

## **THE SECOND OPENING OF THE WASTE ISOLATION PILOT PLANT? REVIEW OF SALIENT CHARACTERISTICS AND UNIQUE OPERATIONAL CONSIDERATIONS FOR REMOTE HANDLED TRANSURANIC WASTE**

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### **ABSTRACT**

The U.S. Department of Energy (DOE) intends to dispose of remote handled (RH) transuranic (TRU) waste at the Waste Isolation Pilot Plant (WIPP) beginning in 2005. (1)

Four principle regulatory agencies are involved in the process of approving the RH TRU waste activities. The DOE is responsible for operational activities. The U. S. Nuclear Regulatory Commission (NRC) approves the design and use of shipping containers. The U.S. Environmental Protection Agency (EPA) is responsible for assuring safe and environmentally effective long-term disposal of the radioactive component of the waste and operational environmental monitoring. The New Mexico Environment Department (NMED) is responsible for the handling and the disposal of the non-radioactive hazardous component of the waste.

The Environmental Evaluation Group (EEG) is responsible for performing independent technical oversight of all WIPP activities, and will comment on documents and practices for the various regulated RH TRU waste activities. The DOE has already obtained the necessary approvals from the NRC, and has submitted a Class 3 Modification request to the NMED. On December 16, 2002 the DOE Carlsbad Field Office (CBFO) provided the EPA with a notice of proposed change, in accordance with 40 CFR 194.4 (b) (3), to receive and dispose of remote handled transuranic waste. (2) WIPP procedures for the management of RH TRU waste at the site are being developed. While there are no issues with current NRC Certificates of Compliance for the RH TRU waste shipping containers, it is likely that there will be some controversy over other aspects of the currently planned RH TRU waste program. These issues may include: (1) the published RH TRU waste inventory, (2) the characterization of the radionuclide portion of the waste, for which one planned method is to use dose-to-Curie conversions, and (3) the plans to use bounding estimates for the hazardous portion of the WIPP waste, rather than measuring VOCs on a container-by-container basis or by representative sampling as is done for contact handled transuranic (CH TRU) waste. This paper discusses the currently planned process and the possible issues related to the DOE's efforts to dispose RH TRU waste at the WIPP.

### **INTRODUCTION**

The Waste Isolation Pilot Plant (WIPP) is located 26 miles (40 km) east of Carlsbad, New Mexico. It is a facility that is sited, designed, constructed and operated to demonstrate the safe disposal of TRU waste. The WIPP consists of above ground receiving and handling facilities and below ground handling and disposal facilities.

The first CH TRU waste shipment arrived at the WIPP at approximately 4:00 AM on March 26, 1999. Disposal of RH TRU waste at the WIPP is planned to begin in 2005. (1) RH TRU waste is transuranic waste with a measured dose rate at the unshielded container surface equal to or greater than 0.2 rem per hour, up to 1,000 rem per hour. The radiation field is produced by the specific radioactivity of relatively short-lived (~ 30-year half-life) beta and gamma radiation emitting radioisotopes, including the fission and activation products that are characteristic of RH TRU waste. The RH TRU waste may contain radioisotopes emitting gamma rays, x-rays and neutrons. Accordingly, the unit rem, the radiation unit relating to dose equivalent, is used to classify RH TRU waste.

Because of the significant radiation dose rates associated with RH TRU waste containers, they must be handled remotely and/or with considerable shielding.

## **INVENTORY UNCERTAINTY**

The estimated radioactivity of the RH TRU waste inventory in the DOE Complex has varied over the years as shown in Figure 1. (3, 4) The estimated volume of RH TRU waste in the DOE Complex has also varied over the years as shown in Figure 2. (1, 3, 4, 5, 6, 7, 8, 9) A June 2002 estimate of RH TRU waste in the DOE Complex is approximately 3800 m<sup>3</sup>. After volume reduction at the generating sites, approximately 1972 m<sup>3</sup> is planned for disposal at the WIPP. (4) In addition, there are other potential sources of RH TRU waste. These include: waste incidental to reprocessing (1, p. 115), waste in a number of silos (1, p 105), "Suspect" RH TRU waste (10) and RH TRU waste at the former Nuclear Fuel Services reprocessing plant at West Valley, New York that was generated as part of a baseload contract to reprocess N Reactor fuel. (11)

On December 16, 2002 the DOE CBFO provided the EPA with a notice of proposed change, in accordance with 40 CFR 194.4 (b) (3), to receive and dispose of remote handled transuranic waste (hereafter referred to as "the Notification") . (2) Section 3.3.1 of the Notification states in part:

*The total amount of RH TRU waste, both legacy and projected volumes, is estimated to be greater than the RH TRU waste disposal volume (250,000 ft<sup>3</sup>) limited by the Consultation and Cooperation Agreement with the State of New Mexico (DOE, 1981).*

For this reason, Figure 1 includes a notation, Dec 2002 \*, which reflects that the total radioactivity of the RH TRU waste destined for the WIPP will most likely be greater than any recent estimate.

Additionally, Figure 2 includes a notation, 2002-Dec, which reflects that the total estimated volume of RH TRU waste in the DOE Complex may be greater than 250,000 ft<sup>3</sup> (7080 m<sup>3</sup>).

Supplement C in the Notification contains an October 2002 RH TRU waste inventory estimate. Table 1 in Supplement C reflects an estimate of 3800 m<sup>3</sup> of RH TRU waste destined for WIPP. Supplement C in the Notification appears to be in conflict with the statement regarding legacy and projected volumes of RH TRU waste in Section 3.3.1 in the Notification.

## **WHY IS THIS IMPORTANT?**

Uncertainty about the inventory would logically result in uncertainty regarding the radionuclide and hazardous waste constituents in the inventory. Assessments of the risks involved in transportation, storage, and disposal of RH TRU waste are questionable without an understanding of the waste to be shipped.

## **DOSE-TO-CURIE**

One method that the DOE is proposing to characterize RH TRU waste is to use a dose-to-Curie method for currently packaged waste. In this approach, the external gamma ray dose of each container is measured and converted to an activity value by comparing it to a subset of containers measured for both dose and activity.

## **WHY IS THIS IMPORTANT?**

Dose-to-Curie ratios may vary greatly within a waste stream depending on the source material and any mixing/blending of sources. Repackaging and/or resorting of RH TRU waste could change the dose-to-Curie ratio. There does not appear to be any empirical evidence to support the dose-to-Curie approach. The effects of matrix shielding and self-shielding could vary from container to container of debris waste, thus making the use of dose-to-Curie problematic. Alpha activity of TRU waste is indicative of key waste characteristics; i.e., decay heat, fissile gram equivalents (FGE) and Plutonium Equivalent Curies (PE-Ci). Reliance on gamma radiation measurements to estimate these key characteristics may not be appropriate.

## **SAMPLING FOR VOLATILE ORGANIC COMPOUNDS (VOCs)**

Rather than measuring the VOCs in each RH TRU waste container, the DOE proposes to reduce the CH TRU waste disposal room limits by the maximum amount that the RH TRU waste could contribute to the room.

## **WHY IS THIS IMPORTANT?**

The validity of the VOC estimates must be confirmed. Cask transportation safety requirements limit flammable VOCs to 500 ppm. This level can reasonably be confirmed by sampling or by calculating VOC concentrations based upon acceptable knowledge. Not sampling the RH TRU waste containers for VOCs would, however, decrease incremental personnel radiation dose.

40 CFR 264.13 (a) (1) states:

*“Before an owner or operator treats, stores, or disposes of any hazardous wastes, or nonhazardous wastes if applicable under § 264.113(d), he must obtain a detailed chemical and physical analysis of a representative sample of the wastes. At a minimum, the analysis must contain all the information which must be known to treat, store, or dispose of the waste in accordance with this part and part 268 of this chapter.”*

The chemical analysis for CH TRU waste is determined principally by VOC sampling and analysis. Elimination of such sampling for RH TRU waste may make the proposed waste characterization process unacceptable.

## **MAINTENANCE**

Contact maintenance may result in personnel radiation doses greater than the doses experienced thus far for WIPP Operations. Personnel radiation doses may approach or be in excess of DOE self-imposed administrative limits.

### **WHY IS THIS IMPORTANT?**

Personnel radiation doses may not be considered "As Low As Reasonably Achievable" (ALARA). Extensive planning for contact maintenance is required (i.e., identify high maintenance items, provide for spare parts, provide for quick disconnects, pre-make portable shielding and video tape maintenance operations, for training purposes, prior to receipt of RH TRU waste).

## **SHIPMENTS**

An increasing number of CH and RH TRU waste shipments are planned. Based upon recent information and the assumption of 200 days a year operation, between 6 and 9 shipments of CH and RH TRU waste a day are planned to be received and disposed at WIPP during the 2002-2008 time period. (1) Figures 3 and 4 show the currently planned number of CH and RH TRU waste shipments.

### **WHY IS THIS IMPORTANT?**

Failure in any key component (for example, the waste hoist) or in the underground (such as the Horizontal Emplacement and Retrieval Equipment {HERE} or the RH TRU waste emplacement forklift) could create major problems. These could result in shipment delays and could cause schedule, financial and regulatory problems.

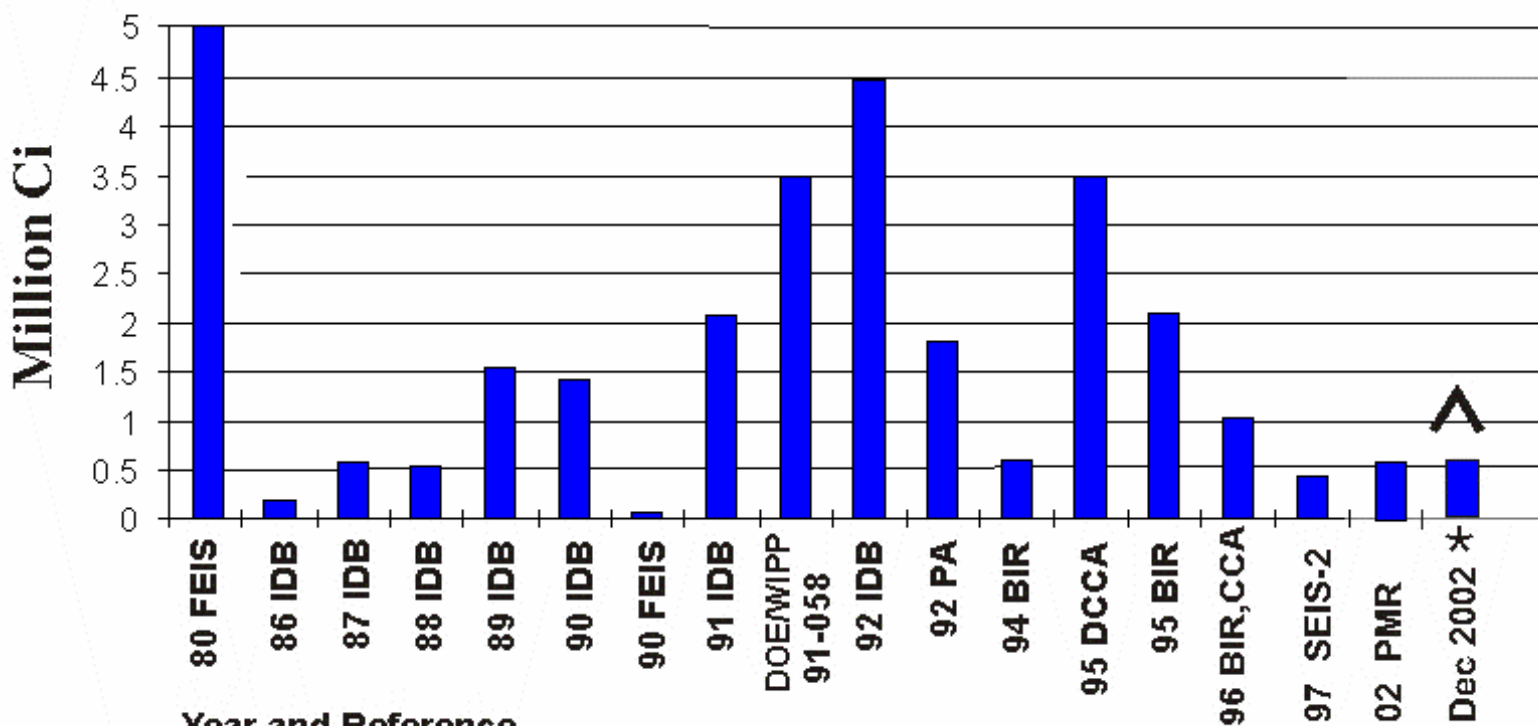
## **SUMMARY**

The disposal of RH TRU waste has been a part of the DOE's plans from the initial concept of the WIPP. The current approach to begin this disposal in 2005 could be delayed by any or a combination of the following potential problems:

- RH TRU waste radionuclide, hazardous waste constituents and/or volume inventory estimates could be suspect.
- Regulatory agencies have to accept the dose-to-Curie approach.
- The requirement contained in 40 CFR 264.13 (a) (1) for a detailed chemical and physical examination of a representative sample of the waste must be met.

- Comprehensive planning for contact maintenance and subsequent implementation of this planning is required in order to reduce the likelihood of personnel radiation exposures exceeding CBFO or DOE self-imposed limits.
- The radiation doses associated with RH TRU waste operations may not be considered ALARA.
- Forced outage of important disposal equipment at the WIPP could severely curtail disposal operations.

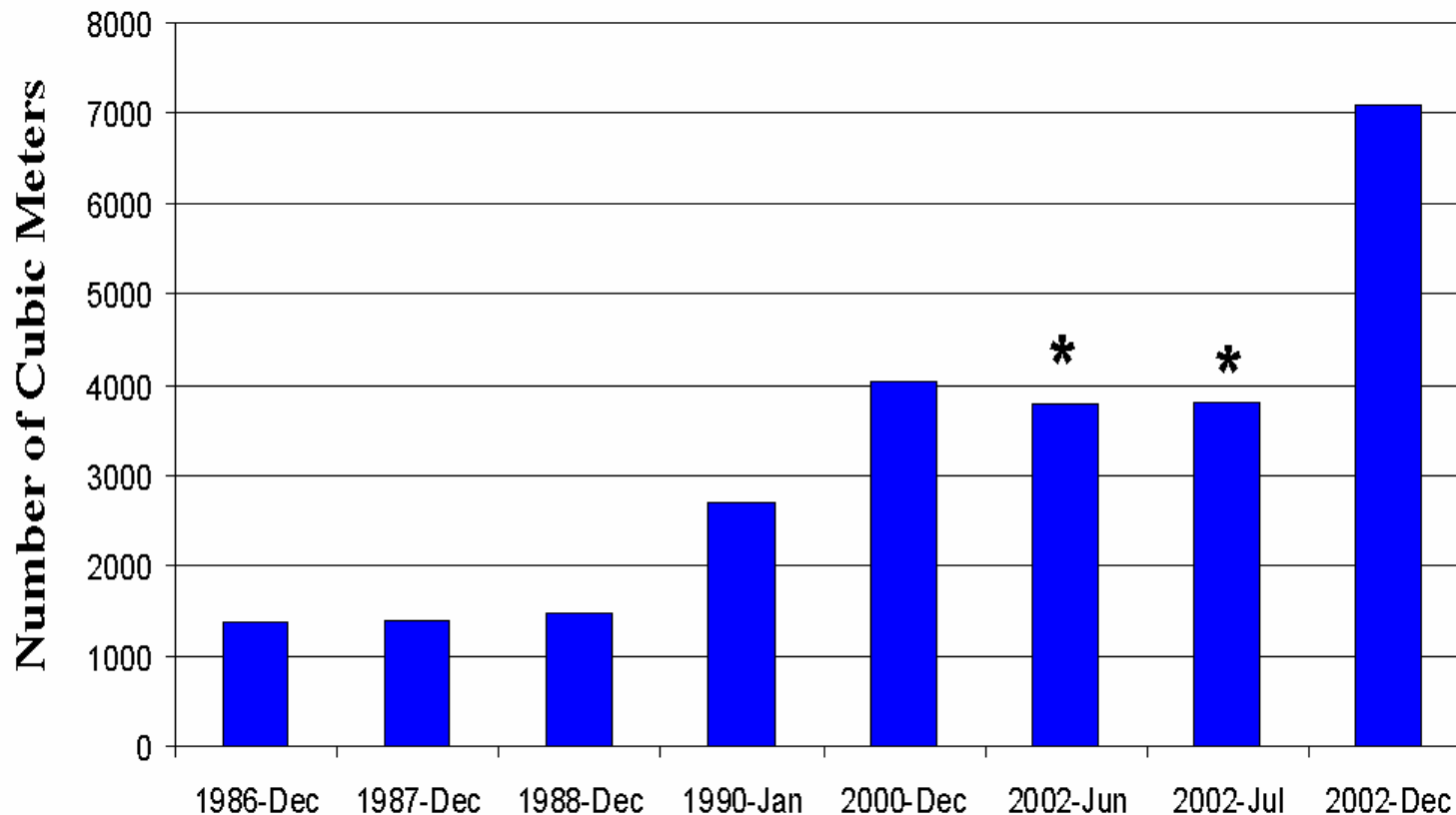
**Figure 1. Estimated RH TRU Inventory Destined for WIPP**



**Year and Reference**

- BIR Baseline Inventory Report (DOE 1994; 1995; 1996)
- CCA Compliance Certification Application (DOE 1996)
- DCCA Draft Compliance Certification Application (DOE 1995)
- FEIS Final Environmental Impact Statement (DOE 1980; 1990)
- IDB Integrated Data Base (DOE 1987; 1988; 1989; 1990; 1991; 1992)
- PA Performance Assessment (SNL 1992)
- PMR RCRA Class 3 Permit Mod. Request- RH TRU Inventory (DOE 2002)
- SEIS Supplemental Environmental Impact Statement (DOE 1997)
- ★ Notification to EPA for RH TRU (DOE 2002)

**Figure 2. ESTIMATED RH TRU INVENTORY IN THE DOE COMPLEX**



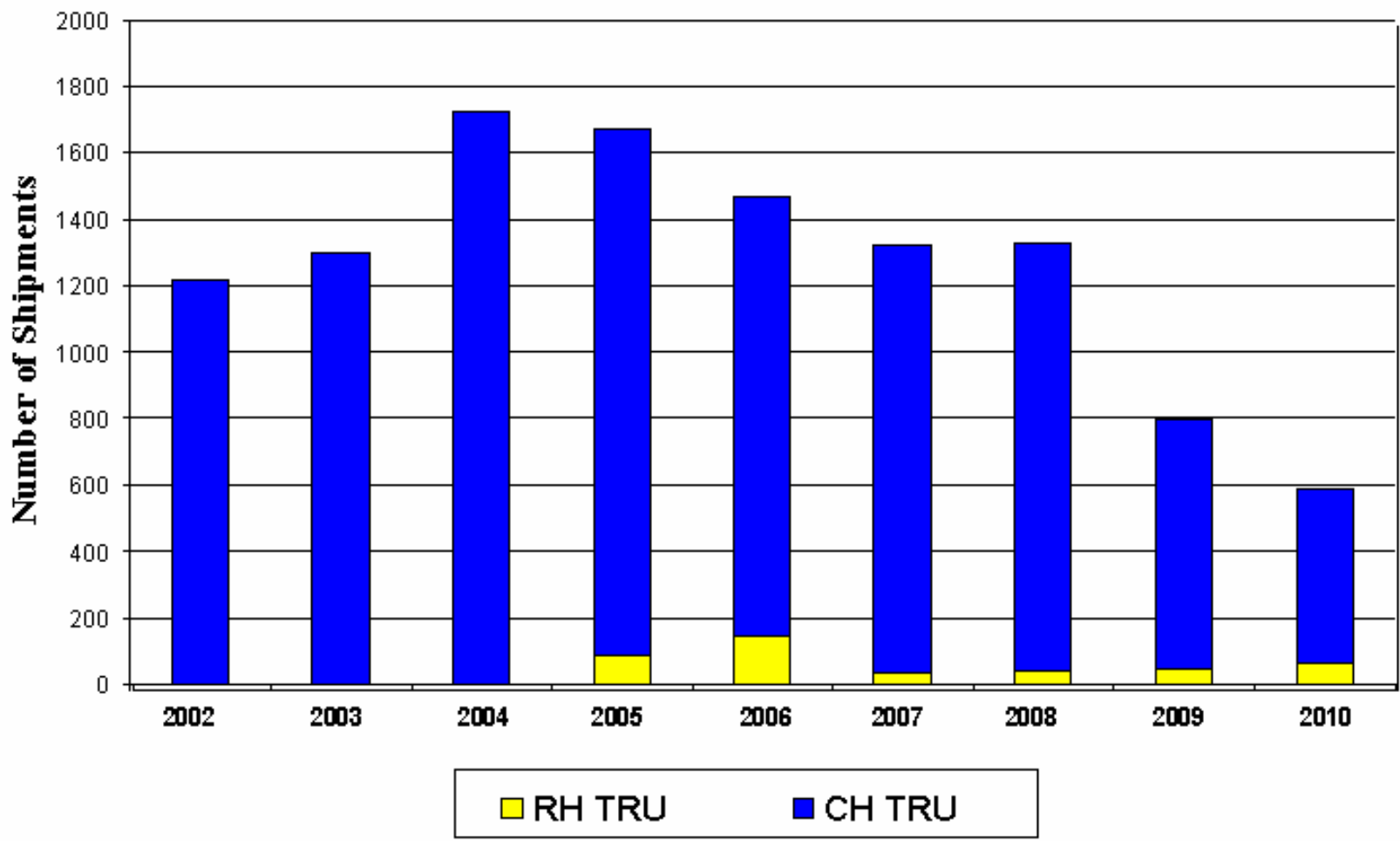
\* Does not include:

- Waste incidental to reprocessing (some fraction of 5,000 m<sup>3</sup>)
- 600 Silos, estimated to be ~0.5 m<sup>3</sup>/ silo
- Suspect RH 220 m<sup>3</sup>

+ + 3800 m<sup>3</sup> also contained in Supplement C of EPA Notification

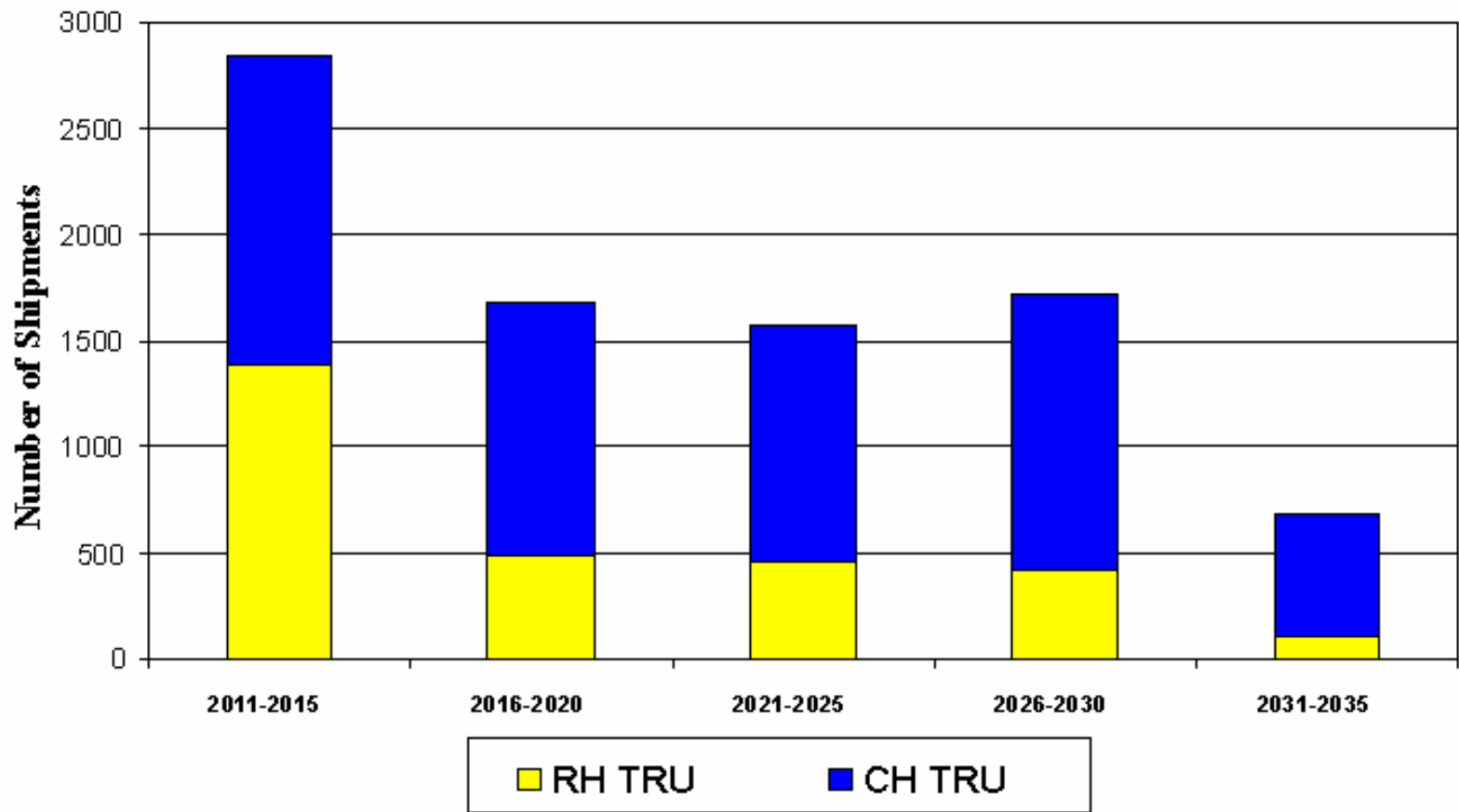
# Total RH TRU estimated to be greater than 7080 m<sup>3</sup> [EPA Notification, sec.3.3.1]

### Figure 3. CH TRU & RH TRU SHIPMENTS 2002-2010





### Figure 4. CH TRU & RH TRU SHIPMENTS 2011-2035



## References

1. US DOE, DOE/NTP-96-1204, Revision 3, National TRU Waste Management Plan, Corporate Board Annual Report, July 2002.
2. December 16, 2002 letter and attachments from Dr. Inés Triay, Manager Carlsbad Field Office, USDOE to Mr. Frank Marcinowski, USEPA.
3. "Issues Identified by EEG on the Characterization of RH TRU Waste," Statement by Dr. Matthew Silva, Director, Environmental Evaluation Group, before the NAS/NRC WIPP Committee, October 4, 2001, Albuquerque, New Mexico.
4. US DOE, Remote Handled Transuranic (RH TRU) Waste Inventory Report and Site Descriptions, June 2002 (attached to the Waste Isolation Pilot Plant Request for a RCRA Class 3 Hazardous Waste Facility Permit Modification Request of June 28, 2002).
5. US DOE, DOE/EIS-0026-FS, Final Supplemental Environmental Impact Statement, Waste Isolation Pilot Plant, January 1990.
6. US DOE, DOE/RW-006, Revision 5, Integrated Data Base for 1989, Spent Fuel and Radioactive Waste Inventories, Projections, and Characteristics, November 1989.
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9. US DOE, National TRU Waste Management Plan, DOE/NTP-96-1204, Revision 2, December 2000.
10. Idaho National Engineering and Environmental Laboratory, Technology Opportunity Statement Outline: Operations Program Description # 11 [online]. Available at: <http://www.ineel.gov/st-needs-detail.asp?id=868>. Origination date 11/16/01. Accessed 29 October 2002.
11. US DOE. Plutonium Recovery from Spent Fuel reprocessing by Nuclear Fuel Services at West Valley, New York from 1996 to 1972, February 1996. Available at: <http://www.osti.gov/osti/opennet/document/purecov/nfsrepro.html>.