International Radioactive Material Acceptance Guidelines

Revision 12

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- [X] Non-Proprietary
- [ ] Proprietary
- [ ] Restricted Information
- [ ] Safeguards Information
- [ ] Sensitive Security Information

- [ ] New
- [ ] Title Change
- [X] Revision
- [ ] Rewrite
- [ ] Cancellation

Reason for Cancelation: _____

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1. RADIOACTIVE MATERIAL MANAGEMENT

1.1. Purpose and Scope

This document provides Radioactive Material Acceptance Guidelines (RMAG) for the Energy*Solutions* (ES) Bear Creek facility located in Oak Ridge, Tennessee. The RMAG provides minimum requirements that international customers must meet to ship radioactive material to this facility. The minimum requirements are as follows:

- Radiological acceptance criteria provided in Table 1.
- Special radioactive material types requiring prior ES evaluation and approval before shipping listed in Table 2, Radioactive Material Requiring Prior Approval and Possibly Special Pricing.
- Components and Materials with Special Restrictions per 10 CFR 110.8 listed in Attachment 7.2, Table 3, Components and Materials with Special Restrictions per 10 CFR 110.8, List of Nuclear Facilities and Equipment under NRC Export Licensing Authority**.**
- Specific packaging guidelines defined in Attachment 7.1.
- Examples of incinerable material, compactable material, and metals for beneficial reuse[1] or recycle[2] can be found in Attachment 7.3, Table 4 (this table simply lists the most common of each category of material).

Radioactive material that does not meet the RMAG may be accepted after evaluation of data **PRIOR** to the shipment of radioactive material to the Bear Creek facility. The radioactive material received at ES that does not meet the RMAG and has not been evaluated and approved by ES may be subject to additional processing surcharges and/or returned at the customer's expense.

All radioactive material must be shipped in accordance with TS-R-1, International Atomic Energy Agency (IAEA): Regulations for the Safe Transport of Radioactive Material.

Each customer who ships radioactive material to ES must have a valid contract mechanism in place prior to shipment that includes a Return of Material clause (processed or unprocessed) as prescribed by E*S*' Tennessee Radioactive Materials licenses. In special cases, for beneficial reuse, when radioactive material cannot be returned due to the customer not having an active license or unable by its regulatory agency or some other restriction to accept the radioactive material back from ES, the Return of Material clause can be exempted. ES will request the Return of Material clause exemption from E*S*' Tennessee Radioactive Materials licenses and the exemption shall be in place prior to the customer shipping the radioactive material.

[1] Metals for beneficial reuse are melted and cast into radiation shielding and/or other reuse products that are used in the nuclear industry and remain subject to a radioactive materials license via a License to License transfer.

[2] Metals with surface radiological contamination only may be surveyed and released for unrestricted use and recycle with special approval. Metals with inaccessible surface or volumetric radiological contamination cannot be released for unrestricted use.

1.2. OOW Expiration

Material that does not meet the RMAG is considered nonstandard material and will require review and prior approval by the Out of WAG[3] (OOW) Committee. OOW approvals generally expire one year after approval and will need to be re-evaluated by both the customer and OOW Committee after one year.

1.3. ES Facility Information

ES Facility	*Main Office*
Energy*Solutions* Services, Inc. Bear Creek Operations (BCO) 1560 Bear Creek Road Oak Ridge, TN 37830	Phone Number.: 865-481-0222 Customer Service: 865-220-1230 Customer Service Fax: 865-220-1612

2. REFERENCES AND FORMS

2.1. References

2.1.1. Tennessee Rule, Chapter 0400-10-.32, Licensing of Shippers of Radioactive Material Into or Within Tennessee

2.1.2. 40 CFR 268.7, Testing, Tracking, and Record Keeping Requirements for Generators, Treaters, and Disposal Facilities

2.1.3. 40 CFR 261, Identification and Listing of Hazardous Wastes

2.1.4. 40 CFR 279.11, Used Oil Specifications

2.1.5. 40 CFR 761, Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions

2.1.6. Tennessee Rule, Chapter 0400-20-13, Physical Protection of Category 1 and Category 2 Quantities of Radioactive Material

2.1.7. ES Tennessee Radioactive Material Licenses (current amendments)

2.2. Forms (can be found at EnergySolutions.com Customer Portal)

2.2.1. WAG-502-F1, Shipment Summary Form-International

2.2.2. WAG-502-F3, Nonstandard Material Approval-International

[3] Waste Acceptance Guidelines (WAG) is domestic nomenclature and equivalent to RMAG for international material.

3. SHIPPING, PACKAGING, AND DOCUMENTATION REQUIREMENTS

3.1. A completed Shipment Summary Form (WAG-502-F1) shall accompany all shipments.

3.2. A valid Category 2 Tennessee Radioactive Materials License-for-Delivery unless ES acts as a broker on behalf of the customer.

3.3. DOE/NRC Form 741 (or equivalent) for quantities of Special Nuclear Material (SNM) exceeding 0.49 grams per shipment or source materials exceeding 0.49 kilograms per shipment (10 CFR 40.4 – Definitions and 10 CFR 70.4 – Definitions).

3.4. Test documentation and/or certification for any package requiring such paperwork as set forth in either IAEA (international standards) or 49 CFR (American Standards) must accompany shipment including such packages (e.g., Type A Package).

3.5. When materials are imported for energy recovery or recycling, specific care must be taken to minimize non-recyclable material used for shoring or contamination control.

4. RADIOACTIVE MATERIAL ACCEPTANCE GUIDELINES

NOTE

See Table 2 for radioactive material that requires approval from ES prior to shipment. Contact your Sales Director or Account Executive regarding advance approval and receipt schedules.

4.1. **Bulk Metals**

4.1.1. Bulk metals (pipe, pumps, valves, tools, file cabinets, etc.) may be melted for beneficial reuse and/or recycling. Carbon steel and stainless steel are the preferred alloys for beneficial reuse and/or recycling.

4.1.2. Metal pieces larger than 4.88 meters x 2.44 meters x 2.44 meters (16 ft. x 8 ft. x 8 ft.) require approval prior to shipping.

4.1.3. Metal pieces heavier than 9,080 kilograms (20,000 pounds) per single piece require approval prior to shipping.

4.1.4. The following metals are specifically excluded from import (incidental quantities of the metals listed below may be accepted on a case-by-case basis and MUST be approved prior to shipment).

Not Candidates for Melting (requires OOW review and approval)
Non-ferrous metals such as brass, bronze, aluminum, cadmium, copper, Inconel, monel, nickel, and chromium
Molybdenum
Uranium metals
Tantalum
Tungsten
Zirconium
Titanium
Magnesium thorium
Metals exceeding 20 mR/hr contact
Metals coated with asbestos
Lead
Galvanized metal with zinc weight percentage >1% of the galvanized metal weight
Stellite
Tin
Oil or solvent contaminated metals
Crushed metal items that contain nonmetallic materials
Alloys with melting points above 1649 degrees C
Bulk metals containing >2% incinerable by weight (e.g. wire insulation, paint, other coatings)
Components/materials that are not recyclable that are mixed with or associated with metal for recycle, to the extent that the mix is RCRA hazardous, i.e., leaded glass in a metal glove box.

4.2. **Lead (Pb)**

4.2.1. Lead received at Bear Creek must have a determined product path designated for the lead. If there is no product demand or path to legitimately recycle, lead will not be accepted.

4.2.2. Lead bricks, sheets, and shapes that have not been deformed, melted, or significantly gouged are acceptable for beneficial reuse and recycling. Lead shot, wool and blankets are not accepted. All other lead shapes or items will be evaluated on a case-by-case basis.

4.2.3. Lead shall be packaged separately from non-lead materials. The lead package must be labeled as Lead.

4.2.4. Lead-encased metal shapes (LEMS) are accepted for lead extraction and lead recycling if the customer provides documentation that the lead was not exposed to radioactive material. If documentation cannot be provided, the lead will be assumed to have been in contact with radioactive material and can be accepted for beneficial reuse. All LEMS are considered OOW and require approval prior to shipment.

4.2.5. Where possible schematic diagrams should be provided for all LEMS prior to shipping. Each LEM shall be marked so it can be linked to the provided diagram(s).

4.3. **Used Oil**

Oil may be accepted for incineration for the purpose of energy recovery. Oils for energy recovery must not be hazardous as defined in 40 CFR 261, Subpart C – Characteristics of Hazardous Waste and must not exceed allowable levels in the On-Specification Used Oil Table below.

On-Specification Used Oil	
Constituent/Property	**Allowable Level**
Arsenic*	5 ppm or less
Cadmium*	2 ppm or less
Chromium*	10 ppm or less
Lead*	100 ppm or less
Flashpoint***	100° F or higher***
PCBs	Less than 2 ppm
Total Halogens**	1,000 ppm or less

Used Oil (as defined by 40 CFR 279.11) means any oil that has been refined from crude oil, or any synthetic oil, that has been used and as a result of such use is contaminated by physical or chemical impurities.
*This specification is for Total Metals (per above specifications), not TCLP.
**Total halogen concentrations 1,000 ppm but less than 5,000 ppm may be acceptable provided the presumption of mixing has been successfully rebutted.
***Flashpoint ≥100 ° F and <140 ° F require prior approval due to increased storage requirements.

Submission of analytical data will be required. Samples of these oils must be collected and analyzed in accordance with the United States Environmental Protection Agency (USEPA) publication SW-846 entitled *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*.

4.4.

4.4. **Waste Oil**

4.4.1. Oils that do not meet the specifications in Section 4.3 must be non-hazardous per 40 CFR 262.11 and will also require submission of analytical data for approval.

4.4.2. Non-hazardous Synthetic Fluid – Most synthetic fluids, including Fyrquel electro-hydraulic control (EHC) fluid are acceptable as undiluted but must be labeled SYNTHETIC FLUID.

4.4.3. Direct Processing – Non-hazardous fuels such as diesel, #4, #6, etc. and lubricating oils meeting the following specifications are accepted for direct processing.

Solids content	≤10% by volume
Aqueous liquid content	≤10% by volume

4.5. **Aqueous Liquids, Sludges, and Resins**

4.5.1. Aqueous liquids are acceptable and must meet the following parameters:

Descriptor (Note 1)	Processing Operations			
	Incineration	**Waste Water Evaporator**	**Liquid Evap. System**	**Drum Oven**
pH	5 to 9	>2 and <12.5	>2 and <12.5	>2 and <12.5
Solids Content by Volume excluding settled sludge	<1.0%	<1%	<1.0%	<1.0%
Oil Content by Volume	<1.0%	No visual sheen	<1.0%	<1.0%
Chelating Agent by Volume	<1.0%	<1.0%	<1.0%	<1.0%
Flash Point ^{0}F	>140	>250	>200 (Note 2)	>200 (Note 2)
Gross Beta-Gamma (µCi/ml)	N/A	<1.0E-3	<1.0E-3	N/A
Gross Alpha (µCi/ml)	N/A	<1.0E-5	<1.0E-6	N/A
Beryllium (mg/L)	<0.02	<0.02	<0.02	<0.02

Note 1: Chemical agents present in the radioactive material shall be identified.
Note 2: Actual Flash Point result needed to determine proper processing plan.

4.5.2. Sludges are considered to be liquids or semi-solids not meeting the above solids criteria because of special incineration handling requirements.

4.5.3. Resins with container contact dose rates in excess of 80 mR/hr require prior approval.

4.6. **Bulk Radioactive Material for Incineration**

Radioactive material consisting of paper, plastic, cloth, rubber, and wood are acceptable. Polyvinyl chloride materials >10% by mass and metal are not candidates for incineration. However incidental small amounts of metal such as nails in boards may be acceptable upon approval.

4.7. **Large Components**

ES will evaluate large components >18,100 kilograms (>39,900 pounds) that do not fit into a standard ISO freight container for receipt on a case-by-case basis for beneficial reuse and/or recycle. Specific examples of large components include heat exchangers, steam generators, low pressure turbines, tanks, closed vessels, and reactor pressure vessels.

4.8. Compaction, Packaging, and Return to Customer

In an effort to help international customers maximize storage space on their sites, ES will evaluate processing material in order to densify/volume reduce the material for return to the customer.

4.9. Sources and Standards

Non-metallic sources/standards (e.g. plastic and epoxy) may be acceptable for incineration if activity is <37 kBq per cc (<1µCi per cc). Surface deposited metal sources/standards (e.g. 50 mm Tc-99 disk source) may be acceptable for metal melt if total alpha activity is <900 kBq (<0.025µCi) , and total beta activity is <9,000 kBq (<0.25 µCi).

4.10. Noninfectious/Medical Waste

After sterilization or other treatment by the customer such as autoclaving or use of bleach to render the wastes noninfectious, infectious and potentially infectious wastes are accepted. Infectious and potentially infectious wastes are radioactive materials that are:

4.10.1. Generated in the diagnosis, treatment, immunization of humans or animals, or

4.10.2. Generated through research involving such beings (including the production or testing of biologicals) that are contaminated or potentially contaminated with infectious agents known or suspected to cause human illness.

4.10.3. Sharps as defined by 49 CFR 173.134 means any object contaminated with a pathogen or that may become contaminated with a pathogen through handling or during transportation and also capable of cutting or penetrating skin or a packaging material. Sharps includes needles, syringes, scalpels, broken glass, culture slides, culture dishes, broken capillary tubes, broken rigid plastic, and exposed ends of dental wires. Sharps will require OOW approval prior to shipment.

4.11. Small Sharp Objects

Small sharp objects such as broken glass, knives, scalpel blades, and other small sharp metal objects will require OOW approval prior to shipping.

4.12. Non-RCRA-Liquid Scintillation Vials (LSV)

LSVs are acceptable for processing provided that they are packaged in accordance with the requirements of Attachment 1. There are three LSV categories:

- Plastic vials ONLY packaged for direct incineration (most preferred/cost effective)
- Glass and Plastic vials packaged for direct incineration
- Glass or Plastic vials in metal drums for incineration

NOTE:

Glass is not acceptable for incineration except for glass liquid scintillation vials. Any glass thicker than a liquid scintillation vial is unacceptable for incineration without prior approval.

4.13. **Engineered Nanomaterials**

Engineered nanomaterials are not acceptable for inspection or processing at the ES Tennessee facilities. An Engineered nanomaterial is any intentionally produced material that has a size in 1, 2, or 3 dimensions of typically between 1-100 nanometers (example: carbon nanotubes or ultrafine particulates). Bucky balls are also included even though they have a size <1 nm. Aggregates and agglomerates with size >100 nm are included if breakdown may occur creating particles in the 1-100 nm range during the lifecycle.

4.14. **Stored or Residual Energy**

All potentially hazardous stored or residual energy present in any radioactive material for processing, and especially equipment that has not been disassembled, must be identified. Systems, components, or equipment, including batteries which have energy must be relieved, drained, disconnected, restrained, and otherwise rendered deactivated and stable. Hazardous energy items shall be marked as “deactivated” or be marked “Danger- hazardous energy” if hazardous energy has not been addressed.

Potential stored energy would include electrical, mechanical, pneumatic (air), hydraulic, steam, gravity, etc. Examples include springs, static eliminators, capacitors, batteries, elevated movable machine parts, hydraulic systems, pressurized liquid/gas systems, cylinders, etc.

Information such as technical manuals, drawings, or manufacturer information related to equipment with stored or residual energy must be provided to ES OOW for evaluation prior to the shipment of radioactive material or equipment with stored or potential energy. Any removal, disabling, or by-passing of a barrier or safety device intended to protect individuals from stored or residual energy shall be identified.

Any item where the potential or residual energy cannot be released by the customer is considered to be outside routine pricing arrangements and ES shall require the customer to accept a Special Quote with respect to this item before ES can agree to accept it.

4.15. Materials Prohibited from Import

Materials with PCB (bulk produce waste) concentration of ≥50 ppm are prohibited from import, as well as wastes defined as hazardous waste per 40 CFR 261 as Resource Conservation and Recovery Act (RCRA), off-specification used oil as defined in 40 CFR 279 and wastes defined in U. S. Code: Title 15 Chapter 53 - Toxic Substances Control without the authorization of the USEPA and the exporting country's appropriate regulatory agency.

4.16. Beryllium Contaminated Radioactive Material

4.16.1. Beryllium contaminated radioactive material may refer to:

- Isotropic beryllium
- Elemental beryllium
- Beryllium compounds (beryllium oxide, beryllium fluoride, etc.)

4.16.2. Radioactive material for processing will be considered as beryllium contaminated if any of the following criteria are exceeded.

Descriptor	Criteria
Loose contamination	0.2 µg/100cm^2 elemental, or 30,000 dpm/100cm^2 radiological
Solid materials (bulk radioactive material, metal, building rubble, etc.)	0.1% by weight
Soil contamination	0.01 mg/m^3
Liquid contamination	0.02 mg/L

4.16.3. Any shipment, package, or container that arrives with beryllium placarding, labeling, markings, etc., without prior approval will be placed on hold and investigated prior to processing.

4.17. Non-conforming Material

If ES identifies non-conforming material, the customer will be contacted for proper disposition. The radioactive material will be put in dispute. Additional charges may apply based on the dispute resolution path.

5. RADIOLOGICAL GUIDANCE

Radiological acceptance criteria are defined in Table 1, Radiological Acceptance Criteria – SI Units. Levels of radiation and radionuclide concentrations exceeding those detailed in Table 1 may be accepted on a case-by-case basis and MUST be approved prior to shipment (Form WAG-502-F3, Nonstandard Material Approval – International).

Table 1. Radiological Acceptance Criteria – SI Units

A. RADIATION AND CONTAMINATION LEVEL OF RADIOACTIVE MATERIAL		
Type	**Contact Dose Rate**	**Removable Contamination (Bq/cm^2)[1]**
Metal for Beneficial Reuse and/or Recycling through Metal Melt	≤ 200 µSv/hr	≤8 β–γ ≤1 α
Bulk Radioactive Material for Processing	≤ 1000 µSv/hr	Not Applicable
Lead for Casting	≤ 50 µSv/hr	0.1 α for uranium and daughters, 0.08 α for transuranics and thorium, and less than 4 β–γ

[1]Customer may apply a fixative such as a PCB-free paint where removable contamination exceeds these levels. Customer should limit the amount of fixative applied as much as practicable.

B. RADIONUCLIDE CONCENTRATION	
Radionuclide concentration per package shall not exceed the following limits without prior evaluation and approval.	
Metals for Beneficial Reuse	**Limiting Values**
All Nuclides	≤ 5000 Bq/gm
H-3	≤ 1000 Bq/gm
C-14	≤ 1000 Bq/gm
Co-60	≤ 40 Bq/gm
Ni-63	≤ 5000 Bq/gm
Sr-90	≤ 35 Bq/gm
Cs-137	≤ 5000 Bq/gm
Pu-241	≤ 800 Bq/gm
Total Transuranics (sum of Am-241, Pu-238, Pu-239, Cm-243, Cm-244)	≤ 20 Bq/gm
Special Nuclear Material	≤ 0.49 grams
Source Material	≤ 0.49 kgs
Other Radioactive Materials	**Limiting Values**
Total, all radionuclides with >5-yr half-lives ***except*** H-3 and C-14	≤ 11 kBq/cc
Total, H-3 and C-14	≤ 5 kBq/cc
I-125	≤ 3700 kBq/package
Other mixed fission and activation products, Z <84	≤ 200 kBq/cc
Tc-99	≤ 0.13 kBq/cc
Th-232	≤ 40 kBq/m^3 or 1e-5 gm Th/cc of radioactive material
U-238 as metal or oxide	≤ 20 kBq/cc or 1.6E-3 g U/cc of radioactive material
Depleted Uranium or Natural Uranium as metal or oxide	≤ 120 kBq/ m^3 or 6e-6 gm U/cc of radioactive material
α for TRUs, Ac, Ra, and Th for processing **(NOTE 1)**	≤ 3.7 Bq/g and less than 1% of activity
No shipment shall equal or exceed 10 CFR 110, Appendix P Category 2 quantities of radionuclides (Sum of Fractions Applies)	
Special Nuclear Material	≤ 0.49 grams
Source Material	≤ 0.49 kgs
NOTE 1: PACKAGES SHALL BE CLEARLY MARKED FOR IDENTIFICATION.	

6. RADIOACTIVE MATERIALS REQUIRING PRIOR APPROVAL

The items listed in Table 2 require advance approval from ES prior to shipment. Additionally, these items shall be specifically identified on the Shipment Summary Form (WAG-502-F1), which is to be included with the shipment. Contact your account executive regarding advanced approval and receipt schedules. If the following material is shipped to ES without prior approval, it will be subject to processing surcharges or returned at the customer's expense.

Table 2 – Radioactive Materials Requiring Prior Approval and Possibly Special Pricing Consideration

Ref. Section	Requirement
General	Non-radiological hazards shall be identified
General	Due to the non-routine nature of the types of wastes generated during decommissioning projects, ES reserves the right to review for approval radioactive wastes that originate from decommissioning projects
General	All cask/OOW shipments (minimum of 3 days prior to arrival of shipment)
General	Wooden or fiber outer containers and poly-wrapped flatbed loads
General	Shipments requiring specialty container or dunnage returns
All	Radioactive material that does not meet the ES WAG or requires expedited processing
4.1.2	Metal pieces larger than 4.88 meters x 2.44 meters x 2.44 meters (16 ft. x 8 ft. x 8 ft.) per individual piece or combination of integral pieces
4.1.3	Metal pieces heavier than 9,080 kilograms (20,000 pounds) per single piece
4.1.4	Bulk Metals that require special evaluation
4.2	Lead & LEMS
4.3	Used Oil Flashpoint ≥100 º F and <140 º F
4.7	Large Components
4.9	Sealed sources
4.10.3	Sharps as defined in 49 CFR 173.134
4.11	Small Sharp Objects
4.12	Liquid Scintillation Vials
4.13	Engineered Nanomaterials
4.14	Stored or Residual Energy
4.16	Beryllium Contaminated Material
4.17	Non-conforming Material
Table 1	When levels in Table 1 are exceeded

7. ATTACHMENTS

7.1. Specific Radioactive Material Packaging and Shipping Guidelines

7.2. Table 3 — Components and Materials with Special Restrictions per 10 CFR 110.8, List of Nuclear Facilities and Equipment under NRC Export Licensing Authority

7.3. Table 4 — Examples of Incinerable, Compactable, and Metal Melt Material

Attachment 7.1, Specific Radioactive Material Packaging and Shipping Guidelines

All radioactive material shipped to ES, shall be delivered in qualified containers per IAEA standards and 49 CFR standards. Wood, fiberboard or super-sack containers require coordination for storage purposes. As a minimum, containers shall meet IP-1 standards. Any deviations shall require prior written approval from ES.

Unless prior written approval is provided, all containers without lifting devices over 34 kilograms (75 lbs.) must be palletized, excluding standard drums 113 liter to 321 liter (30-gal to 85-gal). Cubic yard boxes may be double stacked provided they contain legs or have 2" x 4" wood spacer boards sized to fit the containers placed vertically on the floor and between the boxes in order to be removed by a Forklift without manual lifting. The boards will be considered sacrificial and incinerated with the boxes, unless requested to be returned with the conveyance.

Any equipment not shipped in its original or intended configuration should be noted on manifest additional notes page or the OOW form. An example would be a compactor or baler that was normally operated in a vertical configuration and now being shipped in a horizontal configuration possibly creating additional pressure applied to certain components.

When metals are imported for beneficial reuse and/or recycling, specific care must be taken to minimize non-recyclable material used for shoring or contamination control.

Material Types

The guidance provided in this attachment applies to packaging for the following material types.

- Bulk Radioactive Material in Bulk Containers for Sorting, Compaction, and Incineration
- Bulk Radioactive Material for Direct Compaction
- Aqueous Liquids for Direct Incineration
- Animal/Biological Radioactive Material for Direct Incineration
- Bulk Radioactive Material in Non-Bulk Containers for Direct Incineration
- Resins and Sludges for Drying/Incineration
- Oil for Direct Incineration
- Non-RCRA Liquid Scintillation Vials Shipments
- Cask Shipments
- Small Sharp Objects

Bulk Radioactive Material in Bulk Containers for Sorting, Compaction, and Incineration

1. Place radioactive material to be sorted inside poly-bags and load the poly-bags into bulk containers.

   NOTE

   Bulk containers larger than 2.8 cubic meter (100 ft^3) containers shall be capable of being off-loaded through the end. Also note that large cargo containers of bulk

radioactive material accepted at ES are limited to top and end-loading sealand type containers. Intermodals may be acceptable with prior approval.

2. Radioactive material with **hot particles** received in packages other than 55-gal drums or ES inner-pack boxes must be size reduced prior to receipt to less than 76 cm W x 96 cm L x 112 cm H (30x W x 38x L x 44x H). Radioactive material with hot particles shall be double bagged, or wrapped in plastic, and marked on the outermost container:

CONTAINS HOT PARTICLES—DO NOT OPEN

3. **High Dose Rate Radioactive Material >2 mSv/hr (>200 mR/hr)** received in packages such as bags, boxes or other discrete items shall be clearly marked and visible upon opening and unloading of bulk containers. The use of colored tape, paint or other clearly marked identifier may be used.

4. **Co-mingled incinerable and compactable radioactive material** for sorting shall be positioned in the bulk container to allow off-loading first. Bulk radioactive material for compaction or incineration which is packaged within the same bulk container (e.g., metal boxes, cargo containers) as other radioactive material that require other processing methods (i.e., metals processing) shall be either segregated by use of partitions or placed in separate containers within the bulk package and must be clearly labeled. Materials needing other processing methods that are packaged within the same bulk container as radioactive materials for sorting and incineration are also subject to the specific radioactive material packaging guidelines for the applicable processing method.

Bulk Radioactive Material for Direct Compaction

1. ES requires the customer ensure radioactive material packaged for direct compaction has been sorted to remove non-conforming materials.

2. Package bulk radioactive material for direct compaction in 208 liter (55-gal) steel drums or ES-provided inner-pack (IP) boxes. ES provided inner packs shall not exceed a gross weight of 385 kilograms (850 pounds).

NOTE

ES does not consider inner-pack boxes strong-tight containers. Therefore, inner-pack boxes must be shipped inside another qualified outer container.

3. Do not place large metal pieces, such as piping, rods, or steel bars, in the drum or inner-pack box vertically. Place other miscellaneous metal pieces either horizontally or diagonally in the inner-pack box or drum.

4. **Asbestos (friable and non-friable) material received for compaction in packages other** than 208 liter (55-gal) drums or ES inner-pack boxes must be size reduced prior to receipt to less than 76 cm W x 96 cm L x 112 cm H (30x W x 38x L x 44x H). Asbestos shall be double bagged using six mil polybags, and marked with the required asbestos warning labels.

Aqueous Liquids for Direct Incineration

1. Put the primary containers in outer-packs to provide double containment in the event of leakage or spillage from the primary container.

2. Use of 113 liter to 321 liter (30-gal to 85-gal) non-leaking polyethylene containers for liquids and sludges is acceptable. In addition, ensure the containers are compatible with the liquids being transported.

3. Over-packed packages containing liquids may be packaged within the same bulk container as materials that require other processing methods; however, the packages need to be segregated by use of partitions. Materials for sorting and incineration should be positioned in the bulk container to allow off-loading first.

4. Bulk quantities of aqueous liquids are acceptable in certified tankers and certified portable tanks designed with forklift pockets compatible with standard fork trucks per IAEA standards and 49 CFR standards.

5. Drums shall not be double stacked in ISO freight containers.

Animal/Biological Waste for Direct Incineration

1. **Inner Wrapping:** Double wrap animal/biological waste that contains liquids or could decompose to produce liquids/fluids using two 4-mil clear poly-bags. Close each bag by heat sealing or taping. Put the bag into a cardboard box or fiberboard drum, with a minimum of 2 in. of incinerable absorbent in the bottom. In all instances, use boxes/drums with no metal parts.

   Wrap other animal/biological waste, including contaminated nonmetal laboratory equipment and trash, in one 4-mil clear poly-bag. Heat seal or tape the bag prior to placing it into the cardboard box or fiberboard drum. Biological wastes shall not be mixed with non-incinerables in the same container.

2. **Outer Container:** Only one generator's (i.e., the licensee that the radiological material is attributed to) waste shall be placed in an individual box/drum. Use cardboard boxes or fiberboard drums with no metal parts. Securely close each box/drum with duct tape so that all edges or flaps are not visible. The box or drum is limited to a maximum of 53 cm x 53 cm x 53 cm (21x x 21x x 21x) and 34 kilograms (75 lbs.) gross weight per package.

   Clearly mark each package with the generator's name, and number the package to correspond with the manifested entry. Mark the top of the container, **THIS END UP**. Mark at least two opposite sides of the container:

   BIOLOGICAL WASTE — FOR INCINERATION ONLY

   NOTE

   DO NOT mark containers as BIOHAZARDOUS. Biohazardous means the same as infectious at ES.

Animal carcasses/tissue shall arrive frozen at ES.

3. **Bulk Container Packaging:** All packaging requirements for individual packages apply to each package in the bulk container.

   Packages containing animal/biological waste may be packaged within the same bulk container as radiological material that require other processing methods; however, the packages need to be segregated by use of partitions. Radiological material for sorting and incineration should be positioned in the bulk container to allow off-loading first.

Bulk Radioactive Material in Non-Bulk Containers for Direct Incineration

ES will work with customers on an individual basis to develop programs and procedures for direct incineration of material. Each customer MUST be approved by ES to participate in a direct incineration program prior to shipping materials. The following items are typical requirements for a direct incineration program, but there may be more depending on individual circumstances:

- Package limited to one cubic meter with no single dimension greater than one meter and gross weight not to exceed 100 kilograms (220 lbs.)
- No metal on or inside the package
- No free-standing liquids in the same package with bulk radioactive material for direct incineration
- Material shall be double bagged and heat-sealed or taped.

Clearly mark each package with the generator's name, address, contact name, and phone number; number the package to correspond with the manifest entry. Each package shall contain only one generator's material.

Resin and Sludge for Drying/Incineration

Resins and sludges may be packaged in steel or poly liners provided the liner is overpacked in a cask and the resin/sludge can be transferred directly from the liner while in the cask. Liners placed directly on the floor of the conveyance or bulk container (e.g., Sealand) are strictly prohibited. ES will accept DOT drums designed for liquids, DOT portable tanks (with fork pockets), and DOT-certified tankers. Small (<30 gallons) polyethylene containers must be overpacked.

NOTE

The preferred packaging for low-dose-rate *sludges* <500 µSv/hr (<50 mrem/hr) for incineration is steel or poly drums or boxes (preferably 1.4 m^3 (50 ft^3) type.

Dewatering laterals that contain multiple-cartridge filters (filter trees) make liners unusually difficult to empty and should be avoided.

Oil for Direct Incineration

Synthetic fluids, including EHC fluids, must be packaged in separate freight containers from petroleum-based oils.

Use of 113 liter to 321 liter (30-gal to 85-gal) non-leaking polyethylene containers for oil is acceptable. In addition, ensure the containers are compatible with the oil being transported.

Put the primary containers in steel or poly outer-packs to provide double containment in the event of leakage or spillage from the primary container.

Over-packed packages containing oil may be packaged within the same bulk container as materials that require other processing methods; however, the packages need to be segregated by use of partitions. Oils should be positioned in the bulk container to allow off-loading first.

Drums shall not be double stacked in ISO freight containers.

Non-RCRA Liquid Scintillation Vials

Liquid Scintillation Vials (LSVs) are acceptable only if packaged in accordance with the following.

Fiberboard containers —

- Shall be double-bagged in sturdy and leak-resistant polyethylene liners. Add enough incinerable absorbent in each bag (e.g., saw dust, corn cobs) to absorb double the amount of liquid contained in the package. Non-incinerable absorbent material (e.g., kitty litter and diatomaceous earth or vermiculite) is not accepted without prior approval.
- Must not exceed 50 kilograms (110 lbs.) container gross weight. Wood cribbing and/or pallets may be required as specified by the beginning of Attachment 1 for containers over 34 kilograms (75 lbs.)

Poly or Fiber drums —

- If packaged in open head drum, shall be double-bagged, containing enough incinerable absorbent to absorb double the amount of liquid contained in the package.
- Packages exceeding 34 kilograms (75 lbs.) need to be palletized or loaded with wood runners underneath the packaging.
- Poly and fiber drums for direct incineration shall not have a metal closure ring.

Cask Shipments

1. All cask shipments require prior approval from ES.
2. Customers using an NRC-licensed or other cask not owned by ES or subsidiaries shall ensure that ES is a “Registered User” of the licensed cask prior to shipment to an ES facility.

3. Third-party cask documents (Certificate of Compliance, Safety Analysis Report and handling and maintenance procedures and drawings) shall be made available to ES as the NRC Registered User of the cask prior to shipment of the cask to an ES facility.

4. Individual internal packages need to be clearly marked to match the itemized manifest line items on NRC Form 541. Additional description of package/loading configuration (e.g. super-sack, drum pallet, rigging) needs to be noted on Shipment Summary Form.

5. Any external smearable levels on packages inside cask exceeding 1,000 dpm/100 cm^2 beta/gamma and 100 dpm/100 cm^2 alpha requires prior notification.

6. All shipments shall strictly comply with the applicable Certificate of Compliance for the cask in use (i.e., lid torquing, sealing gaskets, weight restrictions, and shoring requirements).

   - Liners containing "grapple bails" are to be identified on the Waste Manifest Form/Shipping Papers. If the liners have non-ES supplied bails, the customer must provide the proper grapple lifting device and instructions or procedure for its use. These are to be provided prior to or at the time the liner is offered for shipment. The customer-provided grapple lifting device may need to be made available at later times to move the liner within the facility.

     NOTE

     Liners containing non-ES grapple bails must have appropriate lifting cables attached if the above criteria cannot be met.

     CAUTION

     Customer-provide grapple lifting devices may have to be shipped separate from the liner if liner requires overweight permit.

   - All drums shall be palletized and pallets shall have proper lifting devices attached. Boxes shall be equipped with appropriate lifting devices or palletized.

   - Radioactive material container and/or pallet shall have the lifting device secured at the top of the container(s). This is to prevent the cable from becoming caught under or between the container(s) or pallet.

     NOTE

     Lifting devices shall be of sufficient length to allow retrieval and crane hook-up without physically entering the cask. Ensure lifting devices are secured as to prevent them from getting trapped between packages and cask wall.

   - Radioactive material container with wire rope/synthetic slings and shackles shall have the shackle pins zip tied or otherwise secured to prevent loosening or backing out.

   - For shipments consisting of high-integrity containers, the pallets on which the containers are placed are considered sacrificial since the pallets are used for proper placement in the concrete vaults.

- When using liners to ship high rad bulk radioactive material, "wide mouth" liners must be used if the liner is to be returned to the customer. "Small mouth" liners will typically be cut up and processed, becoming ES secondary waste.

- When using pallets, the containers shall be positioned to remain balanced and stable on the pallet when lifted clear of the cask.

- When tall, slender containers (i.e., demineralizers) are loaded on a pallet inside a cask, the containers shall be tied or secured together at the tops to prevent containers from falling off the pallets during off-loading. This is not required for a single tier of drums that are placed on a pallet.

- Palletized drums inside a cask shall be loaded to prevent shifting of drums resulting in increased radiation levels measured outside the cask.

- Soft side packages shipped in cask shall be closed per manufacturer's specifications and shall include appropriately rated and accessible lifting devices.

Small Sharp Objects

Sharp objects such as broken glass, knives, scalpel blades, and other small sharp metal objects shall be bagged separate from other radioactive material and labelled with "Small Sharp Objects" on the outer packaging.

Attachment 7.2, Table 3
Components and Materials with Special Restrictions per 10 CFR 110.8, List of Nuclear Facilities and Equipment under NRC Export Licensing Authority

App.	Description
A	Nuclear Reactor Equipment
B	Gas Centrifuge Enrichment Plant Components
C	Gaseous Diffusion Enrichment Plant Assemblies and Components
D	Aerodynamic Enrichment Plant Equipment and Components
E	Chemical Exchange or Ion Exchange Enrichment Plant Equipment and Components
F	Laser-Based Enrichment Plant Equipment and Components
G	Plasma Separation Enrichment Plant Equipment and Components
H	Electromagnetic Enrichment Plant Equipment and Components
I	Reprocessing Plant Components
J	Uranium Conversion Plant Equipment and Plutonium Conversion Plant Equipment
K	Equipment and Components for the Production of Heavy Water, deuterium, and Deuterium Compounds
M	Categorization of Nuclear Material
N	Lithium Isotope Separation Facilities, Plants, and Equipment
O	Fuel Element Fabrication Plant Equipment and Components

NOTE: See 10 CFR 110 for details

Attachment 7.3, Table 4
Examples of Incinerable Material, Compactable Material and Metal Melt

Incinerable	Compactable	Metal Melt
Paper and Paper Towels	Large PVC Components	Empty Drums
Tyvek Coverall, booties and Hoods	Insulation and Fire Blankets	Light Gauge Metals
Plastic booties	Ventilation Filters That Contain Metal	Welding rods
Rubber Booties	Metal Reinforced Air Hoses	Metals Cans
Plastic suits	Electrical Cable	Metal Mop Buckets and presses
Rubber Gloves		Heavy Gauge Metal
Plastic and glass bottles		Tools
Wood		Tanks and Components
Cardboard		Piping
Mop heads – dry or damp		Valves
Smears/filter papers		
Cloth		
Rope and nylon slings		
Floor Buffing Pads		
Safety Shoes		
Cotton Gloves		
Vicraft hoods		
Floor sweepings, dust bane, stay dry, etc.		

NOTE: Call your ES Technical Representative for questions regarding materials not listed on this table.