Transport of Oak Ridge Reservation Legacy High Moisture Low Level Waste: Overcoming the Challenge

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ABSTRACT

Several years of mission specific enriched uranium production, laboratory testing, weapons production, construction, maintenance, and environmental remediation at the DOE Oak Ridge Reservation Plants, K-25 Gaseous Diffusion Plant, Oak Ridge National Laboratory, and Y-12 National Security Complex, resulted in an accumulation of 1.2 million cubic feet of low-level waste (LLW). This population of LLW is known as legacy LLW based on its generation time frame of 1970 through 2000. Bechtel Jacobs Company, LLC was awarded an Oak Ridge Accelerated Cleanup Project that includes the characterization, processing, and disposal of the 1.2 million cubic feet of legacy LLW. The legacy LLW encompasses wastes from several generation facilities and organizations, within various container types, containing a wide range of radiological isotopes, and a blend of matrixes, each presenting a unique challenge in completion of disposal by September 30, 2005.

The characterization results identified the presence of free liquids and the potential for free liquids stratification within several matrixes in the legacy LLW inventory comprised of soils, sludges, treatment residues, resins, and trapping materials. As a result of these findings, Bechtel Jacobs, WESKEM, and MHF Logistical Solutions, Inc. collaborated on the disposition strategy and designed a unique transportation technique that was employed to ensure that the high moisture content wastes were safely and compliantly transported within the time allocated under the Accelerated Cleanup Project.

INTRODUCTION

The DOE Oak Ridge Reservation (ORR) is located in east Tennessee, in and around the city of Oak Ridge, approximately 40 km northwest of the metropolitan Knoxville area. This was one of three sites selected by the Manhattan Engineer District in 1943 on which to construct and operate facilities that would be key to development of the technology and production of the fission materials required to build the atomic bombs that would later be credited with bringing and end to the Second World War.

Beginning with these earliest weapons development and production activities at the ORR, radioactive by-products, radioactive wastes, and hazardous wastes containing radiological constituents were generated. However, at that time the priority for finding a solution to adequately address the issue of waste management and disposal was secondary to the urgency of establishing the ability to exploit the awesome power offered from this new energy source. Consequently the practice of accumulating materials in "interim" storage locations was adopted pending development of a solution for their longer term or permanent disposition.

The proliferation of enrichment technologies by the mid 1980s had resulted in excess international enrichment capacity and enriched Uranium stockpiles. These changed conditions and increased awareness of the environmental consequences presented by the legacy generated from decades of wartime and cold war research, development, and weapons production activities throughout the DOE Complex prompted DOE to shift its focus to environmental cleanup.

OBJECTIVES AND SUCCESS CRITERIA

It was understood that characterization and eventual disposal of the large legacy waste inventory would present a challenge, primarily because documentation supporting decisions on appropriate disposal options was generated prior to the time that categorization and management of these wastes were subject to environmental statutes under which they are currently regulated. Nevertheless, DOE and Bechtel Jacobs Company, LLC (BJC) adopted an aggressive posture to move forward with categorization and removal of the legacy waste inventory from the ORR as one of the high priority objectives of the Accelerated Cleanup Program.

The Legacy Low Level Waste Project (LLLWP) was planned and implemented in part to meet commitments made to USEPA and the State of Tennessee in an Oak Ridge Accelerated Cleanup Plan Agreement presented by DOE and BJC in June 2002. This Agreement was developed to address Notices of Violation issued in 2001 in response to DOE notifications to the state regulatory agency in compliance with systematic discovery self-reporting criteria that potentially hazardous constituents might be present in legacy LLW containers. This Agreement was further supplemented by a March, 2003 Comprehensive Waste Disposition Plan that specifically defined

an approach to characterize and remove or permanently dispose of the inventory of legacy low level radioactive and mixed wastes that had accumulated at the ORR by September 30, 2005.

WASTE POPULATION CHARACTERTICS AND DISPOSAL CRITERIA

The ORR legacy waste population has been subdivided into 11 general categories based on matrix type and other factors to facilitate completion of the characterization process and to establish a consistent approach for processing and disposal. The categories are:

- Dry Active Waste
- Radioactive Scrap Metal
- Construction Debris
- Soils
- Sludge/Treatment Residues

- Resins/Trapping Materials
- Uranium Oxide
- Wastewaters
- Organic Liquids
- Volume Reduction Residues
- Special Case Waste (e.g., classified, high activity LLW, etc.)

The soils, sludge/treatment residues, and resins/trapping materials comprise of 5% of the legacy waste inventory consisting of roughly 1.2 million cubic feet of wastes stored in B-25 type boxes, sea/land containers, and assorted drums. This waste population was thought likely to contain free liquids that would probably not meet low level waste acceptance criteria established at the off-site government or commercially operated facilities. This position was based on the results of a characterization campaign that included 100% visual inspection indicating the presence of high moisture in approximately 90% of the waste containers. Typically, the waste was damp; therefore, the container was identified as a candidate for direct shipment in a specially designed gondola package.

STRATEGY AND CONSTRAINTS

The identification of high moisture wastes initiated the need for treatment prior to disposal to ensure that there were no free liquids bound up within the wastes that could release during disposal. The wastes were planned for disposal at Envirocare; therefore, it was ideal for the processing to occur at the disposal facility. Upon the decision for treatment and disposal outlet, safe transportation became the next hurdle. BJC, WESKEM, and MHF Logistical Solutions, Inc. planning sessions commenced to discuss potential transport strategies and identify constraints. The primary constraints for a 1,900-mile transport to Envirocare from Oak Ridge included the lack of a liquids transport package for a B25 box container type and weight limitations for highway transport; therefore, rail transport became a key consideration.

The original strategy utilized the visual inspection documentation to screen the containers for free liquids to ensure that only solids were actually shipped. The original strategy also employed the use of two MHF Logistical Solution's developed IP-1 Certified Super Load Wrapper™ (SLW) container inside of a MHF Logistical Solution's Specialized High-Sided gondola rail car as the shipping package and included the addition of absorbent within the inner SLW™ container in the event there was a B25 box leak during transport. As the lessons learned from the Oak Ridge Sr-90 free liquids release were applied to this project, a new strategy evolved. A decision was made to reinvestigate 100% of the containers for free liquids and add absorbent to 100% of the containers prior to loading into the shipping package in order to further reduce the risk of shipping a container with free liquids. Based on years of experience with the transport of wastes found to contain free liquids, the liquids were forced to the top due to settling during transport; therefore, a conservative amount of absorbent was added to absorb approximately 790 gallons of water and eliminate the generation of free liquids during transport. The reinvestigation resulted in the elimination of approximately 2% of the containers for direct shipment in double layered IP-1 Certified SLW™ container inside of a gondola rail car, a portion of which were not identified as containing free liquids upon review of the visual inspection documentation.

WASTE TRANSPORT AND DISPOSAL

Implementation of the strategy is commonly when the real challenge begins which held true for this project. Further discussions on the Oak Ridge Sr-90 free liquids release indicated a need to ensure that the gondolas did not collect rain water and release it during transport; thus, creating a potential perception issue (i.e., DOT Class 7 container leaking waste water while traveling 1,900 miles to Envirocare). As a result of these discussions, it was decided to place a tarp over each gondola and plug each of the gondola car drain holes to reduce the potential issues associated with the collection and release of rain water from the gondola during transport. The potential for rainwater in the gondolas was also discussed with Envirocare and it was determined that the Envirocare procedures cover the protocol for testing and release of gondolas with water. The tarp and the plugs were employed as best management practices and are not part of the required package; therefore, if tarp damage occurs during transport, Envirocare and the State of Utah have no issues dealing with some potential water in the gondola.

The first step in the shipping process was to inspect the B25 containers for signs of deterioration and deficiencies were corrected with caulk or binding.

Gondola railcars were prepared for the waste containers as detailed in the Securement / Load Plan developed by MHF Logistical Solutions, Inc. The gondolas were lined with two IP-1 Certified SLW^{TM} in the following fashion:

1. A rubber mat was placed in the gondola car
2. The first SLW was installed.
3. The second (inner most) SLW was installed.
4. A layer of padding and absorbent powder were installed.

The rubber mat and liners served as a cushion for the load and help to prevent tears in the SLW. Absorbent powder (about 16 pounds per gondola) was distributed on top of the padding on the floor of the innermost liner to bind any small amount of liquid should a leak occur from the waste B25 containers.

The B25 containers were loaded by crane into the gondolas, the SLW were closed, a tarp was placed over the package, and the drain plugs were secured.

This shipping configuration provided multiple layers of containment to protect against release of liquids:

1. Visual inspection and detection of free-standing water – containers discovered with free-standing liquid were removed from this shipping campaign.
2. Addition of absorbent – designed to bind any liquid that moves to the top of the waste during transit. Vibration causes settling of solids that forces the liquids to the top of the waste matrix.
3. Metal containers – the B25 containers were DOT inspected prior to loading into the gondola cars.

4. Absorbent powder between the B25 containers and the innermost liner – if leaks occurred from the metal containers, such leaks were anticipated to be of small volume. The padding will also protect against tearing of the liner.
5. First SLW – this liner was to hold any leaked fluid against the absorbent powder to facilitate stabilization of the liquid and mitigate outward migration.
6. Second SLW – the final barrier to the unlikely release of liquids.

SUMMARY AND CONCLUSIONS

BJC, the cleanup contractor for DOE in Oak Ridge, awarded WESKEM and MHF Logistical Solutions, Inc. a subcontract to participate in the disposition of a portion of the 1.2 million cubic feet of low-level radioactive waste generated by decades of ORR operations. Bechtel Jacobs committed to DOE that the legacy waste population will be dispositioned off-site by June 30, 2005. WESKEM and MHF Logistical Solutions, Inc. have made its cadre of personnel and resources available to support BJC in this endeavor and has placed the highest priority on exhibiting the teamwork required to achieve the objectives established for this project. The challenges encountered by the project team were consistently met with energy and enthusiasm and many innovative solutions were developed to address issues as they arose.

The uniquely designed double layered IP-1 Super Load Wrapper™ container inside of a Specialized High-Sided gondola rail car has proven to be a reliable shipping package for the high moisture wastes in B25 boxes.
A total of 18 cars (containing ~540 B-25 boxes) were safely and successfully shipped to Envirocare with no release of contents, violations and/or DOT related issues. All shipments also occurred with no injuries to the work force.

These achievements were made in the face of conditions that required a delicate balance of knowledge and expertise in implementing operations under stringent regulatory criteria while adopting proactive and innovative approaches to resolving issues that have arisen during project execution. MHF's support of this important project is significant because it reaffirms the Company's determination to aggressively support Bechtel Jacobs in meeting its Accelerated Closure Program commitments to DOE.

REFERENCES

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