

## WASTE MAXIMIZATION

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### ABSTRACT

There are many variables in the equation for the site decommissioning process that decommissioning and remediation projects have dissected in the attempt to reduce costs. Cost reduction and/or cost management are the major conditions for site decommissioning to become more feasible in the future. In order for costs to be reduced without sacrificing quality or safety, business must shift to a new generation of rationalization in all aspects of the process.

One shift that has produced significant cost savings is waste maximization. How's that? Maximization? Maximize through packaging and transportation. Packaging and transportation are variables that can be maximized to significantly reduce costs.

Recently, in the past four years, unique technical and "turnkey" transportation logistical processes have been developed to move large and small quantities of bulk or packaged low level waste via rail and truck transport. Rail transportation offers material movement of a larger dimension and quantity as opposed to traditional methods. The maximization concept is to move material in specialized equipment utilizing truck, rail and marine transport verses small packages transported only by trucks.

The benefit of maximizing movement of waste materials not only lowers direct cost of packaging and transportation, but, is reflected upstream as well. Some of the upstream benefits are less material size reduction, less handling of waste and containers, greater ALARA benefits, and lower transportation risks. Properly applying the most efficient means of transportation and package selection can reduce direct transportation costs up to 50% or more.

These unique maximization techniques are implemented by waste stream project specific planning, container design, container usage, railcar usage and transportation logistics. Applying these elements to the equation further maximize the cost saving effort for decommissioning.

### INTRODUCTION

Waste maximization is an innovation using transportation logistical management and new equipment designs to produce significant cost savings for the nuclear decommissioning industry. These innovative and unique equipment designs utilized were adopted from the commercial

waste and industrial municipal waste industries and upgraded to meet more stringent transportation code of federal regulations and the nuclear industry requirements. Waste maximization is a shift from using traditional container/content disposal packaging techniques and over the road transportation methods to using unique technical and “turnkey” intermodal truck/rail transportation logistical processes and reusable large volume containers and railcars. Since the revised rule for power reactor decommissioning in July 1996, public participation in the decommissioning process will influence safer, better, and lower cost alternatives. The use of this innovation is a natural evolution for the Nuclear Utilities to implement for the decommission and deconstruction of aging nuclear facilities. Past practice, such as waste minimization programs, enhanced decontamination processes, and free release programs have saved millions of dollars for decommissioning. As decommissioning begins the phase of building and large component removals, handling and shipping of this material will become the cost concern. The solution to the concern will be *Waste Maximization*. By utilizing innovative transportation techniques through the use of upfront waste stream project planning, package design, and transportation methods, direct transportation cost can be reduced by up to 50 % over traditional methods and create a enormous reduction of indirect costs such as handling, packaging, and paperwork administration.

### **Waste Maximization?**

Waste maximization is a term used to describe a packaging transportation theory. By maximizing the amount of material through a transportation conveyance from point A to point B, the cost of that activity will lessen proportionately as the amount of material transported increases. Waste maximization also lessens the project duration in that a greater quantity is moved over time.

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 deconstruction projects involve thousands of tons of material that need to be transported thousands of miles to waste processing or final disposition. Truck transport cost's increase as weight, volume, and distance increases. To implement the waste maximization theory, a different method of transport needs to be considered. To meet the volume and weight needs, a transport conveyance that has four times the volume and five times the weight capacity would greatly reduce the cost of transport.

The conveyance method needed to implement the waste maximization theory is the utilization of rail. The rail transportation or intermodal truck to rail of hazardous waste materials has been newly developed and is the major component when implementing the waste maximization theory. The benefits and cost savings through rail transport provides significant cost savings and risk reductions.

Although the rail transportation is not the only factor, specialized equipment such as Articulating Bulk Commodity (ABC) Railcars<sup>a</sup>, hard lid covered gondola rail cars, and DOT IP-1 and IP-2 bulk 685 to 1000 cubic feet intermodal containers provide the types of equipment needed to facilitate maximization. Appendix A provides an illustration and descriptions of these types of equipment.

The other area needed to achieve waste maximization is shipment tracking and expediting. In truck transport, the driver is the custodian of the shipment. In a rail shipment, it is interchanged with other rail companies before it reaches its destination. Today, technology has provided special tracking systems that are minimum cost to the overall rail shipment and in some cases provide better monitoring of a shipments than that of the trucking companies. The tracking systems provide tracing information to shippers, which is gathered from all of the railroads in the United States by the way of a direct computer link with the Railroad administration in Washington, DC. The railcar or intermodal container reporting marks are down loaded into a customized database and compared to the Railroad administrations system in Washington, D.C. A unique program is then used to manage the data to be able to create project specific car location reports and daily status of car locations. Other tracking systems can track individual cars or containers through use of Global Positioning Satellite (GPS). This system can track at any time during the shipment and provide the shipper the location of the package.

The four areas that solidify the theory of waste maximization are transportation cost, material handling cost, ALARA benefit, and lowered risks. These areas provide concrete evidence that waste maximization is feasible.

### Transportation Cost

To demonstrate the direct cost savings achieved from the utilization of rail versus flat bed truck, the following table is an actual cost savings comparison of moving bulk radioactive waste from a eastern rail served decommissioning project to three different destinations across the United States (US). The first comparison represents bulk radioactive waste being transported to burial sites, one burial site in the western part of the US the other in the southwestern part and a waste processor in the southern part of the US. The second cost savings comparison represents intermodal radioactive waste being transported to one burial site in the western part of the US, another in the southwestern part and two different waste processors in the southern part of the US.

Table I. Gondola Railcars vs. Flat Bed Truck

| <b>Transportation Type Round Trip</b> | <b>Origin Loading Site</b> | <b>Destination Site</b> | <b>Savings/ ton</b> | <b>Railcars Needed</b> | <b>Trucks Needed</b> |
|---------------------------------------|----------------------------|-------------------------|---------------------|------------------------|----------------------|
| B-25's via Gondola Railcar            | Utility E                  | Waste Proc S            | <b>46%</b>          | 1                      | 5                    |
| B-25's via Gondola Railcar            | Utility E                  | Burial Site W           | <b>56%</b>          | 1                      | 5                    |
| B-25's via Gondola Railcar            | Utility E                  | Burial Site SW          | <b>49%</b>          | 1                      | 5                    |
| Bulk Material via Gondola Car         | Utility E                  | Burial Site SW          | <b>54%</b>          | 1                      | 5                    |
| Bulk Material via Gondola Car         | Utility E                  | Burial Site W           | <b>48%</b>          | 1                      | 5                    |

Table II. Gondola Railcars vs. Flat Bed Truck

| Transportation Type<br>One-way | Origin Loading Site | Destination Site | Savings/ ton | Railcars Needed | Trucks Needed |
|--------------------------------|---------------------|------------------|--------------|-----------------|---------------|
| B-25's via Gondola Railcar     | Utility E           | Waste Proc S     | 15%          | 1               | 5             |
| B-25's via Gondola Railcar     | Utility E           | Burial Site W    | 36%          | 1               | 5             |
| B-25's via Gondola Railcar     | Utility E           | Burial Site SW   | 29%          | 1               | 5             |
| Bulk Material via Gondola Car  | Utility E           | Burial Site SW   | 34%          | 1               | 5             |
| Bulk Material via Gondola Car  | Utility E           | Burial Site W    | 27%          | 1               | 5             |

Factors Used in Estimates

Railcars rates based on a minimum of 95 tons of material per shipment

Railcars rates based on using private equipment

Truck rates based on 20 tons per shipment

Truck rates based on industry standards for radioactive materials

*Due to current pricing and contract confidentiality actual dollar amounts can not be listed*

Table III. Intermodal Container vs. Flatbed Truck

| Transportation Type<br>Round-Trip Intermodal | Origin Loading Site | Destination Site | Savings/ ton | Railcars Needed | Trucks Needed |
|----------------------------------------------|---------------------|------------------|--------------|-----------------|---------------|
| Intermodal Container                         | Utility E           | Waste Proc S     | 52%          | 1               | 6             |
| Intermodal Container                         | Utility E           | Waste Proc S1    | 32%          | 1               | 6             |
| Intermodal Container                         | Utility E           | Burial Site SW   | 40%          | 1               | 6             |
| Intermodal Container                         | Utility E           | Burial Site W    | 47%          | 1               | 6             |

Factors Used in Estimates

Rail rates based on 25 tons per intermodal container

Rail rates based on using private 177 ton articulating railcars

Rail rates includes the use of private 25 cubic yard intermodal containers for 60 days per shipment

Truck rates based on 20 tons per shipment

Truck rates based on industry standards for radioactive materials

*Due to current pricing and contract confidentiality actual dollar amounts can not be listed*

## Material Handling Cost

The cost tables demonstrate direct savings through rail utilization. Another advantage of waste maximization 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. Cutting and sizing of 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 hard lid covered gondola rail cars can virtually eliminate the cutting and sizing exercise that occurs during the decommissioning effort. In many cases, waste processors would rather receive the material in larger pieces because it can be easily managed and takes less storage space than if it was broken up into smaller containers.

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

## ALARA Benefit

Waste maximization provides 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.

## Lowered Risks

According to the Bureau of Transportation Statistics (BTS) U.S. Department of Transportation (US DOT) the number of train crashes<sup>b</sup> is 1300 times less than truck crashes. Also, the number of truck crashes has been steadily increasing while train crashes are steady if not slowly decreasing. The comparison of crashes to the number of miles of freight moved demonstrates both truck and train are increasing equally. The risk of moving material by rail is significantly lower than truck as demonstrated by the follow tables from U.S. DOT.

Table IV. Number of Crashes from 1991-1996

|                    | 1991      | 1992      | 1993      | 1994      | 1995 <sup>c</sup> | 1996      | 1997 <sup>d</sup> |
|--------------------|-----------|-----------|-----------|-----------|-------------------|-----------|-------------------|
| Truck <sup>e</sup> | 2,519,000 | 2,554,000 | 2,776,000 | 3,008,000 | 3,071,000         | 3,293,000 | 3,767,000         |
| Train <sup>f</sup> | 2,658     | 2,359     | 2,611     | 2,504     | 2,459             | 2,443     | 2,397             |

Taken From Table 3-3 1998 BTS US DOT

Table V. Number of Ton-Miles of Freight (in millions) from 1991-1996

|       | 1991      | 1992      | 1993      | 1994      | 1995      | 1996      | 1997 <sup>g</sup> |
|-------|-----------|-----------|-----------|-----------|-----------|-----------|-------------------|
| Truck | 758,000   | 815,000   | 861,000   | 908,000   | 921,000   | 986,000   | 993,000           |
| Train | 1,038,875 | 1,066,781 | 1,109,000 | 1,200,701 | 1,305,688 | 1,355,975 | 2,397             |

Taken From Table 1-11 1998 BTS US DOT

## IMPLEMENTATION

Waste maximization is best implemented in the planning stages of a decommissioning project. As material types and disposition of material are classified, then packaging and transport can be determined to provide the lowest costs achievable. In larger distances and repetitive movements of bulk material the cost transportation logistics can be adjusted to better accommodate the project and further lower costs. Cost savings can still be attained very quickly even on existing projects.

## CONCLUSION

Waste Maximization is “out of the box thinking” in which a very old transportation method is being utilized by combining new technologies, tracking systems, and transportation logistical infrastructures. The combination of specialized “purpose built” equipment, sophisticated tracking and expediting effort, results in a 50% cost reduction or more in bulk radioactive transportation. Proper implementation not only reduces the costs, it provides the indirect cost reductions as well.

## FOOTNOTES

<sup>a</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.

<sup>b</sup>The U.S. DOT/NHTSA uses the term “crash” instead of accident in it its highway safety data.

<sup>c</sup>Revised Data

<sup>d</sup>Preliminary Data

<sup>e</sup>Includes commercial light and large trucks

<sup>f</sup>Includes Amtrak

<sup>g</sup>Preliminary Data

## Appendix A



- Truck, rail, marine certified
- 52,000 lbs. rated capacity
- 20' Container with end and top loading
- Radioactive soils, sludge, DAW, metal, debris

Fig. 1. DOT IP-1 Container



- 354,000 pounds of net carrying capacity
- Transports: Intermodal containers  
sea/land containers, ISO container tanks

Fig. 2. ABC Rail Car



- 200,000 lbs. capacity
- Radioactive soils, debris, metal, (32) B-25's

Fig. 3. Hard Lid Gondola Rail Car