WIPP Status and Plans - 2010 – 10363

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ABSTRACT

The Waste Isolation Pilot Plant (WIPP) is completing its 11th year of operations. The 10-year RCRA permit renewal process by the State and the periodic 5-year re-certification process by EPA are both in process. New small quantity sites are being de-inventoried by consolidating their waste through the certified characterization line at the Idaho National Laboratory (INL). New emplacement methods for RH waste in shielded containers (gamma and neutron) are under development. A new Type B shipping package, the TRUPACT-III is being added to the transportation fleet. Waste emplacement recently switched from the eastern half to the western half of the underground footprint, thereby visually implying WIPP is more than half full. These, and other developments, make for exciting times at WIPP.

This paper presents an up-to-date look at the many aspects of America's only deep geologic long-lived radioactive waste repository. WIPP's mission includes coordination of all Department of Energy (DOE) sites to prepare, package and characterize transuranic (TRU) waste for final shipment and emplacement in WIPP. This paper discusses the inventory emplaced to date and those waste streams planned for characterization in the near future. In the past year, DOE has issued packaging guidelines for TRU waste sites that want to package prior to the development of a certified characterization program at that site. The guidelines minimize the possibility of having to repackage once a certified characterization program is instituted.

Several new routes for shipping TRU waste both to WIPP and from small quantity sites to the consolidation site at the Idaho National Laboratory (INL) were negotiated and established in the past year. These new routes required emergency responder training along them. The paper presents the routes and describes this process. Additionally, the paper presents the status of the new shipping container, called the TRUPACT-III, and that of two new shielded payload containers, one for gamma-emitting remote handled waste and the other for neutron-emitting remote handled waste.

In 2009, the fourth disposal panel (out of 10 planned) was filled, and disposal operations began in panel No. 5. Simultaneously, mining operations began to create Panel No. 6. These two new disposal units are situated on the west side of the common access drift at WIPP, opposite the four filled panels. This requires new ventilation patterns underground. The paper describes this accomplishment and discusses how the new underground waste footprint does not necessarily imply that WIPP is more than half full.

WIPP is using American Recovery and Reinvestment Act (ARRA) funding ($172M planned) for a very wide variety of efforts, including accelerating characterization and shipping rates to record highs. ARRA funds are also being employed for facility upgrades to ensure longevity and reliability, which are described by priority in the paper.

INTRODUCTION

The WIPP project has been the subject of literally hundreds of papers and presentations over almost 40 years since its conception in the early 1970's, so no introductory description of its operation is given here. A recent issue of Radwaste Solutions Magazine (May/June 2009) was entirely devoted to WIPP in recognition of the facility's 10th operating anniversary. For a detailed look at WIPP and its many attributes, along with a complete description of its operation, the reader is encouraged to review that issue [1].

2009 ACCOMPLISHMENTS

Last year, the 11th year of operation, saw many WIPP accomplishments, and few setbacks, although there were a few. The most notable accomplishments are summarized in the list below (ranked according to the authors' opinion in descending order of importance).

- Celebrated 10-years of operations, receiving over 21,000 shipping packages in over 8,000 shipments over almost 20 million miles of safe transportation, and filling WIPP to more than a third of its legislated capacity.
- Submittal of the Compliance Recertification Application to EPA to authorize 5 more years of operation under their certification.
- Submittal of the Hazardous Waste Facility Permit renewal application to the New Mexico Environment Department to authorize 10 more years under their permit.
- Opened a new Carlsbad office specifically for coordinating work under the American Recovery and Reinvestment Act, and obligated all $172M stimulus funds allotted to the Carlsbad Field Office.
- Initiated waste characterization and certification efforts at 2 more sites with Centralized Characterization Project staff at Oak Ridge National Laboratory and the General Electric Vallecitos facility (California), bringing the number of active shipping sites up to seven.
- Initiated inter-site shipments from small quantity sites to the Idaho National Laboratory for characterization for disposal and subsequent shipment to WIPP.
- Implemented the first site-wide Documented Safety Analysis in the Environmental Management complex under DOE's new order: DOE-STD-5506-2007.
- Developed and issued packaging guidance to minimize the likelihood of re-packaging at future DOE sites that might potentially send TRU waste to WIPP.
- WIPP was honored with a special achievement transportation safety award from the United States Transport Council.
- Completed the first shipping campaign of 16 remote handled waste canisters from Los Alamos National Laboratory.
- Researchers initiated operation of the world's largest double-beta decay particle physics experiment in the WIPP underground, attempting to determine the mass of the neutrino.
- Completed longest maintenance outage since opening (6-weeks), which will allow uninterrupted shipments for many more years to come.
- Developed a new shielded canister configuration for shipping neutron emitting waste.
- Successfully retested a Type B shipping cask, the TRUPACT-III, for large boxes.

WIPP STATUS

Regulatory Status

Several other papers presented in this year's Waste Management Symposium (and to be published in the proceedings) discuss the regulatory status of the Hazardous Waste Facility Permit (HWFP) granted by the New Mexico Environment Department (NMED), and the Compliance Re-certification from the Environmental Protection Agency (EPA). For detailed discussion of these two major regulatory umbrellas, the reader is encouraged to peruse these other papers in Session 30. However, it will be mentioned here that the HWFP (which is the State equivalent of a permit under the Resource Recovery and Conservation Act for hazardous materials) was issued by NMED in 1999 for an effective period of 10 years. Thus, DOE submitted a permit renewal application to NMED in May 2009, with a supplemental submittal in October 2009. The NMED declared the renewal application "administratively complete" at the end of November 2009, which means that a draft permit for comment will be issued (by NMED) in the Spring of 2010. After comments are received, DOE expects that there will still be a hearing that will require some time before the "renewed" permit is issued. Similarly, the certification under Title 40 Code of Federal Regulation, Part 194, issued by EPA, must be reevaluated every five years to demonstrate continued compliance with the disposal standards at 40CFR191. DOE submitted the second re-certification application to EPA in March 2009 and it is also undergoing review by the agency for administrative completeness.

To improve efficiency, DOE has developed and proposed alternate methods of safely packaging and shipping remote handled waste to WIPP. A lead-lined Type A container [2] for overpacking 114 liter (30-gallon) drums containing gamma emitting radioactive materials was certified by the Nuclear Regulatory Commission (NRC) in May 2009 for transport in the previously licensed Type B shipping cask known as the HalfPACT [3]. In addition, DOE completed development and testing of a neutron shielded canister for shipping neutron emitting waste with dose rates greater than 2 mSv/hr on contact [4]. These neutron shielded canisters employ commercial high density polyethylene pipe materials to lower the neutron flux escaping the canister. This is needed when both gamma and neutron-emitting materials are present since the RH-72B shipping cask for remote handled waste only shields gamma radiation [5].

Figure 1 shows both the gamma shielded container and the neutron shielded canister schematically. The gamma shielded container was developed and tested in 2007, and was the subject of a planned change request submitted to EPA in November 2007. EPA continues to consider its approval. DOE plans on submitting a HWFP modification request to NMED near the beginning of 2010 for NMED approval to the use the gamma shielded container for disposal of remote handled waste in WIPP. The neutron shielded canister was developed and tested in the Fall of 2009, and DOE will submit a license amendment request to the NRC in January 2010 for shipment of the neutron shielded canister inside the RH-72 remote handled waste shipping cask. NRC approval is expected by the end of 2010. Note that DOE does not believe that use of the neutron shielded canister requires regulatory approval by EPA or NMED because there will be no change to the way that remote handled canisters (with neutron shield inserts inside) are managed or emplaced at WIPP; the only change is in the shipping configuration, which is regulated by the NRC. However, DOE will engage its regulators as the neutron shielded canister program proceeds and, if necessary, submit a permit modification request to NMED and planned change request to EPA. Barring challenges made by WIPP critics during the regulatory

approval process, DOE anticipates the use of both gamma shielded containers and neutron shielded canisters in 2011.

Another initiative to gain efficiency is the development of a new shipping package, called the TRUPACT-III. A significant fraction of the retrievable TRU waste around the DOE complex is already packaged into large boxes [6]. The exposure hazard and cost of facilities to repackage these boxes into payload containers that could be shipped in the workhorse of the WIPP shipping fleet, the (cylindrical) TRUPACT-II, led DOE to propose a large box initiative in 2003 that would eventually result in a new (rectangular) shipping container, referred to as the TRUPACT-III. A design based on an Areva shipping container used in France for similar purposes (the Gemini cask), was adopted and a test unit was constructed in 2005. In 2006, DOE tested the TRUPACT-III and submitted an initial license application to the NRC in 2007 for shipment of CH TRU waste in this new Type B package. Unfortunately, the licensing process led to a requirement to perform additional testing, which required construction of a second test unit. These supplemental tests were successfully completed in November 2009.

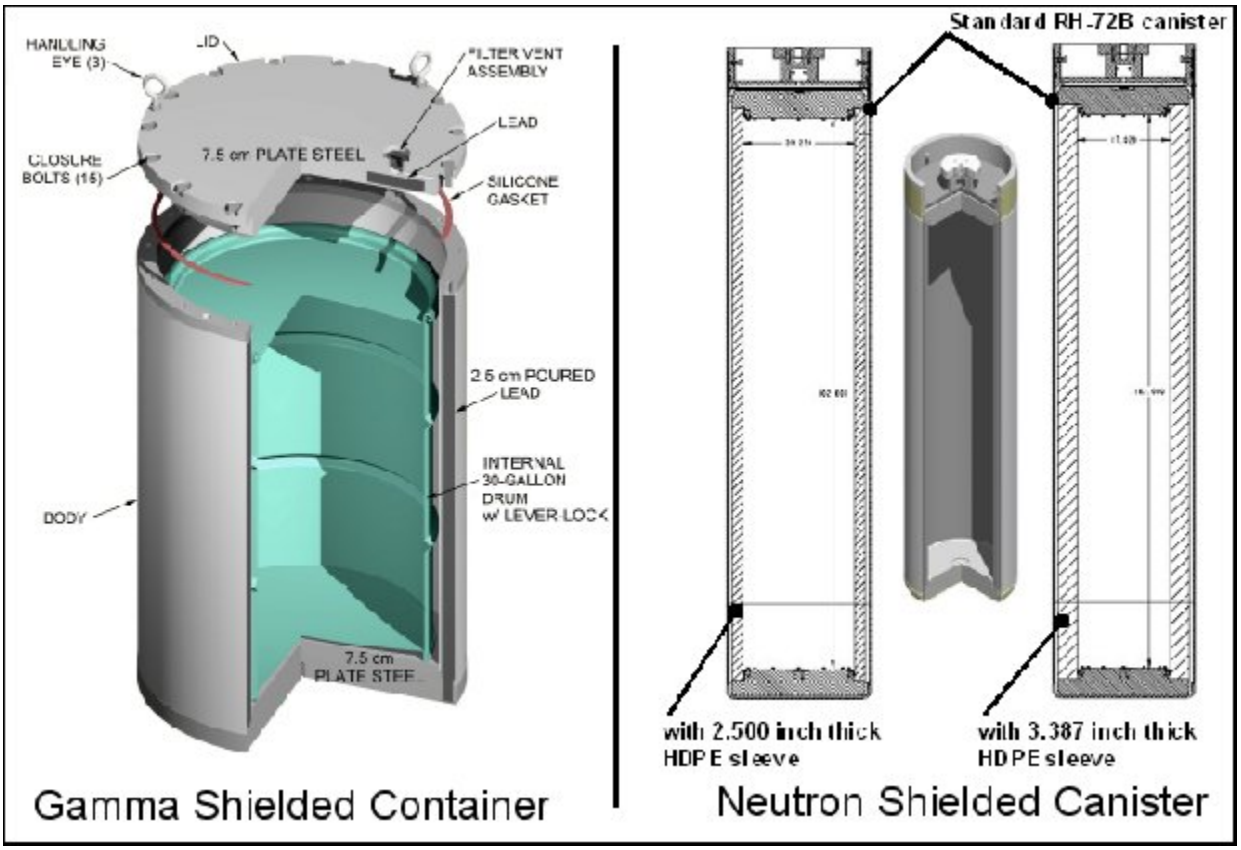

Fig. 1 Schematic of the gamma shielded containers and neutron shielded canisters proposed as alternative shipping and emplacement methods for remote handled waste at WIPP.

DOE submitted the TRUPACT-III supplemental license application to NRC at the beginning of 2010, and expects approval by the end of 2010. However, after NRC license approval, DOE must still submit a planned change request to EPA for approval of the payload containers that will be shipped inside the TRUPACT-III, the so-called Standard Large Box No.2 (SLB-2), as a waste emplacement container. This planned change request will demonstrate that the new waste configuration will not compromise the long term performance of the repository. Subsequently, a

permit modification request to allow the use of the SLB-2 as an approved disposal container must additionally be submitted to the New Mexico Environment Department to demonstrate that the new payload configuration will meet the requirements for protection of human health and the environment from the hazardous characteristics of the waste. It is unlikely that shipments to WIPP using the TRUPACT-III would occur before 2012. However, inter-site shipments of large boxes from Hanford to the Idaho National Laboratory (INL) could take advantage of the Advanced Mixed Waste Treatment Plant's (AMWTP) ability to repackage boxes for disposal at WIPP, and may occur in 2011.

Disposal Status

An unheralded milestone for WIPP was achieved in May 2009. Emplacement operations in Panel 4 were completed, and disposal in Panel 5 initiated. While this seemingly innocuous transition went smoothly and without fanfare, it is symbolic because it represents a flip across the symmetry axis of the underground disposal footprint, and visually implies that WIPP has passed the halfway point in filling the repository to its legislated capacity. Figure 2 shows the repository configuration, now that emplacement operations are active in Panel 5. Note that mining of Panel 6 began essentially in concert with waste emplacement operations in Panel 5.

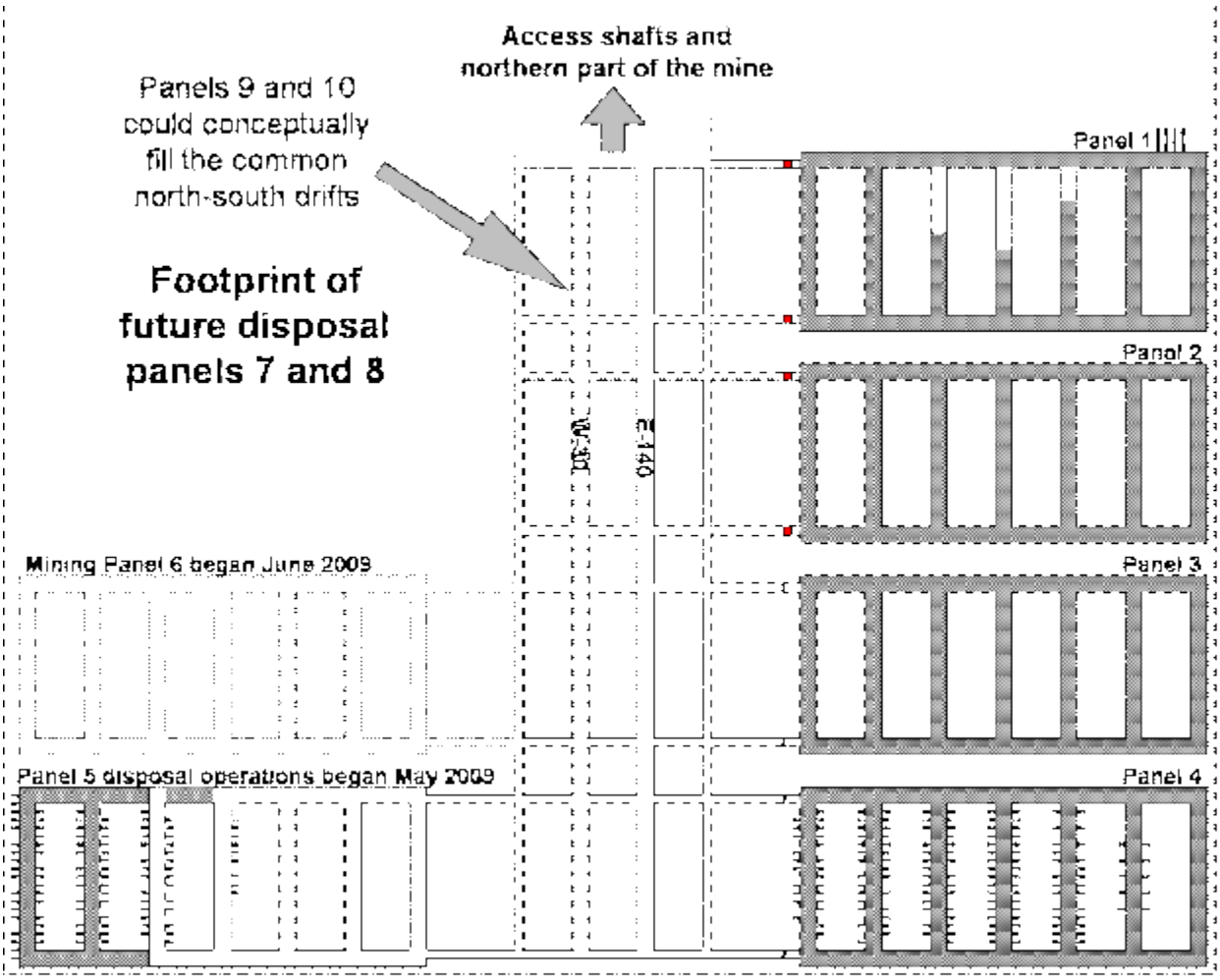

Fig. 2. Underground operations layout (approximate scale), showing four filled panels on the eastern side of the main axis, emplacement status of disposal operations beginning in Panel 5 and mining of Panel 6. Panels 5 and 6 are both on the western side of the facility's axis of symmetry.

The reader is reminded that the concept of a permanent deep geologic repository in salt for long-lived radioactive waste is based on the behavior of salt at lithostatic pressure to "creep" and close/fill any openings that have been created. Fractures heal, and the salt encapsulates the waste within, re-consolidating the formation to essentially an undisturbed state. At the disposal horizon at WIPP (656 meters deep), this closure rate is about 10-15 cm/y. Therefore, mining of future disposal rooms does not begin until about a year before they are needed in order to minimize ground control during emplacement operations. The legislated "capacity" of WIPP is actually a legal limit of 175,564 m^3. At the end of 2009, WIPP had emplaced a total volume of about 64,100 m^3, or about 36% of the limit.

Figure 2 shows both the contact handled and remote handled waste disposal footprint. The shading in each disposal room and panel indicates contact handled waste emplacement, while the remote handled waste canisters are schematically shown as dark lines in the ribs of the disposal rooms. Note that remote handled waste disposal did not begin until room six of panel 4. Early remote handled waste disposal rates have been slower than the contact handled waste receipt rates, leading to much of the rib "capacity" in panel 4 being unused. A similar trend can be seen in the remote handled disposal patterns in panel 5 to date.

After almost 30 years since initial entry, the WIPP underground repository continues to be stable and complies with the original geotechnical objectives and requirements. WIPP's underground layout is essentially unchanged since its original design. Excavation performance has met, and continues to meet, design requirements. However, the expected life of the project has increased through the years due to startup delays and modified priorities. Even with the extension, there is no reason to believe that with continued maintenance, the repository will not continue to perform adequately and will meet any desired life extensions. Geotechnical monitoring continues in all open areas, not only to confirm long-term performance, but also to ensure operational safety. This monitoring includes subsidence monitoring on the surface and geomechanical monitoring (e.g., convergence monitoring in the openings and dilation of the roof) in the underground at thousands of locations, visual observations including mapping and tracking developing fractures, and borehole observations.

However, this monitoring has shown sufficient degradation along the main north-south access drift (labeled E-140) in Figure 2 along Panel 1 that a decision was made in 2009 to widen the adjacent north-south access drift immediately to the west (W-30). This will allow alternate access to the disposal panels from the access hoist shafts to the north. DOE does not anticipate abandoning E-140, but intends to ensure redundant access will be available. That is why the central two north-south access drifts are shown as wider than the others in Figure 2.

Another mining stability consideration that is being studied is the use of the common drifts interior to the "wing-like" disposal panels, one through eight (1-8). The original design configuration of WIPP incorporated eight disposal panels (four to the east and four to the west of the common north-south running drifts). The full legislated disposal capacity) was originally (conceptually) planned to fill these eight panels plus the common areas in between the north-south access drifts as "equivalent" panels 9 and 10. DOE is evaluating the merits of abandoning the use of these common drifts as "equivalent" disposal panels 9 and 10. Alternatives include mining the area to the west of where panels 7 and 8 would be nominally mined and extending the footprint further to the west, or to mine additional space south of Panels 4 and 5. While 30 years

of geologic and geotechnical experience makes these obvious options to minimize risk to workers and the disposal mission (and save cost for the American taxpayer), any potential footprint change will certainly generate significant controversy among WIPP critics. Panel 6 mining will be complete by the end of 2010.

Facility upgrades began in 2009 and will continue into 2011 using ARRA stimulus funding. One of these is the development of a new, lightweight facility cask and associated emplacement equipment for transferring remote handled waste from shipping casks at the surface to its borehole emplacement in the underground. The original WIPP facility, including the existing facility cask and equipment was designed to shield canisters with surface dose rates more than 10 Sv/hr on contact. Negotiations with the State of New Mexico in the early 1980's led to a legally binding settlement called the Consultation and Cooperation Agreement, and limited the dose rates of 95% of the remote handled waste that WIPP could receive to less than 1 Sv/hr (only 5% was allowed to be between 1-10 Sv/hr). These limits were again codified in the 1992 WIPP Land Withdrawal Act [7]. Contrast this with the fact that the vast majority of the remote handled waste received to date exhibits dose rates on the surface of the canisters less than about 0.1 Sv/hr. Thus, the existing facility cask and emplacement equipment is far more robust than necessary to safely shield typical remote handled waste being shipped to WIPP. This makes movement of the equipment more difficult than it needs to be, and a lighter facility cask and associated equipment will allow significant efficiency gains. Of course the existing heavy shielding facility cask and equipment will also be maintained so that the small fraction of higher dose rate remote handled waste can be accommodated when it does show up.

Other ARRA stimulus funds are being used to replace or refurbish some of the older mining equipment, such as Load-Haul-Dumps and forklifts. Additionally, the waste hoist control system is being upgraded to minimize downtime and maintenance delays. Other infrastructure upgrades using ARRA funds include construction of additional storm-water evaporation pond capacity. WIPP is a zero-discharge facility; all storm water is captured and evaporated. Improvement of the south access road to the WIPP facility will begin in early 2010. While this is an important upgrade since most employees travel daily to and from work on the south access road, it is also DOE's intent to seek approval to use the south access road from State Highway 128 as the primary shipping route for shipments from the Savannah River and Oak Ridge generator sites.

Shipping Status

With almost 20 million miles logged by WIPP shipments to date (round trips), a companion paper in this Symposium discusses the lessons learned from this major waste transportation campaign, which is the largest type B shipping program in the world [8]. Figure 3 shows the transportation corridors between the DOE sites and WIPP, along with a tally of the number of shipments that have been made from each site. Inter-site shipments from small quantity sites to the major sites are not shown on Figure 3. The great majority of shipments have been from the Idaho National Laboratory and now completed Rocky Flats site in Colorado. Note that not all routes shown in Figure 3 are open at any given time. Considerable interaction with states and regional intergovernmental transportation authorities must occur before designated shipping routes are approved. As shipping campaigns from various sites end, approval of the routes is also suspended.

In 2009, several route deviations were necessary due to maintenance or new construction. In each instance, DOE sought and received approval from local or regional transportation

authorities for these temporary deviations. Only in one case was a route deviation required to be temporarily escorted by local authorities. This was along the southern entrance route to New Mexico from Texas. Although every other shipment to WIPP from western and northern sites was not escorted, the State of New Mexico required escort of all shipments over the temporary route deviation (while in New Mexico) from the southeastern generator sites due to a highway culvert repair in west Texas.

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Fig. 3. Shipping routes and number of shipments to WIPP though the end of 2009 (includes both contact handled waste and remote handled waste shipments).

NEAR-TERM PLANS – 2010-2011

The American Recovery and Reinvestment Act (ARRA) stimulus funding allotted to the Carlsbad Field Office for WIPP totaled $172 million, which was all obligated in 2009. The proposed use of the stimulus funds centered on accelerating the cleanup of EM sites, specifically shipping legacy TRU waste to WIPP. Both ARRA and base funding are directed to that goal.

One key element of the complex regulatory fabric woven throughout WIPP is the requirement that each and every payload container be “certified for disposal” before being shipped to WIPP, which includes information related to packaging. This is important since the WIPP permit issued by the State of New Mexico requires all containers be characterized according to the Waste Analysis Plan under an approved characterization program. Because packaging must sometimes be performed well in advance of a site being ready to ship waste to WIPP (e.g., due to funding constraints), this “cart before the horse” conflict can result (and has resulted) in previously packaged waste being re-packaged under a certified program when that waste is finally readied and characterized for disposal.

To minimize this possibility, DOE developed packaging instructions in 2008 and 2009 which attempt to ensure that the packaging information will meet the WIPP permit requirements when the waste stream eventually is shipped to WIPP [9]. The packaging instructions apply to DOE and contractors as set forth in DOE Order DOE 0 435.1-1, Radioactive Waste Management [10]; except, when TRU waste packaging and or repackaging is performed in conjunction with visual examination of the waste using the approved procedures and qualified personnel of a WIPP certified program. The packaging instructions apply to TRU waste resulting from activities and operations at new and existing DOE radioactive waste management facilities where the planned path for disposition is WIPP, and incorporate requirements of DOE Order 435.1 as well as all WIPP programmatic documents. In other words, the packaging instructions are to be used by sites when they must package waste destined for WIPP outside of a certified (i.e., approved by WIPP's regulators) characterization program. These instructions will be considered for inclusion in the next revision of the DOE Order 435.1 Manual.

At the Savannah River Site (SRS), the great majority of legacy drummed waste has been processed and shipped compliantly to WIPP (about 12, 500 m^3 emplaced), however about 5,200 m^3 remains, still packaged in a variety of containers. Most of this remaining volume is expected to be re-packaged into 55-gallon drums and SWBs, for shipment to WIPP over the next two years. DOE expects to continue deployment of Central Characterization Project (CCP) personnel [11] there through FY12. CCP performs characterization and certification for disposal at WIPP. SRS will repackage the large containers into standard waste boxes (SWBs), which are currently approved payload containers for shipment in the TRUPACT-II. A small portion of the inventory will be packaged into SLB-2 containers due to size reduction issues, and may eventually be shipped from SRS in the TRPACT-III, once licensed. The large box non-destructive assay and non-destructive examination units at SRS will be used for both SWB and SLB-2 containers [6].

The Idaho National Laboratory (INL) will continue to dominate shipments from all other DOE sites by providing feedstock of TRU waste for disposal at WIPP for the foreseeable future. There are two certified programs at INL; 1) the AMWTP, and 2) a supporting characterization and certification line operated by CCP. Both of these will continue.

At the Los Alamos National Laboratory (LANL), CCP support will continue to characterize and certify legacy contact handled and remote handled waste to WIPP, as needed to support Area G cleanup and as funding is available.

At Oak Ridge, the TRU waste processing facility will continue to package both contact handled and remote handled waste. CCP personnel will continue to support the characterization and certification, and will provide mobile loading operations on their behalf.

DOE will deploy the CCP to the Hanford site in Richland Washington in 2010. The initial goal is to characterize and certify about 1000 existing over-packed drums for transportation to INL for treatment and subsequent CCP certification (at INL) for disposal and shipment to WIPP, depending on funding. In FY11, it is expected that CCP at Hanford will support the site's direct shipment of both contact handled and remote handled waste directly to WIPP.

In its complex-wide Waste Management Programmatic Environmental Impact Statement (WM PEIS) in 1997, DOE's focus for transuranic (TRU) waste was on where to characterize, treat, and store such waste from DOE sites that had packaged or would generate TRU waste in the future. In the WM PEIS, DOE analyzed the full range of reasonable programmatic alternatives, including decentralized TRU waste treatment and storage at all TRU waste sites, and alternatives in which the waste would be shipped to regional or centralized DOE sites having the appropriate capability for treatment and storage. INL was one of the regional sites analyzed in the WM PEIS. In 2008, DOE published a Supplemental Analysis to the WM PEIS and reached a Record of Decision [12] to consolidate TRU waste at up to 14 small quantity sites (SQS) by characterizing each SQS' waste for transportation at the SQS and then shipping it to INL, where it would subsequently be treated and repackaged (if necessary), and certified for disposal at WIPP.

An agreement with the State of Idaho (known as the Batt agreement, after former ID Governor Batt) was negotiated in the 1990s to allow such consolidation, provided that the offsite waste was characterized and shipped out of Idaho within a year of receipt [13]. This consolidation program began with TRU waste at the Nevada Test Site shipped to INL in 2009, most of which has already been shipped to WIPP. In the next few years, this program is planned to support the removal of TRU waste from the following small quantity sites:

- Argonne National Laboratory (ANL), Illinois
- Bettis Atomic Power Laboratory (BAPL), Pennsylvania
- GE-Vallecitos Nuclear Center (GE-VNC), California
- Knolls Atomic Power Laboratory (KAPL), New York
- Nuclear Fuel Services (NFS), Tennessee
- Lawrence Berkeley Laboratory (LBL), California
- Lawrence Livermore National Lab (LLNL - both main site & 300 Area), California
- Nevada Test Site (NTS - remaining newly generated waste streams), Nevada
- Sandia National Laboratories (SNL), New Mexico

A companion session (No. 86) at the 2010 Waste Management Symposium is devoted to this subject, and provides a forum in which small quantity sites tell their stories about their own efforts to use this consolidation option. At the end of 2009, only NTS and GE-VCNC had completed their shipping campaigns, although several others had begun packaging their waste in anticipation of exercising the consolidation program.

CONCLUSIONS

After almost 11 years of operation, WIPP has demonstrated that deep geologic disposal of long-lived radioactive waste is not only feasible, it has also shown that it can be accomplished safely and efficiently. Balancing the various generator site's waste removal priorities (risk reduction) with characterization and transportation resources requires constant communication between WIPP and the TRU waste complex. The WIPP project enjoys one of the most complex regulatory envelopes imaginable, and is one of the most scrutinized operations in the DOE. Substantial resources are needed to satisfy the information requirements resulting from this oversight. 2009 marked the dual regulatory reauthorization of the 10-year hazardous waste permit renewal from the state of New Mexico, as well as the 5-year re-certification of compliance with long term repository disposal standards from the EPA. With the easily

characterized waste streams already emplaced, the next few years' goal will be to keep the pipeline filled. Recovery Act funds will be used to accelerate shipments to WIPP and resulting clean-up of many of the TRU waste sites in the DOE complex. New and more difficult waste streams will make the road to WIPP disposal even more challenging.

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