

Information for Plutonium Waste Shipments

Babcock & Wilcox, Nuclear Materials & Manufacturing Division

Plutonium Fuel Facility

Parks Township, Pennsylvania

Docket No. 71-6400

Certificate of Compliance No. USA/6400/B( )F

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## I. Introduction

Plutonium-bearing wastes of soft, hard, and liquid forms are generated at Pennsylvania Operations. Prior to shipment, the waste is processed as required and packaged in DOT Specification 17H 55-gallon drums or approved burial boxes, as appropriate. The packaged waste is subsequently transported to a remote site for permanent burial (or temporary burial pending plutonium retrieval at U.S. DOE Hanford facilities) in Richland, Washington.

The amendments to Certificate of Compliance USA/6400/B( )F requested by Pennsylvania Operations are summarized as follows:

- 1) Pennsylvania Operations requests that the maximum quantity of plutonium per each drum or burial box be limited to 200 grams, with the total quantity of plutonium per Supertiger package limited to 2000 grams. The nuclear criticality safety of this requested limit is supported by a previously demonstrated safe practice given in Rocky Flats document - RFP-1411, entitled "ATMX-600 Railcars for Radioactive Waste Shipments", dated January 7, 1970 (Attachment #1). The requested limit of 2000 grams plutonium per Supertiger will ensure that shipments of plutonium-contaminated waste are made in accordance with pertinent safeguards requirements of 10 CFR Part 73, without necessitating the use of the Safe Secure Transport (SST) and its associated precautionary measures. The requested drum limit also reflects an ongoing concern for reducing the volume of plutonium-contaminated waste and subsequent shipments generated by Pennsylvania Operations; and further, it should be noted that the requested Supertiger limit is some twenty percent lower than that permitted by the current Revision 7 of Certificate of Compliance 6400.
- 2) Pennsylvania Operations' packaging procedures process soft waste of a type and form essentially identical to that currently authorized by Revision No. 7 of the Certificate of Compliance; however, our site-specific procedure does necessitate a minor change in that section. Specifically, our 12 mil thick PVC bags are typically of dimensions 22" x 10" x 10", which are different from those currently specified in the certificate. Although these are the bag dimensions typically used, it may occasionally be necessary to utilize bags of different dimensions; hence, we request that there be no specification of exact dimensions in the certificate. Our current soft waste packaging methods are described in Section II of this document.
- 3) Pennsylvania Operations has established and is currently solidifying liquid wastes in a form similar to that now authorized by the certificate; however, the quantities and conditions involved in our processing procedure does necessitate a revision in the applicable certificate section. Specifically, we request that cylindrical containers of typical dimensions 10-1/4" in length and 6-1/4" in diameter be approved for stacking and shipment in 55 gallon steel drums. Section III describes our pre-shipment handling, solidification, and packaging procedures for plutonium-contaminated liquid waste.

## II. Soft Wastes

### A. Description:

This material includes paper, cardboard, fibreboard, soft plastics, rubber,

cloth, etc. in forms such as Kimwipes, HEPA filter material, shoe covers, gloves, empty polyethylene bottles, and other discarded materials incidental to processing.

B. Pre-shipment Handling:

Soft waste generated within the gloveboxes is double-bagged in 12 mil thick polyvinyl chloride (PVC) plastic bags, each of which is individually dielectrically sealed. Soft waste generated outside gloveboxes is placed in a polyethylene bag and sealed with tape. HEPA filters are bagged off at the nipple and double-bagged in 12 mil thick PVC plastic which is dielectrically sealed.

Soft waste to be compacted is transferred to a compactor glovebox and placed in a compactor bag prior to compacting. After the waste has been compacted, the package is removed from the glovebox, double-bagged and dielectrically sealed in 12 mil thick PVC plastic.

Soft waste packages are nondestructively assayed for plutonium content, before being placed into a polyethylene bag which lines a 17H 55-gallon steel drum equipped with a standard drum closure. Each drum is restricted to contain not greater than 200 grams of plutonium.

When the drum is filled, the liner bag is sealed with plastic tape and the drum closure secured.

C. Packaging Procedures:

Current packaging methods for noncompacted and compacted soft waste will remain the same. In addition, the following practices have been established:

- 1) Soft wastes will not be comingled with hard wastes within the same 17H 55-gallon drum; and,
- 2) Combustible waste will not be comingled with non-combustible waste.

### III. Liquid Wastes

#### A. Description

These consist of analytical solutions, generally of acidic pH.

#### B. Pre-shipment Handling:

These wastes are transported to the solidification glovebox in 2 liter polyethylene bottles which have been previously nondestructively analyzed by gamma counting. Once in the solidification glovebox, approximately one liter of the waste from one bottle is poured into a large beaker, and cement is added until the proper consistency is obtained. This mixture is then transferred into a cardboard container (approximate dimensions: 10-1/4" length and 6-1/4" diameter), which is lined with a polyethylene bag. The remaining liquid from the bottle is then mixed with cement in the same manner, and placed in the cardboard container, which is assigned the Pu content measured for the 2 liter bottle. No container will contain waste from more than one bottle; the contents of any one bottle will be poured into only one container. The mixture requires approximately 24 hours to harden, and is allowed to stand in the glovebox during this time interval.

For removal from the glovebox, the plastic bag excess is folded into the container, the lid is placed on the container, and the container is "bagged out" of the glovebox using standard PVC bagging material, dielectrically sealing the bag. A second bag of PVC is placed over the first and dielectrically sealed. The double-bagged container is then transferred to the NMC vault for packaging in a 17H 55-gallon steel drum.

#### C. Packaging:

The double-bagged cardboard containers are placed in a type 17H 55-gallon steel drum lined with a polyethylene bag and equipped with a standard drum closure. The entrapped air in the PVC bags provides a cushion between the cement cylinders within the drum. The mass limit per drum is controlled by observing the plutonium content recorded on the individual packages, with packing performed as tightly as is safely achievable in order to retain the individual packages securely in place. When filled, the drum is sealed with a standard drum closure, tamperproofed, and properly labeled according to its plutonium content.

### IV. Results of Testing of Cement Solidification of Pu Process Liquid Waste

Several solutions were made up, and cement was then added. The mixtures were set aside to determine if the cement would harden. Each test was done in a 1/2 gallon polyethylene bottle which could be then cut away to examine the cement and to determine if any free liquid was present. The solutions tested were as follows:

- 1) A one normal sulfuric acid solution (with 75 gms/liter of sodium bisulfate) was neutralized to a pH of 7.0 (essentially neutral). One liter was added to five pounds of cement and thoroughly blended. The mixture hardened completely after approximately 24 hours.

- 2) A one normal sulfuric acid solution (with 75 gms/liter of sodium bisulfate) was over-neutralized to a pH of 14.0 (extremely basic). One liter of liquid was added to five pounds of cement and blended. Again, the mixture hardened completely after 24 hours.
- 3) Two hundred milliliters of a one normal sulfuric acid solution (not neutralized) was added to one pound of cement. Once again, after 24 hours, the mixture had completely hardened.
- 4) One liter of a two normal sulfuric acid mixture was added to four pounds of cement. This mixture hardened completely after 24 hours. This solution was twice the strength of the normal laboratory waste. It was thought that if this mixture solidified, then any solution generated by the Analytical Lab could be mixed directly with cement and the intermediate operation of neutralization could be eliminated. In actuality, the cement itself will neutralize the acid. The cement cylinder obtained from this experiment was washed with water and the resulting liquid tested for acidity. The water was strongly basic (pH 10 to 13) indicating that all the acid had been neutralized.

In each of the above tests, when the polyethylene bottle was cut away a free standing cement cylinder was obtained. No free liquid was found in any bottle.

Based on these trials, it was decided to solidify actual laboratory waste. Laboratory waste is packaged in polyethylene bottles in two liter quantities. One bottle was selected and one half (one liter) was poured into a large beaker. Cement was slowly added until the proper consistency was obtained. This mixture was then transferred into a 10-1/4 inch high by 6-1/4 inch diameter cardboard container lined with a polyethylene bag. The remaining liquid was also mixed with cement and placed in the cardboard container. After 24 hours, it was found that the cement had hardened and that no free liquid was present. (This was determined by pulling the polyethylene bag out of the cardboard container and visually examining the resultant cement cylinder.) Since the test was deemed successful, all other liquid laboratory waste was solidified in the same manner.

Upon removal from the glovebox, the protruding polyethylene bag excess was folded and placed inside the cardboard container. The lid was placed on the container and then the item was "bagged out" of the glovebox using standard polyvinyl chloride bagging material and dielectrically sealing the bag. A second bag of PVC was placed around the first as per standard NM&MD procedure. These doubly bagged cardboard containers were placed in a 20 year retrievable storage, 55 gallon, 17H type drum. Due to the fact that each package of cement is doubly bagged, the entrapped air within the bags acts as a cushion to prevent the cement cylinders from contacting one another within the drum. For Nuclear Material Accountability, each two liter bottle of solution transferred to the solidification box will have been analyzed by gamma counting. Each bottle will be solidified in 2 approximate one liter batches and then placed in one cardboard container. Since a one to one correspondence will exist, the plutonium number for the liquid is assigned to the cement cylinder. The results of these tests are illustrated in the photograph given as Attachment 2.

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