



CONTROLLING BERYLLIUM CONTAMINATED MATERIAL AND EQUIPMENT FOR THE BUILDING 9201-5 LEGACY MATERIAL DISPOSITION PROJECT

October, 2010

Prepared by the
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Oak Ridge, TN 37831
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for the
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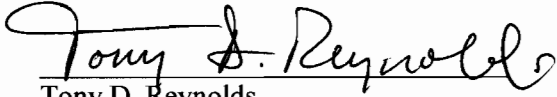
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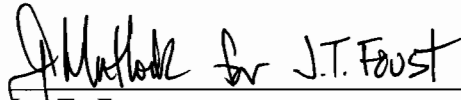
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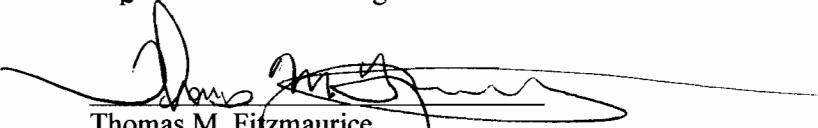

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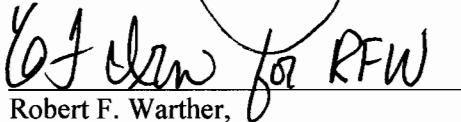

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1. PURPOSE

This position paper addresses the management of beryllium contamination on legacy waste. The goal of the beryllium management program is to protect human health and the environment by preventing the release of beryllium through controlling surface contamination. Studies have shown by controlling beryllium surface contamination, potential airborne contamination is reduced or eliminated. Although there are areas in Building 9201-5 that are contaminated with radioactive materials and mercury, only beryllium contamination is addressed in this management plan. The overall goal of this initiative is the compliant packaging and disposal of beryllium waste from the 9201-5 Legacy Material Removal (LMR) Project to ensure that beryllium surface contamination and any potential airborne release of beryllium is controlled to levels as low as practicable in accordance with 10 CFR 850.25.

2. INTRODUCTION

The current scope of work for the Building 9201-5 (Alpha 5) Legacy Material Disposition Project is to complete removal and disposition of all legacy materials in Alpha 5 to prepare the facility for eventual deactivation and demolition. All work shall be performed in accordance with Appropriate or Relevant and Appropriate Requirements (ARARs). Legacy materials are defined as easily removable items that involve minimal reconfiguration efforts (e.g., unbolting, unplugging, wire cutting, or cold cutting). The project is being performed in accordance with the requirements of the Federal Facility Agreement for the Oak Ridge Reservation and an approved action memorandum for a time-critical removal action (DOE/OR/01-2404). Legacy waste will be characterized appropriately, prepared and packaged for shipment for disposal.

Alpha 5 was completed in May 1944 and served as a production facility for Y-12 functioning as a uranium enrichment facility beginning with the Manhattan Project. The facility has been renovated and altered over the years converting some shop and laboratory spaces to office and administration services space. The facility has been characterized for hazardous materials, and the characterization has identified beryllium and radioactive contamination in certain areas. Beryllium contamination in 9201-5 is within approximately sixty percent of the facility. Concentrations vary from very low ($< 0.2 \mu\text{g}/100 \text{ cm}^2$) to areas where concentrations are relatively high (approximately $600 \mu\text{g}/100 \text{ cm}^2$) in regulated beryllium areas. All work involving beryllium is conducted in accordance with the DOE approved B&W Y-12 *Chronic Beryllium Disease Prevention Program Manual*, Y73-201.

The project is proposing a comprehensive strategy to manage the beryllium contamination, ensure worker protection, and minimize handling. The strategy is compliant with 10 CFR 850.

3. REGULATORY CONSIDERATIONS

3.1. Occupational Safety and Health Administration (OSHA) Requirements

Section 5(a)(1) of the OSH Act, often referred to as the General Duty Clause, requires employers to "furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees." Section 5(a) (2) requires employers to "comply with occupational safety and health standards promulgated under this Act."

OSHA also requires beryllium air contamination to be monitored and assessed under the General Industry Regulations (29 CFR 1910) which includes 1910.1000, Air contaminants with Table Z-1 and Z-2 specifying limits for air contaminants . Table Z-2 specifies

Table 1, Regulatory Limits for Beryllium Exposure

Substance	8-hour time weighted average	Acceptable ceiling concentration	Acceptable maximum peak above the acceptable ceiling concentration for an 8-hr shift	
			Concentration	Maximum duration
Beryllium and beryllium compounds (Z37.29-1970)	2 µg/m(3)	5 µg/m(3)	25 µg/m(3)	30 minutes.

3.2. Department of Energy (DOE) Requirements

- 10 CFR Part 850, Chronic Beryllium Disease Prevention Program; Final Rule. (1999, December 8), 400 KB [PDF](#), 62 pages.
- 10 CFR Part 850 Part II, Chronic Beryllium Disease Prevention Program; Final Rule Amendments. (2006, February 9), 342 KB [PDF](#), 8 pages.

§ 850.3(a) Definitions. Beryllium Regulatory requirements:

Beryllium means elemental beryllium and any insoluble beryllium compound or alloy containing 0.1 percent beryllium or greater that may be released as an airborne particulate.

§ 850.32 Waste disposal.

- (a) The responsible employer must control the generation of beryllium containing waste, and beryllium-contaminated equipment and other items that are disposed of as waste, through the application of waste minimization principles.
- (b) Beryllium-containing waste, and beryllium-contaminated equipment and other items that are disposed of as waste, must be disposed of in sealed, impermeable bags, containers, or enclosures to prevent the release of beryllium dust during handling and

transportation. The bags, containers, and enclosures that are used for disposal of beryllium waste must be labeled according to § 850.38.

§ 850.38 Warning signs and labels.

- (a) *Warning signs.* The responsible employer must post warning signs at each access point to a regulated area with the following information:

DANGER

BERYLLIUM CAN CAUSE LUNG DAMAGE

CANCER HAZARD

AUTHORIZED PERSONNEL ONLY

- (b) *Warning labels.* (1) The responsible employer must affix warning labels to all containers of beryllium, beryllium compounds, or beryllium-contaminated clothing, equipment, waste, scrap, or debris. (2) Warning labels must contain the following information:

DANGER

CONTAMINATED WITH BERYLLIUM

DO NOT REMOVE DUST BY BLOWING OR SHAKING

CANCER AND LUNG DISEASE HAZARD

- (c) Warning signs and labels must be in accordance with 29 CFR 1910.1200, Hazard Communication.

§ 850.23 Action level.

- (a) The responsible employer must include in its Chronic Beryllium Disease Prevention Program (CBDPP) *an action level that is no greater than 0.2 µg/m³, calculated as an 8-hour TWA exposure, as measured in the worker's breathing zone by personal monitoring.*

- (b) If an airborne concentration of beryllium is at or above the action level, the responsible employer must implement §§ 850.24(c) (periodic monitoring), 850.25 (exposure reduction and minimization), 850.26 (regulated areas), 850.27 (hygiene facilities and practices), 850.28 (respiratory protection), 850.29 (protective clothing and equipment), and 850.38 (warning signs) of this part.

Regulatory Review by DOE Office of Health, Safety, and Security

Because of the vagueness in the CFR, the DOE Office of Health, Safety and Security was contacted and an interpretation of the CFR for waste disposal was requested. Their response is below:

The Department of Energy does not have an official definition of beryllium waste as it applies to the 10 CFR 850, "Chronic Beryllium Disease Prevention Program." The following is an informal description of beryllium waste. In general, beryllium-containing material or beryllium-contaminated equipment and other items that are generated by a beryllium activity and are intended to be disposed would be considered beryllium waste. Section 10 CFR 850.3 states that "Beryllium activity means an activity taken for, or by, DOE at a DOE facility that can expose workers to airborne beryllium, including but not limited to design, construction, operation, maintenance, or decommissioning, and which may involve one DOE facility or operation or a combination of facilities and operations." The rule requires that a designated, qualified individual identify beryllium activities and describe them in the site's written CBDPP. Beryllium-containing material and beryllium-contaminated equipment and other items generated by an identified beryllium activity and destined for disposal would be presumed to be beryllium waste unless evidence or logic supports a conclusion that it is not. Also (under the 10 CFR 850 provisions), beryllium waste would meet one of the following criteria based on process knowledge, calculation and analysis, and/or sampling:

- Elemental beryllium, insoluble beryllium compounds (e.g., beryllium oxide), and any alloy containing 0.1 percent or greater beryllium by weight that is destined to be disposed of as waste;
- Equipment with removable beryllium contamination (internal or external) exceeding, or potentially exceeding, 0.2 $\mu\text{g}/100\text{ cm}^2$;
- Building materials and demolition debris containing beryllium exceeding 0.1 percent (w:w) (1,000 parts per million); or
- Job-associated materials such as gloves, booties, and disposable coveralls coming from a regulated area or from an area where the beryllium can reasonably be expected to exceed 0.2 $\mu\text{g}/\text{m}^3$ in air or 0.2 $\mu\text{g}/100\text{ cm}^2$ removable from surfaces (unless it can be demonstrated that the material could not become contaminated through the use of isolation techniques such as placing a clip-board inside a plastic bag for a walkthrough of the area).

Waste streams that may contain beryllium that meet the above criteria often are highly variable in terms of the matrix and concentration. A qualified individual (e.g., an industrial hygienist) can determine the conditions under which a waste stream, or part of a waste stream, should be designated as beryllium waste. Naturally occurring beryllium in background soil is not considered to be beryllium in 10 CFR 850 and therefore does not contribute to a material being designated as beryllium waste. It also is worth mentioning that certain beryllium-containing materials may be subject to the Resource Conservation and Recovery Act (RCRA) hazardous waste regulations (40 CFR 261 – 268). Under RCRA, a waste is generally defined as any "discarded material." For instance, discarded "beryllium powder" has been designated as a RCRA listed hazardous waste (EPA Hazardous Waste No. P015) and must be managed in accordance with the applicable RCRA hazardous waste requirements. This listing [see 40 CFR 261.33(e)] applies to beryllium powder that is an unused commercial-grade chemical product. In addition, certain beryllium-contaminated materials or equipment to be disposed may also be subject to the RCRA hazardous waste requirements if the waste (that the beryllium is

contained in) also exhibits a characteristic of hazardous waste as described in 40 CFR 261.20 – 261.24 (ignitability, corrosivity, reactivity, or toxicity).

3.3. EPA/TDEC REQUIREMENTS

The Alpha 5 LMR project has already removed all chemicals that were in the facility and properly disposed of them. Additionally the project has completed a listed waste determination documenting that there are no listed waste issues associated with the LMR project.

As discussed in the section above, the EPA only regulates beryllium as a listed waste for RCRA (40 CFR). The project has no listed waste. Although TDEC administers the federal program and has the authority to add additional constraints, TDEC has not added any additional requirements on beryllium waste disposal.

4. ANALYTICAL DATA FOR LEGACY MATERIAL REMOVAL

During the sampling process to characterize LMR material for EMWMF, 319 samples were collected. The five highest results were 317 mg/kg, 35.8 mg/kg, 33.1 mg/kg, 10 mg/kg, and 5.49 mg/kg. The minimum was 0.056 mg/kg. The mean was 1.617 mg/kg and the UCL-95 is 143 mg/kg:

5. TEST CASE FOR INDUSTRIAL HYGIENE (IH) CONTROLS OF BERYLLIUM WASTE

Recent lessons learned from the Foundry Decontamination Project, which focused on reducing Personal Protective Equipment (PPE) needed for previous beryllium contamination operating areas, have provided techniques for decontamination and encapsulation useful to the Alpha 5 Project. It is worth noting that Y-12 does comply with the 10 CFR 850 beryllium rule, which requires use of the DOE action level.

The Foundry in Building 9202 exceeded the DOE and B&W Y-12 surface contamination criterion of $0.2 \mu\text{g}/100 \text{ cm}^2$ in the range of detectable to approximately $300 \mu\text{g}/100\text{cm}^2$ levels. The Foundry Decontamination Project utilized effective housekeeping, decontamination and encapsulation to remove legacy equipment for waste transport and disposal and to mitigate the remaining Foundry facility conditions (structures and equipment) such that required PPE could be significantly reduced. During the months following the project, IH performed personnel breathing zone and area air samples on all Foundry activities and demonstrated that routine airborne levels were below the action level of $0.2 \mu\text{g}/\text{m}^3$. Of the hundreds of air samples collected, the high was $12 \mu\text{g}/\text{m}^3$, and the majority were non-detects (below $0.01 \mu\text{g}/\text{m}^3$) with an average of less than $0.2 \mu\text{g}/\text{m}^3$ (the action level). Similarly, surface smear results from established IH routine surveys remain $<0.02 \mu\text{g}/100\text{cm}^2$.

Alpha 5 will utilize essentially the same encapsulation processes as the Foundry Decontamination Project — fixative (Foster Chil-Lock CP-240® and/or Pittsburg Paint

Speedhide®) applied with garden sprayers to encapsulate and fix the contamination to the surface and render the contamination inaccessible.

6. Facility Controls:

Facility controls implemented for potential beryllium contamination include managing beryllium regulated areas, beryllium areas, beryllium storage areas and beryllium buffer areas through administrative posting of areas to control potential sources and to minimize spread of contamination. The beryllium contaminated legacy waste has been characterized as either:

- Beryllium detectable waste based on process knowledge and/or analytical data. Waste may be assumed to meet the definition of beryllium detectable if statistical sampling to verify that it meets free release criteria would add extraordinary or unnecessary cost for disposal; or
- Beryllium regulated waste based on process knowledge and/or analytical data

Multiple contamination control systems for beryllium contamination on legacy waste have been implemented using a graded approach under the direction of IH personnel assigned full time to the project:

- Housekeeping – routine wet mopping, spray waxing utilizing garden sprayers and use of floor scrubbers as a dust control measure
- Methodically controlled egress of personnel (slow and deliberate doffing techniques, incorporation of several controls to limit the potential spread of contamination)
- Use of step off pads, garden sprayers/misters and HEPA vacuums at doffing stations
- Airless sprayers/garden sprayers in work areas applying water and/or surfactants as a dust control measure

6.1. Specific Pre-Packaging Activities

Prior to packaging, the following actions will be taken:

- The Y-12 Project IH will review the beryllium work practices and controls and certify in writing that the different or modified controls are adequate to “reduce potential airborne levels of beryllium to below applicable regulatory limits.”
- The Y-12 Project IH will recommend areas where spray encapsulant should be used, if needed, for “lockdown” of beryllium to prevent airborne releases during mechanical demolition. These and other controls identified through inspections may be documented in the work package.
- Beryllium waste will be loaded in regulated beryllium areas, beryllium areas, or in an enclosure. A schematic of a typical enclosure is shown below in Figure 1.

The areas have been surveyed for beryllium and both swipe and analytical samples collected. All items in the beryllium regulated area will be encapsulated. Within the beryllium areas, beryllium waste will be wrapped or encapsulated.

Encapsulation will completely cover exposed surfaces of equipment and material. Application of encapsulant will be controlled to minimize overspray on buffer areas already characterized. Items that are disposed as double encapsulated, will have openings, access panels and voids encapsulated to ensure all potential contaminated surfaces are encapsulated.

6.3. Additional Specific Work Controls

Additionally, through the work control process:

- Dismantling of equipment and material handling practices will be chosen to minimize airborne suspension of beryllium.
- Beryllium material shall not be intentionally subjected to sanding, grinding, or abrading.
- All conveyances shall comply with other applicable transportation requirements for waste packaging as mandated by the Y-12 Waste Management and Transportation Group.
- Y-12 Project Industrial Hygiene monitoring data will be reviewed to confirm that airborne levels of beryllium do not exceed applicable regulatory limits.

6.4. Packaging Process:

Waste may be packaged into soft sided shipping/storage containers (i.e., Supersacks) or boxes that meet or exceed the requirements for Department of Transportation (DOT) Industrial Packaging Type 1 (IP-1) or under an approved TSP variance from transportation. The containers may be used for solid radioactive material including Low Specific Activity (LSA-1) Objects, Surface-Contaminated Objects (SCO-1), and other material which requires the use of a DOT IP-1 packaging.

6.4.1. Supersacks

Supersacks will be selected in accordance with the attached B&W packaging specification **JS-EA-801545-A021**. In addition, example vendor specifications have also been included to provide details of the supersack packaging specifications. The following methods will be taken to prevent punctures, rips, and tears of the supersacks:

- Additional padding will be used because the equipment and materials are irregularly shaped
- Equipment and waste loaded into supersacks will undergo an evaluation by B&W Waste Engineers to ensure that the internal voids have been adequately filled. Use of

operator aids and void space calculation packages have been developed to assist the waste engineers in making these determinations. These documents provide specific guidance on what items need to be removed from equipment to ensure that the void spaces are filled to the maximum extent practical, which will be a minimum of 90% filled.

- Void space contained in the supersacks will be reduced by utilizing guidance from the manufacturer;
- Weight and fill specifications for each package will be strictly followed as directed by the manufacturer and feedback from EMWMF;
- Packages will be labeled in accordance with 10 CFR 850.38(b)(2); and
- The exterior of all supersacks that enter the beryllium and beryllium regulated areas will be smeared and verified to be below $0.2 \text{ ug}/100 \text{ cm}^2$, the beryllium release levels allowed before shipping in accordance with Y73-201.
- If an unlined supersack is used, all items placed in the supersack will have 2 wraps. This may be either double encapsulated, encapsulated and wrapped or double-wrapped.

6.4.2. Boxes

Boxes, in the context of this paper, will be IP-1 strong-tight containers that are of a size and configuration that can be handled at EMWMF (e.g., B-25s, ST-90s, roll-offs, sealands, etc.).

- Boxed waste may undergo additional void space fill using gravel or grout prior to direct placement at EMWMF. Due to weight restrictions on packages this activity shall be performed at EMWMF.
- The exterior of all boxes that enter the beryllium and beryllium regulated areas will be smeared and verified to be below $0.2 \text{ }\mu\text{g}/100 \text{ cm}^2$ the beryllium levels allowed before shipping in accordance with Y73-201.

6.4.3. Double – Bagged

Some waste may be double bagged in impermeable plastic (minimum 6-mil polyethylene). These items will be compliant with the EMWMF PWAC and weigh less than 40 pounds.

6.4.4. TSP Permitted Variance

The site transportation plan permits variances to the IP-1 for on-site moves. This will be evaluated by transportation for each shipment. The packages will meet the general design requirements and be closed containers that will remain intact. Evaluation criteria will include wind, weather, and vibration forces. Double-wrapped or double-encapsulated items that ship on a flat-bed are subject to this variance.

6.4.4.1. Double – Wrapped

Some waste may be double wrapped in impermeable plastic (minimum 6-mil polyethylene). These items will be shipped as single debris items requiring placement at EMWMF.

6.4.4.2. Double - Encapsulated

Some waste may be double encapsulated to ensure all beryllium dust is encapsulated. This will be determined by Y-12 Industrial Hygiene and used on large items with specific safety issues, such as hoisting and rigging. Y-12 Transportation will then decide the packaging requirements for these single items to ensure compliance with DOT.

6.4.4.3. Single Encapsulated and Wrapped

Some waste may be encapsulated and wrapped in impermeable plastic (minimum 6-mil polyethylene). These items will be shipped as single debris items requiring placement at EMWMF. Y-12 Transportation will then decide the packaging requirements for these single items to ensure compliance with DOT.

7. PROPOSED BERYLLIUM CONTROL STRATEGY:

A comprehensive approach is being implemented within the Alpha 5 Facility to manage beryllium contamination and to minimize the spread of beryllium in accordance with the DOE approved B&W Y-12 *Chronic Beryllium Disease Prevention Program Manual*, Y73-201.

7.1. Preparing Waste for Shipment

Beryllium waste shall be packaged in a buffer area or in an enclosure. This will prevent the shipping container from getting contaminated. To further monitor and verify that the level of beryllium is minimized, IH will continue utilizing engineering, administrative, and PPE controls. The effectiveness of these controls will be verified by several methods including personal air monitoring, area sampling, and weekly smears of all buffer areas. This allows IH to monitor the effectiveness of the housekeeping and engineering controls in place in the facility. Beryllium buffer areas are maintained and verified below $0.2 \mu\text{g}/\text{cm}^2$. Waste items shall be prepared for shipment and disposal by one of the following means (Table 1) utilizing the flow in Figure 2:

- 1) Single-encapsulated per Section 6.2, placed into a box, and shipped via flatbed or roll-off.
- 2) Single-encapsulated per Section 6.2, single-wrapped with 6-mil poly, placed into a supersack, and shipped via dump truck, roll-off, or flatbed.
- 3) Single-wrapped with 6-mil poly, placed into a supersack, and shipped via dump truck, roll-off, or flatbed.
- 4) Single-wrapped with 6-mil poly, placed into a box, and shipped via flatbed or roll-off truck.

- 5) Single-encapsulated per Section 6.2, single-wrapped with 6-mil poly, and shipped via roll-off or flatbed..
- 6) Double-wrapped with 6-mil poly and shipped via dump truck, roll-off, or flatbed.
- 7) Select Items approved by IH may be double -encapsulated per Section 6.2 and shipped via dump truck, roll-off, or flatbed.
- 8) Double-bagged and less than 40 pounds (i.e., compliant with the EMWMF PWAC).

Table 2: Packaging Methods

Method	Spray-on encapsulant (§ 6.2)	6-mil poly wrap (§ 6.4.3) ¹	IP-1 container (§ 6.4.1 & 6.4.2 & 7.3)	Shipping method ²
1	Single-encapsulated		Box	Flatbed
2	Single-encapsulated		Supersack	Dump truck Roll-off Flatbed
3		Single-wrapped	Supersack	Dump truck Roll-off Flatbed
4		Single-wrapped	Box	Flatbed
5	Single-encapsulated	Single-wrapped		Roll-off Flatbed
6		Double-wrapped (large single-debris items)		Dump truck Roll-off Flatbed
7	Double-encapsulated			Roll-off Flatbed
8		Double-bagged (Compliant with EMWMF PWAC)		Dump truck Roll-off

Notes

1. Y-12 Transportation will ensure decide packaging requirements are compliance with DOT.
2. The exact shipping method will be coordinated between the Project and EMWMF Operations depending on the waste type, waste packaging, and unloading method. For example, large metal equipment will typically be shipped via flatbed on dunnage for unloading and placement using a forklift; it will not be dumped from a dump truck.

Two B&W Y-12 internal variances (Figure 3 and 4) have been granted for these processes.

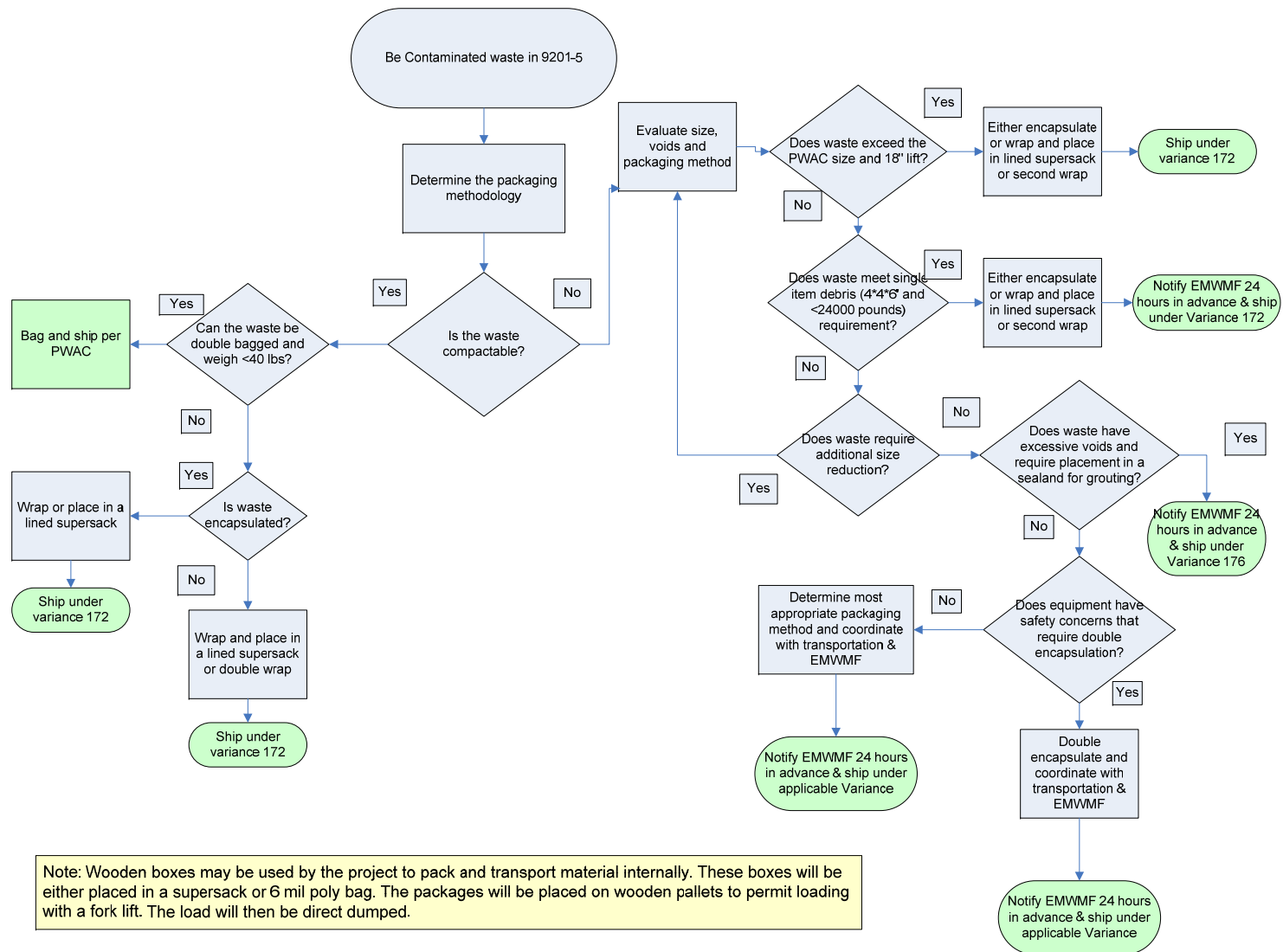


Figure 2: Be-Waste Strategy Flow Diagram



Date: March 11, 2010
To: R. F. Warther
c: J. W. Birchfield III, S. D. Easterling, R. T. Ford, C. D. Nichols, T. D. Reynolds
From: M. M. Reichert, 301BCR, MS-8111 (241-5104) *M. M. Reichert*
Subject: **Exemption from Y73-201, Chronic Beryllium Disease Prevention Program, Requirements for American Recovery Reinvestment Act Funded Project, Beryllium Waste Disposal**

The B&W Y-12 *Chronic Beryllium Disease Prevention Program*, Y73-201, Chapter 8 Transfer Requirements Section A, requires that equipment, other items, and beryllium-contaminated waste shall be enclosed or placed in a sealed container (i.e., metal or fiber drum) or two 6-mil poly bags for handling and transportation. This requirement is more explicit than DOE Rule 10 CFR 850; however, Y73-201 Chapter Introduction "Applies To" section does allow the Vice President of Environment, Safety and Health to grant exemptions from the B&W Y-12 *Chronic Beryllium Disease Prevention Program*.

The Department of Energy DOE Rule 10 CFR 850, *Chronic Beryllium Disease Prevention Program*, requirements include 850.32 Waste Disposal (a) The responsible employer must control the generation of beryllium-containing waste, and beryllium contaminated equipment and other contaminated equipment and other items that are disposed of as waste, through the application of waste minimization principles, and (b) Beryllium-containing waste, and beryllium-contaminated equipment and other items that are disposed of as waste, must be disposed of in sealed, impermeable bags, containers, or enclosures to prevent the release of beryllium dust during handling and transportation. The bags, containers, and enclosures that are used for disposal of beryllium waste must be labeled according to 850.38

Based on guidance from the Industrial Hygiene Organization, I am granting the following exemption from Y73-201 requirement for two 6-mil poly bags based on equivalent controls. Encapsulation of the beryllium contaminated material in conjunction with the minimum of a 6-mil poly bag provides effective enclosure to prevent the release of the beryllium dust during the handling and transportation. This exemption does not relieve the additional requirements of Y73-201 (i.e. labeling of the waste containers), the Waste Acceptance Criteria for waste disposal, or Department of Transportation requirements.

MMR:pld

Managed by B&W Y-12, LLC for the U.S. Department of Energy

Figure 3: Internal Variance 1



Date: September 30, 2010
To: R. F. Warther
c: R. E. Bell, S. D. Easterling, T. H. Fitzmaurice, R. T. Ford, W. O. Lawless,
T. D. Reynolds
From: M. M. Reichert, 301BCR, MS-8111 (241-5104) *M. M. Reichert*
Subject: **Exemption from Y73-201, *B&W Y-12 Chronic Beryllium Disease Prevention Program Manual***

Chapter eight of the *B&W Y-12 Chronic Beryllium Disease Prevention Program Manual* addresses the transfer of beryllium contaminated equipment, items, etc., and requires that line management enclose or place equipment, other items, and beryllium contaminated waste in a sealed container and/or two six-mil poly bags for handling and transportation.

In accordance with my authority to grant exemptions from specific requirements of the manual, I am granting an exemption to the above-stated requirement for the Building 9201-5 Legacy Waste Removal Project in instances where the safety risk associated with the wrapping/bagging of the equipment or item is determined to be unacceptable by Environment, Safety and Health (ES&H) project representatives.

In such instances, the unacceptable risk will be documented by ES&H, and the equipment/item in question shall be fully coated with two layers of an ES&H-approved encapsulating material in order to minimize the potential for release of beryllium contamination.

Should you have any questions or require additional information regarding this matter, please contact Tom Ford at 576-7182.

MMR:mt

Figure 4: Internal Variance 2

7.2. Packaging and Contamination Control of Conveyance:

- Waste material and equipment that are encapsulated will be placed into a shipping / storage container that meets Department of Transportation (DOT) requirements or an approved TSP variance.
- The waste material will be packaged by the methods indicated in Section 7.1 to ensure the packaging exterior will remain below regulatory beryllium limits.
- Surface smear sampling will be conducted to establish baseline beryllium levels in transport equipment. This will be done for all vehicles prior to their initial shipments in accordance with Y-12 IH and Transportation procedures.
- Each container (e.g., double-wrapped, supersack or box) will be labeled in accordance with 10 CFR 850.38(b) (2).

7.3. Packaging Specifications:

For information on supersacks and boxes, see Sections 4.1 and 6.4, respectively.

Supersacks will either have lifting fixtures that enable the waste to be lifted and directly placed into the designated location within EMWMF or be direct dumped into the designated location.

Items that exceed the weight capacity or other limitations of the supersacks (e.g., sharp objects that could cut the supersacks) will be evaluated for segmentation, alternative packaging (wrapped, boxed and void fill or double wrapped with voids filled) and disposal at EMWMF.

Items that are shipped under the TSP will be evaluated by transportation and negotiated on an item specific basis prior to disposal at EMWMF.

Boxes will be filled to the maximum extent practical. The lids will be compatible with the grouting equipment to be used at the EMWMF.

8. COMPLIANCE MONITORING

B&W has been disposing of beryllium waste at the Nevada Test Site (NTS) from the fourth floor of Alpha 5. This waste is very similar to the waste on the third and first floors that will be sent to EMWMF, because the waste on all four floors is excess equipment, furniture, and general debris from machining operations. Air samples were collected and analyzed. The air samples were both personal air samples and area samples. All of the air samples were well below the action level of $0.2 \mu\text{g}/\text{m}^3$.

8.1. Airborne Beryllium Sampling Strategy

Both area and personal air samples for beryllium will be collected during the LMR. It has been determined by a hazard analysis/assessment conducted in accordance with 10 CFR 850 that the workers performing dismantlement and packaging have the greatest potential to generate airborne levels of beryllium. For this reason, full work shift samples will be collected on these individuals. The results of these samples will be time-weighted to reflect a 10-hour work shift.

Area samples will be collected at multiple locations along the work area boundary. These sample locations will be equally spaced, as feasible, to monitor any potential release of material outside of the work area and to verify that established work area boundaries are adequate to protect any personnel outside defined boundaries of the work area.

8.2. Analytical Sample Results

Air monitoring will be reported to project supervision and those employees who are sampled. The data will be stored electronically in the Y-12 Industrial Hygiene Analytical System. Summaries will be available for project personnel review and will be provided to the EMWMF Project IH Lead upon request for reference. Additionally, any negative exposure assessments developed through the monitoring of initial demonstration of work tasks will be made available to EMWMF management upon request. (Note: Periodic personal breathing zone monitoring and daily perimeter monitoring will continue even if negative exposure assessments are achieved.)

9. Disposal Requirements

Waste generated will be packaged and disposed in accordance with the approved waste lot profile and *Attainment Plan for Risk/Toxicity-Based Waste Acceptance Criteria at the Oak Ridge Reservation, Oak Ridge, Tennessee (DOE/OR-01-1909&D3)*.

10. Justification for the Proposed Process:

Recent lessons learned from the Foundry Decontamination Project, which focused on reducing Personal Protective Equipment (PPE) needed for previous beryllium contamination operating areas, have provided techniques for maintaining safe work areas, decontamination and encapsulation of equipment/material, and packaging of waste, all of which are useful to the Alpha 5 Project. The Foundry in Building 9202 exceeded the B&W Y-12 contamination criterion of $0.2 \mu\text{g}/100 \text{ cm}^2$ in the range of detectable to approximately $300 \mu\text{g}/100 \text{ cm}^2$ levels. The Foundry Decontamination Project utilized effective housekeeping, decontamination and encapsulation to remove legacy equipment for waste transport and disposal and to mitigate the remaining Foundry facility conditions (structures and equipment) such that required PPE could be significantly reduced. During the months following the project, IH performed personnel breathing zone and area air samples on all Foundry activities and have demonstrated that routine airborne levels are acceptable. Similarly, surface smear results from established IH survey routines remain $<0.02 \mu\text{g}/100 \text{ cm}^2$.

11. Conclusion:

By controlling the potential surface contamination for beryllium through implementation of comprehensive controls at the source by the Alpha 5 Facility and the Alpha 5 Legacy Material Disposition Project, beryllium contaminated materials can be managed, packaged and transported for disposal at EMWMF utilizing methods that control potential releases of airborne beryllium contamination and surface contamination to levels that are as low as practicable in accordance with 10 CFR 850.25. Previous use of the materials and techniques included in this plan has been effectively implemented to control the potential surface contamination of beryllium. By controlling beryllium surface contamination using the described methods (e.g., spray-on encapsulants, poly wrap, and/or IP-1 containers or approved TSPs), the possibility of airborne exposures to the workers are minimized. By using the described methods for packaging and shipping coupled with direct placement or direct disposal at predesignated locations within EMWMF, beryllium waste disposal from the Alpha-5 LMR Project can be accomplished safely and compliantly.

Attachments:

1. MSDSs for Encapsulant
2. Y-12 Specification for Packaging (JS-EA-801545-A021)
3. Supersack Vendor Specifications
4. Enclosure Drawings