The Successful Utilization of Commercial Treatment Capabilities to Disposition Hanford's No-Path-Forward, Suspect Transuranic Wastes – 12408

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ABSTRACT

The US Department of Energy (DOE) Richland Operations Office (RL) has adopted the 2015 Vision for Cleanup of the Hanford Site. The CH2M HILL Plateau Remediation Company's (CHPRC) Waste and Fuels Management Project (W&FMP) and their partners support this mission by providing centralized waste management services for the Hanford Site waste generating organizations. At the time of the CHPRC contract award (August 2008) slightly more than 9,000 cubic meters (m^3) of legacy waste was defined as "no-path-forward waste." A significant portion of this waste (7,650 m^3) comprised wastes with up to 50 grams of special nuclear material (SNM) in oversized packages recovered during retrieval operations and large glove boxes removed from Hanford's Plutonium Finishing Plant (PFP). Through a collaborative effort between the DOE, CHPRC, and Perma-Fix Environmental Services, Inc. (PESI), pathways for these problematic wastes were developed and are currently being implemented.

INTRODUCTION

DOE has successfully accessed offsite commercial treatment capabilities as a means to disposition low-level waste and mixed low-level waste (LLW/MLLW) at reduced costs compared to onsite treatment. A distinct advantage to Hanford is a commercial treatment facility, Perma-Fix Northwest (PFNW), located adjacent to the site. This commercial treatment facility is restricted by the SNM limits set for the total quantity of SNM allowed at the facility in accordance with the facility's radioactive materials license(s) (RML). Greater than 50 percent of the Hanford "no path forward" wastes met the requirements for acceptance and treatment at PFNW with few or no modifications to the vendor's treatment envelope. Except for the size of the package, and/or doses associated with them, these wastes represent a major target of opportunity to disposition Hanford suspect transuranic (TRU) wastes through the expanded use of commercial treatment processing.

The overriding consideration in accessing off-site commercial facilities for disposition of the subject waste was compliance with the requirements imposed by the Resource Conservation and Recovery Act (RCRA); the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA); the Tri-Party Agreement (TPA) between the State of Washington, the Environmental Protection Agency (EPA), and the DOE, and DOE Order 435.1, which mandates the management of radioactive wastes on DOE sites. In addition, due to the possible need to transport these wastes on publicly accessible highways to access the commercial processing capabilities, consideration was given to both the Nuclear Regulatory Commission (NRC) and Department of Transportation (DOT) requirements for transporting wastes of this type.
The goals of this program were to: 1) manage highly degraded large waste packages and glove boxes from retrieval operations or PFP directly to treatment, 2) economically produce TRU waste packages that meet Waste Isolation Pilot Plant (WIPP) acceptance criteria, 3) reduce Site

inventory of TRU waste, and 4) avoid costs associated with building an on-site facility that was originally planned to process these large package suspect TRU wastes.

In addition to addressing wastes with no near-term path to disposition, this program would reduce the total expected volume of Hanford TRU waste requiring WIPP disposal by nearly 65 percent.

A 63 m^3 container being retrieved

Super 7A packaging system

TRU waste repackaging at PFNW

Large, often degraded packages containing suspect TRU wastes are retrieved, packaged in a specially engineered Super 7A container, and transported directly to Perma-Fix Northwest where the contents are segregated into TRU and M/LLW, packaged appropriately, and returned to Hanford for disposition.

A PHASED APPROACH

The DOE/CHPRC strategy to disposition these wastes was planned to be conducted in three phases. The first phase, a Pilot Program, was initiated in the spring of 2010 and completed in September of that year. The Pilot Program demonstrated the feasibility of commercial processing as an efficient means of managing this suspect TRU waste in a manner that was safe and compliant while minimizing unnecessary waste handling or storage at the site. Specifically, the goal was to demonstrate that production level throughput at a commercial facility was achievable versus the current process on a case-by-case basis or storage until on-site capabilities could be obtained. Approximately 243 m^3 of suspect TRU waste was dispositioned during the Pilot Program.

Wastes included in the Pilot Program were large package, low gram (g) suspect TRU waste (<15g SNM per container), in addition to the large package contact and remote handled MLLW already in process, that met DOT requirements for transport to the off-site PFNW facility. Low gram TRU waste was defined by the CHPRC as <15 g of SNM per the NRC definition and includes all Pu isotopes as well as U-235 and U-233 isotopes. The intent of this pilot process was to also prove that segregation of the wastes could prove cost effective. It was fully expected that most of the material in the large boxes could easily be removed, with the vast majority of the suspect TRU waste characterized and subsequently managed as MLLW. It was also important to prove this process was achievable while not interfering with the commercial facility's commitment to their other waste generators and CHPRC's own MLLW treatment program. Commercial facilities generally have NRC RML limits that must not be exceeded making quick turnaround times essential. Once segregated and assayed, the TRU portions were packaged to meet the WIPP requirements and returned to the Hanford Site where they were certified by the Central Characterization Project (CCP) for WIPP disposal. MLLW/LLW

portions were immediately treated at the PFNW facility and then disposed at Hanford through the CHPRC Mixed/Low Level Waste Disposition Project. Under the Pilot Project 44 m^3 of TRU waste compliantly packaged and returned to the Hanford Site for certification; the remainder was MLLW. Clearly, the process could achieve significant cost savings, and reduce TRU waste volumes.

The second phase, begun in November of 2010, targeted an additional 485 m^3 of suspect TRU waste in large packages. This phase was intended to demonstrate that the remaining 7,400 m^3 of lower gram suspect TRU could be segregated, size reduced, and repackaged at "production level" throughputs. However, many of these remaining waste packages were at the upper end of the low gram category, had higher dose rates associated with them, and incorporated much larger packages (some in excess of 60 $m^{3)}$ than the packages that were addressed in Phase One. This required additional development of tools and capabilities. As before, segregation, characterization, and size reduction were to be completed at the commercial facility, with the LLW/MLLW portion being immediately treated at the commercial facility and the TRU portion returned to the Hanford Site for certification and shipment to WIPP. Many of these large packages did not meet DOT regulations for transport and required additional safety analyses or equivalencies prior to shipment; therefore this phase included working with the DOT regulations and DOE regulators on issues to transport these large packages safely and compliantly off-site for processing.

1,316m^3 of suspect TRU waste in large containers has been processed during Phase 2.

Another part of the program that grew out of the two phases was the incorporation of processing suspect TRU wastes from a point of generation (POG) perspective. In this case, it was common practice for waste generators to deliver suspect TRU wastes to the Hanford Central Waste Complex (CWC), where the waste would be stored until it could be entered into the Hanford TRU waste program for repackaging and certification. This process creates multiple handling of wastes and additional storage costs and hampers efficiency in having adequate backlog volumes of certifiable TRU waste for shipment. In two specific cases, demolition preparation of the PFP and the Waste Retrieval Project, it was determined that most if not all the waste could be added to the phase two process for commercial processing to augment the site's strapped resources addressing repackaging of the legacy suspect TRU waste volumes already in storage at the CWC. Direct packaging and shipment of PFP TRU waste glove boxes commenced in March of 2011 and continues today. Direct packaging and shipment of suspect TRU waste from retrievably stored waste commenced in May of 2011 and finished in September when the project was shut down. To date more than 1,300 m^3 of suspect TRU waste has been successfully transported, segregated, characterized, treated, and returned to the Hanford Site during phases one and two of this project.

The current plan is to continue to process the remaining volume of Phase Two lower gram suspect TRU waste that the commercial facility can accept, as well as adding in Phase Three wastes; the next level of SNM concentration. This portion of waste is >50g of SNM per container but will be limited by what can be received in the PFNW facility under their RML and agreed to

contractually to support their continued operations. Thus the process will be highly dependent upon CHPRC and PFNW carefully managing license inventories at the PFNW facility. A fourth phase is now envisioned with the potential of increasing the PFNW RML limits and negotiating higher SNM quantities within the CHPRC contract. However, funding to disposition the remaining phase two volume or to proceed with phase three is not currently available and the processes have been placed on hold, except for newly generated suspect TRU waste from the continued PFP demolition preparation mission. Additionally, the WIPP Certification program through CCP is no longer operational at the Hanford Site, and shipments are not planned from the Hanford Site to WIPP until FY2015, at the earliest.

CHALLENGES

A significant challenge to implementing this program has been the fact that the majority of the Phase Two and all of the Phase Three wastes contain greater than A2 quantities that would normally require transport in Type B packaging systems. Existing Type B packages are not large enough to transport the majority of the waste whole and are cost prohibitive to develop. Also critical to program success was the ability to manage SNM inventories through the commercial facility. These challenges drove the following lines of inquiry during program planning:

1. Can we safely and compliantly transport the Type B waste in Type A packages and do we have the mechanism to do so?
2. Can we design and procure containers that were large enough to contain the waste being transported - either whole glove boxes or very large, degraded waste packages directly from the retrieval site?
3. Can we effectively manage SNM levels at the commercial facility to maintain both RML and contract compliance?
4. Does the commercial facility have the existing capabilities to accept and manage the waste economically and compliantly and can those capabilities be expanded?

ADDRESSING TRANSPORTATION AND CONTAINERS

The Hanford Site transportation programs are managed under the auspices of the Hanford Transportation Safety Document (TSD). This safety document, among other things, provides a methodology that allows for the safe transport of specific waste types with greater than A2 quantities using DOT-compliant, Type A containers as risk-based packages. The methodology is based on transportation hazards and accident analyses, resulting in a series of pre-approved risk-based packages and controls for specific waste types (e.g., contaminated equipment, retrieval packages). These risk-based authorizations typically address repetitive shipments of high volume payloads for which it would be cost prohibitive to achieve DOT compliance during transport with little or no benefit in increased safety margin. Also included are provisions for shipping packages on public access roadways on DOE property. Under these provisions the risk-based approach provides DOT-equivalent controls that ensure that the payload is contained in multiple packages or confinement layers sufficient to meet normal conditions of transport without failure. Further, since the PFNW facility is immediately adjacent to the Hanford Site, the roads are on DOE property and can be effectively controlled to avoid interaction with or increased risk to the public and workers.

Once the transport methodology was identified, CHPRC designed and procured large Type A packages for use in transporting the waste to PFNW. The resulting packaging systems include the Super 7A, a DOT-compliant system capable of transporting a waste package in excess of

70 m^3, the Top Hat container, an IP II transport system of similar dimensions, as well as a variety of DOT-complaint "connex" container systems of both classifications. All are capable of containing truckload volumes of waste, which have been the primary means of transporting these wastes for processing. Additionally, each was designed and created to address multiple needs and remain "re-usable" to avoid long-term expenses with one time transport system replacements. The key component in these packaging systems is to reduce the amount of sizing by projects that are not equipped to do so, as well as the avoidance of excess costs and schedule impacts created by having to handle wastes multiple times. This is especially impractical when a facility designed and built to do such work is located so near the proximity of the Hanford Site.

In accordance with the TSD provisions and using these specially designed packaging systems, high-activity glove boxes have been packaged and transported whole from the POG directly to PFNW for size reduction, segregation, characterization, and packaging into WIPP-compliant forms. Similarly, large, highly degraded retrieval packages containing up to 70 m^3 of waste per package were managed directly from the retrieval trench face to PFNW for processing and disposition. In each case, the projects were able to maintain, and even improve, cost and schedule performance, and move more efficiently in completing their primary missions.

An additional benefit derived from these efforts was the inclusion of small container wastes (e.g.; small boxes and drums) from the POG into the waste processing streams. In this case, use of the smaller "connex" style transport systems, known as the "cruiser", were able to be directly loaded at the remote burial ground areas and moved directly off site for commercial processing. Coupled with the "next generation" retrieval process, which characterized suspect TRU containers at the trench retrieval face, this allowed for segregating streams earlier in the process that were able to be sent directly for treatment, or repackaging into WIPP-compliant containers at the PFNW facility. At one trench alone, the process allowed for over 1,000 drums of waste to be directly sent for processing and treatment, nearly 85 percent of the total volume retrieved there, with those containers going to the LLW/MLLW side of the ledger.

Some wastes required unique packaging approaches and designs. In the case of the PFP glove boxes, the typical end-load "connex" box was not practical or effective. The real need was to allow for rigging crews to set the larger boxes, some in excess of sixteen feet long, into a container with a crane but assure that access could be safely maintained for cribbing. The design of choice was a flip top box, with side and/or end access for personnel to brace. Another choice was the side load with ramps to allow for rigging crews to simply wheel in the smaller boxes and secure them in the container.

As stated previously, each of the systems was designed for multiple uses with life expectancies in the range of twenty years.

INVENTORY CONTROL

To provide cradle-to-grave management of SNM, Materials and Energy Corporation (M&EC), a subsidiary of PESI and contractor to CHPRC, developed a robust planning tool that provides real-time data to support waste generation, transportation, treatment, and disposition. This tool, which is known as the Treatment Integration and Planning Tool (TIPT), is an Excel®-based spreadsheet that tracks required resources, scheduled shipments, SNM quantities, receipt and each processing step at the PFNW facility, as well as waste return and disposition. It has been a key development to ensuring compliance while achieving goals for suspect TRU waste processing at PFNW.

Most importantly, the tool now provides a predictive capability to the W&FMP to assess and manage inventory projections to determine a more reasonably manageable feed stream into the commercial facility. The tool is also valuable in that the W&FMP, along with the DOE, are able to include other site contractors into the planning processes and use this to evaluate priority, and assure the facilities are able to process material in a timely and effective manner. While this is not always optimal for a material handling standpoint, it acknowledges and manages the reality of problems as they arise.

A specific example was the demolition processes of the 209E facility on the site. During characterization a series of tanks were found that were used in the criticality laboratory section of the building. Unfortunately, these tanks, thought to have been thoroughly flushed many years ago, proved to be highly contaminated and contain a significant amount of TRU material. Since the facility was already in demolition, stopping to handle the tanks in field was out of the question. Further, the PFNW facility was already committed to other waste streams and did not have sufficient inventory available to accept the tanks. Working with the DOE, the W&FMP was able to predict when the tanks could be processed and funding and schedules were adjusted to assure the tanks could be processed under American Reinvestment and Recovery Act (ARRA) funding without impact to on-going projects. The tanks were removed and packaged for transport but remained in interim storage until the waste could be moved safely to the PFNW facility. This kept the project on schedule for demolition and assured funds remained for processing of all the waste materials. Since the capability to predict now existed, the contractor and DOE had time to make funding adjustments.

FACILITY ADAPTATION

Finally, in order to offer the most robust capabilities possible, PFNW has made modifications to accommodate shipments of large container, high dose rate materials including:

- Installation of a rail spur at the vendor facility to more efficiently transport oversized containers that do not meet DOT requirements for transport. Prior to this addition, many containers were transported using road closures from the Hanford Site to the vendor facility.
- Installation of a contracted assay capability by CHPRC to provide accurate segregation of TRU waste from LLW/MLLW at the vendor facility. This allowed PFNW, with CHPRC approval, to treat LLW/MLLW prior to returning the waste to the site for disposal. It also provided confidence that, upon return to the site, CCP would be able to certify TRU wastes for WIPP characterization with lower percentages of drop outs of LLW/MLLW.
- PFNW was able to adjust facility configurations to more effectively manage the larger packages after the phase one pilot project. Lessons learned from this process were also incorporated into the physical facility with the enlargement of access doors to allow for the waste packages to be move into the facility in one piece, versus some sizing prior to entering the enclosed part of the facility.

As previously mentioned, PFNW is exploring RML amendments to allow more efficient processing of higher SNM anticipated during phase three of this program, as well as the now envisioned phase four.

CONCLUSION

In this truly collaborative effort:

- DOE, through the Hanford Sitewide TSD, modified and approved special packaging authorizations that are used to safely transport oversized packages to the offsite treatment facility.
- CHPRC designed and procured an oversized Type A container for transport and developed a robust inventory control system with real-time flexibility to ensure inventory control of special nuclear materials at the offsite facility.
- PESI expanded capabilities at their PFNW facility including plans to modify existing radioactive materials licenses to allow receipt of greater quantities of SNM, physical modifications to the facility (including installation of a rail spur) to enable acceptance of large packages, and placement of a CHPRC held subcontract for the installation and independent operation of an assay system in the facility to support waste classification.

DOE-RL and CHPRC continue to evaluate commercial capabilities for waste disposition that may increase the volume of waste suitable for commercial treatment, incorporating lessons learned to continually improve the process and provide the most cost-effective route to disposition newly generated and legacy wastes from the Hanford Site.

To date, the results of these efforts have been promising and yielded results previously believed to have been impossible to achieve. Much of the planning for the Hanford Site had assumed the development and construction of a new, purpose-built capability to handle these waste streams. However, since costs were clearly limiting in development of that capability, as demonstrated by the continual movement of the schedule for this into the future, it was obvious that an alternative approach would be necessary and desirable. Further, while disappointing that the current funding profiles do not support continuation of the process at this time, it is also clear that the process is possible, practical, and beneficial. CHPRC remains committed to this process as the primary tool in addressing these waste streams going forward.

Based on the current plans, coupled with future licensing plans, it is believed that all but 1,000 m^3 of the estimated 11,900 m^3 of suspect TRU waste can be effectively processed commercially at a total project cost of approximately $300 million. The remaining 1000 m^3 can then be processed via mobile enclosures with adapted tools at an estimated cost of $40 million, versus the previously planned facility build, or modification of existing facilities. The plans would avoid the estimated cost of $540 million for a new facility and $1.2 billion operational costs over 10 years.