VOLUME REDUCTION OF DRY ACTIVE

WASTE - THE MOBILE SERVICE OPTION

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ABSTRACT

Dry activated waste (DAW) produced at nuclear power plants accounts for the largest fraction of the radioactive waste volume generated and shipped for burial. Since burial of this waste is charged on a dollar per cubic foot basis, the application of advanced volume reduction techniques to DAW merits attention to reduce a plant's burial costs. This paper addresses the mobile high force compaction service option as an economic alternate to capital expenditures for purchase of volume reduction equipment.

INTRODUCTION

Dry activated waste (DAW) produced at nuclear power plants accounts for the largest fraction of the radioactive waste volume generated and shipped for burial. EPRI studies conclude that as much as 60% of a plant's low-level radioactive waste is DAW. This waste is currently compacted into either 55-gallon drums or large boxes using low force (20-80,000 lb) off-the-shelf equipment and shipped to a low-level radioactive waste burial site. Burial of DAW is billed on a dollars per cubic foot basis. Since 1974, the price for burial of DAW at one burial site has increased from $1.10 per cubic foot to a current rate of $24.89 per cubic foot. The application of advanced volume reduction techniques to DAW, therefore, merits attention in order to reduce the plant's overall burial costs. Furthermore, volume reduction of DAW enhances a utility's compliance with recent Nuclear Regulatory Commission (NRC) and Institute of Nuclear Plant Operations (INPO) guidelines for packaging of radwaste and DAW.

Several utilities have investigated and are proceeding with purchase and installation of radwaste incinerators as an approach to volume reduction of their DAW. This paper addresses the mobile high force compaction service option for volume reduction of DAW. This option eliminates the capital expenditures and licensing process related to purchase of a radwaste incinerator.

The Westinghouse Hittman Mobile Supercompactor

The technology and benefits of supercompaction have long been appreciated by U.S. utilities; however, the cost of equipment purchase has made this approach uneconomical for even the largest generators of DAW. The Westinghouse Hittman Nuclear Incorporated Mobile Supercompaction Service, called SAVEPAK, economically provides the benefits of supercompaction to even the smallest of DAW generators.

The key element of the SAVEPAK service is a mobile 1,000-ton hydraulically operated compactor, COMPACT I. The compactor configuration and compressive force were selected, after extensive engineering tests, to optimize the volume reduction factor while still retaining mobility. The compactor is mounted on an enclosed over-the-road forty-foot trailer (see Fig. 1). In addition to the compactor, the enclosed trailer contains a hydraulic power unit, waste container loading system, air filtration system, liquid collection system, waste container unloading crane and interior lighting.

The air filtration system is designed to collect and filter all airborne matter from the main compaction sleeve and from a radiological control tent that encloses the trailer's main operating doors. The filter unit consists of two 24-inch square filters. One is a 2-inch pre-filter and the second is an 11.5-inch thick 99% DOP HEPA filter. System flow for the radiological control tent is provided by a one horsepower blower motor which creates 800 cfm airflow. System flow for the main compaction sleeve is provided by a one-third horsepower blower motor which creates 20 cfm airflow. An electrical interlock with the main press prevents press operation unless the filter system is turned on. A differential pressure gauge across the filters provides operator indication for filter replacement.

The entire compaction sleeve is sealed and isolated from the trailer enclosure during the compaction cycle except for lines leading to the air filtration and liquid collection systems. The rear waste collection tank is the primary tank for liquid collection during the actual compaction cycle. A liquid line sensor provides a visual and audible alarm indication to the operator which alerts him to the presence of liquid in the drum that is being compacted. The tank also has a level sensor that will shutdown the main press when a high level signal is initiated. The forward waste collection tank is used to collect any residual liquid when the compacted drum and sleeve are being rotated to the eject position. This forward tank also has a level sensor that will shutdown the main press when a high level signal is initiated. The entire press is installed on an angle to facilitate liquid collection.

Fig. 1. COMPACT I is Mounted on an Enclosed Over-the-Road Trailer

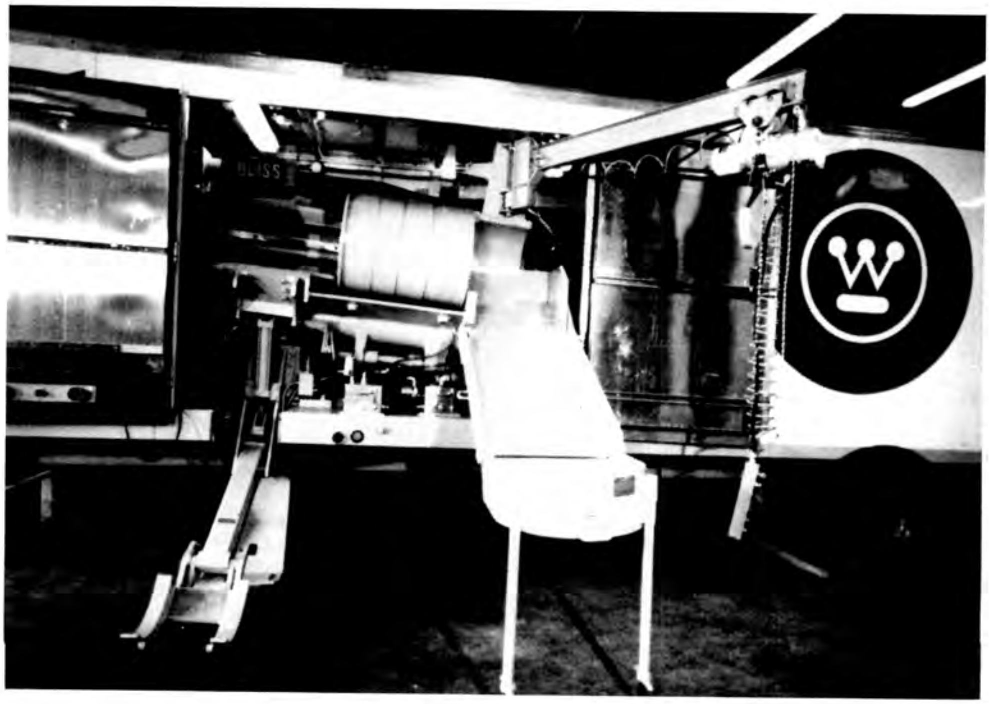

Fig. 2. COMPACT I is Operated Through Two Doors in the Side of the Trailer

Each basic system operating motion must be completed before another motion can be initiated. The primary operator must maintain continual hand engagement with the permissive lever in order to run any press motion. The operator's assistant must maintain permissive switch contact with both hands during operation of the waste container loading mechanism. Circuits are also provided to prevent system operation during low oil level and high or low oil temperature.

Radiation levels from DAW drums are not high enough to require additional shielding. The press components provide the necessary operator shielding. The steel compaction sleeve is 1.5 inches thick and the steel bed plate behind which the operator stands is 16 inches thick. Locallized shielding is used to shield the waste collection containers if the presence of liquids in the container causes unacceptable radiation levels.

COMPACT I is operated through the two doors in the side of the trailer (see Fig. 2).

The Hittman SAVEPAK service results in the plant's DAW being packaged to a net waste density (density of waste excluding drum) of approximately 60 lbs. per cubic foot (for a normal mix of compactible waste). A comparison with other waste packaging options is shown in Table I.

TABLE I

DAW Packaging Options

Packaging Option	Net Waste Density (lbs/CF)
Uncompacted Waste	7-10
Standard Drum Compactors	17-30
Shredder/Compactor	41
Hittman COMPACT I Compactor	60

Besides providing the benefits of improved volume reduction, the SAVEPAK service allows compaction of certain DAW forms that cannot be packaged using currently existing equipment. DAW, such as contaminated pipe, concrete and wood are now shipped to the burial site packaged "as is" in large metal or wooden boxes. When properly "pre-packaged" in drums using Hittman supplied procedures, these waste forms are compacted by COMPACT I with resultant burial cost savings to the utility.

Use of the Mobile Supercompaction at the Ginna Nuclear Power Plant

The Robert E. Ginna Nuclear Power Plant is a single unit 490 megawatt Pressurized Water Reactor located on Lake Ontario near Rochester, New York. The plant generates approximately 7,500 cubic feet of DAW per year. Prior to the use of the mobile supercompactor, the plant had been compacting DAW into 4' x 4' x 6' metal boxes. When filled and compacted, the boxes weighed approximately 2,700 pounds each. This represents a net waste density of approximately 23 pounds per cubic foot.

Since the use of the mobile supercompactor represented an obvious change to the Ginna radwaste processing system, a 10CFR50.59 review was performed. Maximum activity levels inside the drums were based on maximum dose rates of 200 mR/Hr contact on the pre-compacted drums. The isotopes chosen for the review are those commonly seen in a PWR, i.e., Co-58, Co-60, Cs-134, Cs-137, I-131, and Mn-54. Based on these assumptions, 100% of the activity from a pre-compacted drum could be released and not exceed the site boundary limits. Other considerations such as excessive liquid or a fire hazard were considered. The systems built into COMPACT I were judged adequate to satisfy plant requirements.

COMPACT I's initial visit to Ginna occurred in May 1984. Several weeks earlier, Ginna personnel placed a drum compactor back into operation and began precompacting waste into commercially available 52-gallon light gauge caustic soda drums. When COMPACT I arrived on-site, 127 52-gallon drums had been pre-compacted to an average gross weight of 215 lbs. The average net waste density was approximately 29 lbs. per cubic foot.

Due to the prevailing weather conditions at Ginna, plant personnel chose to erect a wooden enclosure, rather than use the Hittman supplied radiological control tent. The enclosure covered the trailer's drum loading and unloading area. A similar enclosure is shown in Figure 3. The enclosure provided adequate space to stage both uncompacted and supercompacted drums. No other plant preparations were required.

COMPACT I was accepted by Plant health physics and quality assurance personnel and was crushing 52-gallon drums within a single shift of arrival on-site. Crushing operations within the enclosure are shown in Figs. 4, 5, 6, and 7. Crushed drums were placed into 55-gallon drums for shipment to the burial site. An average of approximately two crushed 52-gallon drums were packaged in a 55-gallon drum.

Table II summarizes the results of the May 1984 supercompaction campaign at Ginna. The campaign resulted in a savings of approximately 632 cubic feet of buriable volume (57%) as compared to the previously used method of disposal by boxes.

TABLE II

Volume Reduction Achieved By Compact I at Ginna Station

		May, 1984 Campaign	November, 1984 Campaign
A.	Number of 52-gallon drums supercompacted	127	137
B.	Number of 55-gallon overpacks used	63	62
C.	Total volume of waste shipped for burial (CF)	472.5	465.0
D.	Total weight of waste shipped for burial (pounds)	24,798	26,592
E.	Weight of waste previously shipped in metal boxes (pounds)	2,200	2,200
F.	Number of boxes previously required to ship waste in Item D.	11.3	12.1
G.	Burial volume of boxes in Item F (CF).	1104.6	1185.8
H.	Total volume reduction using supercompactor vs. boxes (G divided by C).	2.34	2.55

TABLE II

Volume Reduction Achieved By
Compact I at Ginna Station
(Continued)

	May, 1984 Campaign	November, 1984 Campaign
I. Burial volume saved (CF)	632.1	720.8
J. Burial Cost Savings at $18.92/CF	$11,959	$13,638

COMPACT I returned to Ginna in November 1984 for another compaction campaign. One hundred thirty seven (137) 52-gallon drums had been pre-compacted to an average gross weight of 214 pounds and an average net waste density of approximately 26 pounds per cubic foot.

Table II summarizes the results of the November, 1984 supercompactor campaign at Ginna. The campaign resulted in a savings of approximately 721 cubic feet of buriable volume (61%) as compared to the previously used method of disposal by boxes.

COMPACT I will return to Ginna Station in mid-1985 and has been made an integral part of Ginna's radwaste volume reduction program.

Aside from Ginna, COMPACT I has been used to crush over 1700 drums at 7 other nuclear facilities through the end of January, 1985.

CONCLUSION

Mobile waste compaction services is a plant proven economically attractive approach to achieving significant volume reduction of DAW. Volume reduction factors in excess of 2:1, as compared to current practices, are achieved, with the following benefits:

1. No capital expenditure is required.
2. No permanent facilities are required.
3. Final net waste densities are high (60 lb/ft^3).
4. Plant preparation and interfaces are minimal.
5. Maintenance is the responsibility of the contractor.
6. There are no regulatory or licensing issues.

Fig. 3. View of Wooden Radiological Enclosure.

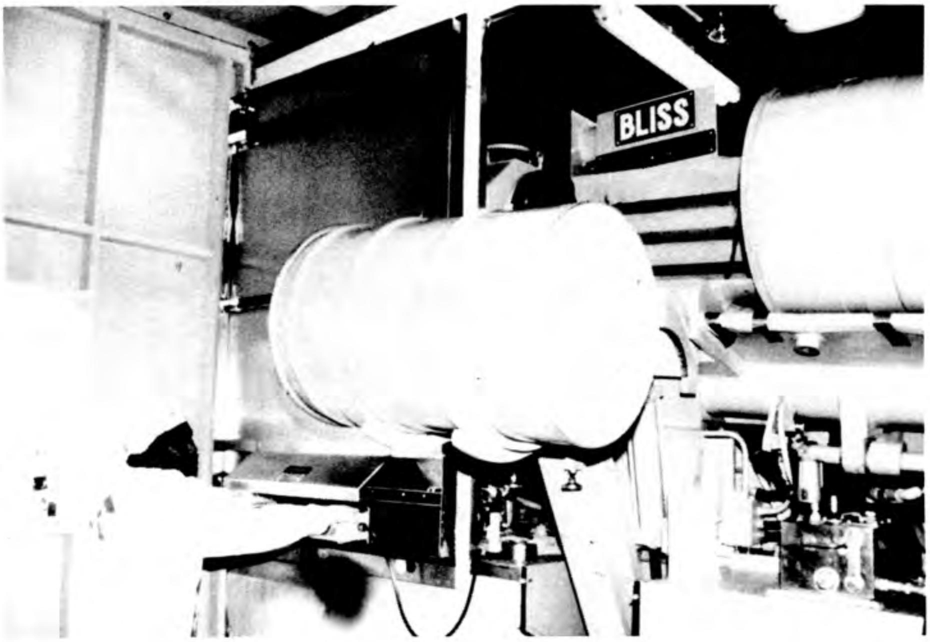

Fig. 4. Drum Being Loaded Into COMPACT I.

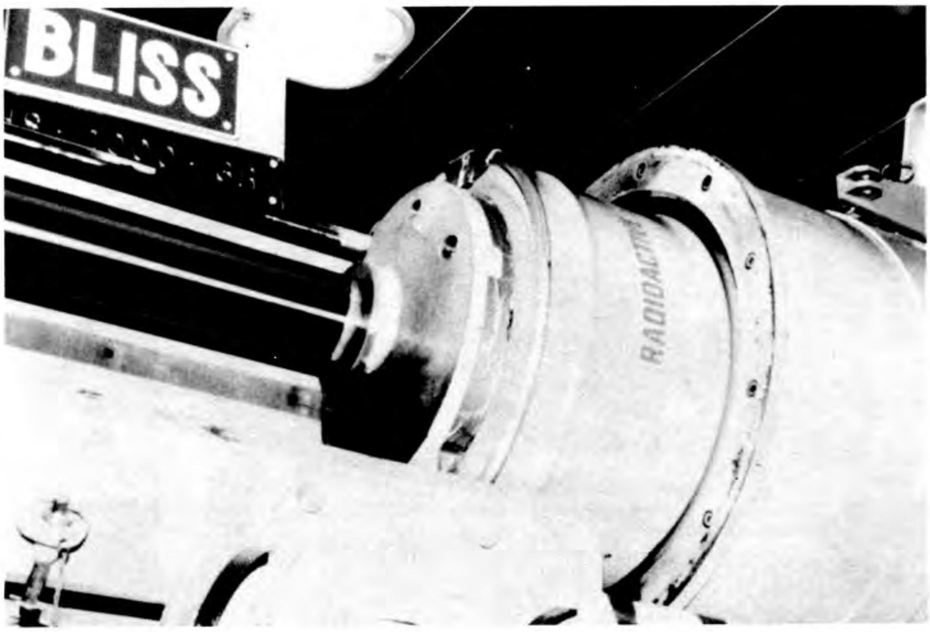

Fig. 5. Drum Entering Compaction Sleeve.

Fig. 6. Drum After Crushing.

Fig. 7. Crushed Drum Being Loaded into 55-Gallon Overpack.