

## TECHNICAL INNOVATIONS IN RAIL TRANSPORT OF RADIOACTIVE MATERIALS

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### ABSTRACT

The purpose of this paper is to explore best practices from DOE Closure Projects and understand how DOE can improve its shipment policy and processes for radioactive and hazardous materials transportation. Categories of activities discussed will mirror DOE practices/policy as articulated in the "Transportation Practices Manual". The paper provides experience on various aspects of shipment planning and execution in the DOE community. The information provides an overview on lessons learned and successful projects involving unique transportation and packaging concepts. By encompassing elements of the "Top to Bottom" report and other DOE or industry studies, the paper will promote discussions that will focus on more process improvements or gaps in DOE shipping processes and how those gaps can be closed for efficient, cost effective, and accelerated cleanup.

On February 4, 2002 a "Top to Bottom" report was presented to The Secretary of Energy by the Assistant Secretary for Environmental Management, the report identified 12 issues from the four major areas of the report. One of the issues in particular focused on "Packaging and Transportation to Support Accelerated Risk Reduction". A call to action was stated in the report that required "...a better approach to packaging and transportation...having a such an approach will accelerate the removal of materials from the sites, with associated risk reduction and cost savings."

Taking into account the DOE practices/policy as articulated in the "Transportation Practices Manual", lessons learned throughout the DOE complexes, and commercial practices industry is answering the call of providing innovative and cost reducing approaches to packaging and transportation issues.

To illustrate this, several categories of activities or "best practices" have been provided.

### EXPECTATIONS

Cheaper, better, faster is easy to require as the goal; although one requirement that overshadows the "Top to Bottom" report is safety will not be compromised in any programmatic change.

So the best practices portrayed encompass the following expectations:

- ✓ Safe Transportation
- ✓ Security and Emergency Response Protocols
- ✓ As Low As Reasonably Achievable
- ✓ Compliant to the Regulations
- ✓ Cost effectiveness
- ✓ Maintain or accelerate closure schedules

### **Safe Transportation**

Using less than adequate equipment, untrained personnel, or poor planning will lead to unsafe transportation. The best practices portrayed clearly define attention to detail, quality equipment, skilled personnel, and planned activities as part of the transportation activity.

### **Security and Emergency Response Protocols**

In the unlikely event of a security breach or accident, protocols are in place to mitigate exposure to the public and environment. Once again, pre-planning and understanding the task will provide the best mitigation and accident.

### **As Low As Reasonably Achievable**

Keeping radioactive exposure at minimal levels during the transportation activity is one consideration; the best practices incorporate up stream ALARA practices such as consideration of exposure that is acquired during over packing and/or repacking of waste materials for noncompliant packaging. Considering all the aspects lowers the exposure to all personnel in the transportation chain.

### **Compliant to the Regulations**

The packaging and transportation activities fall under several levels of regulations such as; DOE, USDOT, and NRC complying and assuring compliance is an important element of the best practices.

### **Cost Effectiveness**

“...a better approach...” Many of the closure sites have been transporting wastes material in small boxes utilizing trucks for years, partly because of the way the end user would accept the waste, partly because of an attitude of “that is the way we always do it.” In order to accelerate the closure massive amounts of waste materials need to be packaged and transported over a short amount of time. In commercial industry this is performed every day. The best practices incorporate cost effective ideals.

### **Maintain Closure Schedules**

The closure schedules are set, the final site landscapes have been rendered, question is, how does the landscape transform under the time period presented? Implementing the best practices will allow the transformation to occur.

## **THE BEST PRACTICES**

### **One time use small packages?**

The 96 cubic foot metal box (B-25) has been used throughout the DOE complexes as a waste package for years. The box design was created to accommodate a flat bed truck width and design to carry a payload of 10,000 pounds.

Under normal plant operations a small container such as the B-25 may be practical to package and transport radioactive waste materials created from production. Under plant remediation and closure it would take over 73,000; B-25 waste containers to remove the amount radioactive waste created from a closure site such the Mound site, located in Miamisburg, Ohio. Obviously larger, more versatile

packaging is required. One package that is considered a best practice is the DOE Innovative Technology (DOE/EM 0445) "Soft-Sided Waste Containers."<sup>i</sup> The soft-side waste container or Lift-Liner<sup>TM</sup> is capable of packaging 24,000 pounds of material and 270 cubic feet of material. It has a much larger opening to reduce the amount material sizing, does not have void space created by the fork-lift risers that a B-25 has and is about a third of the cost of a typical B-25.

### Over- packing?

One of the West Valley Demonstration Project (WVDP) goals was to maximize the number of boxes that could be shipped per conveyance in order to minimize the transportation and labor costs, represented by time, for these waste streams. Removing the soil from the boxes was evaluated and would have been a labor intensive alternative. Another option evaluated was the use of cargo containers to transport the prepackaged waste by truck to a rail spur for rail shipment to Envirocare. The ultimate goal was to transition from truck shipments, through truck-to-rail shipments, in preparation of shipping directly from the WVDP by rail.

Twenty standard 20 foot top-loading cargo containers were outfitted with a specially designed rack system that could accommodate four S-70 boxes. The rack system allowed the boxes to be placed inside the cargo container with minimal time and labor. The railcar used to transport the cargo container was a Articulating Bulk Commodity (ABC) railcar with a maximum weight capacity of 177 tons and is capable of transporting four cargo containers.

The project scope originally started by transporting the loaded cargo containers with S-70 (296 ft<sup>3</sup>) boxes in them to Conway, PA by truck. The cargo containers were then loaded onto an ABC railcar in Conway and transported by rail directly to Envirocare of Utah. Unfortunately, since the containers had to be trucked on the first leg, the weight of the containers had to be limited.

Later, the WVDP upgraded the rail sighting from the site and the cargo containers were modified to handle eight S-70 (2,368 ft<sup>3</sup>) boxes in each cargo container. Each railcar is now transporting 32 S-70 (9,472 ft<sup>3</sup>) boxes at a time.

To demonstrate the direct cost savings achieved from the utilization of rail versus flat bed truck the following table is the actual cost savings and cubic foot costs comparison of transporting the containers to Envirocare of Utah from The WVDP. The first comparison represents transportation by truck to the burial site and returning with the empty over pack. The second comparison is transportation by truck to a rail spur 220 miles from the site. The third comparison represents the current method utilizing the upgraded rail spur at the site and ship directly rail to rail. The biggest advantage is the increased shipment volume and lower cost of rail exclusively.

Table I Direct Costs

Transportation Type (Round Trip)	Origin	Destination	Savings per ton vs. truck only	Cost per cubic foot	Rail cars needed	Trucks Needed	Number of tons in a shipment
Truck	WVDP	Envirocare of Utah		\$26.14		4	70
Truck to Rail	WVDP	Envirocare of Utah	33%	\$20.00	1	4	70
Rail to Rail	WVDP	Envirocare of Utah	49%	\$13.60	1	0	124

Factors used: Shipments involving truck were 17.5 tons per container  
Shipments involving direct rail were 31 tons per container  
Amount shipped in FY 2000 was 33,705 cubic feet on material

Another advantage of the WVDP concept is lower material handling costs. When the volume of waste in an individual package is increased, the benefit achieved is less handling of the waste. Unpackaging packaged waste and cutting, sizing, and sorting material is costly and involves an increased labor effort. The handling costs increase as the containers and shipment volume decrease. Larger containers and increased shipment volume, such as direct loading into the cargo containers, can virtually eliminate the repackaging, cutting, sizing, and sorting exercise that occurs during the decommissioning effort. In many cases, the final dispositioner would rather receive the material in larger pieces because it can be more easily managed and takes less storage space than if it was broken up into smaller containers.

Other handling cost are realized through less surveying and monitoring of containers, E. G., more material can be surveyed for transportation with less survey paperwork. Also, there is a significant reduction in shipment manifest preparation, documentation, and the possibility of error when a lower number of individual containers are shipped.

The concept creates an ALARA benefit to the decommissioning project as well. As radioactive material is physically handled less, worker exposure is decreased. Workers will spend less time handling, surveying, and inspecting packages as the amount of the packages decrease. Again, as the amount of the material is increased per package, the benefits increase.

### **Rail Intermodal?**

Typically, truck transport is the chosen conveyance method, and in some applications is the lowest cost and provides the most expeditious method of transport. Typical closure projects such as RMI, in Ashtabula OH involve thousands of tons of material that need to be transported thousands of miles to final disposition. Truck transport cost's increase as weight, volume, and distance increases. Reusable intermodal containers and rail transport offer significant lower costs than traditional truck transport. The rail transportation or intermodal truck to rail offers the closure site incredible cost savings while maintaining the safety standards.

Although the rail transportation is not the only factor, specialized equipment such as Articulating Bulk Commodity (ABC) Railcars<sup>ii</sup>, hard lid and USDOT IP-1 and IP-2 bulk 685 to 1000 cubic feet intermodal containers provide the types of equipment needed to facilitate proper rail intermodal transportation.

RMI was able to utilize properly design intermodal containers, truck transport, transload, and rail transport to reduce their cost of transportation and package by 40% than traditional truck methods

### **Gondolas railcars as a package?**

In early CY 2003, in accordance with present Savanna River Site missions, the U.S. Department of Energy (DOE) made the decision to ship several thousands drums of Depleted Uranium Oxide (DUO) off-site to Envirocare of Utah. Under direction from the DOE, the Westinghouse Savannah River Company (WSRC), working in conjunction with MHF Logistical Solutions, Inc., safely, and cost effectively bulk packaged, transported, and disposed of approximately 3270 drums of DUO waste material.

The optimal choice for safe and cost effective transportation of this DUO material was private gondola railcar transport. The conveyance vehicle utilized for this project was a sixty-six foot low-sided gondola

railcar with a net payload capacity of approximately 220,000 pounds. The custom designed load plan allowed for an average of approximately 120 drums per shipment. This choice proved to be beneficial from a USDOT compliance perspective, and also afforded a very cost effective mode of transport as compared to alternative over the road truck conveyance. Each railcar transported approximately five times the capacity of one weight-legal truck conveyance. This 5:1 Truck to Rail ratio was very effective and proved to be directly attributing to the substantial overall DUO Project life cycle cost reduction to WSCR and ultimately to the DOE.

### **Answering the Call**

Based on these examples of best practices DOE is answering the call to actions from the top to bottom report, although there is a long road ahead before success can be declared. The bulk of the waste materials are yet to be transported and packaged and the timeline is getting short with every passing day. There are several key areas that will need to be continually addressed to assure that best practices are being implemented at each site for every project.

- ✓ Lower Waste Packaging Cost  
Continually integrating the correct package concept within the project. Intermodal, soft-sided, railcars, and reusable packaging is just the beginning. Closure sites must be willing to adapt and get away from traditional methods and be willing to implement new ideas.
- ✓ Bring Commercial Experience of Rail Initiatives  
DOE has not had a great history with contracting short-term project with the railroads. Utilizing outside commercial companies to take the lead on rail contracts will provide the logistics support, knowledge base, and transload networks to support the closure projects.
- ✓ Integrate Site Activities on Waste Packaging and Transportation  
Each site need to share ideas and indorse each other's success and learn from their failures. DOE needs to support contractors that are willing to change normal modes of transportation and packaging protocols in order to lower costs and reduce closure schedules.

As 2006 approaches the closure of many key DOE projects will come to an end. Implementation of innovative waste packaging and transportation will be a major indicator of on time closures of the sites. It will be very apparent that the Department of Energy "Best Practices in Shipping Radioactive Material" were utilized and built on as the success of the accelerated closures near completion.

### **FOOTNOTES**

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<sup>i</sup> Can be found at <http://apps.em.doe.gov/ost/pubs/itsrs/itsr2240.pdf>

<sup>ii</sup> ABC rail cars are higher efficient flat cars that are designed to carry up to eight 685 cubic foot intermodal containers with a total capacity of 354,000 pounds.