

PROCESSING OF PANTEX WET WASTE FOR DISPOSAL AT THE NEVADA TEST SITE

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ABSTRACT

The Department of Energy's Pantex Plant is where the nation's nuclear weapons are being dismantled. The facility generated low-level radioactive waste contaminated with tritium. The waste consists of scintillation liquid, scintillation vials (glass and plastic) and support material (dry activated waste). The waste was generated as a result of plant processing and area surveys. Mason and Hanger Corporation under contract to DOE to operate the Pantex Plant processed these waste streams for interim storage by crushing the solids and separating the liquids.

GTS Duratek further treated the waste streams for disposal at the Nevada Test Site (NTS). Drums containing scintillation vials were dewatered, compacted and repacked. The liquid collected was injected into an incinerator at GTS Duratek's Bear Creek Facility. The support material was compacted and repackaged. All empty metal containers were recycled through the Metal Melt facility. The compacted waste was sent to NTS for final disposal.

INTRODUCTION

Mason and Hanger Corporation (MHC) is under contract with the Department of Energy (DOE) to operate the Pantex Plant located approximately 18 miles north east of Amarillo, Texas. The Pantex Plant is DOE's weapons facility where the nation's nuclear weapons are being dismantled. Battelle Memorial Institute is a subcontractor to MHC and is referred to as Battelle Pantex. Battelle is responsible for the Pantex Plant's environmental, safety and health requirements. In this paper, MHC, DOE and Battelle will collectively be referred to as Pantex.

Pantex has generated low-level radioactive tritiated Ultima-Gold® (non-hazardous scintillation liquid) and scintillation vials (both glass and plastic) as a result of plant process and area surveys. The tritiated Ultima-Gold and glass/plastic vials were crushed and separated as much as possible, then repackaged and put into storage. Pantex does not have the facilities to treat this waste and render the solids and support material containers free of liquids to meet the less than 1 percent free liquid requirement by NTS.

GTS Duratek responded to a Request for Proposal to further treat this waste stream for disposal. Pantex requested that the containers of solid and support material be de-watered to ensure there were no free liquids (less than 1 percent of the volume) for proper disposal at the Nevada Test Site (1). Once the containers were de-watered, they were compacted and over-packed into larger containers. Any liquids that were collected or generated during the treatment process were incinerated at GTS Duratek's Bear Creek Facility incinerator. All empty metal containers were recycled in the metal melt facility mainly to provide shielding for the DOE Spallation Neutron Source Program and other projects. Once all waste was processed, the containers were properly labeled, manifested, certified and shipped to Nevada Test Site for disposal under the direction of the Pantex Waste Certification Official. Figure 1 shows the overall all process flow for treating the wet waste.

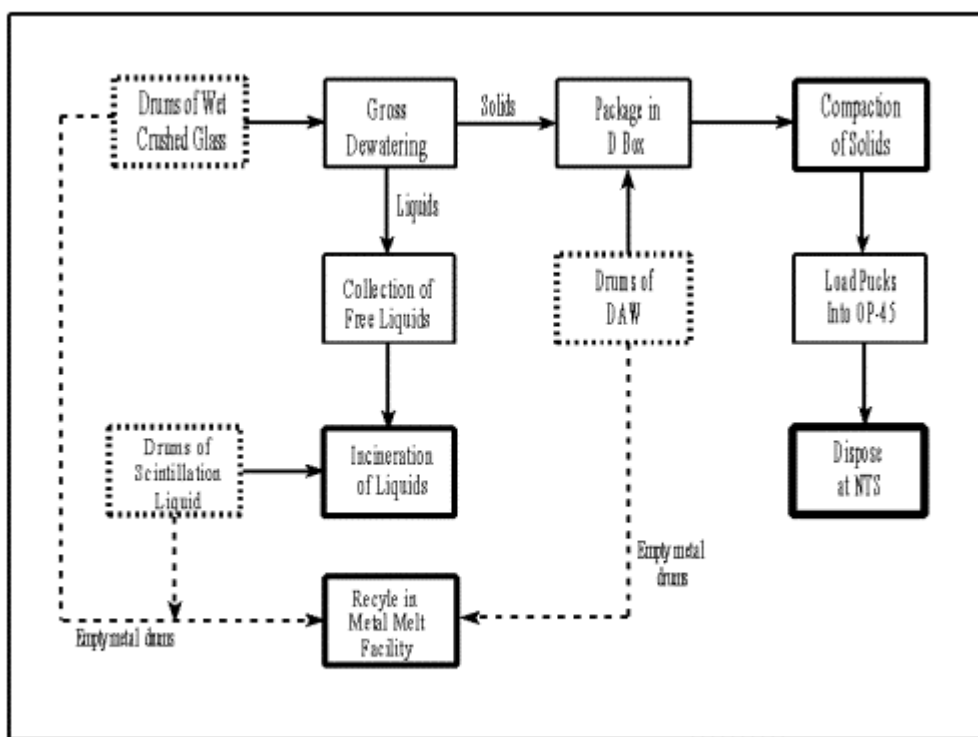


Fig 1. Process Flow of Wet Waste Treatment

WASTE STREAMS

Pantex generates approximately two 55-gallon drums of glass and/or plastic vials and Ultima-Gold each week. The inventory to be treated consisted of 160 55-gallon drums; 100 drums of wet crushed glass, 50 drums of Ultima-Gold scintillation liquid, and 10 drums of dry active waste Support Material.

The 100 drums of wet crushed glass contained crushed glass, about 4 pounds of Petroset II, and about 4 gallons of Ultima-Gold liquid. Each of these drums weighed approximately 340 pounds, gross weight. Other drums contained crushed glass and/or plastic vials and Ultima-Gold, but not the Petroset II. The 50 drums of Ultima-Gold contained liquid with each drum weighing about 400 pounds each, gross weight. The 10 drums of support material consists of plastic drum liners, personal protective equipment (PPE such as gloves, lab coats, etc.), approximately 4 pounds of Petroset II, and vermiculite. Each of these containers averaged 90 pounds, gross weight.

OBJECTIVE

The objective of the project was to perform dewatering treatment on the containers of crushed glass and/or plastic vials and support material (2). The amount of liquid in the containers would be verified to not exceed 1 percent of the volume of waste when the waste is in the disposal container. Included was the filtering of glass fines and plastic from the containers of liquid Ultima-Gold and disposal of all liquid from both operations. GTS Duratek provided the following services;

- Development of all procedures, permits and transportation documents

- Performed dewatering treatment of the three waste streams

- Performed filtering of liquid Ultima-Gold

- Incinerated all shipped and collected liquids

- Compact and repackage solid waste streams

- Process metal wastes for recycling

- Sample for liquids and verify that free liquids did not exceed 1 percent of the volume of waste in the disposal containers

- Shipped the processed waste streams for disposal at the Nevada Test Site

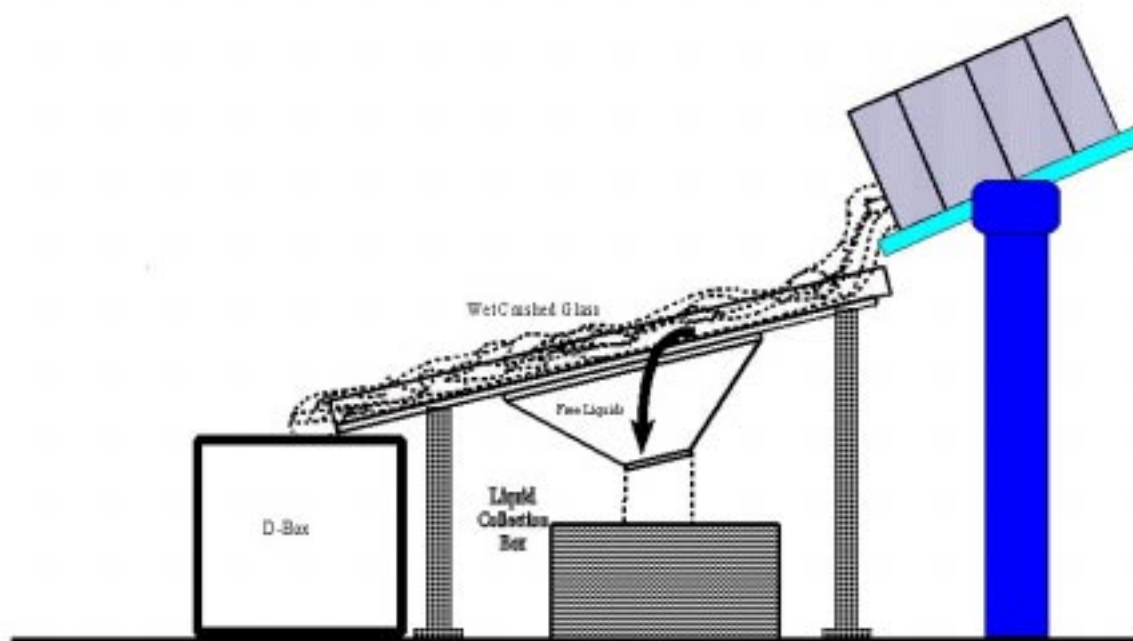
WASTE PROCESSING

GTS Duratek successfully processed 160 55-gallon drums of wet waste for the Pantex Facility in Amarillo, Texas. All processed waste containers met the NTS Waste Acceptance Criteria. Several steps were involved with treatment of these waste streams as discussed below.

Gross Dewatering

During this step, the drum lids were removed and the drums secured to a drum lift and inverter device. This allowed the operators to “dump” the contents onto the separation table. The “Screen Table” supports were constructed of 2 X 2 steel angle iron. The table top was constructed of 304L stainless steel plates (11 and 16 gauge). The center of the table had a perforated stainless steel sheet to act as a screen and allow free liquids to drain below into a

collection container. The table was inclined about 30% to allow minimal downward movement of the drum contents (Figure 2).



Once the wet contents were slowly released from each drum, free liquids flowed through the screen and into the collection box. The solid wastes (glass and plastic) were manually “raked” down the table to facilitate further draining of the waste. A D-box was placed at the end of the table with absorbent placed in the bottom. D-Boxes are light weight metal boxes (61 kilograms) used to collect approximately 1 cubic meter of waste destined for compaction. This D-box was used to collect all the solid wastes for compaction (Figure 3). When the drums were empty, they were transported to the Metal Melt facility for melting and casting into ingots. All liquids collected were sent to the Incinerator Facility for burning.



Incineration of Liquids

All liquids either shipped or collected during the treatment process were incinerated in the Bear Creek Incinerator Facility. Drums of liquid received were moved directly to the Incinerator and the liquid transferred into holding tanks. Containers of liquid collected during treatment were also pumped into holding tanks. Once all liquid was combined, it was injected directly into the primary combustion chamber of the Incinerator. The scintillation liquids were used for controlling the temperature of the furnace while processing other waste streams.

GTS Duratek operates two incinerators, each with an operating capacity of 1000 pounds per hour for dry active waste (paper, plastic, wood, etc.). The incinerator is equipped with feed systems for both solid and liquid wastes. The incinerator primary combustion chamber operates between 800 and 1,100 C in a partial-pyrolysis (oxygen starved) mode to convert waste into combustible gases and water vapor. Incinerator hearth ash is transported by dual screw augers across the bottom of the chamber where the ash is gravity fed into ash boxes or drums. Flue gases from the primary combustion chamber proceed to the secondary combustion chamber, where the combustion reactions are completed under excess oxygen conditions at temperatures between 900 to 1,200 C.

Effluent gases from the secondary combustion chamber proceed to an air pollution control system (APCS) which consists of the following sequential unit operations that ensure stack emissions meet or better regulatory standards:

Waste heat recovery boiler for initial gas cooling,

Redundant baghouse filters for initial particulate removal,

Redundant three-stage HEPA bank filters for additional particulate removal with 99.97% removal efficiency of particles greater or less than 0.3μ ,

A water quench and packed bed absorber for further gas cooling and acid gas removal,

Redundant ID fans to maintain negative pressure in the incinerator and APCS, and

A steam-coil reheater to prevent water condensation in process piping and ensure that a visible steam plume does not occur at the facility stack.

Compaction of Solids

All support material sent from Pantex was repackaged into light-gauge D-boxes for compaction. All drained wet solids were also packaged into D-boxes. All void spaces were filled using absorbent material. The combination of gross dewatering, supercompaction, and use of an absorbent expelled all free liquids.

Supercompaction was performed using the GTS Duratek UltraCompactor®. The supercompactor processes either 4' x 3' x 3' boxes or drums of waste with a force of 10 million pounds. Typical wastes processed include materials such as paper, rubber, plastic, asbestos, metals, and filters. Supercompaction reduces the waste volume by an average factor of 4:1, based on a typical dry active waste (DAW) density of 65 lb/ft^3 . Fifty percent (50%) theoretical density is normally achieved for metals, or up to 250 lb/ft^3 . The supercompactor can process over $70,000 \text{ ft}^3$ of DAW per month. Any liquid waste generated from the compaction process is collected in a sump beneath the supercompactor. This liquid waste is either incinerated or solidified depending on its waste characteristics.

Metal Melt of Containers

Metals generated in the process were recycled using the GTS Duratek 20-ton, 7200 kW electric induction furnace with a capacity of 25,000,000 lbs/year. Recyclable metal is recast into shield blocks which are provided for no charge to U.S. DOE laboratories such as Los Alamos. Recycling the metal is beneficial because it eliminates original generator liability for the recast metal and it avoids burial costs. Metal melting also provides significant volume reduction of metals that cannot be decontaminated to recyclable levels.

Waste received at the Metal Melt Facility is size reduced, if required, by cutting torches or a shredder, and is placed in one of three holding bins. Metal is then retrieved from the bins and placed in a transfer cart which is preheated with natural gas fired burners to drive off moisture and combustibles. Overhead cranes feed the heated metal from the transfer carts into the induction furnace. When the furnace is fully charged, the molten metal is poured into three to twelve ton molds for use as shield blocks. The metal ingots are cut, milled and painted to meet client specifications. Process gases from the furnace and the preheat area are exhausted through

a ventilation system consisting of four parallel bag house chambers followed by two three-stage HEPA filter banks.

Shipment And Disposal of Waste

Pantex selected to send the dewatered and compacted waste directly from GTS Duatek. All container markings and labeling were applied by GTS Duratek at their Bear Creek Facility under the direction of the Pantex Waste Certification Officer. The waste containers were loaded and shipped to NTS in December 1998.

Conclusion

GTS Duatek successfully processed 160 drums of wet waste for the Pantex Facility in Amarillo, Texas. The processing was done to meet the Waste Acceptance Criteria at the Nevada Test Site burial grounds. The waste consisted of wet crushed glass and plastic scintillation vials, support materials and scintillation liquids. Processing included dewatering, compaction of solid waste, incineration of liquid wastes, and metal melting of empty metal containers.

REFERENCES

1. GTS Duratek, GTS Duratek Waste Acceptance Criteria, WM-ADM-I-101, August 1998.
2. Mason And Hanger Corporation, Statement of Work for Treatment of Radioactive Ultim-Gold, Crushed Glass and Plastic; August 25, 1998.