THE ADVANTAGES OF FIXED FACILITIES IN THE CHARACTERIZATION OF TRU WASTE

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ABSTRACT

In May 1998 the Hanford Site started developing a program for characterization of transuranic (TRU) waste for shipment to the Waste Isolation Pilot Plant (WIPP) in New Mexico. After less than two years, Hanford will have a program certified by the Carlsbad Area Office (CAO). By picking a simple waste stream, taking advantage of lessons learned at the other sites, as well as communicating effectively with the CAO, Hanford was able to achieve certification in record time. This effort was further simplified by having a centralized program centered on the Waste Receiving and Processing (WRAP) Facility that contains most of the equipment required to characterize TRU waste.

The use of fixed facilities for the characterization of TRU waste at sites with a long-term clean-up mission can be cost effective for several reasons. These include the ability to control the environment in which sensitive instrumentation is required to operate and ensuring that calibrations and maintenance activities are scheduled and performed as an operating routine. Other factors contributing to cost effectiveness include providing approved procedures and facilities for handling hazardous materials and anticipated contingencies and performing essential evolutions, and regulating and smoothing the work load and environmental conditions to provide maximal efficiency and productivity. Another advantage is the ability to efficiently provide characterization services to other sites in the Department of Energy (DOE) Complex that do not have the same capabilities.

The Waste Receiving and Processing (WRAP) Facility is a state-of-the-art facility designed to consolidate the operations necessary to inspect, process and ship waste to facilitate verification of contents for certification to established waste acceptance criteria. The WRAP facility inspects, characterizes, treats, and certifies transuranic (TRU), low-level and mixed waste at the Hanford Site in Washington state. Fluor Hanford operates the $89 million facility under the Project Hanford Management Contract. This paper describes the operating experiences and results obtained during the first year of full operations at WRAP. Interested audiences include personnel involved in TRU waste characterization activities, TRU waste treatment and disposal facilities and TRU waste certification. The conclusions of this paper are that WRAP has proven itself to be a valuable asset for low-level and TRU waste management.

INTRODUCTION

With the opening of the Waste Isolation Pilot Plant (WIPP) facility in New Mexico in the spring of 1999, the possibility of the long-planned disposal of transuranic (TRU) waste from facilities across the country is being realized. Disposal of waste at WIPP, however, requires compliance with all applicable regulations, including the WIPP Hazardous Waste Permit and WIPP Waste Acceptance Criteria (WAC). These criteria require

facilities to thoroughly characterize and certify the contents of waste packages prior to acceptance for disposal. Facilities desiring to dispose of their TRU waste at WIPP must decide how that characterization and certification can best be performed for their particular waste streams. The choice of approaches often involves decisions on construction of new "fixed" or permanent facilities for waste characterization versus use of "portable" equipment or field methods. This paper presents some of the pros and cons involved in making these decisions, and describes the first year of full operations experience at Hanford's fixed waste characterization facility.

WASTE RECEIVING AND PROCESSING FACILITY

At Hanford, the Waste Receiving and Processing Facility (WRAP) is a central component of the TRU waste certification process. WRAP is a recently commissioned facility designed to consolidate the operations necessary to inspect, process and ship waste containers to facilitate verification of contents for disposal of low-level waste (LLW) or certification of compliance with established acceptance criteria for disposal of TRU waste. WRAP was authorized to begin full operations with TRU waste in September 1998. The decision to construct a permanent facility to accomplish waste characterization and processing was made several years ago and included evaluations of the tradeoffs involved between fixed and mobile systems.

With WRAP becoming fully functional, Hanford has been able to successfully prepare for shipment of TRU waste to the WIPP. Hanford started its WIPP certification program in May 1998, and received the initial Carlsbad Area Office (CAO) audit of the certification program in July 1999. During preparation for the initial audit, Hanford personnel were in close communication with CAO personnel to keep abreast of the latest problems and developments, and took advantage of lessons learned at other sites as they developed their certification programs. Hanford chose a simple waste stream, commonly referred to as the "low hanging fruit," to be the initial candidate for certification. The results of these efforts were effective, with CAO noting only minor deficiencies and no major programmatic issues. Final certification of the Hanford Site was delayed to January 2000 to allow implementation of the WIPP hazardous waste permit. Initial shipments from Hanford to WIPP consisting of waste that has been characterized, certified and packaged at WRAP are anticipated in the March 2000 timeframe following successful completion of the WIPP certification process.

MOBILE SYSTEM CHARACTERISTICS

Mobile waste characterization systems have been developed over the past few years, and will have a legitimate role in overall waste management schemes, depending on specific waste stream parameters and site missions. Mobile systems are generally designed to be located where the waste is stored or generated, as distinct from a separate fixed characterization facility located further from the waste source(s). Most mobile systems utilize non-destructive examination capabilities such as x-ray machines, radiation detection equipment, and/or passive/active neutron interrogation systems similar to those found in fixed facilities. Possible advantages of mobile systems include relatively lower capital costs, flexibility to accommodate moving the system to where the waste is located, and general simplicity of operations arising from use of equipment that can be

made portable. On the other hand, mobile systems with the capability to perform visual examinations and waste repackaging to remove non-compliant items are not commonly available at this time. There are also potential disadvantages to mobile systems, including changing background conditions complicating instrument calibrations and sensitivities as they are moved from place to place, size limitations, and less engineered protection against operational upsets that may be encountered from unknowns in the waste. With a mobile system, any unplanned downtime can incur standby costs, in addition to the mobilization costs. For TRU waste certification, decisions on the use of mobile systems must be integrated into the certifying site's waste certification program.

FIXED SYSTEM CHARACTERISTICS

Permanent fixed facilities provide some advantages over mobile systems at the expense of higher capital costs. The advantages include greater operational flexibility and capability to handle more diverse waste forms. Being located in permanent buildings, fixed facilities provide a stable controlled location for sensitive equipment and facilitate regular routine maintenance and calibration schedules. Improved calibration practices can provide commensurate enhanced reliability and better sensitivity. Fixed facilities also can generally accommodate a broader spectrum of waste forms through incorporation of engineered protective safety features such as shielding, confinement systems and remote waste handling that provide improved worker safety and environmental protection from operational upsets. Fixed facilities also allow potentially higher production rates by incorporating weather protection, surge storage capacity that provides planned campaign flexibility, and designed waste treatment capacity. Anomalies discovered during the waste characterization process can often be remedied on the spot through the designed treatment capacity of the facility. Fixed facilities also have the added advantage of providing operational flexibility. If a problem arises with one area of operations, resources can be shifted to work in other areas. One potential disadvantage of fixed facilities is that waste that has been stored for long periods may require more robust packaging for transport to the fixed facility (possibly overpacking into new shipping containers) than may be required for mobile systems that bring the characterization equipment to the storage location of the waste. The major disadvantage for smaller sites with short-term missions is the high cost of constructing fixed facilities.

LESSONS LEARNED AT WRAP

Based on the foregoing types of considerations, Hanford decided on construction of WRAP, an $89 million facility designed to characterize and provide limited treatment of contact handled TRU and low-level waste. The WRAP facility was described in more detail in a poster session by the same authors at last year's Waste Management '99 Symposium. WRAP also includes a TRUPACT load out station that provides a platform for safe loading of waste containers into TRUPACT-II casks for transport to WIPP. During its first full year of operations, WRAP faced several challenges in starting and operating the process area confinement systems (gloveboxes), automatic remote container opening equipment, calibration of the nondestructive assay equipment, and other normal shakedown problems associated with new equipment and systems.

There are several "lessons learned" from the initial year of operations mentioned here for the benefit of others who may need to construct similar facilities. The WRAP operating staff has indicated that there are some operational penalties associated with sophisticated and complex technological systems which could be mitigated to some extent during the design phase of a project much more effectively than during operations after systems have become contaminated. It is imperative that manual modes of operation be provided for complex systems that may fail or require extensive troubleshooting and maintenance to operate. The remote manipulator systems for removing drum lids in the glovebox experienced difficulty in removing highly torqued or corroded bolts and lids that had adhered to the tops of the drums. Better tools and procedures were required to resolve this problem. The drum tipper, used to lift and dump the drum contents onto a sorting table in the TRU waste glovebox, failed during the first six months of operation. A backup system for the tipper was not provided, and only through an innovative approach employed by operations personnel was the facility able to continue glovebox operations. Final corrective actions for this problem, in a glovebox contaminated with TRU isotopes, are still being developed.

The bagless transfer system used at WRAP to remove drums of waste from the TRU waste process glovebox typifies the types of problems encountered. Although conceptually sound, practical experience has shown that the designed airflow and connection devices required improvement to effectively control the contamination hazard from highly mobile TRU radionuclide contaminants released when drums are opened and the contents emptied. The relatively small amounts of contamination that leaked past the as-designed lids required workers who receive discharged containers to wear more personal protective equipment (respirators) than initially planned until the design was corrected. Installation of supplemental ventilation exhaust to control the airspace around the lids largely corrected the problem.

An additional issue is that 55-gallon drums are not precision pieces of equipment. Tolerance variations between drums caused numerous sensor problems resulting in interruption of operations. For example, the bagless transfer system uses a special inner drum lid (one- trip lid) that serves to isolate the waste while the drum is being moved away from the glovebox after repackaging. The one-trip lids were not ordered to exact specifications, and as a result the swaging device that locks the lid into the drum did not always work, leaving the lid attached to the glovebox port when the drum was removed. Several months of effort were required to correct the problem, as well as establishing exact dimensional tolerances for manufacture of the lids.

As another example, to transfer drums from station to station at WRAP, an automatic guided vehicles (AGV) is used to minimize worker exposure. The AGVs are guided by laser beams that can be interrupted, interfered with and reflected by shiny surfaces causing the vehicles to become "lost". Resolution of this problem required the expenditure of considerable effort to make the system work under operational conditions. The AGVs are also slow and generally less efficient than using manual drum hand dollies for moving the waste containers short distances. While appearing to be a good idea

during the design phase, in reality, this level of automation is not necessary to protect workers handling low dose rate, contact handled waste.

Use of "one of a kind" or uniquely designed articles can cause problems with spare parts and maintenance. Use of well-proven "off the shelf" commercial products that have been tested under similar work conditions is highly recommended. WRAP also incorporated several components supplied by foreign vendors, making procuring replacement parts or assistance in troubleshooting problems a logistics nightmare.

Some additional space for other operating equipment and flexibility would be desirable. The design could have accommodated use of either glovebox line for TRU waste to provide more throughput capacity and flexibility. Additional surge storage would also be desirable. Anticipation of all functional requirements early in the design would be good, along with more involvement of operations staff. There are also some ergonomic issues, including excessive noise from hydraulic power units and vacuum pumps located in the process area, and less than optimum NDE operator workstation layout that could have been avoided in the design. The concrete masonry walls, epoxy-coated floors, and size and location of gloveboxes in the process area combine to render the facility public address system very difficult to hear without extensive reengineering. Some improvements in Radiological Control design could also have been incorporated. At WRAP, the personnel decontamination room is in the same airspace as the process area, and the ingress/egress areas could be designed to facilitate easier access.

Complicating the planning effort was the lack of understanding and final definition of the WIPP certification requirements when the facility was being designed in the early 1990s. Drum head-gas sampling equipment was not included in the original WRAP design, necessitating transfer of waste containers to another facility to perform this activity. The NDE/NDA equipment is situated so close together that interference from calibration sources prevent operation of one set while the other is being calibrated. The difficulty in completing the NDA data reduction was also underestimated when planning facility throughput and capacity. Additionally, the complexity of the WIPP requirements for NDA system calibration and operation, and the requisite expertise to incorporate these requirements, is not widely available. WRAP has been required to procure NDA expertise from off-site sources to resolve issues associated with calibration of the equipment to meet WIPP certification requirements. For Hanford, calibration of the NDA equipment has been the hardest problem to overcome.

Some positive features demonstrated during operations include the automatic drum stacker/retrieval system, actual operation of the NDE equipment, and the supercompactor in the LLW glovebox. The TRUPACT loading area is well designed and allows for efficient, safe loading of the casks for shipment to WIPP. The supercompactor in the LLW line is effectively reducing the volume of processed waste, which effectively reduces the footprint of on-site disposal trenches.

The waste streams processed at WRAP during FY-1999 consisted of drummed waste from storage at the Central Waste Complex (CWC) adjacent to WRAP. During the year,

349 drums of TRU waste were shipped from CWC for processing; 64 of which were determined to be ready for disposal, and 195 of which were scheduled for head gas sampling at another Hanford facility. The balance (90 drums) was in surge storage at WRAP; 25 of these drums were determined to contain only LLW, falling below the 100 nCi/g TRU threshold, and 28 drums were selected for visual examination in the process gloveboxes. During the year, several items were observed in drums that were not anticipated. The nondestructive examinations detected such non-compliant items as light bulbs (containing lead), a fire extinguisher (not listed in the contents), batteries (regulated disposal requirements), lead shielding and other objects (regulated disposal requirements), and unabsorbed liquids (untreated liquids prohibited) that require removal during processing in the gloveboxes.

CONCLUSION

In summary, WRAP has shown itself to be a valuable asset in managing wastes at Hanford. As systems become more familiar, operational "bugs" are worked out, and WIPP certification requirements are finalized and implemented, the operations at WRAP will become increasingly more efficient and effective in allowing proper characterization, sampling and verification of waste streams to their associated acceptance criteria. There have been numerous lessons learned subsequent to completion of the design of the WRAP facility. However, the success achieved during the initial year of operations has proven the value of the overall facility concept. As a final illustration of the benefit WRAP is providing to date, the miscertification rate of containers processed through WRAP, as defined by the WIPP WAC, is zero. This provides the high degree of confidence needed to ensure compliance with applicable regulations, permits and criteria for disposal of Hanford waste.