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**SANDIA NATIONAL LABORATORIES  
RH REPACKAGING EFFORTS - 10490**

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**ABSTRACT**

This paper describes the transuranic (TRU) contact- handled (CH) and remote-handled (RH) waste repackaging activities planned, initiated, completed, the lessons learned, and the scheduled shipment activities at the Sandia National Laboratories/New Mexico (Sandia), designated as a small quantity site (SQS) by the National TRU Program (NTP). The TRU waste at Sandia consists of legacy waste generated primarily from the decontamination and cleanout of glove boxes at the Hot Cell Facility (HCF) at Technical Area (TA) V; newly-generated waste from the Pu-ICE experiments; and TRU waste generated by the Lovelace Respiratory Research Institute (LRRI) (formerly the Inhalation Toxicology Research Institute (ITRI)).

In FY10, CH and RH TRU waste and less than Hazard Category (HC) 3 threshold limits is being repackaged at the Radioactive and Mixed Waste Management Facility (RMWMF) in Technical Area (TA) III. The HC-3 CH and RH TRU waste is scheduled to be repackaged at the Auxiliary Hot Cell Facility (AHCF), located in TAV. Approval of a Basis for Interim Operation (BIO) is required for operations to begin at the AHCF and a Documented Safety Analysis (DSA) must be approved for transportation of HC-3 TRU waste for repackaging

This paper describes the processes used and procedures developed to conduct the repackaging operations, the issues identified and mitigated, and the support provided by the Central Characterization Program (CCP). It will also describe the real-time radiography (RTR) activities, including the authorization basis updates required. It will document the video/audio changes made based on the results of the CH repackaging effort. The paper will also list the inventory, identify the different campaigns, discuss the challenges, and report on the final product. In addition, this paper will also present the schedule and plans for loading TRUPACT-IIIs and RH 72-B casks at TA-V.

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## INTRODUCTION

Sandia is located in Bernalillo County in north-central New Mexico, immediately south of Albuquerque, within the boundaries of Kirtland Air Force Base. Sandia is owned by the U.S. Department of Energy (DOE) and has been operated jointly by DOE and a Management and Operating (M & O) contractor for over 50 years. The current contractor is Lockheed-Martin, LLC. The Sandia site is divided into five technical areas (TAs). The TRU waste discussed in this paper includes five waste streams:

- Legacy CH non-mixed TRU waste generated by Sandia in the HCF located in TA-V, Building 6580,
- Legacy CH mixed TRU waste generated by Sandia in the HCF,
- Legacy RH non-mixed TRU waste generated by Sandia in the HCF,
- Newly-generated CH non-mixed generated from the Pu-ICE experiments, and
- Legacy CH TRU generated by LRRRI and stored by Sandia.

The HCF, located in the basement of Building 6580, contained steel confinement boxes, a glove box laboratory, ancillary analytical equipment, support areas, and fissile- and radioactive-material storage areas. It had the capability for working with experiments and materials containing up to a nominal maximum of 6000 Curies (Ci) of fission products and 500 Ci of plutonium or other fissile material. Research projects conducted in the HCF included material, fuel, and safety studies. There were seven projects conducted in the HCF that generated the TRU waste discussed in this paper. They were all part of the Severe Accident Research Program, funded by the Nuclear Regulatory Commission (NRC) and the DOE. Both CH and RH TRU waste was generated at this facility.

The HCF provided support to the Annular Core Research Reactor (ACRR), both of which were managed by the Office of Defense Programs to provide for defense research needs. Experiments conducted in the HCF were performed over several years where Sandia investigated severe accident scenarios resulting from fuel disruption; axial relocation of breeder reactor fuel; and vapor pressure of mixed oxide (MOX) fuels during reactor accidents. In the late 1990s the HCF was decontaminated and cleaned out; the waste was packaged to meet the Sandia waste acceptance criteria; and the Regulated Waste/Nuclear Material Disposition Department (RWNMDD) stored the waste until ready for disposal at the WIPP. The waste includes sealed sources, personal protective equipment (PPE), small tools, pre-filters, roughing, and high efficiency particulate air (HEPA) filters, plastic bags, swipes, lead bricks, decontamination debris, rubber gloves, metal pieces from equipment, laboratory

The SNL/NM Pu-ICE experiments support the U.S. Department of Energy's (DOE) science-based approach to stockpile stewardship and tests radiation effects on various materials in experiments designed to mimic nuclear explosions. Data collected during

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experiments using the Z machine are used to validate computational models of nuclear weapon performance. The experiments generating this waste stream provide DOE with materials data in support of the stockpile stewardship program. The waste consists of metal experimental vessels packaged in 55-gallon drums.

The LRRRI mission was to investigate the effects on human health of inhalation of airborne materials encountered in the work place or in the general environment. This waste consists of combustible and noncombustible debris waste generated from activities conducted in the Alpha Wing at the LRRRI from 1984 to 1996 and 2002. The waste was generated during the preparation of aerosols of TRU isotopes for inhalation studies. The waste includes metals (iron-based metal/alloys, aluminum-based metal alloys, and non-ferrous metals), cellulose, rubber, plastics, inorganic materials, and other matrices. The waste was transferred to SNL/NM in 1995, 1996, 2004, and 2008 for storage until shipment to a centralization site for final characterization, certification, and shipment to WIPP.

## **BACKGROUND**

Sandia is not certified to ship TRU waste directly to the Waste Isolation Pilot Plant (WIPP) for disposal, but instead, must send their TRU waste to a centralization site for final certification and shipment to WIPP, or in the case of RH TRU waste, CCP will provide a visual examination (VE) expert to certify the waste for direct shipment to WIPP. The Idaho National Laboratory (INL), specifically the Advanced Mixed Waste Treatment Project (AMWTP), has been approved as a centralization site. In order to prepare shipments to the centralization site, the Sandia TRU waste must be repackaged to meet transportation requirements and the process knowledge (PK) documented and approved. Figure 1 is a map illustrating where the TRU waste was generated and is stored.

The RWNMDD is responsible for management, storage, and disposition of the TRU waste at Sandia and is the managing department for the Radioactive and Mixed Waste Management Facility (RMWMF), a radiological facility that has the capability to process and repackage TRU waste less than HC-3 threshold limits. Building 6920 houses a Permacon® structure equipped with glove boxes for repackaging.

The TRU waste that is high dose and/or HC-3 will be repackaged in the AHCF, a nuclear facility in FY10, under the direction of a VE expert provided by the CCP. RTR and loading in TRUPACT-IIs and RH 72-B casks activities will be conducted at the SPR Facility, also located in TAV.

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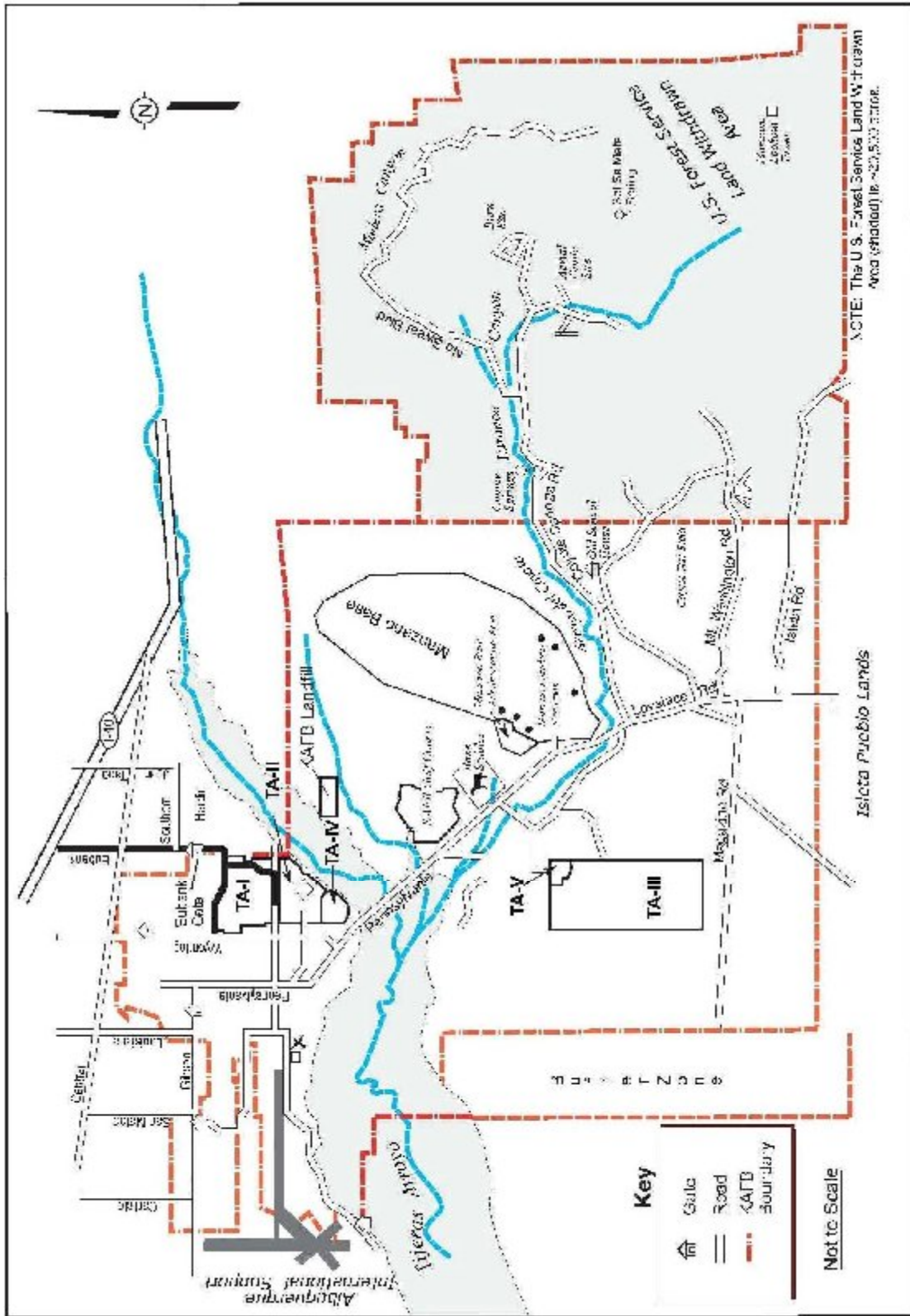


Figure 1. Map of Sandia National Laboratories/New Mexico

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Beginning in September FY07 and continuing through October FY09, the RWNMDD repackaged Sandia's CH TRU waste to meet FY08 performance milestones. Five campaigns were completed with a volume reduction of more than 9 m<sup>3</sup> either by repackaging or re-characterization to low-level waste (LLW). Containers were fitted with NucFil® 019DS filters, inner and liner bags were slit to remove all layers of confinement, and repackaging activities were video recorded with audio narration.

This repackaging effort was conducted prior to the issue of the CH packaging guidance for small quantity generators. After a WIPP review of the video and audio recording, Sandia was notified that they did not provide the level of detail required for transportation in a TRUPACT-II. In December 2008, Sandia performed radiography on the repackaged Sandia and LRRRI CH TRU waste, totally 43 containers. Sandia uses radiography for weapons components, but the instrument was not capable of producing images that could meet the requirements of WIPP. Therefore, a new approach was in order.

## **WASTE INVENTORY**

### **Sandia TRU Waste**

The Sandia TRU waste inventory consists containers of sealed sources, mixed and non-mixed, CH and RH, less than HC-3, and HC-3 debris waste stored in cans, small buckets, 20-, 30-, 55-gallon drums, casks, and large boxes..The inventory includes:

- Sealed sources (will be repackaged by the Los Alamos National Laboratory (LANL) Off-Site Source Recovery Program (OSRP);
- CH waste that has been repackaged;
- RH waste that is less than HC-3 quantities (will be repackaged in the RMWMF);
- CH and RH waste that is HC-3 quantities (will be repackaged in the AHCF pending authorization basis updates and approval); and
- CH waste generated by the Pu-ICE experiments.

### **LRRRI TRU Waste**

The LRRRI TRU waste is packaged in 55-gallon drums fitted with NucFil® 019DS filters, with no layers of confinement. The waste is debris waste generated from preparation of aerosols for inhalation studies funded by the DOE to study health effects from actinides. Sandia agreed to store the LRRRI TRU waste until a path forward for transportation to a certification site was established. These containers have not been repackaged.

## **CURRENT STATUS**

### **Repackaged CH TRU Waste**

The RWNMDD began planning for the TRU waste repackaging in FY07. At that time, DOE/HQ had not issued the repackaging guidance for small quantity generators, so, Sandia used the CCP visual examination procedure as a guide for preparing for the

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repackaging effort and documenting the required information. Several objectives were established for the repackaging effort including:

- Repackage TRU waste into WIPP compliant packaging configurations to meet weight, fissile gram equivalent (FGE), plutonium equivalent Curies (PECi), and decay heat limits;
- Minimize dose to workers;
- Document and video/audio record the repackaging activities;
- Remove and/or remediate prohibited items;
- Remove all layers of confinement to maximize decay heat limits;
- Identify waste less than 100 nCi/g and segregate;
- Segregate mixed items from non-mixed if appropriate; and
- Consolidate waste into fewer containers, if possible.

Based on the information documented in the disposal requests, five CH campaigns were conducted, four non-mixed, and one mixed. A work plan for each campaign was prepared, reviewed, and approved that included a list of containers to be repackaged, the steps required to repackage, radiological characteristics including activity, dose rate, PPE requirements, a pre-job checklist, hold points, and training materials for the campaign. Each work plan is reviewed and approved by health physicists, ES&H personnel and sorting supervisors.

### **FlamGas**

Sandia is working with CCP to prepare for FlamGas sampling and analysis. The RWNMDD prepared a Technical Work Document (TWD) in accordance with *Waste Isolation Pilot Plant Flammable Gas Analysis*, DOE/WIPP 06-3345, and obtained comments from CCP which have been incorporated. The gas chromatograph/mass spectrometer is scheduled to be shipped to Sandia in January/February 2010 with sampling and analysis to follow.

### **Real-Time Radiography**

CCP provided real-time radiography (RTR) to Sandia for the LRRRI and SNL CH TRU waste. The trailer arrived in late November 2009 and was located at the SPR facility. In January 2010, 43 containers were RTR'd, the results will be provided to CCP/CBFO, and anticipate that all 43 containers will be approved.

### **Non-Destructive Assay**

Sandia is working with CCP to provide acceptable assay data for shipment to the AMWTP. The Sandia CH TRU waste has elevated levels of Cs-137 resulting in high dose making it difficult to evaluate the transuranic radionuclides at the AMWTP for certification. Sandia is currently working to obtain acceptable assay data by using filters and pulsers as suggested by WIPP.

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### **Repackaging CH TRU Waste**

There are two containers of CH TRU waste that need repackaging in FY10 and is scheduled for December 2010 following the CH repackaging guidance. Sandia prepared a procedure in accordance with the CH repackaging guidance and forwarded it to DOE headquarters and CBFO for approval and concurrence. The CH repackaging effort has been completed, however, approval/comments on the procedure were not received.

### **Repackaging RH TRU Waste**

In FY10, the RH < HC-3 threshold TRU waste will be repackaged at the RMWMF and two campaigns are scheduled. If the dose is determined to be greater than what can be handled at the RMWMF, the containers will be transported to the AHCF for repackaging. In FY10, the HC-3 TRU waste is scheduled to be repackaged at the AHCF. Approval of the Basis for Interim Operation (BIO) is required and approval of a transportation Documented Safety Analysis (DSA) and one campaign is scheduled. The RWNMDD will provide an inventory list, obtain required supplies, support TA-V The CBFO and CCP are providing Sandia with visual examination experts for repackaging RH waste. The U.S. Environmental Protection Agency (EPA) will audit the CCP program and if approved, shipment of RH waste will be directly to WIPP. Figures 2 and 3 are examples of RH casks at Sandia.



**Figure 2. RH Casks**



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**Figure 3. PACO Casks**

### **TRANSPORTATION TO CENTRALIZATION SITE**

The DOE Carlsbad Field Office (CBFO) and LANL-Carlsbad Operations provide a Central Characterization Project (CCP) Mobile Loading Unit (MLU) to support loading activities for TRU waste within the DOE complex. The MLU team is certified under DOE for TRU waste loading and shipment directly to WIPP or to a centralization site. The MLU team is responsible for providing a WIPP Transportation Certification Official and two MLU operators/helium leak testers. The CCP is also responsible for performing flammable gas sampling and analysis in accordance with *Waste Isolation Pilot Plant Flammable Gas Analysis*, DOE/WIPP 06-3345 (DOE/WIPP 2008c). Sandia is responsible for providing a point of contact (POC), 2 RCTs, 1 crane operator, 1 forklift operator, 1 spotter, and 1 transportation person (for generating shipping manifest). CBFO is responsible for providing the tractor/trailer, the certified driver, and the Type B shipping containers.

Initially, Sandia was scheduled to ship to the centralization site in calendar year 2010, with CH waste being shipped first in the third quarter of FY10, and the RH being shipped



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in the first quarter of FY11. The CCP MLU has met with the RWNMDD and TA-V staff and toured the AHCF and the SPR and determined that the AHCF and/or the SPR could accommodate loading operations. The CCP MLU forwarded photos of loading operations at other DOE sites and provided links to loading operations manuals. The RWNMDD, TA-V, and the CCP MLU will jointly conduct loading operations into a TRUPACT-II, HalfPACT or RH 72-B cask in accordance with *CH Packaging Operations Manual*, DOE/WIPP 02-3184 (DOE/WIPP 2008d) and *RH Packaging Operations Manual*, DOE/WIPP 02-3284 (DOE/WIPP 2008e).

The most recent schedule for shipment has Sandia shipping CH TRU waste to the AMWTP in March 2010 and RH TRU waste directly to WIPP in the second quarter of FY11.

## **LESSONS LEARNED**

Lessons learned for the CH and the RH campaigns are:

- The TRU concentration assigned initially by the generator was usually conservative. Sandia re-assayed packages before repackaging, hence, some waste designated as TRU initially, was determined to be low level. This significantly contributed to the volume reduction.
- Many containers that were originally identified as HC-3 have been re-evaluated and are now designated as < HC-3. This allows repackaging to be accomplished at the RMWMF in a glovebox, instead of the AHCF.
- Videotaping was difficult. The original videotaping was not sufficient to provide the detail required. An entire new video system was purchased with multiple cameras to ensure capture of the necessary information.
- Those involved in the repackaging effort were not accustomed to the detail required for the paperwork, waste tracking, videotaping, and acceptable knowledge requirements.

## **CONCLUSIONS**

The Sandia repackaging effort has been a success even with some stumbling blocks. If CH TRU waste can be shipped to the AMWTP during FY10, Sandia will have accomplished their goals for this shipping window of opportunity. The personnel involved in this effort with the support from the CBFO, CCP, stimulus money, have made the adjustments necessary to update processes to meet the requirements of WIPP, to adjust schedules, and work with different departments to accomplish the goals of this program.

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The RH and HC3 waste will have their challenges, but Sandia is certain that with the support of CBFO and CCP and the VE expert, WIPP requirements will be met and the RH TRU waste will be shipped directly to WIPP..

## **REFERENCES**

DOE/WIPP 2005, *Contact Handled Transuranic Waste Authorized Methods of Payload Control (CH-TRAMPAC)*

DOE/WIPP 2006, *Remote Handled Transuranic Waste Authorized Methods of Payload Control (RH-TRAMPAC)*

DOE/WIPP 2008a, *Transuranic Waste Acceptance Criteria for the Waste Isolation Pilot Plant (WIPP WAC)*, DOE/WIPP 02-3122

DOE/HQ 2008, *Contact-Handled Transuranic Waste Packaging Instructions and Remote-Handled Transuranic Waste Packaging Instructions*

DOE/WIPP 2008c, *Waste Isolation Pilot Plant Flammable Gas Analysis*, DOE/WIPP 06-3345

DOE/WIPP 2008d, *CH Packaging Operations Manual*, DOE/WIPP 02-3184