TRU CONFESSIONS

REAL LIFE EXPERIENCES IN SHIPPING TRANSURANIC WASTE TO THE WASTE ISOLATION PILOT PLANT FROM THE ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE

by
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Introduction

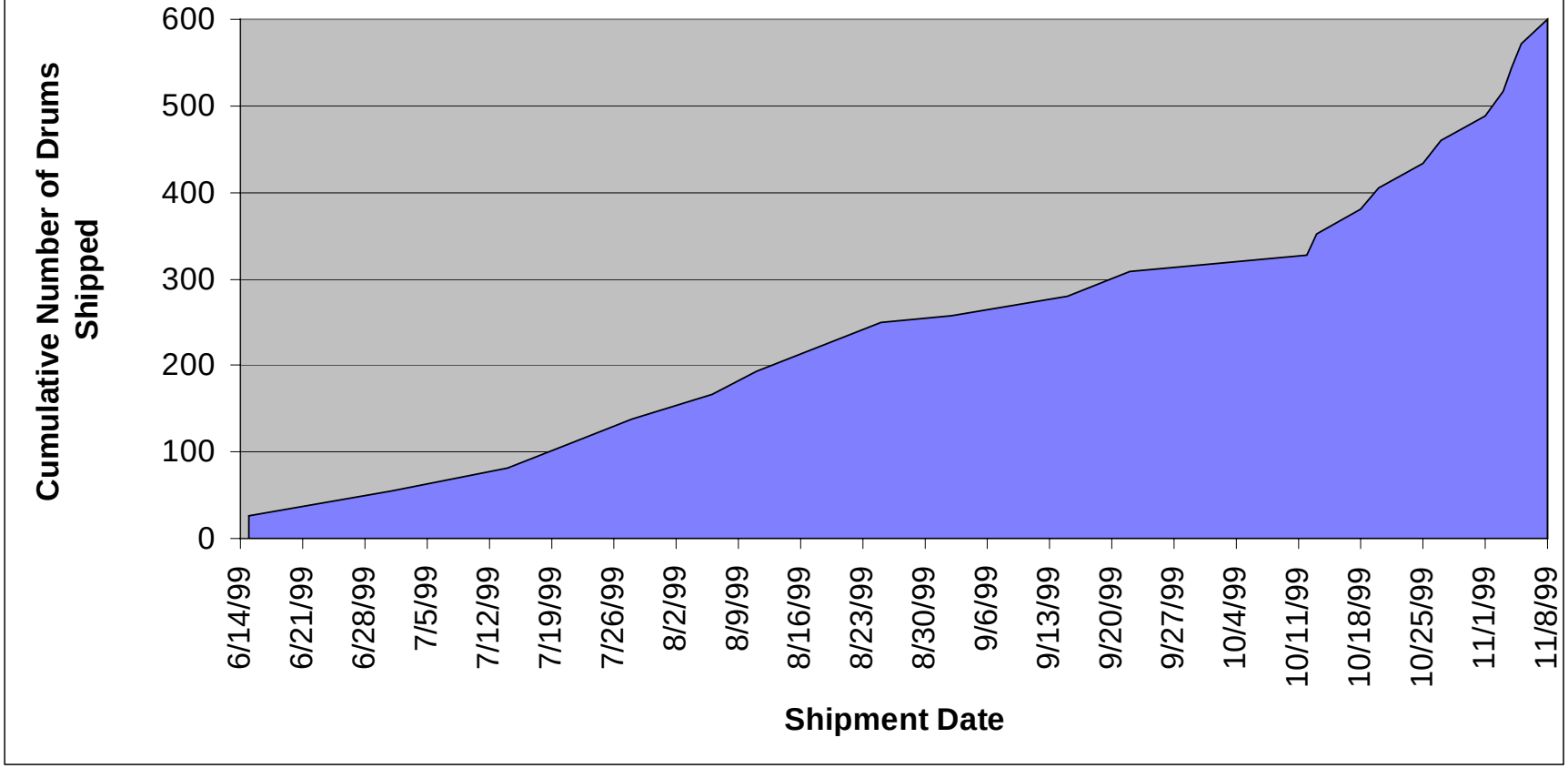
The Rocky Flats Environmental Technology Site (RFETS) is currently undergoing site closure. An accelerated closure schedule has been established to close RFETS by the year 2006. To support this accelerated schedule, it is estimated that RFETS will have to ship and dispose of approximately 15,000 cubic meters of transuranic (TRU) waste at the Waste Isolation Pilot Plant (WIPP) by the end of 2006. The shipment and disposal of TRU waste from RFETS is a critical component to the successful completion of the accelerated site closure schedule.

During calendar year 1999, RFETS shipped 600 drums of TRU waste to WIPP for disposal. This represents a significant achievement in that this was the first TRU waste ever shipped from RFETS to WIPP for disposal. This paper describes some of the real life difficulties and challenges experienced at RFETS associated with the preparation, certification, shipment and disposal of TRU waste to/at WIPP.

Discussion

On June 15, 1999, RFETS made its first shipment of TRU waste to WIPP. This shipment consisted of non-mixed graphite debris waste and accounted for all of the characterized/certified graphite waste in the RFETS inventory. Graphite was shipped initially because this same type of waste was shipped to WIPP previously from Idaho National Environmental and Engineering Laboratory (INEEL) and it was well characterized both at Rocky Flats and INEEL as non-mixed waste. On November 8, 1999, RFETS completed its twenty-third shipment of TRU waste to WIPP. During this time period 600 drums of non-mixed TRU waste from RFETS were shipped and disposed of at WIPP. This represents an overall average shipment rate of about 1 shipment per week. The exact shipment rate profile is presented in Figure 1. From Figure 1 it can be seen that the shipment rate did vary somewhat due to factors that will be discussed later. Figure 1 shows a rather steady shipment rate initially, followed by an accelerated shipment rate towards the end of the shipment time period. Typically, a shipment consisted of two loaded Transuranic Package Transporter (TRUPACT-II) vessels.

Figure 1
Rocky Flats TRU Waste Shipment Rate Profile



Five hundred seventy four (574) of the 600 drums (i.e., all but the first shipment) of waste shipped to WIPP consisted of stabilized pyrochemical salt waste (a newly generated, homogeneous solid) containing higher than average levels of special nuclear material (SNM) as compared to other TRU waste materials designated for shipment to WIPP. The pyrochemical salts were packaged in pipe overpack components (POC). Stabilized pyrochemical salts are the product of a thermal stabilization treatment process that consists of heating the salts to a liquid state, in the presence of an oxidant, for approximately two hours. Acceptable knowledge, solid sampling and analysis, and the application of the thermal stabilization process demonstrated that these salts were non-mixed waste. Since WIPP could not accept mixed waste at this time, these salts were selected for shipment because of the defensibility of the non-mixed waste characterization.

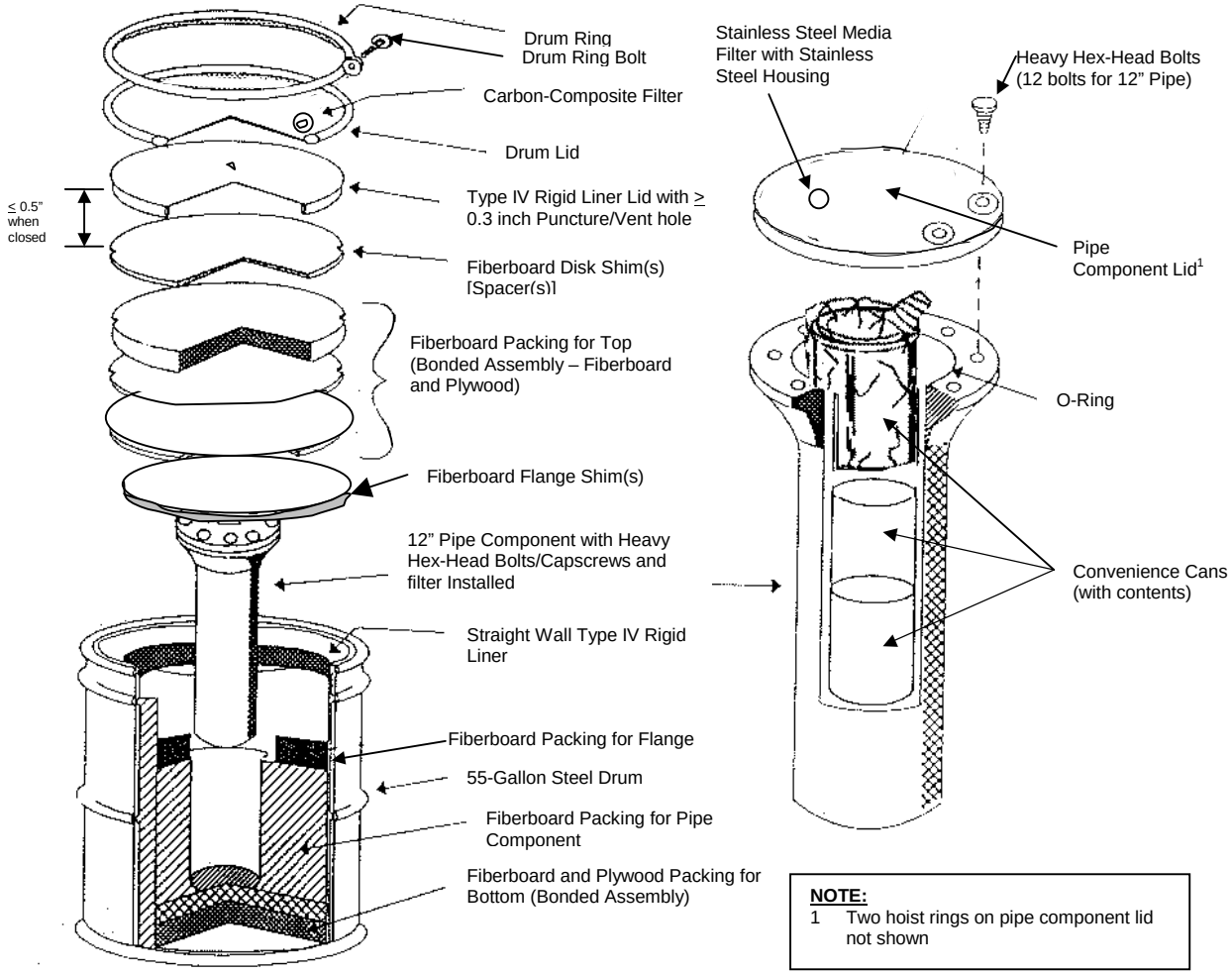
A POC (see Figure 2) is a specially designed and fabricated steel container that is overpacked into a 55-gallon drum and is used primarily to package TRU waste (or residue material itself) that is derived directly from plutonium residue material (e.g., stabilized salts). Plutonium residue material is distinguished from other TRU wastes in that residue is contaminated with SNM (primarily plutonium) at levels that were determined to be economically recoverable at the time the material was originally generated and assayed.

POCs typically contain material approaching 200 Pu-239 fissile gram equivalents (FGE). One of the main advantages of using a POC is that a TRUPACT-II vessel containing fourteen POC drums has a total FGE restriction of 2,800 grams while a TRUPACT-II vessel containing fourteen 55-gallon drums (without POCs) has a total FGE restriction of only 325 grams. This greater than eight fold increase in allowed FGE loading per TRUPACT-II vessel greatly enhances shipping efficiency of waste material with high FGE loading (such as that composed of or derived from plutonium residue material).

Plutonium residue material requires safeguarding until such time that the material is processed into a form that the concentration and attractiveness of the SNM present complies with specified safeguards termination limits (STLs). A vulnerability assessment (VA) was conducted to establish protective measures required from the point of transfer outside of the safeguarded area through permanent storage of the residue-derived material in underground disposal areas at WIPP. The assessment mandated requirements needing implementation after packaging, during storage and loading operations as well as during disposal at WIPP. Because of the application of the STLs, the application of new, additional requirements and the high gram loading of the POCs, problems arose that hindered overall shipping efficiency/capability. Given this background, below is a bulletized list of some of the specific operational difficulties encountered along with short-term solutions executed by Rocky Flats during its first year of shipment and disposal of TRU waste at WIPP. Based on this operational experience, some longer-term enhancements, either planned or underway, to improve overall shipping efficiency are also included and discussed.

Figure 2

Pipe Overpack Component (POC) Assembly in a 55-Gallon Drum



NOTE:
1 Two hoist rings on pipe component lid not shown

- Disablement of POCs - Additional security measures to disable each POC had to be performed on the stabilized pyrochemical salts.
- Shipping Facility Modifications - Enhanced safeguards and security modifications to the shipping facility were required prior to receipt of the containers for loading operations.
- TRUPACT-II Weight restrictions - Weight restrictions for the payload and Department of Transportation weight restrictions limited the number of containers that could be loaded for a single shipment.
- Shipping Facility Limitations on Number of Containers - The security requirements imposed constraints on the number of containers allowed in the shipping facility.
- Existing Authorization Basis (AB) Constraints - POCs with high americium quantities were not allowed in the shipping facility per its AB.
- Enhancement of Shipping Efficiency. - Several modifications to the existing shipping facility and improvements to the process of certification and transfer of containers were implemented to increase shipping efficiency.

Each of these items is discussed in greater detail below.

Disablement of POCs

Figure 2 presents a diagram of a POC. The POC contains a lid that is bolted onto a flange of the POC body with 12 bolts. In order for the stabilized pyrochemical salts waste material to be released from safeguards, each pipe component was subjected to a mechanical method which prevented access to the contents by unauthorized persons. Several possible methods for disabling the POCs were considered in the vulnerability assessment but ultimately the optimum method selected and tested provided sufficient delay time to access the material.

Disablement of the POC bolts was performed in a safeguarded area prior to transfer of the POCs to the shipping facility. The disablement of the POCs imposed an additional handling and processing operation that significantly impacted the overall efficiency and capability to prepare, load and ship this waste material offsite. The operation involved removal of the drum lid and associated packaging material to gain access to the POC lid followed by the mechanical disabling process and then final closure of the drum itself. During this time additional problems were discovered in that some of the POC lid bolts were not adequately torqued due, in one case at least, to the O-ring not being properly seated in the POC flange. This resulted in additional rework and verification of all previously packaged POCs to ensure the POC lids were properly sealed to the POC flange. Disabling of the POCs became the overall rate-limiting step in the shipment of the stabilized pyrochemical salt waste from RFETS.

Shipping Facility Modifications

The current shipping facility was constructed in the early 1990's with the expectation that WIPP would be able to receive shipments during that time. When WIPP did not open as planned, the shipping facility was used as a storage area for waste containers. All loading equipment was removed from the area and stored. During preparations to ship over the past two years, all equipment had to be re-installed, inspected and tested for operability. Hoisting and rigging equipment was inspected per required OSHA/ANSI regulations. Several training sessions on loading operations were held to qualify personnel. During the training sessions, potential improvements to the facility and the loading process were identified. Loading personnel were actively involved in planning efforts to identify improvements to the facility and to streamline the shipping process.

One area identified for improvement was the lack of sufficient lighting in the loading dock area. When shipments were increased, it necessitated working on off-shifts. Temporary lighting had to be brought into the loading dock area. Additional lighting was also required underneath the loading dock to facilitate inspections to the TRUPACT-II trailer and for loosening tie downs. Permanent lighting was installed both above and underneath the loading dock. Also, additional lid stands were obtained from WIPP and installed. This allowed loading personnel to work on two TRUPACT-II vessels at the same time.

Another area addressed was the use of the existing crane. Currently, a 30-ton overhead bridge crane is used for lid removal and to place payloads into the vessels. This operation required two people. The crane

operator is stationed in the cab of the crane well above the loading dock. The operator must depend on a signaler to receive directions during loading operations. The crane is being modified to include the use of a pendant control which will allow the operator to be stationed on or near the loading dock without having a signaler for directional control.

TRUPACT-II Weight Restrictions

Individual payload weights must not exceed 7,265 pounds. The maximum allowable gross weight of a loaded TRUPACT-II vessel is 19,250 pounds. This weight restriction takes into account the weight of the vessel, the payload weight and the payload hardware (pallet, guide tubes, slip sheets and stretch wrap or banding materials). Three loaded vessels plus the trailer weight can not exceed 62,000 pounds. The weight restrictions precluded shipping of three fully load TRUPACT-II vessels (see Table 1 for additional clarification). Additionally, the gross vehicle weight (three loaded vessels, trailer and tractor) can not exceed the maximum Department of Transportation (DOT) limit of 80,000 pounds. These requirements necessitated careful planning of the load management activities. POC drums averaged approximately 350 pounds per drum, therefore one payload assembly would average approximately 5,156 pounds. Load management planning was based on adding the average payload weights, the heaviest vessel weight and heaviest trailer weights in order to ensure the maximum weight restrictions would not be exceeded. Colorado also has a weight restriction which limits the weight on the front axle of the trailer to 20,000 pounds. Because of TRUPACT-II weight restrictions (refer to Table 1), a typical shipment of POC drums containing stabilized pyrochemical salts consisted of only two loaded TRUPACT-II vessels (i.e., 28 POC drums). The option of partially loading a third TRUPACT-II vessel per shipment was considered but subsequently rejected as ineffective and inefficient given the other constraints that were imposed and the additional time and resources needed to prepare the partially filled third vessel. The additional time needed to prepare and load a partially filled third TRUPACT-II vessel would have resulted in an overall lowered shipment rate than that realized by limiting shipments to only two fully loaded TRUPACT-II vessels. This does not imply that all future shipments of waste from RFETS will consist of only two fully loaded vessels. Shipments of other waste containers (not in POCs) that are not weight limited in this manner (i.e., they have lighter average container weights) will be shipped using three fully loaded vessels, as appropriate.

Table 1
TRUPACT -II WEIGHT RESTRICTIONS

	Vessel #1	Vessel#2	Vessel#3	TOTAL	Max Weight Allowed
Maximum payload weight	7,265	7,265	7,265	21,795	19,250
Heaviest vessel weight	13,140	13,140	13,140	39,420	
Heaviest trailer weight	9,900			9,900	
				71,115	62,000
			Exceeded weight capacity		9,115
Three vessels of POC's					
Avg. weight of POC's @ 350 lbs X14 + hardware weight (i.e., 256 lbs)	5,156	5,156	5,156	15,468	19,250
Heaviest vessel weight	13,140	13,140	13,140	39,420	
Heaviest trailer weight	9,900			9,900	
				64,788	62,000
			Exceeded weight capacity		2,788
Two vessels of POC's					
Avg. weight of POC's @ 350 lbs X14 + hardware weight (i.e., 256 lbs)	5,156	5,156		10,312	19,250
Heaviest vessel weight	13,140	13,140		26,280	
Heaviest trailer weight	9,900			9,900	
				46,492	62,000
			Below weight capacity		-15,508

Shipping Facility Limitations on Number of Containers

The vulnerability assessment affected the transfer and storage of the pyrochemical salts outside RFETS' main security area by limiting the amount of residue-derived SNM allowed outside its boundary at any one time. The existing TRUPACT-II shipping facility is located in a minimal security area. Because the shipping facility was not a tightly secured/controlled facility, a limit of approximately 3 kg of Pu-239 FGE or approximately 28 POC drums were allowed in the shipping facility at one time initially. Additional security measures had to be implemented prior to receipt of the drums for loading operations. This meant that only one shipment of POC drums could be staged/prepared for shipment at any given time. Additional POC drums could not be received at the TRUPACT-II shipping facility until the first TRUPACT-II vessel was loaded and sealed.

This restriction significantly impeded the efficient loading and shipping operations of POC drums from RFETS. To alleviate this restriction somewhat, security enhancements were undertaken. Specifically, access control to the shipping/loading area was enhanced, physical barriers were constructed to create two special segregated security areas within the shipping facility and random patrols were conducted by armed security officers. A security fence was installed and access to the area was restricted.

Even with the completion of the safeguards and security enhancements of the shipping facility, limitations were still imposed on the total number of POC drums of stabilized pyrochemical salts allowed in the shipping facility. With completion of the enhancements, the total number of POC drums authorized in the facility was increased to approximately 56. Consequently, the new security enhancements did allow for

more POC drums to be staged/prepared for shipment, but it still did not allow RFETS to prepare and assemble more than four 14 drum payload assemblies at a time in the shipping facility. Ultimately, the restrictions prohibited the implementation of an efficient loading and shipping operation. In order to maximize shipping efficiency, a backlog of certified containers needs to be available for immediate payload assembly and loading. The inventory should be sufficient to allow adequate time for all transportation-related activities in order to afford a smooth transition through the entire process. Instead, the "just in time" inventory caused many delays in certification, transmittal of certification data to WIPP and load management activities.

Existing Authorization Basis (AB) Constraints

Some of the stabilized pyrochemical salts contain rather high americium-241 (Am-241) levels – on the order of 10 to 15 grams per POC drum. The storing, staging and loading of POC drums containing these levels of Am-241 was not analyzed as part of the existing shipping facility authorization basis during the startup of shipments to WIPP. Consequently, an additional Am-241 constraint was initially imposed on POC drums of stabilized pyrochemical salts that were transferred to the shipping facility until the authorization basis was modified to include the analysis of the higher Am-241 levels. This, in conjunction with the other constraints previously mentioned caused considerable logistical difficulties in the efficient execution of certification and shipment activities of stabilized pyrochemical salt waste to WIPP.

Enhancement of Shipping Efficiency

As a result of these additional requirements and other difficulties encountered, the following modifications/efforts were initiated and/or implemented to enhance the shipping process:

- The current shipping facility, previously a storage facility for TRU and Low Level waste is now dedicated to transuranic waste shipments. Approximately 700 TRU and TRU mixed waste drums were relocated from the shipping facility to other storage facilities in order to increase the staging area for loading operations. Although Low Level waste shipments still occur at the facility due to the amount of Low Level waste inventory of waste in the outlying storage yard, the majority of Low Level waste shipping operations have been moved to other facilities.

- The shipping facility's authorization basis (AB) was amended to allow an increase in the fissile gram content of each container of high SNM (i.e., POCs). In order to amend the existing AB, review and approval had to be obtained from the Nuclear Criticality Safety and Nuclear Materials Control and Accountability departments. The AB amendment took approximately three weeks to complete and implement.

- The size of the security area in the shipping facility for high SNM waste has been increased. The evacuated area within the shipping facility is now an additional security area for POC drums needing additional safeguarding. This area also serves as a pre-staging payload assembly area. Drums can now be pre-staged for application of WIPP and DOT required labeling. The area provides sufficient room for personnel to perform the final transportation inspections and payloads can be staged in the proper order for payload assembly. Other areas in the shipping facility can now be used for staging of certified drums as well as staging of containers for Real Time Radiography.

- The loading and shipping procedures were streamlined. Initially, the TRUPACT-II loading procedures were composed of four separate procedures for TRUPACT-II vessel inspections, payload assembly, loading and unloading operations. Each procedure also contained numerous checklists that required supervision signoff after the completion of each step. Once the loading activities became routine, it became apparent that completion of the numerous checklists was very time consuming and, in many cases, redundant. Additionally, each checklist is considered a WIPP record that must be strictly controlled. The four procedures have now been combined into one procedure. Redundant steps have been combined and checklists have been reduced to a more manageable number.

- A collaborative information exchange between both WIPP and Rocky Flats operations personnel enhanced the efficiency of loading operations. Prior to the first shipment, operations personnel from

WIPP were present to offer help during the entire shipping process. Their participation and help proved to be most valuable. They were available to answer any questions as they arose. They willingly offered their expertise and operational experience when difficulties were encountered. Their supportive presence established a positive basis of communication that led to an information exchange among other shipping sites. WIPP personnel responsible for the data transmission of certified container information were also extremely helpful. RFETS requested and received short turnaround time for the transmission and approval of data in the WIPP Waste Information System (WWIS). Personnel were available to support shipping efforts on weekends, holidays and outside of normal working hours in order to help RFETS meet the accelerated shipping schedule.

A meeting was held at Los Alamos National Laboratories (LANL) on September 13, 1999 with engineers from WIPP and TRUPACT-II subject matter experts from RFETS, Idaho Environmental and Engineering Laboratory, Savannah River Site and Los Alamos National Laboratory. The purpose of the meeting was to introduce and standardize qualification requirements for TRUPACT-II users at each site. Representatives from each site agreed to meet on a regular basis to develop a universal procedure that can be utilized complex wide for TRUPACT-II operations. All TRUPACT-II personnel will be trained to the requirements of DOE/WIPP 93-1001 and the Nuclear Regulatory Commission (NRC) Certificate of Compliance.

- An additional shipping/storage facility is planned for fiscal year 2001 to accommodate future shipping schedules (estimated to peak at approximately 10 shipments per week). The new facility will accommodate two fully equipped loading docks and provide a payload staging area to prepare certified containers for payload assembly. The facility will also have sufficient area to stage pre-assembled payloads and will allow simultaneous activities to be performed. The new facility will have sufficient room to stage six payloads at any one time. RFETS can easily meet three to four shipments per week based on a one-shift operation.

WIPP Hazardous Waste Permit

On November 26, 1999, the Hazardous Waste Facility Operating Permit for WIPP became effective. All shipments to WIPP were suspended until compliance with Attachment B of the WIPP hazardous waste permit Waste Analysis Plan (WAP) is achieved[1]. This includes modification and implementation, as necessary, of waste characterization methods (e.g., headspace gas sampling/analysis, real-time radiography) and other programmatic elements (e.g., data validation, reporting and use of data).

With the assistance of WIPP personnel, RFETS initiated an accelerated and aggressive effort to modify its TRU waste disposal program to bring it into compliance with the new WIPP WAP requirements. In mid-December 1999, an initial audit of the modified RFETS program by WIPP personnel was conducted for retrievably stored, debris TRU waste. The RFETS program was determined to be indeterminate as of this audit because of insufficient operating history to demonstrate the implementation and effectiveness of the modified RFETS program to all aspects of the WIPP WAP. A follow-up audit is scheduled for mid-January 2000, at which time RFETS will have sufficient implementation documentation to demonstrate compliance with the new WIPP WAP. After this follow-up audit, a final audit report will be prepared and submitted to the New Mexico Environment Department (NMED) for their review and approval. Once approved, RFETS will commence shipment of retrievably stored TRU debris waste (both non-mixed and mixed) to WIPP. The modified RFETS TRU waste program for homogeneous solids will be audited to the new WAP requirements sometime during the middle of calendar year 2000. Hopefully, shipment and disposal of this waste material to/at WIPP will resume later in the year.

Conclusion

Shipment of transuranic waste to WIPP is a critical aspect to the successful closure of Rocky Flats by 2006 because decontamination and decommissioning of old buildings produces TRU waste which cannot be stored. As the frequency of scheduled shipments increases, starting in fiscal year 2000, system efficiency and capability will have to increase accordingly. Actual operational experience in shipping the stabilized salt waste stream from Rocky Flats has proven more difficult and complicated than initially anticipated. All difficulties encountered to date, have been overcome through various operational and facility

enhancements and modifications. With current resources and facilities, Rocky Flats has demonstrated the ability to sustain, over an extended period, one shipment a week – reaching a maximum rate of four shipments per week at one point in time. Achievement of future, accelerated shipping schedules will be realized through expansion of shipping facilities, acquisition of additional resources and continued process improvements.

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[1]WIPP Waste Analysis Plan (WAP) hazardous waste permit. October 27, 1999.