

A COMPARISON BETWEEN MOBILE VR SERVICES AND CENTRAL VR SERVICE FACILITY FOR DRY ACTIVE WASTE

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ABSTRACT

Low level radioactive dry wastes can be volume reduced using either mobile or central facilities with super-compactors, or incinerators, or both. This paper compares the technical, operational and economic factors for mobile versus central facilities. Analyses indicated that customer costs, in addition to the service vendors fee, are a significant factor in the evaluation of mobile services. The most attractive option is a central facility offering both incineration and super-compaction.

INTRODUCTION

Rising disposal costs for low level radioactive waste (LLRW) are plaguing nuclear plant utility management and other LLRW generators and brokers. The majority of these disposal costs are based on volume, and so reducing the volume of waste has become increasingly important over the past few years. Yet, installing and financing volume reduction equipment is very costly, and LLRW generators are turning to alternative services to assist in reducing their waste volumes.

This paper compares two basic concepts for handling volume reduction services for dry active waste (DAW) -- mobile services at the generator's facility and central service facilities at strategic sites throughout the country. Specific examples of these concepts and their respective technical, operational and economic advantages are discussed and conclusions reached about which concept is more favorable for various applications.

OPTIONS

A LLRW generator or broker has a variety of options for services as discussed below: mobile or central super-compactors, mobile shredders, mobile or central facility incinerators, and a central facility incineration/super-compaction combination.

Mobile Super-Compactors

Mobile super-compactor services have been offered by one vendor for the past year. Technical papers presented at Waste Management '84¹ and the recent EPRI Radwaste Seminar^{2,3} have described this system and its operating experience. The system is a trailer-mounted 1,000-ton force compactor which compacts 52-gallon caustic soda drums and uses a standard 55-gallon drum as the overpack. The system is basically hand operated (crane assisted). A temporary interface structure comes with the trailer and is assembled on site. The feed rate is about four drums per hour with a VR factor of 2:1, depending upon the amount of pre-compaction.

Another vendor is now offering a mobile compactor service.⁴ According to a January, 1985, press release, a contract has been awarded for this mobile equipment to service two operating plant sites.

Other vendors have offered similar equipment; however, to the best of the authors' knowledge, these are the only two systems for which there exists contracts or actual operating experience exists.

Mobile Shredder

At least one vendor has been advertising a mobile shredder for volume reduction of DAW. The trailer-mounted system consists of a shredder and the associated material handling, controls and support systems. It is not presently known if there is any experience with this system, therefore, it has not been included in the remainder of this paper.

Mobile Incinerator

A number of mobile incinerator systems have been proposed to the utility industry for processing dry DAW. However, to the best of the authors' knowledge, only one vendor has a contract for a mobile service using a mobile incinerator system.⁵ This system consists of three trailers -- an operations trailer, including ash packaging; an incineration trailer; and, off-gas treatment trailer, including emergency power. The incinerator, fired with propane and requiring water and power connections, must be set on a special concrete pad. The customer must supply these support services and concrete pad. The first system, for Commonwealth Edison Company, is scheduled to begin testing in April, 1985. Waste materials are packaged in burnable 55-gallon drums or 2' x 2' x 3' boxes and are batch fed. The system will handle about 375 lb/hour depending on the waste Btu content. VR factors range from 16:1 to 33:1 depending on the polyvinyl chloride (PVC) content. This provides a feed rate of about two drums per hour and output of about two ash drums per day. The ash is densified and then fed into a 55-gallon drum.

Central Facility Super-Compactor

One service company had announced plans to provide a central facility which would offer super-compaction services to customers. To the best of the authors' knowledge, these plans are not proceeding. Nevertheless, the authors have included this option in this evaluation for completeness. The compaction facility would utilize a single super-compactor (1,500-ton force) with a feed rate of 30 drums per hour. Due to set up and handling time,

only about four hours per day are actually spent compacting drums during a single shift operational day.

Central Facility Incinerator

A regional incineration facility has been announced to be located in North Carolina.⁶ This facility will use a controlled-air incinerator with an off-gas treatment system. The incinerator capacity will be about 600 lb/hour or about four drums per hour. The ash will be packaged in 55-gallon drums and about four drums of ash will be generated per day. The facility is designed for DAW and institutional wastes, including biological wastes, scintillation fluids, and turbine oil. Aqueous wastes will also be processed. The facility will include some short-term storage capacity.

Central Facility Super-Compactor and Incinerator

A central commercial facility utilizing super-compaction and incineration has been announced by Babcock & Wilcox to be located in Parks Township, PA.⁷ This facility will utilize a 1,500-ton force super-compactor, with automated handling equipment, that is capable of processing at least thirty, 55-gallon drums per hour. After super-compaction, the compacted drums will be placed in 70-gallon metal overpack drums. A VR factor of at least 3:1 over pre-compacted materials is expected. The system has the capability of compacting steel pipe, electric motors, and wood -- items typically considered "non-compactible". The incinerator system for this facility is of the type described in the Mobile Incinerator section above. Material is fed to the Incinerator via a conveyor system. Ash drums are handled using remotely operated handling equipment consisting of a transfer cart and an overhead crane.

DAW CHARACTERISTICS

DAW, which makes up 60%-70% of all waste materials generated, consists of paper, plastic, cloth, wood, metal, rubber, glass, and other similar materials. These materials are typically reported as "compactible" or "non-compactible" based on typical (low force) compaction technology. A recent EPRI study of 60 utility plants reported that an average of about 60% of all DAW is "compactible" (within a wide range of 30% to 100%).⁸ Also, an average of about 80% of all DAW is burnable, since super-compactors are able to efficiently handle metal and wood, then about 90% of the total DAW is assumed super-compactible, based on the same EPRI study. Average PVC content is taken about 10%, again with a wide variation.

B&W surveyed 21 utility plant sites and two waste brokers that handle institutional and industrial waste generators. This study showed 73% of their waste was burnable. Due to limits on PVC for incineration, 60% of all DAW assumed to be burnable and the remaining 40% as super-compactible for the economic analysis reported later in this paper.

TECHNICAL AND OPERATIONAL FACTORS

When considering whether to use mobile services for DAW volume reduction (VR), or to ship the DAW to a central facility for processing, certain technical and operational factors should be considered. A good starting point is examining present operations and then quantifying the impact of mobile services versus a central facility.

Mobile services require site support -- equipment, services, and manpower. Equipment needs

will vary greatly depending on the choice of VR technology and the specific vendor. One mobile incinerator requires a special foundation while one mobile super-compactor requires a temporary building for weather protection. Also, most mobile systems require one or more of the following services: electricity/lights, water, HVAC, HP/LP air, fire protection, and liquid waste processing.

Due to the relatively high costs of mobile equipment transportation, set-up, knock-down, mobile services fees encourage storing up large DAW volumes prior to processing. To accommodate this, a plant may have to store DAW for up to a year -- which will impact on operations and space allocation. Central facilities operate around-the-clock and encourage regular shipments of waste.

Manpower support for mobile services should be considered carefully. The fact that the site provides this support is what makes many mobile services seem, at first, economically attractive. Manpower needs include health physics coverage; QA support/review; and site maintenance support for services and cleanup. In addition, most mobile systems require at least one plant operator for full-time VR operations support.

The VR processing equipment characteristics are important technical factors to consider. Specifically, the VR ratio for the currently available 1,000-ton mobile super-compaction systems is about 2:1 and the VR ratio for the 1,500-ton central facility super-compactors is about 3:1. An incinerator gives a much better VR, approximately 30:1, than a super-compactor; however, the incinerator process rate is slower and the slower the process rate, the longer the unit is on-site. A mobile incinerator will only process about two drums per hour, while a mobile super-compactor will process about four drums per hour. Therefore, for the same amount of DAW, site support will be required for twice as long for mobile incineration as for mobile super-compaction. Central facilities are automated for higher throughput to help keep costs down.

An important factor in the selection of the VR method is the waste material characteristics. DAW having large quantities of PVC or a low percentage of burnables is not well suited to incineration only. Therefore, the use of both incineration and super-compaction can provide a method for optimization of VR technology. For those plants that are in compacts without a burial site, the final VR package characteristics and size are also important. The package must accommodate the waste storage facility handling systems and must be able to withstand a minimum of five years of storage.

Licensing by the customer is needed to support the use of mobile services. For a shredder or a super-compactor, the only licensing required may be a simple review to determine that there are no unreviewed safety items per 10 CFR 50.59. However, for a mobile incinerator, a more rigorous licensing analysis and environmental review is required and, in some areas of the country, licensing for incineration may prove to be an insurmountable problem.

ECONOMIC FACTORS

The economic factors for assessing mobile services versus a central facility include more than just comparing service fees. Mobile services usually don't charge for, and don't provide for, support services such as health physics, QC, utility services, on-site storage, licensing, temporary structures,

TABLE I
Customer Costs Summary

CUSTOMER COSTS	MOBILE INCINERATION	MOBILE COMPACTION	FACILITY INCINERATION	FACILITY COMPACTION
DAW Packages	X	X	X	X
Utility Services	X	X		
HP Support	X	X		
QC	X	X		
Operations Support	X	X		
Liquid Waste Processing		X		
DAW On-Site Storage	X	X		
Licensing	X	X		
Interface Structures	X	X		
Transport --> Central Facility			X	X
Transport --> Burial Site	X	X	X	X
DAW Burial	X	X	X	X

liquid waste processing and others. For this reason, mobile service fees will usually be less than central facility fees. However, support services must be provided for and the costs are significant.

The cost of DAW disposal can be separated into two broad categories; VR service fees and other customer costs. Table I provides a summary of some of the costs that would be included in the category of customer costs. Actual customer costs to support VR services will vary greatly from plant to plant. Estimates for those costs were calculated, based on using Table I for a guideline. The customer costs associated with mobile super-compaction are approximately \$40/drum higher than the customer costs associated with a central facility. This difference varies slightly between small and large generators. The customer costs associated with mobile incineration are approximately 80¢/lb higher than the customer costs associated with a central facility for a small DAW generator. For a large DAW generator, this difference is approximately 20¢/lb. This range of 20¢/lb. to 80¢/lb. primarily reflects the high one-time cost associated with licensing for incineration prorated over a five year period.

Comparing the total costs for DAW disposal (i.e., VR service fees and customer costs), a central facility is more economical for all cases except for mobile incineration at a large DAW generator's plant. For this case, the economics were essentially a draw. Also, incineration alone, whether mobile or a central facility, may not be economical if the percentage of burnable DAW is low. Nevertheless, a central facility that provides both incineration and compaction is the most economical. In this case, the benefits of incineration and super-compaction are applied where they are most effective.

This conclusion is based upon using industry norms, however, costs factors such as percent burnable DAW, site-support costs, VR process rate, and others, may vary considerably. A detailed, plant-specific, economic evaluation is recommended.

OTHER FACTORS

Additional factors to consider, but which have no detail in this paper, are man-rem exposure and liability. The use of mobile services will result in increased man-rem exposure to plant personnel primarily from the

additional handling of the DAW and providing the mobile VR service site support. Also, the additional liabilities associated with on-site volume reduction operations and having sub-contractors on-site needs to be weighed against the minimal liability impacts of a central facility.

SUMMARY

When choosing between mobile VR services and central facility VR services, all technical, operational, and economic factors must be considered. Mobile VR services depend on the customer to provide much of the support functions. Technically and operationally, this adds up to a lot of extra work for the site. Economically, this means incurring costs equal to 20% - 100% of the mobile VR service fees.

In general, a central facility for incineration or super-compaction is more advantageous for DAW volume reduction. A central facility has lower risks, less impact on the customer operationally and technically, and significantly lower customer support costs. A central facility with both incineration and super-compaction provides the optimum combination of DAW volume reduction services.

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