containers are magnetic pulse welded aluminum cans. The third layer of confinement is a welded schedule 30 stainless steel pipe (per the Criticality Safety Analysis Report). The fourth layer of confinement is a shipping container that was licensed for transport of these materials. Aluminum shot is between the third and fourth layers of confinement. The fifth and outer layer is a 55-gallon drum. Because the condition of the aluminum inner containers may be suspect and cannot be verified, analyses have assumed, for conservatism, that these inner containers are not present. The storage conditions would likely cause the aluminum containers to spall and lose integrity. The condition of the 55- gallon drum and other confinement layers will be confirmed during retrieval.

The actual inner container configuration used in these drums is not certain. Drawings of the shipping container and inner containers differ from the description of the inner containers used in the original criticality safety evaluation report and packaging factor analyses. A review of the packaging factor and its impact on safety analyses performed for these drums is now being prepared. In addition, an analysis to determine the impact on inner container integrity (both configurations) of significant parameters, e.g., time, temperature, materials, pressure, is being prepared. Both of these reviews will be completed and issued at least 6 months before retrieval of these 12 drums is scheduled. In no case will the retrieval be undertaken before the documents are issued and all necessary changes to safety basis and retrieval procedures and controls have been implemented.

The shipping records from SRS have also revealed that this material includes hazardous constituents, specifically chromium and cadmium, and must be considered TRU mixed waste.

Engineering Calculations

The engineering calculations are based on the assumed configuration described above. Engineering calculations have established current curie loading, decay heat, temperature profile, gas generation, pressurization, and dose rate for the drums. The engineering calculations represent the worst case condition. Drum T112 represents the worst case drum and was used in most calculations. Drum T108 was used for the hydrogen generation part of the pressure calculations and Drum T104 was used in the criticality calculations. Summary results of the calculations are as follows:

- Decay has reduced ^{238}Pu content of the material to less than 15 weight percent;
- Decay heat is less than 50 watts per drum;
- Photon dose directly from the material could be as high as 1,750 mrem/hr, but shielding from the robust package brings photon dose down to about 10 mrem/hr at the outer surface of the drum;
- Neutron dose is about 20 mrem/hr at the outer surface of the drum;

- Temperature within the plutonium dioxide (PuO_2) will approach 405° F, but temperature of the outer surface of the drum will be only about 10° F warmer than ambient during interim storage;

- Depending on the presence of solar radiation and the diurnal cycle during retrieval, handling precautions may be required to avoid thermally hot drum surfaces;

- Quantity of helium generated by the material is less than 3 liters at standard temperature and pressure and the quantity of hydrogen will be less than 4 liters; and

- Temperature and gas generation could drive the pressure in the welded schedule 30 stainless steel pipe up to 130 psi, and if gas is released into the drum it would cause a pressure increase of less than 4 psi and a hydrogen concentration of less than 4 percent.

These engineering calculations have been completed and are issued in the Hanford Site document system as HNF-20701.

Safety of Current Configuration

The 12 drums are now located in a standard retrievable storage array in Burial Ground 218-W-4C in the 200 W area. The drums were placed into this configuration in October 1980.

Criticality Safety Analysis Report 78-015, 1979, the Criticality Prevention Specification, RHO-MA-149, 1979, Criticality Safety Analysis Report 80-021, 1981, Criticality Safety Evaluation Report 91-003, 1994, and Criticality Safety Evaluation Report 91-003, Addendum 2, 1996, provided bases for criticality considerations for these 12 drums. A review of these reports identified that no specific arrangement of these drums is required from a criticality viewpoint, and the inclusion of high 238-Pu drums in the array increases the margin of safety.

Further review of these documents indicated that the criticality safety basis remains valid as long as some amount of container integrity is maintained within burial grounds and that the containers involved in the analysis have an actual design life in excess of 40 years vice the documented 20 year design life. These analyses were referring only to container integrity of the outer drum, not the internal packaging array.

Calculations for the waste and containers, updated to current conditions, and the PHA indicate that the container temperatures, dose rates, internal pressures, dose-equivalent curies (DE-Ci) values, criticality margins, and the storage array all support that the drums and contents are in a safe storage configuration and should not pose an unacceptable hazard during retrieval.

Retrieval Operations Process Flow

The process flow diagram for TRU retrieval operations was reviewed and updated to specifically address the potentially more hazardous characteristics of ^{238}Pu drums (Figure 1). The normal retrieval process is structured to safely uncover, examine, vent the outer drum (if

required) and transfer these drums to interim above surface storage. Adequate instructions to avoid hazards from a thermally hot drum already exist. Additional steps to confirm confidence in the integrity of the ^{238}Pu drums and to ensure safe and secure handling were added to the TRU process flow diagram. These steps include the use of radiological survey results (including collimated scans of the outer drum) and radiography of both the inner containers and the outer drum to verify the integrity and configuration of the confinement layers and birdcage as early in the retrieval process as practical. Additionally, procedures require all drums to be placed in vented overpacks with lid and bottom restraints.

This activity will ensure protection of the workers and full compliance with the spirit of Integrated Safety Management System, as described in WMP-100, section 4.06 WMP Integrated Safety Management Roles, Responsibilities, and Functions.

Prior to retrieval, a specific work package will be generated, in accordance with WMP-200, Work Management. A specific Job Hazards Analysis will be performed, using a team planning approach as described in HNF-PRO-079.

Due to the hazards contained within these drums and the unknown condition of the inner drums, additional monitoring will be required, and hold points called out in the work package. These hold points will be to monitor for drum condition and Pu-238 location, as described in "Activity Plan, Pu-238 Drums," (currently in draft form). These hold points will require sign-off by Rad Con and the Manager of TRU Waste Retrieval Project, with assistance of Oversight and Steering Panel.

The results of the Job Hazard Analysis and technical reviews (i.e., analysis of the inner packaging integrity as it relates to the packaging factor used in the safety analysis and the analysis determining impacts on the inner container integrity from significant parameters) will be used to specifically develop contingency plans to ensure that as the as retrieved package will be or can be made compliant with the requirements on the MDSA. These contingency plans will be integrated with the Abnormal Container Management Program that has been developed to address management of drums that pose an elevated risk during retrieval operations.

MDSA Review and Preliminary Hazard Assessment

Using information from the records search, the engineering calculations, and the process flow diagram development, the MDSA was reviewed and a PHA of the ^{238}Pu drum retrieval process was performed. This PHA was performed in accordance with established procedures by a team that included specialists from Nuclear Safety, Industrial Safety, Operations, Engineering, and project management. The conclusion of the MDSA review and of the PHA was that the MDSA bounds the ^{238}Pu drums and, therefore, the MDSA does not require revision for the retrieval of these drums.

A review of the consequences of loss of the inner container integrity is underway. Results of this review will support development of contingency planning and for revision to the MDSA, should a revision be required.

Security Requirements Analysis (SRA)

A SRA was performed. The security requirements for retrieval and interim storage provide important input to the selection of the interim storage location. The SRA indicated that significant upgrades could be required for interim storage in an area that is not a protected area.

ALTERNATIVES EVALUATED

Disposition path alternatives have been developed and evaluated in workshops that included Hanford Site staff familiar with TRU waste retrieval, certification, and shipping along with experts from WIPP, LANL, and SRS. Ten potential disposition paths were qualitatively evaluated against the following criteria; schedule, cost, regulatory/legal feasibility, technical feasibility, operational feasibility, and stakeholder acceptability. Alternatives ranged from shipment off-site as a sealed source or special nuclear material asset to repackaging as TRU waste destined for disposal at WIPP. All disposition paths presented significant challenges with respect to program acceptance, repackaging (if managed as TRU waste) and shipment, and would require extensive coordination with DOE, state regulatory agencies, and other federal agencies such as the Nuclear Regulatory Commission.

Several alternatives involving shipment off-site as a sealed source or as a heat source material were evaluated and eliminated as viable disposition strategies due to the lack of acceptability into the respective Program offices (i.e., Off-site Sealed Source Recovery Program and LANL's Nuclear Material Technology-9 Group). Processing at LANL was completely eliminated when SRS records indicated that the material contained hazardous constituents and need to be treated as mixed wastes. The remaining alternatives were eliminated because of prohibitive costs or not supporting sites schedules.

Of the ten alternatives evaluated, the most viable disposition paths included repackaging of the waste for final disposal at WIPP. The evaluation identified that repackaging of the waste could be performed either at Hanford at the Plutonium Finishing Plant (PFP) or at repackaging facilities located at SRS. Additionally, processing the material through the SRS HB line is another possible disposal path at SRS. The following is a listing of advantages associated with implementing each option, as well as major activities to be done including estimated durations.

On-Site Processing Path – Repackaging at PFP For Shipment as TRU Mixed Waste to WIPP

The advantages associated with implementation of this disposition path are as follows:

- Least reliance on external decisions
- Potentially negates the need for interim storage at Hanford
- Direct shipment to WIPP in TRUPACT II transportation fleet
- Minimize shipment of current container configuration

- Uses an existing facility with a functioning protected area, staffed by personnel that are experienced in residue repackaging for WIPP using the Pipe Overpack Containers.

In order to fully establish this disposal path, the following major actions are required. Activity durations have been estimated as well as the identification of the decision authority.

1 - Action: Approval that the ^{238}Pu waste material category meets Section 310 Energy and Water Appropriations Act language and approval of this waste stream as defense TRU eligible for disposal at WIPP.

Decision Authority: DOE Headquarters (HQ) General Counsel

Duration: 5 months

2 – Action: Receipt of a Resource Conservation and Recovery Act Hazardous Waste Permit or successful negotiation of provisions in the Tri-Party Agreement to allow processing of this material at PFP

Decision Authority: DOE RL and State of Washington Department of Ecology

Duration: 12-24 months

3 – Action: Revision of facility authorization basis to accommodate this waste, including revision to DSA, environmental documents (National Environmental Policy Act (NEPA), Notice of Construction), and CSER.

Decision Authority: DOE RL and Washington Department of Health

Duration: 6 months

4 – Action: Prepare an integrated schedule for PFP packaging and shipment of ^{238}Pu waste to WIPP. The schedule will be integrated with decontamination and decommissioning activities.

Decision Authority: Fluor Hanford, Inc.

Duration: 4 months

Implementation of these actions would allow this disposal path to be fully established in 12 to 24 months. Many of the activities would not start until the preferred path is eliminated. Some actions (e.g., RCRA Hazardous Waste Permit) may have to proceed in parallel to mitigate schedule impacts. Duration of repackaging operations is estimated as 13 months.

<u>Preferred Processing Path - Shipment As TRU Mixed Waste To SRS For Repackaging and Then Shipment to WIPP</u>

The advantages associated with implementation of this disposition path are as follows:

- Compatible with SRS long term mission associated with management of ^{238}Pu wastes;
- Consistent with earlier established precedent of acceptance of ^{238}Pu from other sites by SRS for repackaging and shipment to WIPP;
- Leverages SRS's experience in operation of facilities using trained personnel with experience in handling high ^{238}Pu wastes;

- Uses RTG cask that is capable of accommodating this waste without on-site repackaging and has been previously unloaded at SRS; and
- Potentially negates the need for interim storage at Hanford

In order to fully establish this disposal path, the following major actions are required. Activity durations have been estimated as well as the identification of the decision authority.

1 - Action: Approval that the ^{238}Pu waste material category meets Section 310 Energy and Water Appropriations Act language and approval of this waste stream as defense TRU eligible for disposal at WIPP.

Decision Authority: DOE Headquarters (HQ) General Counsel

Duration: 5 months

2 – Action: Approved shipper/receiver agreement between Hanford and SRS to confirm their ability to repackage these materials in an existing operating facility to meet the WIPP Waste Acceptance Criteria. Activities include preliminary evaluations of processing facility Documented Safety Analysis (DSA), site environmental permits, and an acceptable window for material shipment. The results of these evaluations will be the basis for confirmation of SRS agreement to repackage this waste and prepare for shipment to WIPP.

Decision Authority: DOE SRS

Duration: 12 months

3 – Action: Obtain a Certificate of Compliance modification and confirm schedule availability of the RTG cask for transportation of this waste to SRS

Decision Authority: DOE National Transportation Program and DOE RL

Duration: 10 months

4 – Action: Verify National Environmental Policy Act (NEPA) Transportation Categorical Exclusion sufficient to ship ^{238}Pu to SRS or develop NEPA strategy.

Decision Authority: DOE RL NEPA Compliance Officer, SRS NEPA Compliance Officer

Duration: 2 months

5 – Action: Prepare an integrated schedule for shipment of the ^{238}Pu to SRS

Decision Authority: Fluor Hanford, Inc.

Duration: 4 months

Implementation of these actions would allow this disposal path to be fully established in 12 months. Cost and duration to ship and repackage have not been estimated, but will likely be less than costs for the Hanford alternative.

<u>Implementation Strategy</u>

The implementation strategy for retrieval and disposal of the ^{238}Pu drums involves pressing forward aggressively to complete preparations for retrieval by January 2005 and to fully establish a disposal path as early as is practical, but no later than 18 months after the work is authorized and funded. The preferred path will be pursued until implemented or eliminated.

Some actions of the baseline path will be done in parallel to mitigate schedule impacts to D&D should the preferred alternative be eliminated. This strategy will support a decision to perform just-in-time retrieval without interim storage if the disposal path can be established a year before the latest acceptable retrieval date. If the disposal path can not be established by that time preparations for interim storage will be initiated and retrieval complete to support completion of retrieval as required by Tri Party Agreement Milestone M-91-40.

RETRIEVAL AND INTERIM STORAGE

An evaluation of alternative locations for safe interim storage was also performed. Just-in-time retrieval is preferable to interim storage and viable if a near-term disposal path can be identified in time. Just-in-time retrieval would be planned such that the number of drums to be removed from the stack in the trench would equal the number to be placed in the preferred transport system. Interim storage was considered in-trench, at the Central Waste Complex (CWC), within the protected area at the PFP, in the Canister Storage Building (CSB) and in the 221-T Canyon Building.

If the disposition path will not support just-in-time retrieval on the current retrieval schedule, deferring retrieval of the module containing the 12 ^{238}Pu drums will be weighed against onsite storage options.

Because of the recent discovery of the need to consider this material TRU mixed waste, the PFP was excluded because it is not permitted for mixed waste storage. The CSB will not have a permit in time or available storage space for mixed waste. Therefore, in-trench options, the CWC, and the 211-T Canyon can be considered further for interim storage. However, either location will require upgrades to meet safeguards and security requirements and will require further analysis if interim storage is pursued.

Further details of the approach for retrieval and storage will be developed within the framework of procedures governing Hanford Site engineering, operations, and nuclear safety analysis. The disposal path will require active interfaces with other sites to fully establish a workable approach.

Figure 1. Waste Retrieval - Typical Drum Detailed Process Flow 4C LLBG