

LOW-LEVEL VOLUME REDUCTION SERVICES FACILITY

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ABSTRACT

The Babcock & Wilcox Company is renovating the shut-down fuel fabrication facilities in Parks Township, Pennsylvania, and installing equipment to operate a Volume Reduction Services Facility for low-level radioactive waste. This facility outfitted with both an incinerator and a super-compactor will have the capability to handle dry solids, contaminated oils, liquid scintillation vials, and biological waste, and is to be the first commercial facility in the United States to utilize both incineration and super-compaction for the volume reduction of low-level radioactive waste. This paper deals with the planned operations for the Babcock & Wilcox Reduction Services Facility in Parks Township, Pennsylvania.

INTRODUCTION

The B&W Volume Reduction Services Facility (VRSF) is located in Parks Township, Pennsylvania. Parks Township is located approximately 30 miles northeast of Pittsburgh and is easily accessible from Interstate 80 and from the Pennsylvania Turnpike. The Parks Township site was the NUMEC Plutonium Fuel Manufacturing Plant that B&W purchased from Atlantic Richfield in 1971. Plutonium fuel manufacturing was phased out at the plant in 1980 and decontamination of the facility was begun. The plutonium plant is still licensed (SNM-414) for radioactive material, which is one reason it was selected for the VRSF. Approximately one-half of the main building is being renovated for volume reduction operations; the other half contains a hot cell and radioactive material handling pool and is currently being used for Control Rod Drive Mechanism (CRDM) refurbishment, CRDM motor rewinding, snubber testing and radioactive equipment storage.

The Parks Township VRSF will use incineration and super-compaction to process low-level radioactive waste, such as dry solids and lubricating oils from nuclear power plants, and dry solids, liquid scintillation vials, and biological waste from universities, medical facilities, and other industrial/institutional radwaste generators. The Parks Township VRSF expects to be the first commercial facility in the United States to offer both incineration and super-compaction. This paper outlines the planned equipment for and operations of the facility.

OPERATIONS

The Parks Township VRSF operations will be computerized for efficiency and quality control and will be heavily automated to keep the occupational radiation exposure to the facility workers as low as reasonably achievable. Incoming dry solid waste intended for incineration will arrive packaged in 55-gallon fiber drums or other combustible containers. Dry solid waste intended for super-compaction will arrive packaged in 55-gallon steel drums. Utility dry solid waste that is packaged in LSA boxes or other containers will be sorted and repackaged in the sorting/repackaging room according to the desired volume reduction method.

An incoming truck containing low-level radioactive waste will back into an enclosed truck ramp. The incoming packages will be surveyed, weighed, and logged into the computerized inventory tracking system as they are unloaded from the truck. The packages will then be transported from the shipping/receiving area to the pre-process staging area via a conveyor system (for 55-gallon containers) or by form lift (for LSA boxes and other containers).

Pre-process staging of the incoming waste serves many important purposes. It allows a sufficient backlog of material to be accumulated to ensure efficient super-compaction and incineration operations and allows flexibility to accommodate fluctuating radwaste outputs from the numerous VRSF users. Pre-process staging also provides the capability to batch process waste, according to the customer, while still allowing for efficient facility operations.

Waste received in LSA boxes or other non-standard containers must be repackaged prior to being volume reduced. The material will be transported by forklift from the pre-process staging area to the room where the sorting/repackaging operations will be performed. The results of this operation will be logged into the computer inventory tracking system and the repackaged material will be transferred back to the pre-process staging area. The emptied original container will then either be decontaminated and transported back to the customer, or reused in some manner.

Biological waste, contaminated oil, and liquid scintillation vials require special handling. The biological waste containers will be stored in freezers in the pre-process staging area prior to incineration. Contaminated oil will arrive in 55-gallon drums that are packed in LSA boxes and surrounded by absorbant. In the sorting/repackaging room, the contaminated oil will be pumped from the 55-gallon drums into the incinerator's contaminated oil feed tank. Similarly, 55-gallon drums of liquid scintillation vials will be opened in the sorting/repackaging room and the scintillation fluid separated from the encapsulating vials. The scintillation fluids will be processed in the same manner as contaminated oil. The empty liquid scintillation vials will be placed back into the 55-gallon drums, absorbant added, and the drum transported back to the pre-processing staging area for super-compaction.

When the time comes to process a particular customer's waste, the waste will be retrieved from the pre-process staging area and automatically fed via conveyor system to the incinerator or super-compactor (the incineration and super-compaction operations will be discussed later). The output of the super-compactor will be a steel overpack, with a volume of about 70-gallons, containing compacted 55-gallon drums. This overpack will be staged in a shielded area adjacent to the super-compactor until it is shipped out. The output of the incinerator will be a 55-gallon steel drum containing agglomerated ash. Similarly, this container will be staged in a shielded area adjacent to the incinerator until it is shipped out.

The containers of volume-reduced waste will be surveyed and prepared for shipment in a shielded shipping preparation area. From there, the containers will be loaded for shipment. All necessary shipping papers will be prepared by the computerized inventory tracking system.

SUPER-COMPACTOR

The super-compactor is a fully-automated high pressure (1,500 ton) compaction press system supplied by STOCK Equipment Company under license from Machinefabriek A. Fontijne B.V. of Holland. A Fontijne super-compactor system has been operating at the Energy Research Center, Petten, Holland, for many years as a central facility for all of Holland. A second system is also operating as a central facility for Germany at Karlsruhe.

The super-compaction system is designed to process standard 55-gallon drums. Incoming 55-gallon drums will be passed through an airlock into the super-compactor press enclosure. Once inside, the sides of the drum will be pierced and the drum transferred to the hydraulic press. At the hydraulic press, the 55-gallon drum and its contents will be surrounded by a drum mold and then super-compacted. The resulting "hockey-puck" will be transferred to a six drum turntable and its height measured and entered into the super-compactor system's process controller. The process controller regulates all super-compaction operations and will select "hockey-pucks" from the six drum turntable to optimize the loading of the overpacks.

INCINERATOR

The incinerator is the Aerojet Energy Conversion Company's (AECC) Mobile Volume Reduction System (MVRS). The MVRS is a mobile incineration system mounted on three trailers and consists of: 1) a batch-fed, two-stage, controlled air incinerator; 2) a liquid off-gas cleanup system with venturi scrubber; and 3) an off-gas discharge system. The controlled air incinerator is patterned after a unit developed and operated at the Los Alamos Laboratories. The off-gas treatment system is based on AECC's experience in low-level radioactive waste incineration. The first MVRS is planned to be operated at Dresden Nuclear Station by AECC. Incoming waste in combustible containers will be batch-fed via an airlock and ram arrangement to the primary incineration chamber and conveyed to an ash hopper. From the ash hopper, the ash will be densified and fed into a 55-gallon drum. The incineration system is fully automated and process controller regulated.

AUXILIARY EQUIPMENT

A cement solidification system will handle liquid runoff from the super-compactor operations. The liquid waste collected in the super-compactor sump will be pumped directly to a holding tank in the liquid solidification room prior to cement solidification. This system is also capable of handling other wastes which may require solidification.

Auxiliary equipment that will be used to increase the efficiency of VRSF operations and to limit the occupational exposure to VRSF personnel from handling radioactive materials includes a remote control 10-ton overhead crane to handle ash containers and solidified 55-gallon drums, and an extensive conveyor system to transport waste packages between the shipping/receiving area, the pre-process staging area, the incinerator, and the super-compactor. All stages of the VRSF operations will be monitored with a closed-circuit television system.

ECONOMICS

B&W has developed a computer program (VRECON) to quantify the cost savings for using the Volume Reduction Services Facility. VRECON takes into account such variables as container specifications, burial site selection, variable costs, radiation levels and customer waste characteristics, as it calculates the disposal costs for dry solid waste. Using Lotus 1-2-3 software, the program specifies the savings in each of the areas of container costs, transportation costs and burial costs.

A hypothetical plant located 200 miles from Parks Township is used for demonstration purposes. The input assumptions and some calculated values are presented in Table I. In 1984, this hypothetical plant disposed of 10,000 cubic feet of waste at a cost of \$263,778.00, broken down as follows:

Transportation Costs	\$ 12,720.00
Container Costs	\$ 36,018.00
Burial Costs	\$215,040.00
TOTAL	\$263,778.00

TABLE I

1984 Hypothetical Plant Dry Solid Waste

<u>VRECON Inputs</u>	<u>VRECON Calculated Values</u>
<u>Dry Active Waste</u>	<u>Freight Rates</u>
Volume: 10,000ft ³	Plant to Barnwell: \$1.59/mile
Weight: 200,000 lbs.	Plant to Hanford: \$1.67/mile
Burnable: 60%	
<u>Container Specifications</u>	<u>Container Weight/Density</u>
Cost: \$27/container	Gross Weight: 150 lbs. ³
Empty Weight: 50 lbs.	Gross Density: 20 lb/ft ³
Burial Volume: 7.5 ft ³	New Waste Density: 14.49 lb/ft ³
Radiation: 2 mr/hr	
<u>Distances</u>	<u>Annual Shipments</u>
Plant to Barnwell: 800 miles	Containers: 1,334/yr to burial site
Plant to Hanford: 2,000 miles	Trucks: 10/yr to burial site
<u>Burial Sites</u>	
<input checked="" type="checkbox"/> Barnwell <input type="checkbox"/> Hanford	
<u>Barnwell Burial Rates</u>	
Base Cost: \$14.50/ft ³	
Escrow Fund: \$ 2.50/ft ³	
SC Tax: \$ 4.00/ft ³	

VRECON calculated that, using the Volume Reduction Services Facility to incinerate the burnable dry solid waste and super-compact the remaining waste, the hypothetical plant would have saved over \$74,400 (28%) in 1984, and that the hypothetical plant would have buried only about 730 cubic feet, a 92% burial volume reduction.

SUMMARY

The Parks Township Volume Reduction Services Facility will utilize incineration and super-compaction to process low-level radioactive waste from

nuclear power plants and institutional/industrial radwaste generators. The highly-automated, computerized operations of the VRSF are designed to provide high quality service at a competitive price.

Building renovation and equipment construction are well underway. The current schedule calls for all equipment to be installed and building modifications completed in June, 1985. Operations will begin when B&W receives the NRC license amendment for the facility and the air quality permit from the Pennsylvania Department of Environmental Resources.